

# Big River Watershed Summit

Discover Your Piece of the Watershed Puzzle

## Tour

Thursday, September 12, 2013 8 a.m. – 4 p.m.  
(Lunch provided)

Optional Farm to Table Dinner hosted by the Missouri Cattleman's Association - St. Joe State Park, 5 p.m.

## Workshop

Wednesday, October 9, 2013 7:30 a.m. – 4 p.m.  
Mineral Area College – North College Center  
(Continental breakfast and lunch provided)

## Planning Committee

The planning committee for the **Big River Watershed Summit** includes: Southeast Missouri Regional Planning Commission, Meramec Regional Planning Commission, East-West Gateway Council of Governments, Missouri Department of Natural Resources, University of Missouri-Extension, Missouri Public Utility Alliance, Missouri Department of Conservation, US Army Corps of Engineers, U.S. Environmental Protection Agency, Jefferson County, St. Francois County, Washington County, the City of Potosi, and several volunteer citizens from within the Big River Watershed.



# Big River Watershed Summit

## Fall 2013

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- Watershed Management – A General Concept
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    - Missouri Department of Conservation
    - U.S. Environmental Protection Agency
    - U.S. Army Corps of Engineers
    - U.S. Fish and Wildlife Service
- Frequently Asked Questions (FAQ)
- Links
- Glossary of terms



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**What is a Watershed?**



## What is a Watershed?

A watershed is an area of land that drains water to a particular body of water. Creeks, streams, rivers, ponds, lakes, and wetlands all have watersheds. Whether you live in a town, city, or in the country, everyone lives in a watershed.

In its simplest terms, a watershed is another name for a drainage basin, a geographic area which, because of land elevation, causes all rain water that falls on it to flow downhill either to a single point or to a single body of water.

In the continental United States, all water flows into one of two major watersheds – the Atlantic or the Pacific – that is, all rainfall eventually flows to one of the two oceans (ignoring evaporation or soil absorption).



It is essential to understand that a watershed is not a political subdivision, but is the description of a land feature like a mountain, a river, a canyon, or a desert. Watersheds regularly cross political boundary lines like cities, counties, states and even nations. Because the water in the rivers and streams crosses boundaries, it is essential that all stakeholders (landowners, towns, cities, counties, and even states) work together to deal with the challenges that exist within a watershed.

Activity upstream that changes anything about a river or stream impacts the quality and character downstream. Pollutants, such as E. coli, nutrients or sediment that enter a stream or river upstream, generally remain through the entire course.

Something as simple as installing a parking lot in the upper part of the watershed can cause rainwater to flow more quickly into a stream after a heavy rain creating a cascade of effects. Water levels rise faster and reach higher than normal, which results in erosion of stream banks, which then produces more sediment, which is likely carrying pollutants, in the river. That's not to say that parking lots should never be paved, only that impacts to our waterways and downstream landowners should be considered and reduced, if possible.

Identification of a watershed can be at many different scales. The Big River watershed is identified as a geographic area of a certain size defined by hills and valleys, which has been calculated by the United States Geological Survey (USGS) at an 8-digit scale. This scale is generally known as an 8-digit Hydrologic Unit Code (HUC).

In the continental United States, there are 2,110 8-digit HUC watersheds. Sixty six of these 8-digit HUC watersheds lie partially or wholly within the State of Missouri. The Big River Watershed is one of these watersheds.

The Big River Watershed, southeast of St. Louis, comprises 955 square miles in portions of six counties. The Big River itself flows for 138 miles, receiving water from eight major tributaries until it empties into the Meramec River. Under the classification developed by the USGS, the Big River Watershed is also identified by its 8-digit HUC, 07140104.



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# **Watershed Management**

## **A General Concept**



## Watershed Management – A General Concept

Watershed management is based on an entirely new paradigm. Rather than focusing on the details of the regulated discharges into the waterways of the watershed, the focus is on the health of the water bodies and waterways as a whole. While regulated entities, such as a wastewater treatment plant, must still be aware of the quality of their effluent and its impact on the receiving waterbody, the focus shifts from the quality of the effluent to the quality of the waterway below the plant.

Nonpoint source pollution is one of the nation's largest remaining water quality challenges. It is not caused by pipes discharging waste from big factories or from sewage treatment plants. Rather, it is generated by rainfall's interaction with many different natural and human activities. Some human activities that can result in nonpoint source pollution include applying pesticides or fertilizers to our lawns, removing vegetation which can result in topsoil loss, and cars parked in parking lots. While most of these individual actions have relatively small impacts on water quality, the cumulative impact can be much larger. By becoming more aware of the effect these actions have on rivers, streams, lakes, and oceans, more water-friendly habits and practices can be developed that will enable protection and restoration of the quality of these waters.

Citizen participation and cooperation is crucial for successful watershed management. When citizens better understand the issues within a watershed, they become more invested in the future of their community, and together, can develop the most effective solution to benefit the state's water resources for generations to come.



The Big River Watershed Summit plans to bring all the pieces together to empower citizens and provide the tools necessary to make a watershed management, a successful way of operating. Partnering with others to combine resources (technical, financial, manpower, etc.) allows greater success in reaching goals together that may not have been feasible alone.

As part of the Big River Watershed Summit, the committee sent a survey to more than 150 local leaders to gauge local interest and to learn about potential concerns regarding watershed management. Based on the results of the survey, the committee was able to identify local leaders to invite to the summit. These leaders represent many sectors of the watershed, including, landowners, stream-teamers, business owners, municipalities, public works directors, farmers (both crop and livestock), etc. The committee will be meeting with these leaders one-on-one or within small groups to present what is known about the Big River Watershed and to find out what the citizens of the watershed are passionate about. On **September 12**, the committee will host a tour and show participants some of the water resource concerns and opportunities throughout the watershed. **October 9**, local leaders will gather at Mineral Area College to discuss the water resources of the watersheds, possible directions to take and resources (both technical and financial) resources available to help reach goals.

**These important decisions cannot be made without the citizens of the watershed. Water resources must be managed at the local watershed level – where specific water resource management needs are best addressed.**



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# History of the Clean Water Act



## Basic History and Administration of the Clean Water Act



The Clean Water Act passed by Congress has been evolving since 1972, although the underlying principals remain essentially unchanged. The goal of the act is that all waters of the United States will be swimmable and fishable by some future date.

Pollution entering a waterway is generally divided into two categories – **point source** and **nonpoint source**. In the simplest terms, **point source** is pollution that enters a river or stream through a pipe, a culvert or a ditch.

A wastewater treatment plant is a good example. **Nonpoint source** is pollution that reaches a river or stream in any other way. Run-off from a roadway carrying oil, grease and fuel is an example. The Clean Water Act primarily controls point source pollution.

The Clean Water Act, although a federal law, can be administered and enforced by both the Environmental Protection Agency (EPA) AND the Missouri Department of Natural Resources (the department). That is done through what is known as a “delegation of authority”. The Environmental Protection Agency grants the department limited authority to operate and enforce the Clean Water program in the State of Missouri because the department has the necessary legal authority from the state to do so, and the state law (Missouri Clean Water Act) has the same requirements as the federal law.

Missouri Department of Natural Resources regulates discharges through the issuance of a National Pollution Discharge Elimination System (NPDES) permit which is essential a permit allowing an entity to discharge a limited amount of pollutants into a waterway. The permit is generally good for five years, after which the owner of the permit has to reapply and agree to any changes in the level of pollutants that can be discharged or in the monitoring and testing they have to do to document the levels they are discharging.

Under the department’s delegation of authority agreement with EPA, it has to legally establish what are known as “beneficial uses” for each stream in the state, as well as the quality of the water that must be maintained if the stream is to meet that classification. For instance, one of the beneficial uses of a stream can be “Whole Body Contact Recreation” (WBCR), which means swimming. Another beneficial use might be “Livestock Watering”. The water quality needed to provide protection for Whole Body Contact Recreation may be much higher than if the beneficial use is Livestock Watering.

There are fifteen different identified beneficial uses. Additionally, the beneficial use may change as the stream moves downhill from its source to its confluence with a larger river as the land and human activity around it change. In many cases an individual stream will be designated for many different beneficial uses, but its protection level is based on the highest of the beneficial uses. It is the identified beneficial use of the stream that determines the amount of any given pollutant that can be discharged into the stream.



## Basic History and Administration of the Clean Water Act (Continued)



The department is required every three years (Triennial Review) to re-evaluate how much pollution can be released into certain classification of streams. The evaluation is subject to citizen input before its adoption and approval by EPA before it is put into operation.

The department is also required in even numbered years to send to EPA a list of “impaired waters” which is sometimes referred to as the 303(d) list because of the section of law in which it is found. An entire stream or a part of stream is listed as ‘impaired’ if its current water quality does not meet the standards for its particular beneficial use. For instance, if stream has been classified for Whole Body Contact Recreation, then there is an in-stream limit on the amount of E. Coli it can have. E. Coli is a bacteria found in the intestines of warm blooded animals and is an indicator that some level of sewage or raw waste is getting into a stream. The stream may be perfectly clear to the eye, but if the E. Coli level is higher than allowed, then the stream is classified as ‘impaired’.

Classifying a section of a stream as ‘impaired’ requires the department to begin a formal process to establish a Total Maximum Daily Load (TMDL) for a stream for one or more pollutants. In other words, the department has to calculate how many pounds, ounces, or parts per million of some pollutant can be allowed to enter a stream from all sources if the stream is going to achieve its designated use. The TMDL process also requires the department to develop a plan to reduce discharge levels to the new limit. In some cases, the new limit can be achieved through making reductions in permitted discharges from point sources. In other cases, it will require finding new voluntary mechanisms to do so.

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Missouri Department of Natural  
Resources'

Our Missouri Waters Initiative



## Missouri Department of Natural Resources' Our Missouri Waters Initiative

Our Missouri waters are as diverse as the varied landscapes they flow through. Missouri is blessed with natural diversity like no other state in the nation. Missouri's flowing waterways and lakes are important to our quality of life in Missouri and play an essential role in the state's overall health and economic well-being.

The department has recently begun an initiative to create a coordinated, holistic approach to protect water resources and preserve our Missouri waters. We've named this innovative statewide watershed approach ***Our Missouri Waters*** because water, like all of our natural resources, belongs to all of us. We all need to understand and protect our waters to ensure a positive future, and the department needs the help of citizens, landowners, communities, industries and local leaders for this effort to be successful.

The department selected three watersheds to focus on in the first phase of the ***Our Missouri Waters*** initiative. One of those watersheds is the **Big River Watershed**. When selecting the initial pilot watersheds, the department examined concerns such as water quality, water quantity, high-quality waters for preservation and local citizen interest.

There are a range of resources to help manage and preserve Missouri's great watersheds, such as cost-share programs for farmers to support good soil and water conservation practices and financial assistance for communities and cities.

One of the keys to this approach will be managing water resources at the local watershed level – where specific water resource management needs are best addressed. The watershed-based approach will also allow a common understanding of the roles, priorities and responsibilities of all partners and citizens within a watershed. With the diverse hydrologic and multi-water-related resources to manage, it makes sense to be able to tailor activities to the unique challenges and opportunities specific to each watershed.

By coordinating the efforts of all the agencies and individuals who have an interest in the watershed, staff and financial resources can be focused toward watershed priorities to solve water resource problems.

The process may appear complex but the overarching goal is quite simple – streamline the department's watershed planning efforts while increasing public engagement and targeting resources to increase the benefits to ***Our Missouri Waters***.

The purpose of the Big River Watershed summit is to share information about the watershed, find out what is most important to the citizens in the watershed, discuss the challenges and opportunities that exist and discuss what the citizens want to do in the future to address them.

The Department of Natural Resources along with several local and regional partners, has engaged a group of approximately 50 local leaders from a variety of backgrounds (landowners, municipal employees, farmers, stream teams, watershed groups, businesses) to participate in the summit. . We are hoping that by engaging a smaller group, we are able to have an open, productive discussion of challenges and opportunities within the watershed.

We are excited to partner with you to explore the wide range of resources available for the Big River Watershed, and to help you discover your piece of the watershed puzzle.



Big River Watershed

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State of the Big River Watershed



# State of the Big River Watershed

## Missouri Department of Conservation's Overview of The Big River Basin

- The Big River basin is located in east-central Missouri and drains 955 square miles of the Ozark Plateau in portions of six counties. Big River has eight, order five, tributaries and flows northward for 138 miles until it reaches the Meramec River.
- The majority of basin land use is forest and pasture with some row cropping along stream bottoms. However, urbanization is rapidly increasing in the lower basin. Only 5% of the basin is owned by state and federal agencies. Surveys have found that local users spend much time recreating (especially fishing) on and around Big River.
- Basin streams exhibit typical Ozarkian characteristics: good water quality and fish habitat, and representative Ozark fish assemblages. Nineteen sensitive natural communities, including good examples of Ozark creeks and Ozark springs and spring branches are present. However, damage to some aquatic habitats and the potential for serious damage to several streams exists due to past lead and barite mining activity.
- Riparian corridor habitat is fair to good, with Big River having slightly better habitat than tributary streams. About 75% of basin stream banks have either minimal or no erosion and are protected by trees or shrubs. Riparian corridors are negatively affected by riparian land use, especially along tributary streams.
- Overall, stream habitat is good with rock slides, boulders, gravel, water willow, downed logs, and root wads. However, eroded mine waste has buried aquatic habitats in some basin streams, leading to extirpation of some benthic invertebrates. This sediment is associated with elevated levels of heavy metals. Habitat quality is threatened by potential releases of mine waste. A fish consumption advisory for some fish species is present on Big River due to lead contamination.
- The basin exhibits good aquatic biodiversity. One hundred fish species, 34 mussel species, eight crayfish species, and 107 aquatic insect taxa have been found within the basin. Four fish and three mussel species are either endangered, rare, or on the State watch list.
- Maintaining and improving species diversity and habitat quality will be the main focus of management efforts. Increasing stream recreational opportunities and educating the public will be stressed. To be successful, cooperation of landowners, volunteer organizations, and other governmental agencies will be needed.





## State of the Big River Watershed (cont)

1984

**Enough, Missouri** was located at the head of the Big River in northern Iron County south of Belgrade Missouri and west of Belleview Missouri.



### *About Council Bluff Lake*

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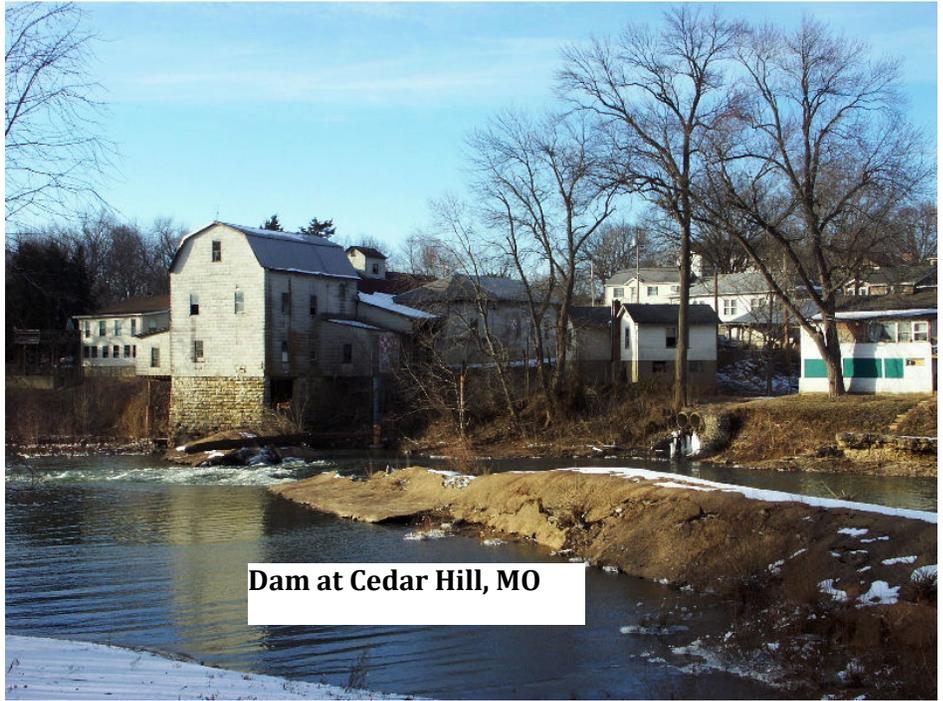
The largest lake within the Mark Twain National Forest, Council Bluff Lake was created when a dam was formed across the Big River in northern Iron County, located in Southeast Missouri. The lake is approximately 440 acres in size, with its deepest point being 87 feet. While fishing is a popular activity at the lake, it is also well known for swimming, with a 54,000 sq. ft. sand swimming beach, extremely popular in the summer. A hiking trail which circles the lake is also popular throughout the year as well.

Popular with fisherman, Council Bluff Lake offers many species such as largemouth bass, red-ear, sunfish, bluegill, crappie and catfish. Many of these species are also stocked by the Missouri Dept. of Conservation, who also control the fishing regulations in Missouri. There are two boat launch ramps available: Wild Boar Hollow and Enough. Boats are limited to 10 horsepower, with a no wake zone across the entire lake. A fishing pier is available to anglers, and fishing from the shore is also allowed.



## “BIG RIVER

The Big River is a tributary of the Meramec River in east-central Missouri. The river rises in western Iron County, near the summit of Johnson Mountain and the locale of Enough; it flows through Washington County, Saint Francois County, and Jefferson County. It forms part of the boundary between Jefferson County and Saint Francois County and also part of the boundary between Jefferson County and Washington County. It empties into the Meramec River opposite Eureka, where the Meramec forms the border between Jefferson



County and Saint Louis County. The river flows through Washington State Park, St. Francois State Park, and the Lead Belt mining district. The elevation of the river at its source is approximately 1,300 feet (400 m) above sea level and at its mouth about 400 feet (120 m). The length of the river is approximately 145 miles (233 km), while the airline distance between source and mouth is about 56 miles (90 km). Its watershed area is 955 square miles (2,470 sq. km).

The river flows through the communities of Belgrade, Caledonia, Irondale, Park Hills, Bonne Terre, Morse Mill, Cedar Hill, Byrnesville, and Byrnes Mill.

Tributaries of Big River include Flat River, Belews Creek, Turkey Creek, Mill Creek, Mineral Fork, Calico Creek, Dulin Creek, and Jones Creek.

Like many other Ozark streams, the Big River has entrenched meanders; its valley is typically about half a mile wide, sometimes much narrower, and the valley is usually from 150 to 400 feet (46 to 120 m) deep. This indicates that this river formed on a plain near sea level, which give the river its meandering nature, and then was subsequently uplifted, causing entrenchment.

About 83 miles (134 km) are navigable; however, the remains of five small mill dams makes portage necessary, due to drops of several feet or high turbulence. Otherwise, the river is gentle for canoeing, with a Class I difficulty rating. Public parks are adjacent to most of these dams, and are popular fishing spots. Due to steady infeed of springwater, this river is navigable in all seasons.

Major pollution sources near Park Hills are due to historic mining activities, which including erosion from mine tailings piles and leaking mine dams.

Major gamefish commonly found in the river include Largemouth bass, Smallmouth bass, Spotted bass, Rock bass, Longear sunfish, Bluegill, Channel catfish, Flathead catfish, and Redhorse suckers.”

[ <http://www.missouricanoe.org/rivers.html>]

# State of the Big River Watershed (continued)

## History of Lead Mining in Missouri and the Big River Watershed

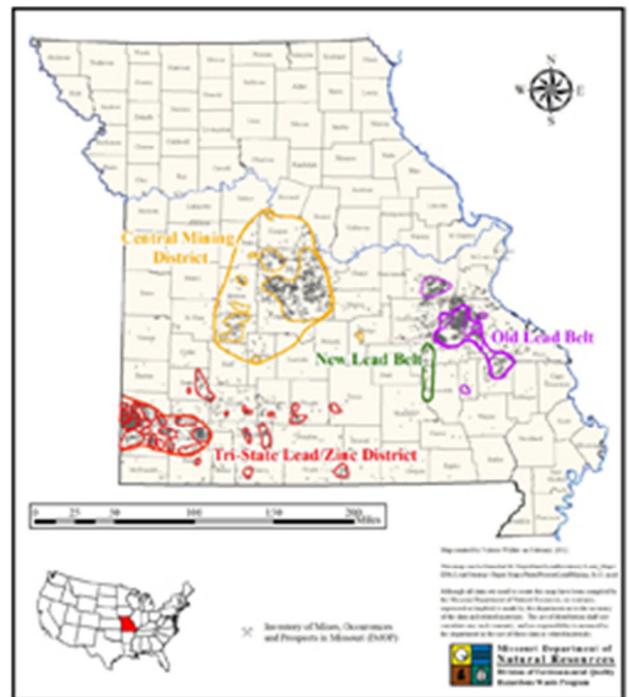
(Missouri Department of Natural Resources, 2013)

It is no coincidence that Missouri's official State Mineral is Galena, the major source of lead ore. For most of the late 19th and early 20th Centuries, Missouri was the global leader in lead production, and even today some of the largest and most important remaining lead deposits in the world are located in southeast Missouri. But well before Missouri was even a state, the region was widely recognized as a center of mining, milling and smelting of lead; the first recorded instance of lead mining in Missouri was by French explorers in the early 1720s. Missouri also has important resources of barium and zinc ores, many of which tend to be co-located with the lead mining areas.

Lead production has played an important role in the economic growth and development of Missouri. Estimates of the aggregate lead production in Missouri since mining began in the early 18th Century, top 17 million tons, at a value of nearly 5 billion dollars. Today, Missouri has the largest active primary lead smelter in the United States (Herculaneum) and the largest secondary lead smelter in the world (Buick).

There were three main mining districts in Missouri. The map to the right shows the approximate locations of these districts and a short description is provided below.

- **Southeast Missouri Lead District, or SEMO**  
This includes the Old Lead Belt and the currently active Viburnum Trend (New Lead Belt).
- **Tri-State District**  
This includes approximately 14 counties in southwest Missouri, Cherokee County, Kansas and Ottawa County, Oklahoma.
- **Central District**  
This is a 600 square mile area centered around Lake of the Ozarks. The Central District produced much less ore than the other two districts.



**Mining in the Old Lead Belt**The Old Lead Belt encompassed Bonne Terre, Desloge, Park Hills, Doe Run and Leadwood (predominantly St. Francois County, with small operations in Washington and Madison counties). Between 1864 and 1972, St. Joe operated numerous lead/zinc mines and mills in the area. During the first 70 years as many as 14 other companies operated in the Old Lead Belt, including ASARCO, St. Louis Smelting and Refining (later National Lead) and Flat River Lead Company. By the mid-1930s, St. Joe owned all competing operations (Kiilsgaard, et al, 1967).

In 1864 drilling led to discovery of deeper ores and underground mining began. Galena was the primary ore mineral. Ore was found in the La Motte down to 100 feet below the contact with the Bonne Terre, and throughout the 400-foot thick Bonne Terre. Mineralization was disseminated in favorable parts of the Bonne Terre, with galena replacing dolomite; ore was also found at bedding-plane contacts, in fracture zones and as breccia cement. Ore bodies spread laterally hundreds of feet and vertically up to 200 feet.

## History of Lead Mining in Missouri and the Big River Watershed (Continued)

### Mining in Southeast Missouri

Lead has been mined in southeast Missouri since before 1700, when French explorers developed deposits under land grants from the French crown. Lead has been produced from Mississippi Valley-type deposits, or MVT's, in several world-class districts: the Old Lead Belt, Mine La Motte and Fredericktown and the Viburnum Trend. The Washington County Barite District, which once led the world in barite production, has also been a significant lead producer. The entire region is sometimes referred to as the Southeast Missouri Lead District. Lead-zinc-barite mineralization occurs in every formation from the upper Cambrian La Motte Sandstone to the lower Ordovician Jefferson City Formation, the youngest formation present in the region. Missouri has been the leading producer of lead in the United States for well over a century and has also been the world's leading producer.

Numerous small mines produced as much as 1,500 pounds a day of ore. Mining was from small surface pits and shallow shafts, often with tens of pits or shafts in a small area. In the Potosi area, Moses Austin erected the first reverberatory furnace, and by 1802 was smelting ore for the entire Potosi region, tripling the yield per pound. Other discoveries made during this time led to lead mining in what are now Washington, Jefferson, Madison and St. Francois counties.

Most lead mining prior to 1869 was from scattered and shallow workings above the water table. Workings were generally small and closely packed to recover the maximum amount of ore.

In 1864 the St. Joseph Lead Company purchased lands in the vicinity of the town of Bonne Terre, which contained rich deposits of galena at or near the surface. This area became known as the Lead Belt, later called the Old Lead Belt.

Declining Old Lead Belt reserves led to exploration in the early 1950s on the northern and western margins of the St. Francois Mountains. The Indian Creek deposit was discovered north of the St. Francois Mountains in 1948 by St.

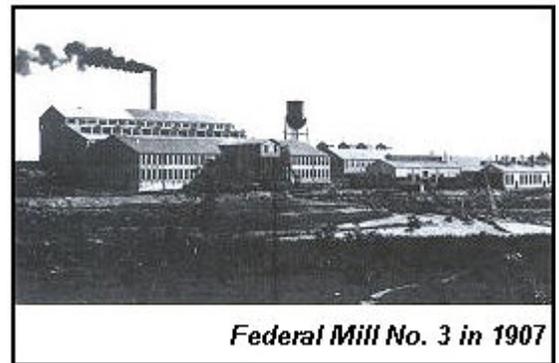
Joe, and began production in 1953. St. Joe drilled the discovery hole for the Viburnum Trend in 1955, and the first ore from the new district was shipped from St. Joe's Number 27 mine in Crawford County in mid-1960. The Viburnum Trend, located in Crawford, Washington, Iron, Dent, Reynolds and Shannon counties, produces lead, zinc, copper and silver. Further exploration led to the opening of the 45-60 mile-long ore trend. The last mine in the Old Lead Belt ceased operation in 1972; Indian Creek closed in 1982.

### Mining in the Washington County Barite District

The Washington County Barite District encompasses most of Washington County and adjacent parts of St. Francois, Jefferson and Franklin counties, including the Potosi-Shirley-Palmer area. Barite and galena occur in fractured bedrock and in red clay residuum weathered from the Potosi and Eminence dolomites; most galena was exposed to an oxidizing environment. Barite and galena in veins and small isolated residual deposits is associated with the Gasconade dolomite in northeastern Washington County and southeastern Franklin County. The deposits have associated limonite, pyrite and sphalerite; considerable galena was recovered from the district before barite mining and as a by-product.

## History of Lead Mining in Missouri and the Big River Watershed (Continued)

Mining was often done by farmers who operated small mines during the winter to supplement their income. In 1818, H.R. Schoolcraft noted of the Potosi area that there were a great number of "old diggings" in the area (Winslow, 1894). In the early 1900s, several thousand people mined galena and



*Federal Mill No. 3 in 1907*

barite in Washington County. Small pits and hand mining gave way in 1924 to mechanized mining. Barite mining boomed in 1926, when it began to be used in oil drilling mud; this also increased production of associated galena. Washington County led the nation and world in barite production for a number of years. Production started to decline in 1985, primarily due to overseas competition (Seeger, 1997, USDA Forest Service, 1999). There is currently no barite production in Missouri.

Until shortly after 1900, barite and galena production was by hand mining and cleaning. Most mining was in small pits and shafts sunk into residuum, and that sometimes penetrated bedrock. Mining tools were a pick, a wooden shovel and a sledge hammer. Ore was raised in buckets, hand-cobbed (hand-separated) from surrounding rock, and cleaned of clay by shaking in a rattle box. Galena fines would have remained in the clay. Careful spacing of pits and shafts allowed recovery of a fourth to a half of the barite and galena available (Wharton, 1972). The first note of mechanization was by Schoolcraft in 1819, when a drill was used for blasting (Winslow, 1894).

By the late 1800s, a greater number of mines penetrated the bedrock at depths of 100 feet or greater (Winslow, 1894). In some deeper mines, vertical crevices were seen to extend from the mine level to the surface of the bedrock. The crevices were originally clay-filled (Winslow, 1894), however, this material was removed during mining of the ore in the crevice.

In 1904, the Point Mining and Milling Company used an early steam shovel and wet-process mill (Wharton, 1972). Hand mining, however, remained the dominant method until 1924. Around 1924, the Eagle-Picher Company and National Pigments and Chemical Company began production with mechanically stripping residuum and processing the material in a washer and jig plant. Bedrock was not mined. Over-sized material was still broken by hand. Jig washers were used to remove the clay after which the material was crushed and separated using a jig or concentration table. A jig shakes the material and separates it by weight; the lighter clay, gravel and dolomite are concentrated separately from the denser barite and galena. However, galena fines would have remained with the clay and gone to tailings ponds. The galena was then separated by hand from the barite. Due to severe unemployment in Washington County, most operations returned to hand mining by 1931; mechanized mining returned in by 1942 (Wharton, 1973).

After 1942, mechanized mining utilized shovels and front-end loaders. Only residuum was mined and processed; no bedrock was mined. Residuum was loaded into trucks and hauled to the washer where clay was removed with high pressure water in a rotary breaker. At this point, the barite began to break from the other rock, and also began to be broken into smaller pieces. It then passed through log washers (parallel counter-rotating cylinders with protruding inter-meshing paddles) that removed more clay and further broke the barite, or trommels (a rotating screen or sieve), and onto the jigs, where the barite and galena were separated from any remaining waste rock (Wharton, 1972). The majority of the waste material that was not placed into tailings ponds was in filled into the existing pit; large tailings piles were generally not created. Some small tailings piles were generated by later mining. Again, the processing method lost galena fines into the clays and tailings ponds.

Many of the later large mining operations reworked lands that had experienced hand mining for lead or barite, as considerable barite ore remained in the material left between the pits and shafts. In some cases, the older pits were used as an exploration guide.



## State of the Big River Watershed (Continued)

### Pollutants of concern in the Big River Watershed

- Under the federal Clean Water Act, the **Total Maximum Daily Load, also known as TMDL**, program provides a framework for identifying and cleaning up impaired waters.
- **Section 303(d)** requires states to list impaired waters for which the necessary pollution controls have not yet been required and for which a TMDL study has not been written.
- **The state is required to develop a Total Maximum Daily Load for all waters on the 303(d) list.**
  - The TMDL is a mathematical calculation of the amount of a specific pollutant a water body can absorb and still meet water quality standards.
  - The calculation takes into account the waterway morphology, landforms, soil types and levels of residual pollutants in stream beds and alluvial banks.
  - Each TMDL document will include allocations of the acceptable load for all sources of the pollutant.
  - Developed in conjunction with a TMDL, and implementation plan will identify how the load will be reduced to a level that will protect water quality.

### Big River watershed (HUC 07140104) Bodies of water that have been determined to be impaired 303(d) Impaired Waters

<i>WB ID No.</i>	<i>WB Name</i>	<i>Size</i>	<i>Pollutant</i>	<i>Source</i>	<i>TMDL Scheduled*</i>
2080	Big R.	81.3	Cadmium (S)	Old Lead Belt tailings	2014
2080	Big R.	81.3	Zinc (S)	Old Lead Belt tailings	2014
2177	Coonville Cr.	1.3	Lead	Source Unknown	2025
2166	Eaton Br.	1.2	Cadmium (S)	Leadwood tailings pond	2014
2166	Eaton Br.	1.2	Cadmium	Leadwood tailings pond	2014
2166	Eaton Br.	1.2	Lead (S)	Leadwood tailings pond	2014
2166	Eaton Br.	1.2	Zinc (S)	Leadwood tailings pond	2014
2166	Eaton Br.	1.2	Zinc	Leadwood tailings pond	2014
2168	Flat River Cr.	10	Cadmium	Old Lead Belt tailings	2014
2171	Koen Cr.	1	Fishes Bioassessments	Source Unknown	2022
2113	Salt Pine Cr.	1.2	Aquatic Macroinvertebrate Bioassessments	Barite tailings pond	2022
2170	Shaw Br.	1.2	Cadmium (S)	Federal tailings pond	2014
3763	Tiff Cr.	2.1	Fishes Bioassessments	Source Unknown	2022
2114	Trib. Old Mines Cr.	1.5	Sedimentation/Siltation (S)	Barite tailings pond	2014
3282	Turkey Cr.	2.4	Cadmium	Bonne Terre chat pile	2014
3282	Turkey Cr.	2.4	Lead	Bonne Terre chat pile	2014
3282	Turkey Cr.	2.4	Zinc	Bonne Terre chat pile	2014
3938	Trib. To Flat River Cr.	0	Zinc	Mill tailings (Aban.)	2014
7297	Terre Du Lac Lakes	103	Chlorophyll-a	Terre du Lac subdivision	2016
7297	Terre Du Lac lakes	103	Total Nitrogen	Terre du Lac subdivision	2016

## Big River watershed (HUC 07140104)

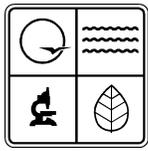
### Total Maximum Daily Load (TMDL) determinations that have been approved for the Big River Watershed

#### Approved TMDLs

<i>WB ID No.</i>	<i>WB Name</i>	<i>Pollutant</i>	<i>Approval Date</i>	<i>NPS contribution</i>
1707.02	Mississippi R.	PCB	11/3/2006	Minor
2074	Big R.	Lead	3/24/2010	Major
2080	Big R.	Lead	3/24/2010	Major
2080	Big R.	NVSS	3/24/2010	Major
2120	Shibboleth Br.	Inorganic Sediment	12/23/2010	Major
2120	Shibboleth Br.	Lead, zinc, cadmium – dissolved and in sediment [these were not 303(d) listed]*	12/23/2010	Major
2128	Pond Cr.	Inorganic Sediment	12/23/2010	Major
2128	Pond Cr.	Lead, zinc, cadmium – dissolved and in sediment [these were not 303(d) listed]*	12/23/2010	Major
2168	Flat River Cr.	Lead	3/24/2010	Major
2168	Flat River Cr.	Zinc	3/24/2010	Major
2168	Flat River Cr.	NVSS	3/24/2010	Major
2170	Shaw Br.	Lead	3/24/2010	Minor
2170	Shaw Br.	NVSS	3/24/2010	Minor
3282	Turkey Cr.	BOD	1/13/2005	None
3282	Turkey Cr.	VSS	1/13/2005	None

\*These metals were addressed in the Shibboleth Br. and Pond Cr. TMDLs, despite these pollutants not being listed at the time. Available data suggested that these pollutants were impairing the streams.

\*TMDL schedule is subject to change



Missouri Department of Natural Resources  
**Total Maximum Daily Load Information Sheet**

## Shaw Branch

---

### Water Body Segment at a Glance:

**County:** St. Francois  
**Nearby Cities:** Elvins  
**Length of impairment:** 2 miles  
**Pollutant:** Nonvolatile Suspended Solids (NVSS) and Lead  
**Source:** Federal Abandoned Mine Land



**TMDL Priority Ranking:** Medium

---

### Description of the Problem

#### Beneficial uses of Shaw Branch

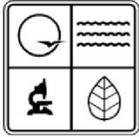
- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life
- Human Health Protection (Fish Consumption)

#### Use that is impaired

- Protection of Warm Water Aquatic Life

#### Standards that apply

- The NVSS impairment is based on exceedence of the general criteria contained in Missouri's Water Quality Standards, 10 CSR 20-7.031(3)(A), (C) and (G) where it states:
  - Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses.
  - Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses.
  - Waters shall be free from physical, chemical or hydrologic changes that would impair the natural biological community.
- The Water Quality Standards for metals found in 10 CSR 20-7.031(4)(B)1 state:
  - Water contaminants shall not cause the criteria in Tables A and B to be exceeded. Concentrations of these substances in bottom sediments or waters shall not harm benthic organisms and shall not accumulate through the food chain in harmful concentrations, nor shall state and federal maximum fish tissue levels for fish consumption be exceeded.
  - The numeric standards for lead are found in Table A. These standards are dependent on the hardness of the water and are expressed in dissolved form. :



Missouri Department of Natural Resources

## Total Maximum Daily Load Information Sheet

### Coonville Creek

---

#### Water Body Segment at a Glance:

<b>County:</b>	St. Francois
<b>Nearby City:</b>	Bonne Terre
<b>Water Body ID:</b>	2177
<b>Segment Length:</b>	1.3 miles
<b>Watershed Size:</b>	3.9 square miles
<b>Pollutants:</b>	Lead dissolved in water
<b>Source:</b>	Unknown



Statewide Map Showing Location of Watershed

**Scheduled for TMDL development: 2025**

---

#### Description of the Problem

##### Designated beneficial uses of Coonville Creek:

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life
- Protection of Human Health (Fish Consumption)
- Whole Body Contact Recreation – Category B

##### Uses that are impaired:

- Protection of Warm Water Aquatic Life

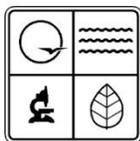
##### Standards that apply

Chronic and acute criteria for dissolved lead are found in Table A of Missouri's water quality standards at 10 CSR 20.7.031. These criteria are hardness dependent and are calculated using the following equations.

- Acute:  $e(1.273 \cdot \ln(\text{Hardness}) - 1.460448) * (1.46203 - (\ln(\text{Hardness}) * 0.145712))$
- Chronic:  $e(1.273 \cdot \ln(\text{Hardness}) - 4.704797) * (1.46203 - (\ln(\text{Hardness}) * 0.145712))$

In addition to the specific numeric criteria found in Table A, the following narrative criteria in Missouri's water quality standards also pertain to this lead impairment.

- Waters shall be free from substances or conditions in sufficient amounts to result in toxicity to human, animal, or aquatic life [10 CSR 20-7.031(3)(D)].
- Waters shall be free from physical, chemical, or hydrologic changes that would impair the natural biological community [10 CSR 20-7.031(3)(G)].



Missouri Department of Natural Resources

## Total Maximum Daily Load Information Sheet

### Shibboleth Creek

(Effective Oct. 30, 2009, name corrected in Missouri Water Quality Standards to “Shibboleth Branch.”)

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#### Water Body Segment at a Glance:

<b>County:</b>	Washington
<b>Nearby Cities:</b>	Cadet and Shibboleth
<b>Length of impaired segment:</b>	3.0 miles
<b>Length of impairment within segment:</b>	0.5 miles
<b>Pollutant:</b>	Inorganic Sediment
<b>Source:</b>	Mill tailings (abandoned)
<b>Water Body ID:</b>	2120



State map showing location of watershed

**Scheduled for TMDL Development:** Approved by EPA 2010

---

#### Description of the Problem

##### Designated Beneficial uses of Shibboleth Branch

- Livestock and Wildlife Watering
- Protection of Warm-Water Aquatic Life
- Protection of Human Health (Fish Consumption)

##### Use that is impaired

- Protection of Warm-Water Aquatic Life

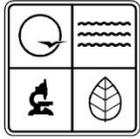
##### Standards that apply

Standards for inorganic sediment may be found in the general criteria section of the WQS, 10 CSR 20-7.031(3)(A), (C) and (G) where it states:

- (A) Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses.
- (C) Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses.
- (G) Waters shall be free from physical, chemical or hydrologic changes that would impair the natural biological community.

And from 10 CSR 20-7.031(4)(H):

- (H) Solids. Water contaminants shall not cause or contribute to solids in excess of a level that will interfere with beneficial uses. The stream or lake bottom shall be free of materials which will adversely alter the composition of the benthos, interfere with



Missouri Department of Natural Resources  
**Total Maximum Daily Load Information Sheet**

## Big River and Flat River Creek

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### Water Body Segment at a Glance:

<b>County:</b>	St. Francois/Jefferson
<b>Nearby Cities:</b>	Leadwood to Eureka
<b>Length of impairment:</b>	Big River - 93 miles
<b>Water Body IDs:</b>	2074 and 2080
	Flat River Creek – 5 miles
<b>Water Body ID:</b>	2168
<b>Pollutants:</b>	Lead, Nonvolatile Suspended Solids (NVSS)
<b>Source:</b>	Old Lead Belt Abandoned Mine Land
<b>Other Pollutant:</b>	Zinc (Flat River Creek only)
<b>Source:</b>	Elvins tailings pile



State Map Showing Location of Watershed

**Note:** See also the Information Sheet for cadmium and zinc, added to the 2008 303(d) list for all segments.

**TMDL Priority Ranking:** TMDL Approved 2010

---

### Description of the Problem

#### Beneficial uses of both Big River and Flat River Creek:

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life
- Human Health Protection (Fish Consumption)
- Whole Body Contact Recreation

#### Uses that are impaired:

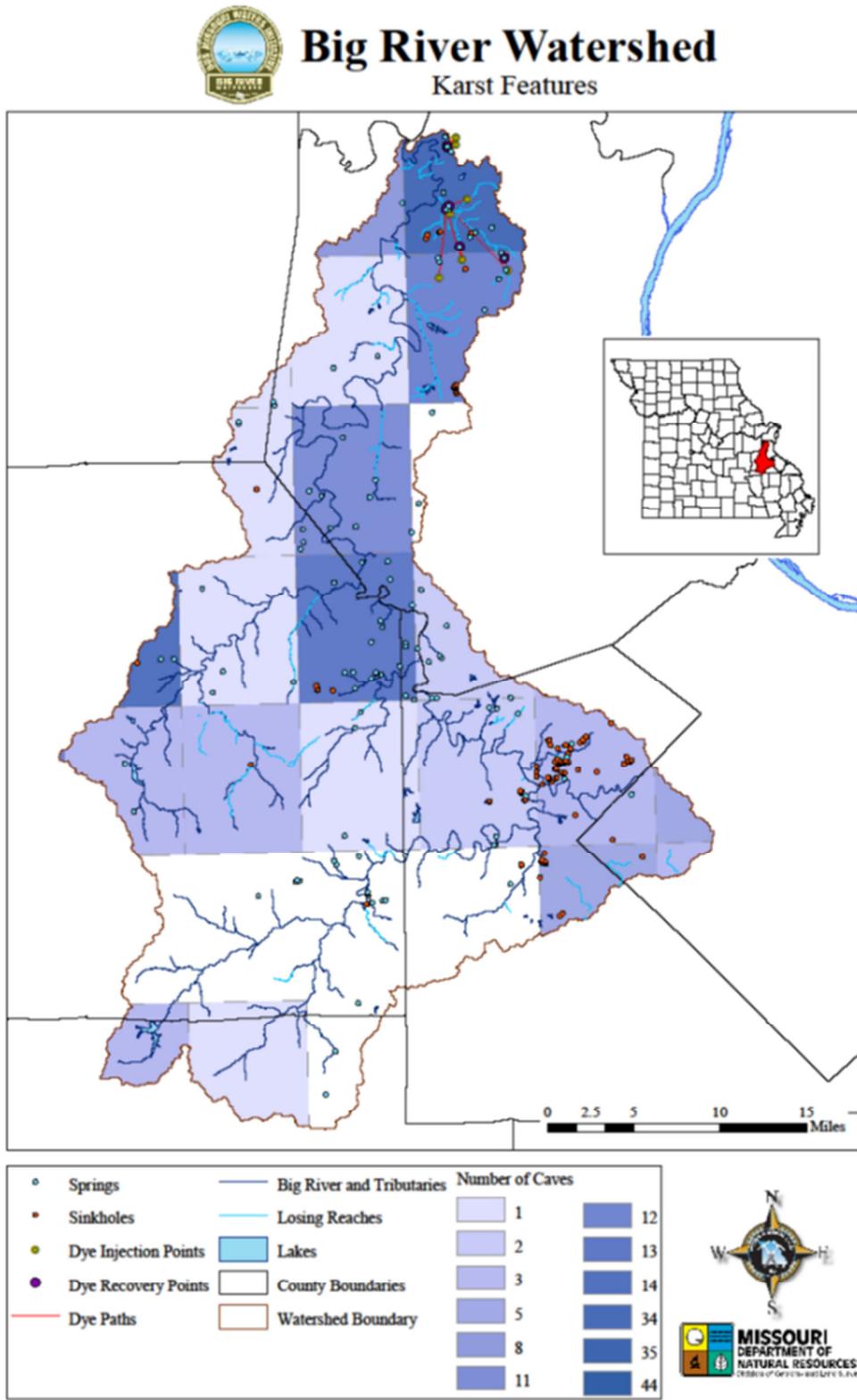
- Protection of Warm Water Aquatic Life
- Human Health Protection (Fish Consumption)

#### Standards that apply:

- Missouri Water Quality Standards for metals found in 10 CSR 20-7.031(4)(B)1 state:
  - Water contaminants shall not cause the criteria in Tables A and B to be exceeded. Concentrations of these substances in bottom sediments or waters shall not harm benthic organisms and shall not accumulate through the food chain in harmful concentrations, nor shall state and federal maximum fish tissue levels for fish consumption be exceeded.
  - Current lead and zinc standards (Table A) for the protection of aquatic life use are expressed in dissolved form. They are hardness dependent and are calculated from these formulas:

# State of the Big River Watershed (Continued)

## Stream Hydrology and Karst Features



- Numerous karst features:
  - 103 sinkholes
  - 113 springs
  - 221 caves
- Two points outside watershed connect to spring within watershed from trace study

## State of the Big River Watershed (Continued)

Streams in the Big River Basin							
Stream Name	Length	Stream Name	Length	Stream Name	Length	Stream Name	Length
Allen Branch	5.59	Drv Creek	9.06	McClura Branch	4.75	Shibboleth Branch	4.30
Andrews Branch	2.70	Drv Creek	12.85	Middle Fork Fourche a	5.27	Simpson Branch	3.86
Arnault Branch	4.51	Dulin Creek	4.66	Mill Branch	4.06	Skullbones Creek	3.68
Ashlev Branch	2.28	Dutch Creek	3.91	Mill Creek	13.54	Smith Branch	1.33
Banister Branch	2.73	East Branch Mill	2.40	Mine a Breton Creek	14.37	Sugar Camp Branch	1.77
Bates Creek	6.10	Eaton Branch	1.42	Mineral Fork	16.72	Swan Branch	4.81
Bear Creek	4.09	Ebo Creek	4.82	Montaomerv Creek	4.11	Svcamore Creek	3.60
Bear Creek	4.44	Flat Creek	2.93	Mud Town Creek	1.17	Taagett Branch	1.70
Bear Creek	5.03	Flat River	14.74	North Fork Clear Creek	4.26	Telleck Branch	2.77
Bee Run	4.95	Fountain Farm	4.42	North Fork Fourche a	5.09	Templetown Creek	2.01
Belews Creek	9.22	Fourche a Renault	13.39	North Fork Jones Creek	2.81	Terre Bleue Creek	20.98
Belleview Creek	5.28	Furnace Creek	5.17	Number Seven Creek	2.10	Three Hill Creek	6.62
Bethlehem Creek	3.83	Galliaher Creek	1.69	Old Mines Creek	8.63	Three Rivers Creek	5.30
Bia River	145.36	Goose Creek	4.53	Old Prairie Branch	0.86	Tiff Creek	6.30
Blav Creek	4.84	Grevs Branch	3.11	Owl Creek	3.70	Townsen Creek	4.10
Bourqawich	2.88	Gus Creek	3.53	Parker Creek	1.61	Turkev Creek	2.43
Bourne Creek	4.82	Harris Branch	2.89	Perkins Creek	3.38	Turkev Creek	3.30
Bouver Creek	3.89	Havden Creek	3.77	Pike Run	5.41	Tvrev Creek	5.52
Brock Creek	6.08	Hazel Run	3.32	Pond Creek	5.44	Walker Branch	2.95
Buck Creek	4.82	Heads Creek	9.24	Primrose Creek	3.47	Wallen Creek	4.51
Butcher Branch	3.30	Hoowell Creek	4.15	Pucket Branch	3.53	Wallen Creek	6.54
Cabanne Course	6.11	Hughes Creek	2.34	Rabbitville Branch	2.64	West Branch Mill	4.44
Cadet Creek	1.92	Isum Creek	2.77	Race Creek	1.45	West Fork Jones	5.35
Calico Creek	6.40	Jacobs Creek	3.45	Reid Creek	7.06	Wine Creek	2.01
Carson Creek	2.83	Janes Creek	4.87	Revnolds Branch	1.10	<b>Total</b>	<b>771.86</b>
Cedar Creek	15.12	Jones Creek	3.54	Revnolds Creek	2.11		
Cedar Falls	1.64	Keesling Branch	2.69	Robidoux Branch	1.22		
Cedar Run	2.07	Keves Branch	1.55	Rockv Branch	3.06		
Chambers Creek	2.47	Knox Branch	2.94	Roque Creek	3.48		
Clancy Branch	0.50	Koen Creek	5.74	Rubeneau Branch	2.40		
Clear Creek	7.85	Kruze Creek	2.38	Rutledge Run	3.72		
Clear Creek	8.13	Little Fourche a	5.80	Salem Creek	4.98		
Coonville Creek	3.71	Logan Creek	2.76	Saline Creek	4.25		
Crawfish Branch	1.35	Lost Creek	7.17	Salt Pine Creek	2.71		
Dent Branch	4.88	Maddin Creek	3.61	Sam Branch	1.47		
Ditch Creek	6.01	Mammoth Creek	0.77	Sand Creek	3.57		
Drv Branch	3.58	Mammoth Creek	2.84	Scott Branch	4.81		
Drv Creek	2.36	Maupin Creek	4.92	Shaw Branch	1.09		

# State of the Big River Watershed (Continued)

## Hydrology

### Precipitation

The average annual precipitation for the Big River basin is 41 inches/year, with 29 inches being rainfall (MDNR 1986). Precipitation usually peaks in May (13") and is lowest in February (6"). Average annual runoff is 12.8 inches.

### U.S. Geological Survey Gaging Stations

Three U.S. Geological Survey (USGS) gaging, all on Big River, are active within the basin (Figure Hy01).

Five other low-flow, partial-recording gaging stations were operated on Big River, Dry Branch, Hopewell Spring, Mineral Fork, and Old Mines Creek until the early 1970s. They are currently inactive.

### Streamflow Characteristics

Big River's average annual discharge is 862 cubic feet per second (cfs) at Byrnesville (USGS 1994). Mean streamflow is lowest in August and highest in April. The lowest and highest instantaneous flows recorded, 25 cfs (August 30, 1936) and 63,600 cfs (September 25, 1993), occurred at the Byrnesville gaging station (USGS 1994). However, an estimated discharge (from high-water marks) of 80,000 cfs, at Byrnesville on August 21, 1915, may have been the highest instantaneous flow (USGS 1994). Flows of 116 cfs, 337 cfs, and 1,720 cfs were exceeded 90%, 50%, and 10% of the time, respectively, at the Byrnesville gaging station.

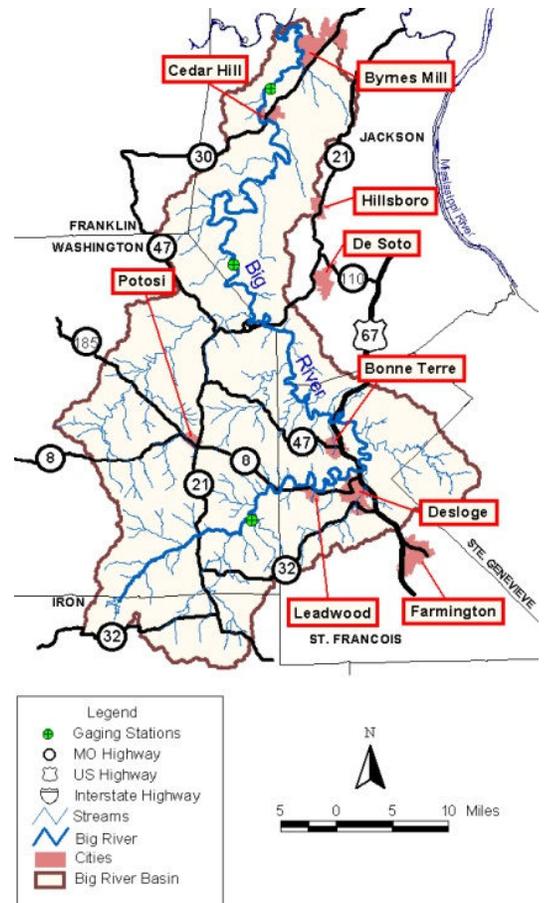


Figure Hy 01

### US Geological Survey Gage Stations-Real Time Flow Data

Real time flow data can be found on the U.S. Geological Survey website. Websites of interest include:

USGS Big River near Richwoods, MO

[http://waterdata.usgs.gov/nwis/uv/?site\\_no=07018100&PARAMeter\\_cd=00065,00060,00062,72020](http://waterdata.usgs.gov/nwis/uv/?site_no=07018100&PARAMeter_cd=00065,00060,00062,72020)

USGS Big River at Byrnesville, MO

[http://waterdata.usgs.gov/nwis/uv/?site\\_no=07018500&PARAMeter\\_cd=00065,00060,00062,72020](http://waterdata.usgs.gov/nwis/uv/?site_no=07018500&PARAMeter_cd=00065,00060,00062,72020)

USGS Big River below Bonne Terre, MO

[http://waterdata.usgs.gov/nwis/uv/?site\\_no=07017610&PARAMeter\\_cd=00065,00060,00062,72020](http://waterdata.usgs.gov/nwis/uv/?site_no=07017610&PARAMeter_cd=00065,00060,00062,72020)

USGS Big River at Irondale, MO

[http://waterdata.usgs.gov/nwis/uv/?site\\_no=07017200&PARAMeter\\_cd=00065,00060,00062,72020](http://waterdata.usgs.gov/nwis/uv/?site_no=07017200&PARAMeter_cd=00065,00060,00062,72020)

## State of the Big River Watershed (Continued)

### Geology

#### Physiographic Region

The Big River basin ([Figure Ge01](#)) lies within two subdivisions (Salem Plateau and St. Francois Mountains) of the Ozark Plateau physiographic region (MDNR 1986). Land elevations range from 435 feet above sea level at the mouth of Big River to 1,740 feet in the headwaters at Buford Mountain.



Figure Ge01

#### Geology

The Big River basin contains geologic formations ([Figure Ge02](#)) ranging in age from Mississippian to Precambrian. The majority of basin streams flow through the Salem Plateau, which is a dissected plateau of sedimentary rock topped by a thin layer of glacial loess. This plateau commonly forms rolling to narrowly-cut river valleys. As Big River flows northward, it cuts through progressively younger limestone and dolomite. Despite Karst topography being locally prominent, few springs are present. Sandstone is common in Jefferson County and shale becomes prominent in the lower basin.

Substantial deposits of lead, zinc, copper, magnesium, and barite have attracted mining operations to Jefferson, St. Francois, and Washington counties beginning over 200 years ago (MDNR 1984). The southeastern portion of the basin drains the northern edge of the St. Francois Mountains which feature rugged, igneous peaks thought to be unaltered from their time of creation. Since these formations are highly-resistant to erosion, streams tend to be high gradient and form very narrow river valleys through thin residuum.

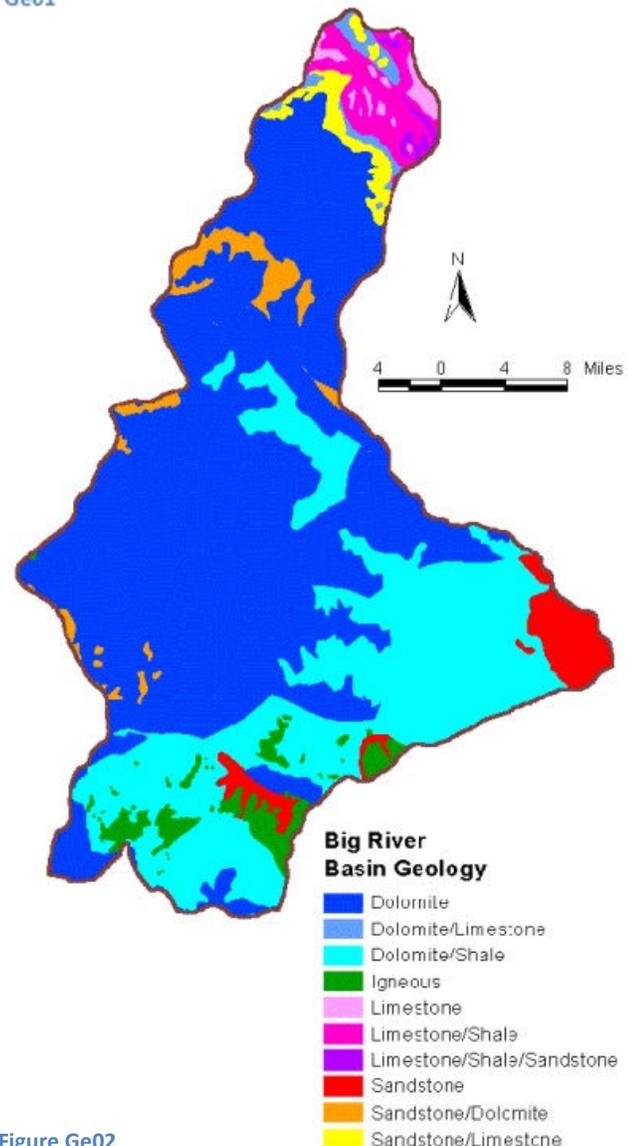
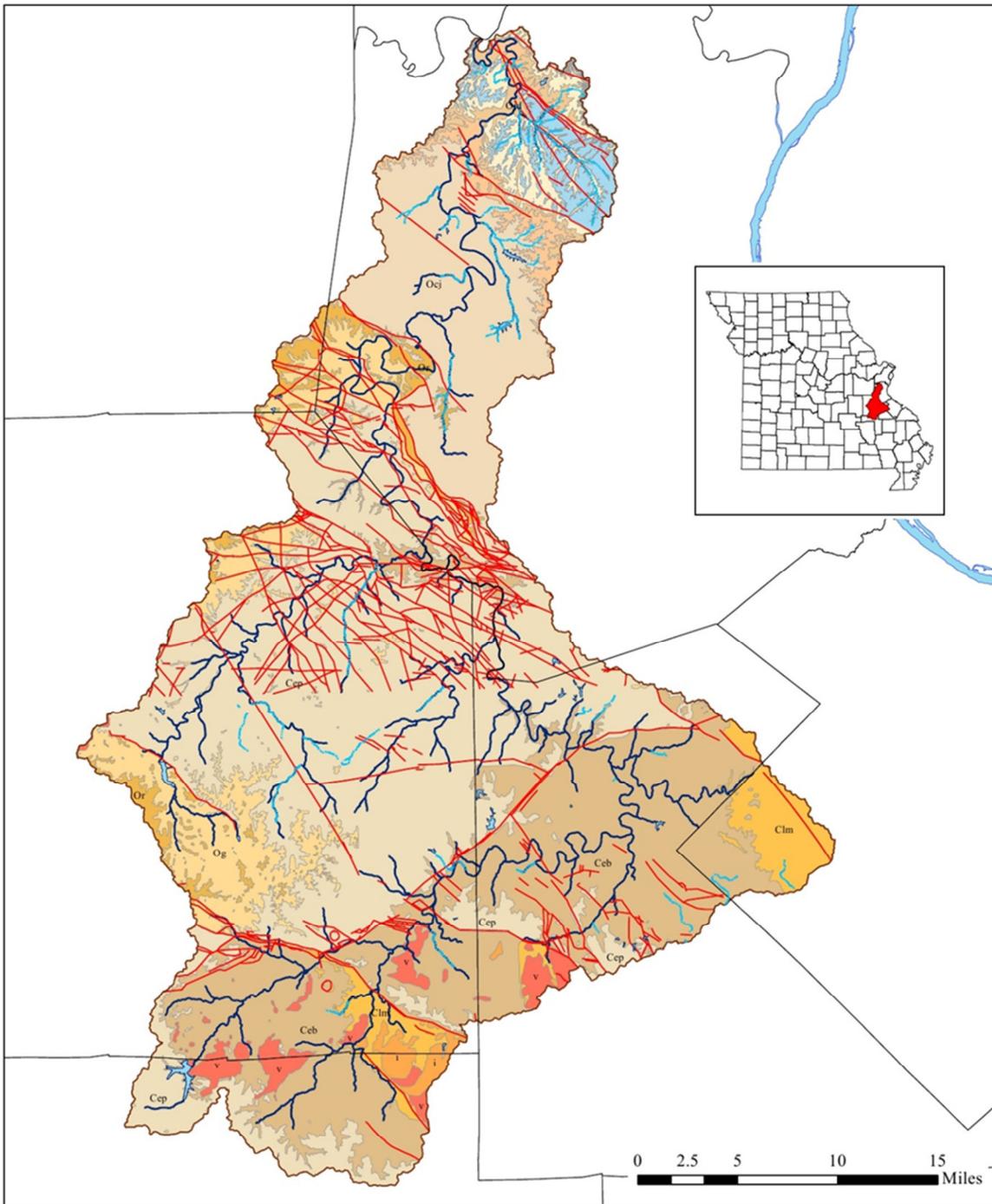


Figure Ge02

# State of the Big River Watershed (Continued)



## Big River Watershed Geology



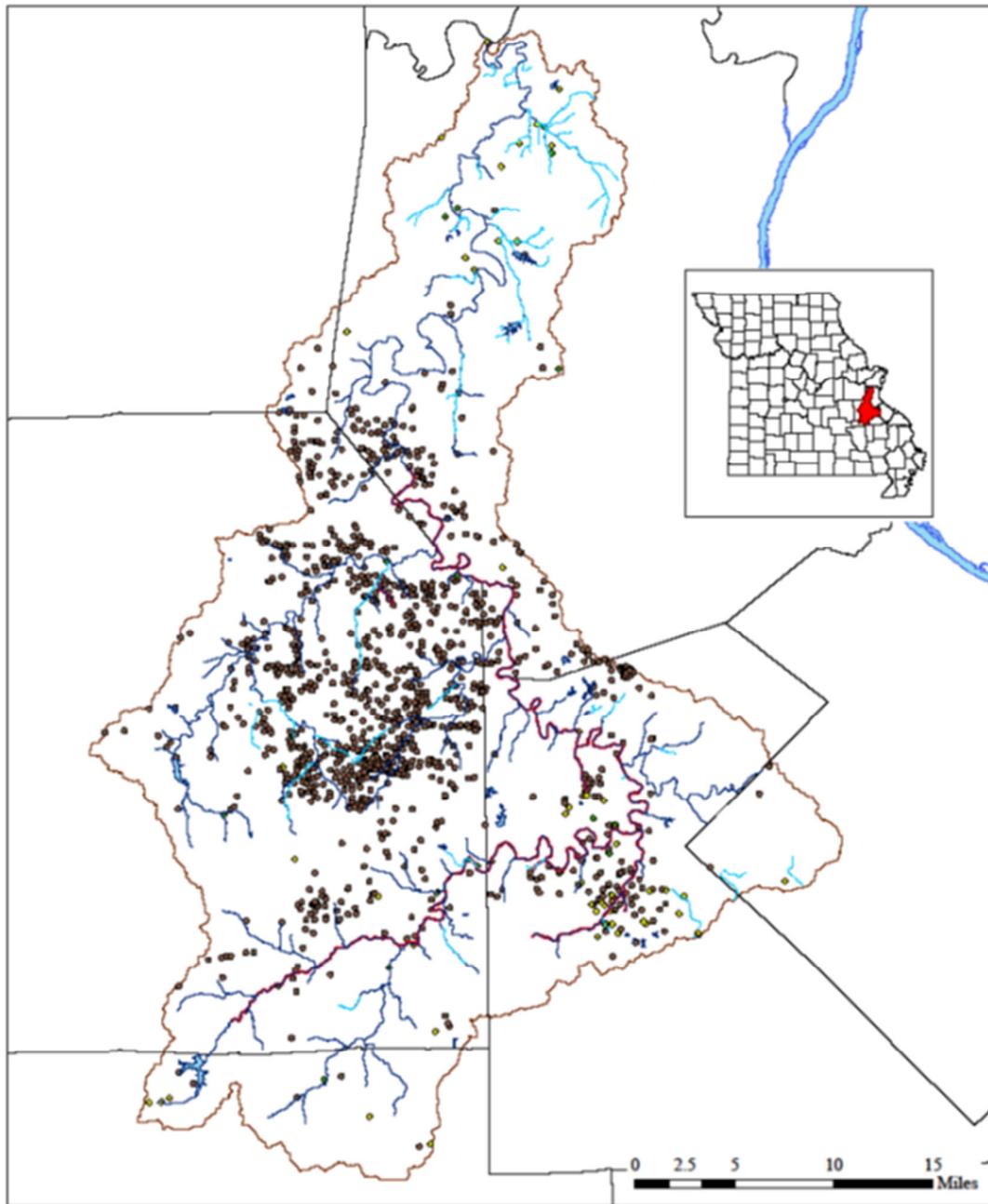
Geologic Units	
Big River and Tributaries	<b>Pennsylvanian</b>
Losing Reaches	<b>P(u)</b> Pennsylvanian undifferentiated
Geologic Structures	<b>Mississippian</b>
Watershed Boundary	<b>Mo</b> Osagean Series
Lakes	<b>Devonian</b>
County Boundaries	<b>(D(u))</b> Devonian undifferentiated
	<b>Ordovician</b>
	<b>Ocj</b> Cotter/Jefferson City Dolomite
	<b>Or</b> Roubidoux Formation
	<b>Og</b> Gasconade Dolomite
	<b>Omk</b> Cincinnati Series and Kimmiswick Limestone
	<b>Odp</b> Decorah and Plattin Groups
	<b>Ojd</b> Joachim Dolomite and Dutchtown Formation
	<b>Ospe</b> St. Peter Sandstone and Everton Formation
	<b>Cambrian</b>
	<b>Cep</b> Eminence and Potosi Dolomites
	<b>Ceb</b> Elvins Group and Bonneterre Dolomite
	<b>CIm</b> Lamotte Sandstone
	<b>Precambrian</b>
	<b>i</b> St. Francois Mountains Intrusive Suite
	<b>y</b> St. Francois Mountains Volcanic Supergroup
	<b>Diabase dikes and sills</b>



# State of the Big River Watershed (Continued)



## Big River Watershed Historic and Active Mining



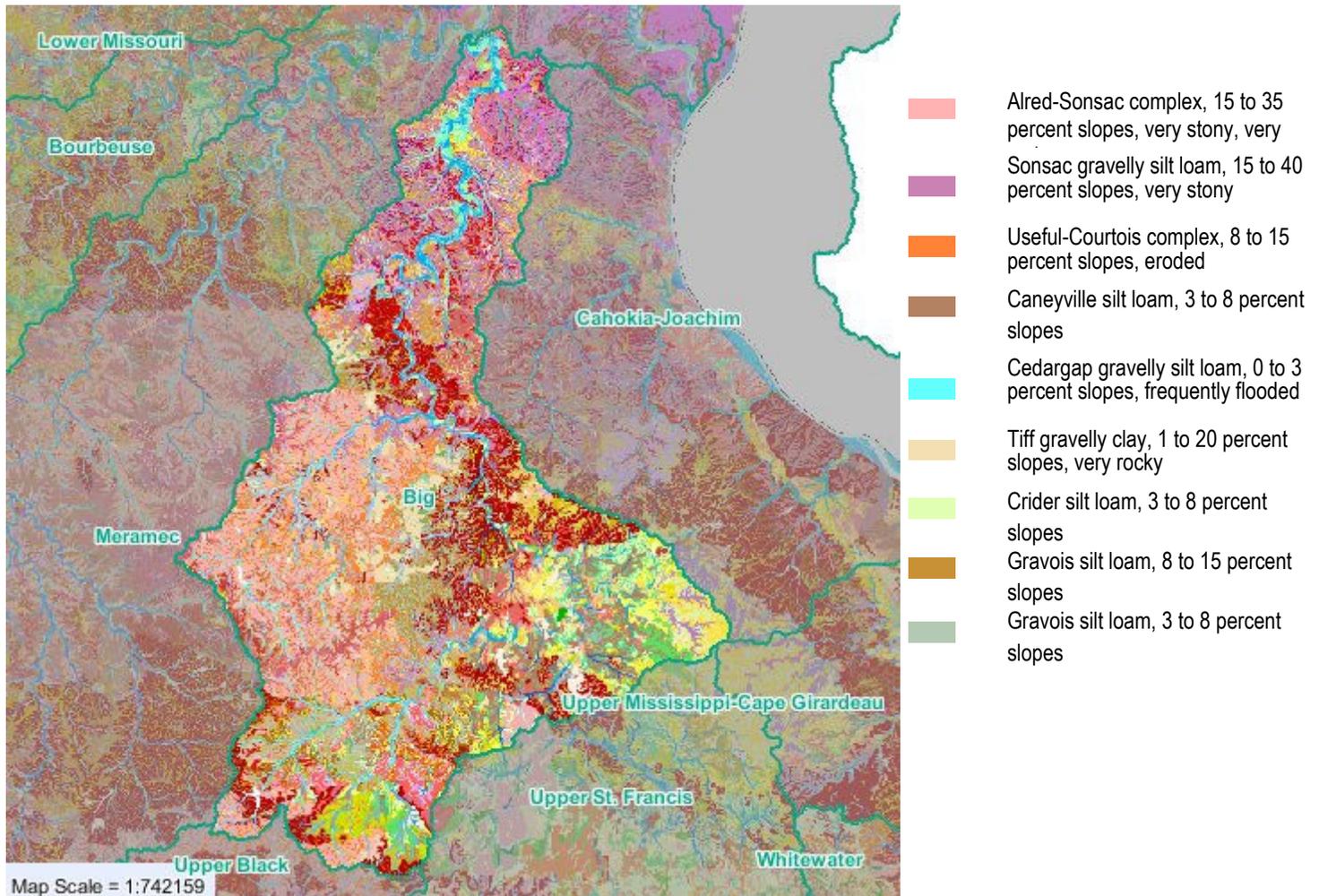
Inventory of Mines, Occurrences, and Prospects	
Big River and Tributaries	Active Magnesium Production
Losing Reaches	Active Industrial Mineral Mines
Impaired Reaches	Historic Industrial Mineral Mines, Occurrences, or Prospects
Lakes	Historic Metallic Mineral Mines, Occurrences, or Prospects
County Boundaries	
Watershed Boundary	



\*Metallic Minerals\* include zinc, barium, lead, copper, and gold. \*Industrial Minerals\* include stone, sand and gravel, carbonate rocks, and clays.

## State of the Big River Watershed (Continued)

### Soil Types

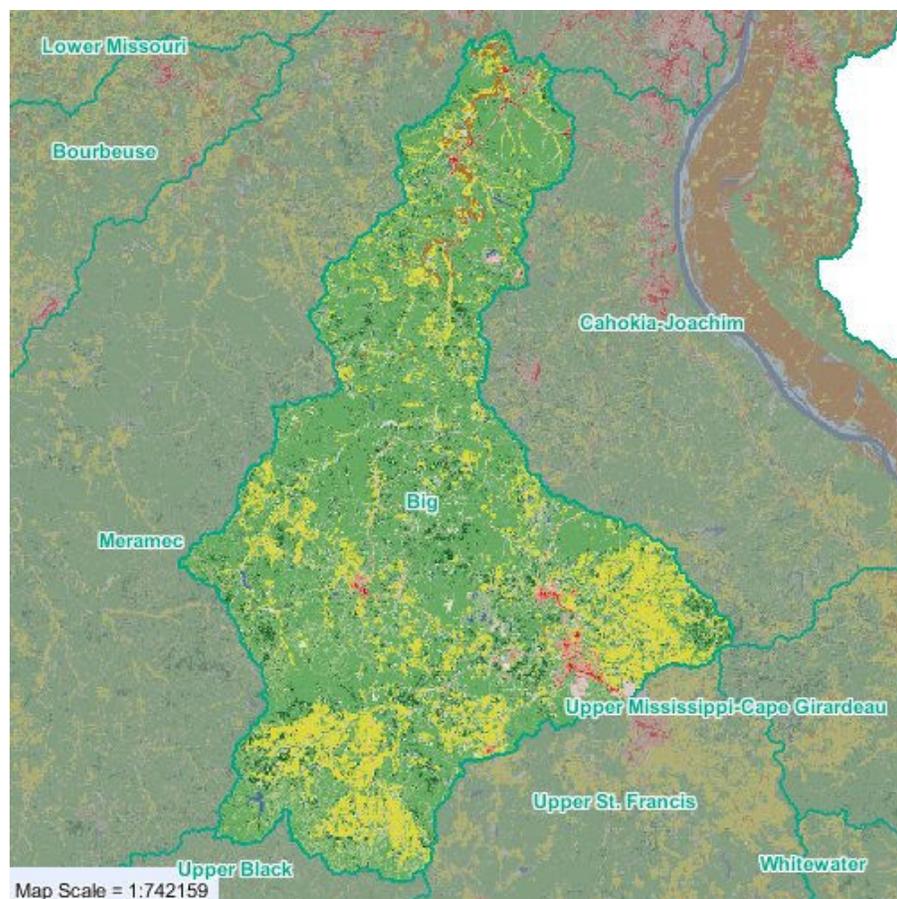


Primary soil series in the upper watershed include: Crider, Fourche, and Hildebrecht on ridge tops; Gasconade, Goss, and Irondale on slopes; and Haymond and Midco in the bottoms (USDA 1981, 1985, 1989, 1991). Soils on ridgetops and slopes are highly erodible, especially when disturbed.

Upper basin soils are typical for the Ozark Dome region, while lower basin soils reflect the Ozark border region (MDNR 1986). Upland soils are moderately shallow and consist of a combination of loess and residuum derived from in-place weathering of dolomite. These soils are silty, moderately well drained, highly susceptible to erosion, and suitable for pasture, forest, and limited row cropping (USDA 1981, 1985, 1989, 1991). However, much of the loess and residuum has been eroded from the slopes, exposing much chert and frequent bedrock outcrops.

The lower elevations of these soils tend to be clayey with high chert content, thin, draughty, infertile, and stony, best suited for grasslands and forest (USDA 1981, 1985, 1989, 1991). Very fertile silt-loam, developed from alluvium, has been deposited over cherty gravel in river valley bottoms and is suitable for row crops, bottomland forest, and pasture.

## State of the Watershed (Continued)



### Land Use/Land Cover



Land Cover Type	Acres	Percent
Developed - High Intensity	307	0.05%
Developed - Medium Intensity	1,527	0.25%
Developed - Low Intensity	7,901	1.27%
Developed - Open Space	30,460	4.91%
Barren Land	1,823	0.29%
Deciduous Forest	352,536	56.77%
Evergreen Forest	41,611	6.70%
<b>Mixed Forest</b>	54,833	8.83%
Shrub/Scrub	1,535	0.25%
Grassland/Herbaceous	16,304	2.63%
Pasture/Hay	98,498	15.86%
Cultivated Crops	6,223	1.00%
Woody Wetlands	3,249	0.52%
Herbaceous Wetlands	144	0.02%
Water	3,990	0.64%
<b>Total</b>	<b>620,940</b>	<b>100%</b>

Big River basin land uses are currently dominated by forest (72.3%) and pastures (15.86%), with lesser amounts of developed areas (6.48%), row crops (1%), grasslands (2.63%), reservoirs, streams and wetlands (1.18%), and other (> 1%) (U.S. Geological Survey National Land Cover Database, 2006.).

## State of the Big River Watershed (Continued)

### Historic Land Use

Pre-settlement conditions indicate that Ozark uplands were mostly prairie and oak savannah, while steep valley slopes and bottoms were dominated by thick deciduous and pine forests. Early settlers cleared trees off valley bottoms and uplands for pasture and row crops. From 1880 to 1920, the Ozarks were subject to heavy timber cutting, leaving large expanses of eroding uplands and valley slopes. This was followed by increased pasture grazing and row cropping. Woodland grazing and seasonal burning became popular, further increasing soil erosion and suppressing young trees. Cutting of the second growth forest began in the mid-1950s (Jacobson and Primm 1994).

Lead was initially discovered in the upper Big River Basin in the early 1700s (Jennet et al. 1981) with the discovery of the Old Lead Belt in St. Francois, Madison, Washington, and Jefferson counties (Figure Lu01). Minimal surface mining began shortly thereafter and continued until 1864 when St. Joseph Lead Company (now St. Joe Minerals Corp.) began advanced lead mining and milling. Since 1920, Missouri has been a leading producer of lead for the United States. Lead mining in the Old Lead Belt ceased in 1972 after over 8 million tons of lead were mined (Kramer 1976). In the early 1970s, barite mining began, primarily in Washington County. By 1978, over 20,000 acres (3%) of Big River watershed was affected by mining (USDA 1980).

Beginning in the 1940s, clusters of cottages and club houses were built on the lower 70 miles of Big River. Most were constructed on top of stilts to avoid flooding. Many of these riverfront dwellings began as vacation cabins, but were transformed into full-time residences in the 1960s and 1970s.

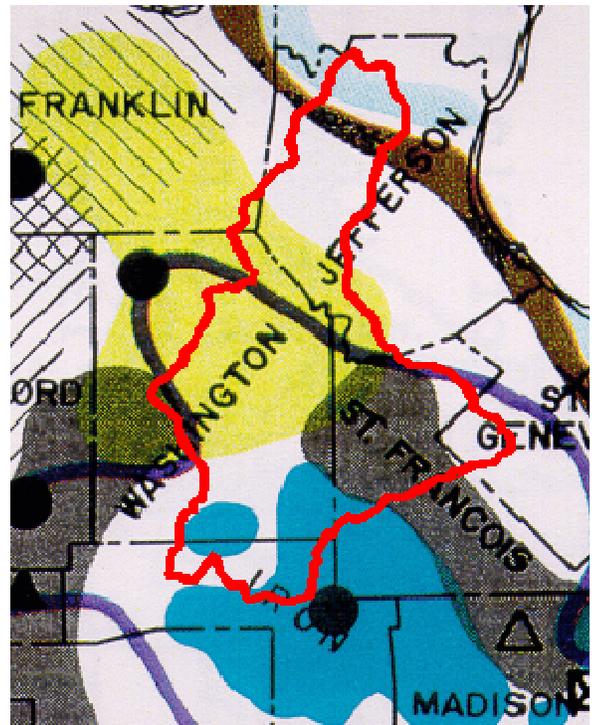


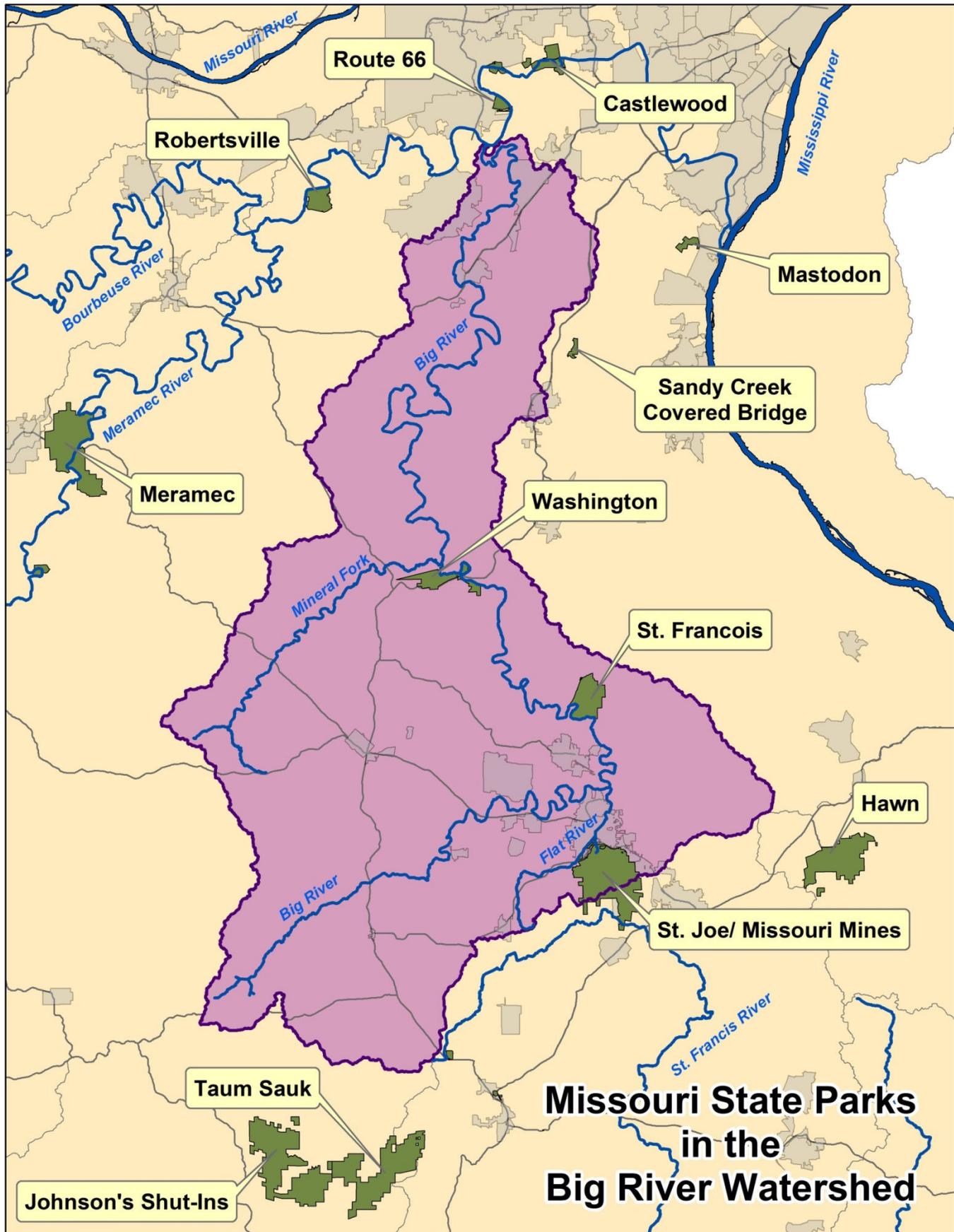
Figure Lu 01



Aerial View of Desloge Consolidated Lead Company and Chat Dump - circa late 1940s or early 1950s (photo courtesy of Dave Darnell)

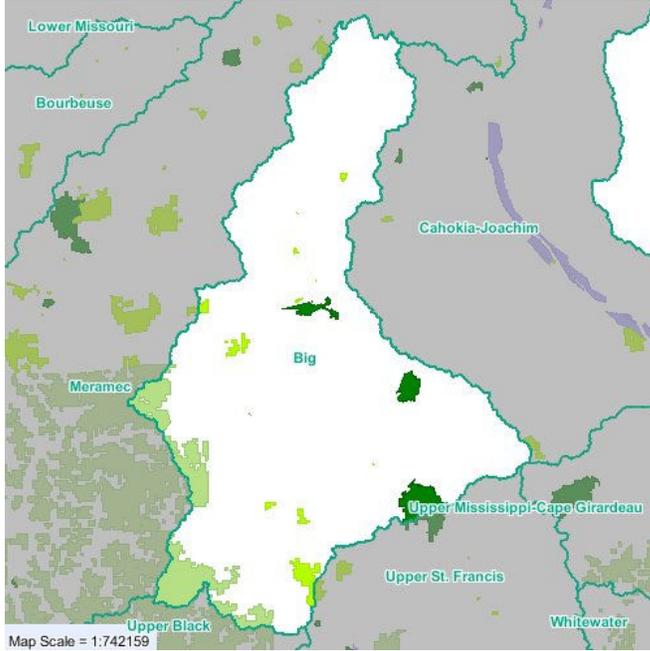
# State of the Big River Watershed (Continued)

## State Parks within the Big River Watershed



# State of the Big River Watershed (Continued)

## Other Public Lands Within the Big River Watershed



The Big River basin contains 21 areas owned by governmental agencies equaling 8% (49,446 acres) of all basin land. The largest tract is a 17,742-acre portion of the Mark Twain National Forest in Iron and Washington counties. Eighteen areas offer a combined 15.5 miles of stream frontage (74% on Big River), including 14 access areas on floatable streams and four boat ramps. About 75% of this stream frontage is along streams with permanent flow.

- Missouri Department of Natural Resources
- Missouri Department of Conservation
- U.S. Army Corps of Engineers
- U.S. Forest Service
- U.S. Fish & Wildlife Service
- National Park Service

<u>Public Land</u>	<u>Acres</u>
BONNE TERRE CITY LAKE	0.00
BOOTLEG ACCESS	288.82
BROWN'S FORD ACCESS	1.04
BUFORD MOUNTAIN CONSERVATION AREA	3,110.94
HICKORY CANYONS NATURAL AREA	2.00
HUGHES MOUNTAIN NATURAL AREA	459.85
KINGSTON ACCESS	56.41
LEADWOOD ACCESS	6.29
MAMMOTH ACCESS	3.87
Mark Twain National Forest - Potosi District	33,277.68
MERRILL HORSE ACCESS	80.00
MINERAL AREA COLLEGE (QUARRY POND)	0.00
MINERAL AREA COLLEGE RANGE	0.00
Missouri Mines State Historic Site	37.27
PEA RIDGE CONSERVATION AREA	1,720.15
POTOSI (ROGER BILDERBACK LAKE)	0.00
St. Francois State Park	2,594.54
St. Joe State Park	5,711.75
VALLEY VIEW GLADES NATURAL AREA	211.76
Washington State Park	1,847.47
YOUNG CONSERVATION AREA	36.71
<b>Total</b>	<b>49,446.54</b>



Big River Watershed  
Summit Fall 2013



## **Sample Goals and Actions**



# Sample Watershed Management Goals and Actions

We know that these important decisions need to be made by you, the local citizens, and we want to provide the resources you need to work on objectives that you feel are important. However, we realize this may be the first time you have thought of your concerns as part of a larger watershed. We have listed some sample goals to help inspire you in your own thought process.

## Goals are general statements that express the broad focus of your effort.

- For example, in response to declining fisheries, the goal of your watershed project might be to protect and restore a local fishery.
  - You (or your planning team) have decided that outreach is needed to increase public awareness about the importance of the trout fishery to the community and to increase community involvement in protecting and restoring the fishery.
  - Later on, you can develop and implement a wide range of specific, measurable objectives to support those goals.
- In some cases, there might not be an overarching water quality improvement effort driving your campaign. For example, if your community's fishery is not yet in trouble but you would like to preserve and protect its pristine nature and ensure its quality for future generations,
  - The goal of your outreach campaign might be simply to generate awareness of the importance of the fishery and the need to protect it.
  - No problem is necessary before a campaign can begin. Prevention is the best medicine. Remember that awareness is the first step toward behavior change.

Other sample goals might include:

- Implement a Total Maximum Daily Load (TMDL)
- Reduce number of homes on septic systems, either by extension of wastewater collection systems or installation of small flow systems
- Reduce erosion and movement of sediment (which carries pollutants)

**Environmental concerns are often too complex and too expensive for one group or organization to tackle on its own. That's where partnerships can be useful.**

- A **partnership** is a voluntary collaboration of individuals and groups, organizations and agencies that have joined to work toward a common goal.
- Partnering can play an instrumental role in the success of reaching a goal.
- In addition, engaging a wide variety of partners early in the outreach process aids in creating a team that will be helpful when it is time to identify audiences, messages and formats for the campaign.
- Partnerships have many advantages, including providing access to resources, increasing effectiveness, efficiency and public influence, allowing for creativity and innovation and improving communication between all parties.

**(EPA's Getting In Step, A Guide for Conducting Watershed Outreach Campaigns, 2010)**

## Sample Watershed Management Goals and Actions (Continued)

### Individual actions that can be taken to protect and/or improve the watershed:

- Plant a buffer zone of vegetation along a stream on your property to slow down stormwater runoff and allow it to soak into the ground before it reaches the stream.
- Avoid farming or building right next to the edge of a stream.
- Limit your use of lawn fertilizers and pesticides or investigate alternatives.
- Plant native species on your property to enhance beauty, create habitat for wildlife and reduce the need for water, fertilizers and pesticides.
- Keep your automobile maintained to reduce the amount of oil, grease and other lubricants leaking onto roads and driveways.
- Dispose of used oil and household chemicals properly. Do not dump oil or hazardous chemicals onto the ground.
- Keep your septic tank properly maintained by having it pumped every 2 to 3 years.
- Do not flush medicines down the toilet. These pharmaceuticals can enter downstream waters. Properly dispose of your expired or unused pharmaceuticals at area drop-off events.
- Incorporate erosion control measures such as silt fences around construction sites.
- Install best management practices on your farm that are designed to reduce soil erosion and runoff of fertilizers and pesticides from your property. Maintain filter strips on the edges of your fields, plant cover crops, conduct soil tests, and mix your chemicals away from wells. Consider rotational grazing, a practice that prevents erosion and unnecessary reseeding, provides cleaner water for livestock and protects nearby streams and creeks.
- Do not dump anything down a storm drain. Storm drains can discharge directly to a local stream or lake.
- Cover exposed soil in your garden or landscaped areas with mulch or hay to prevent soil erosion.
- Construct a rain garden in your yard.
- Support developers who include rain gardens, storm water retention basins and green space in their development plans.

Big River Watershed  
Summit Fall 2013



# **Missouri Department of Natural Resources'**

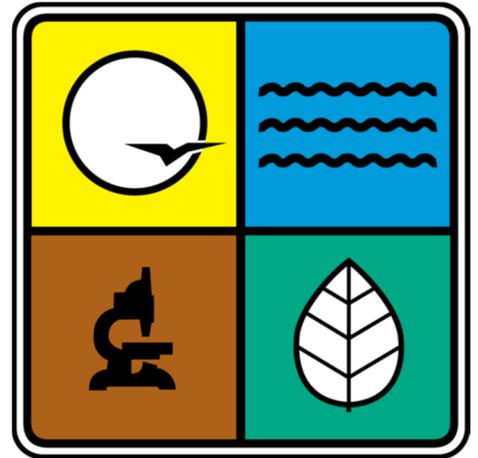
## **Activities in the Big River Watershed**



# Missouri Department of Natural Resources

## Water Protection Program

- Key activities in the Water Pollution Control Branch include the issuance of permits to build, erect, alter, replace, operate, use or maintain existing point sources of water pollution.
  - The majority of permits are for the discharge of treated wastewater from domestic and industrial facilities.
  - The Water Protection Program also issues permits for land application of wastes from domestic, industrial and agricultural facilities.
- Permits usually specify requirements for regular sampling of wastewater at the discharge points.
- Permits also specify water quality standards for any discharges.
- Most of these permits are written to be site-specific to reflect the unique nature of the waste water or the receiving stream.
  - These permits usually have a five year cycle.
  - As a permit expires, it is re-drafted, modified if needed, then placed on public notice for 30 days. When on public notice, a draft permit is open for comments.
  - When the 30-day notice period expires, comments are reviewed and the permit is issued with needed changes, modified and re-noticed to resolve any concerns.
- General Permits (as opposed to site-specific permits) are issued to multiple locations where activities are similar enough to be covered by a single set of requirements.
  - The conditions in General Permits are placed on public notice prior to being issued to applicants.
  - After being finalized, a General Permit cannot be modified.
  - All facilities receiving a General Permit must adhere to the conditions contained in the General Permit until it expires or until the facility obtains a site-specific permit.
  - General Permits cover many different activities, such as airports, chemical manufacturing, fabricated structured metal, foundries, limestone and rock quarries, lubricant manufacturing, petroleum storage greater than 50,000 gallons and wood treaters
  - General Permits are required to be placed on public notice prior to issuance to a new facility.





# Missouri Department of Natural Resources

## National Pollutant Discharge Elimination System Permits Big River Watershed

There are approximately 117 permitted point sources in the Big River Watershed.

PERMIT #	FACILITY NAME	CITY	COUNTY
MO0001422	VALLEY MINERALS, LLC	BONNE TERRE	ST. FRANCOIS
MO0022942	BISMARCK WWTF	BISMARCK	ST. FRANCOIS
MO0035700	TERRE DU LAC NORTH	BONNE TERRE	ST. FRANCOIS
MO0040461	MO AMERICAN, CEDAR HILL L	CEDAR HILL	JEFFERSON
MO0043818	GRANDVIEW R-II SCHOOL DISTRICT	HILLSBORO	JEFFERSON
MO0044571	COUNTRY AIRE MANOR MHP	CEDAR HILL	JEFFERSON
MO0044580	HSSC, NORTHWEST VALLEY MIDDLE SCHOOL	HOUSE SPRINGS	JEFFERSON
MO0045446	LAKES OF DEERWOOD SUBD	CEDAR HILL	JEFFERSON
MO0049000	BISMARCK W STORMW	BISMARCK	ST. FRANCOIS
MO0049441	PEMBROKE HEIGHTS	HIGH RIDGE	JEFFERSON
MO0053163	OUR LADY QUEEN OF PEACE	HOUSE SPRINGS	JEFFERSON
MO0053180	TOWN AND COUNTRY MHP	FARMINGTON	ST. FRANCOIS
MO0053708	LAKE ADELLE SEWER DIST	CEDAR HILL	JEFFERSON
MO0057312	TERRE DU LAC SOUTH	BONNE TERRE	ST. FRANCOIS
MO0058378	COUNTRY HILL MHP	CALEDONIA	WASHINGTON
MO0084395	GRANDVIEW PLAZA MHP	POTOSI	WASHINGTON
MO0084450	CREST MANOR MHP	HOUSE SPRINGS	JEFFERSON
MO0085111	BELLEVIEW R-3 SCHOOL	BELLEVIEW	IRON
MO0085383	HILLSBORO WW RECLAMATION PLANT	HILLSBORO	JEFFERSON
MO0086363	SYCAMORE GREEN ACRES MHP	DITTMER	JEFFERSON
MO0086576	BEL AIR ESTATES MHP SUBD	CEDAR HILL	JEFFERSON
MO0086932	FISHER COMMERCIAL AREA	HILLSBORO	JEFFERSON
MO0087181	ROGUE CREEK UTILITIES INC	POTOSI	WASHINGTON
MO0087921	KINGSTON K-14 SCHOOL WWTF	CADET	WASHINGTON
MO0089354	LAKE TAMARAC SUBD	CEDAR HILL	JEFFERSON
MO0089893	WHISPERING PINES MHP	POTOSI	WASHINGTON
MO0090051	PARADISE ESTATES MHP WWTF	CEDAR HILL	JEFFERSON
MO0090395	EL CHAPARREL ESTATES SUBD WWTF	CEDAR HILL	JEFFERSON
MO0090522	SUMMIT ACRES MHP	MINERAL PT	WASHINGTON
MO0090905	COUNTRY LIFE ACRES SUBD	CEDAR HILL	JEFFERSON
MO0090913	LAKE KINIPPI SUBDIVISION	DE SOTO	JEFFERSON

PERMIT #	FACILITY NAME	CITY	COUNTY
MO0090948	GREEN ACRES MHP	HOUSE SPRINGS	JEFFERSON
MO0092584	GOLDEN ACRES MHP	HOUSE SPRINGS	JEFFERSON
MO0092738	MAPLE GROVE ELEM SCHOOL	DITTMER	JEFFERSON
MO0092941	SUGAR MAPLE COURT MHP	DESLOGE	ST. FRANCOIS
MO0094242	BELLEVIEW VALLEY NURSING HOME	BELLEVIEW	IRON
MO0095311	TERRE DU LAC OXIDATION DI	BONNE TERRE	ST. FRANCOIS
MO0097993	MDNR, ST JOE STATE PARK	PARK HILLS	ST. FRANCOIS
MO0098647	PIRAMAL GLASS USA, INC	PARK HILLS	ST. FRANCOIS
MO0099091	HOUSE SPRINGS APARTMENTS	HOUSE SPRINGS	JEFFERSON
MO0099431	POTOSI WWTF #1	POTOSI	WASHINGTON
MO0099473	RAINTREE PLANTATION	HILLSBORO	JEFFERSON
MO0099635	JEFFERSON CO PWSD #2	EUREKA	JEFFERSON
MO0099732	POTOSI WWTF #2	MINERAL POINT	WASHINGTON
MO0100374	HSSC, HOUSE SPRINGS INTERMEDIATE SCH	HOUSE SPRINGS	JEFFERSON
MO0100668	HSSC, ECHO VALLEY ESTATES	HOUSE SPRINGS	JEFFERSON
MO0100706	BONNE TERRE NW WWTF	BONNE TERRE	ST. FRANCOIS
MO0101184	BUCKMAN LABORATORIES INC.	CADET	WASHINGTON
MO0101893	CAMP SUNNYHILL ADVENTURE	DITTMER	JEFFERSON
MO0101958	JEFFERSON COUNTY LIBRARY	HIGH RIDGE	JEFFERSON
MO0103233	HSSC, BEAR CREEK ESTATES	HOUSE SPRINGS	JEFFERSON
MO0103438	HSSC, WOODRIDGE ESTATES	HOUSE SPRINGS	JEFFERSON
MO0103446	COUNTRY TRAIL ESTATES MHP	BARNHART	JEFFERSON
MO0103551	AUSTIN TRAILS WWTF	CEDAR HILL	JEFFERSON
MO0103560	PARK HILL WWTF	PARK HILLS	ST. FRANCOIS
MO0103799	MO AMERICAN, SAND CREEK F	CEDAR HILL	JEFFERSON
MO0104256	LEADWOOD WWTF	LEADWOOD	ST. FRANCOIS
MO0105201	HSSC, PINE GROVE MANOR	HOUSE SPRINGS	JEFFERSON
MO0105597	SECLUDED FOREST SUBD WWTF	CEDAR HILL	JEFFERSON
MO0105856	BYRNES MILL MOBILE HOME PARK	HOUSE SPRINGS	JEFFERSON
MO0105970	WEDGEWOOD VILLAGE PLAT 2	CEDAR HILL	JEFFERSON
MO0106577	SENAWOOD VILLAGE	CEDAR HILL	JEFFERSON
MO0106909	HSSC, MEADOWBROOK ESTATES	HOUSE SPRINGS	JEFFERSON
MO0108642	SYCAMORE SPRINGS MHP	HOUSE SPRINGS	JEFFERSON
MO0108774	ST FRANCOIS CO ENVIR CORP	PARK HILLS	ST. FRANCOIS
MO0109304	HSSC, CEDAR SPRINGS ELEM SCH	HOUSE SPRINGS	JEFFERSON
MO0109568	IRONDALE WWTF	IRONDALE	WASHINGTON
MO0110019	PINE FORD VILLAGE MHP	DE SOTO	JEFFERSON

PERMIT #	FACILITY NAME	CITY	COUNTY
MO0110035	THUNDERBIRD MHP	POTOSI	WASHINGTON
MO0111457	FEED MY PEOPLE	HIGH RIDGE	JEFFERSON
MO0113107	FOX RUN GOLF CLUB	EUREKA	JEFFERSON
MO0113191	SUNRISE ACRES SUBDIVISION	CEDAR HILL	JEFFERSON
MO0115223	SEVEN SPRINGS/TWIN LAKES	EUREKA	JEFFERSON
MO0115428	BYRNES MILL SOUTH WWTP	HOUSE SPRINGS	JEFFERSON
MO0120260	EAGLE ESTATES	BONNE TERRE	ST. FRANCOIS
MO0120600	ST MARTIN'S UNITED CHURCH	DITTMER	JEFFERSON
MO0121321	BONNE TERRE NE WWTF	BONNE TERRE	ST. FRANCOIS
MO0121371	HUNTER'S RIDGE SUBD WWTP	FARMINGTON	ST. FRANCOIS
MO0123544	BATES CREEK BAPTIST CAMP	POTOSI	WASHINGTON
MO0123561	MEADOWBROOK VALLEY ESTATE	HOUSE SPRINGS	JEFFERSON
MO0123765	VILLAGE INN TRAILER COURT	POTOSI	WASHINGTON
MO0124788	HSSC, MILLER CROSSING WTF	HOUSE SPRINGS	JEFFERSON
MO0125083	WEST ST. FRANCOIS CO R-IV HIGH SCHOOL	PARK HILLS	ST. FRANCOIS
MO0126926	HSSC, FISHER RD	HOUSE SPRINGS	JEFFERSON
MO0127345	TIMBER RIDGE LANDFILL	RICHWOODS	WASHINGTON
MO0127345	TIMBER RIDGE LANDFILL	RICHWOODS	WASHINGTON
MO0127388	MOORE RECIRCULATING FILTR	BONNE TERRE	ST. FRANCOIS
MO0127922	YMCA OF THE OZARKS	POTOSI	WASHINGTON
MO0128571	CALEDONIA WWTF	CALEDONIA	WASHINGTON
MO0129097	PHILLIPS PROPERTY WWTF	HOUSE SPRINGS	JEFFERSON
MO0131024	HSSC, YORKTOWN WWTF	HOUSE SPRINGS	JEFFERSON
MO0131253	BLUFFS WWTF	HOUSE SPRINGS	JEFFERSON
MO0132071	CEDAR HILL U-GAS	CEDAR HILL	JEFFERSON
MO0132519	WASHINGTON COUNTY PWSO #4	CALEDONIA	WASHINGTON
MO0133728	MDNR/WASHINGTON PARK	RICHWOODS	WASHINGTON
MO0133884	VILLAGE OF CEDAR HILL LKS	CEDAR HILL	JEFFERSON
MO0133981	CAMP NE-O-TEZ	HILLSBORO	JEFFERSON
MO0136298	LAKE TISHOMINGO WWTF	HILLSBORO	JEFFERSON
MOG640065	CITY OF PARK HILLS WTP	PARK HILLS	ST. FRANCOIS
MOG641030	MINERAL POINT WELL 1	MINERAL POINT	WASHINGTON
MOG821017	KING SEPTIC SERVICE	HOUSE SPRINGS	JEFFERSON
MOG821026	WALLACH SEPTIC SERV, INC	CEDAR HILL	JEFFERSON
MOG821031	HAWK'S BACKHOE SERV, INC	BONNE TERRE	ST. FRANCOIS
MOG821055	JENNEWEIN SEPTIC SERVICE LLC	HILLSBORO	JEFFERSON
MOG821067	JONES PLUMBING SERVICE	RICHWOODS	WASHINGTON

PERMIT #	FACILITY NAME	CITY	COUNTY
MOG821074	O'BRIEN FARM	HOUSE SPRINGS	JEFFERSON
MOG821096	RITE NOW SEPTIC CLEANING	HOUSE SPRINGS	JEFFERSON
MOG821108	W M PUMPING	STE. GENEVIEVE	STE. GENEVIEVE
MOG821116	AA QUICK SEWER	DITTMER	JEFFERSON
MOG821117	WM PUMPING	HILLSBORO	JEFFERSON
MOG821118	ABR SEPTIC SERVICE INC	CEDAR HILL	JEFFERSON
MOG821123	BONACKER FARMS INC	HOUSE SPRINGS	JEFFERSON
MOG821145	O'NEAIL'S SEPTIC SERVICE	FRENCH VILLAGE	ST. FRANCOIS
MOG821162	JOSHUA ALAN CAMPBELL LLC	BELLEVIEW	IRON
MOG821164	M.A.C. WASTE HAULING	HILLSBORO	JEFFERSON
MOG821172	ALL TYPE SEPTIC TANK PUMP	FRENCH VILLAGE	ST. FRANCOIS
MOG822125	DITTMER MEAT PACKING COMP	DITTMER	JEFFERSON

# Missouri Department of Natural Resources

## Public Drinking Water Branch

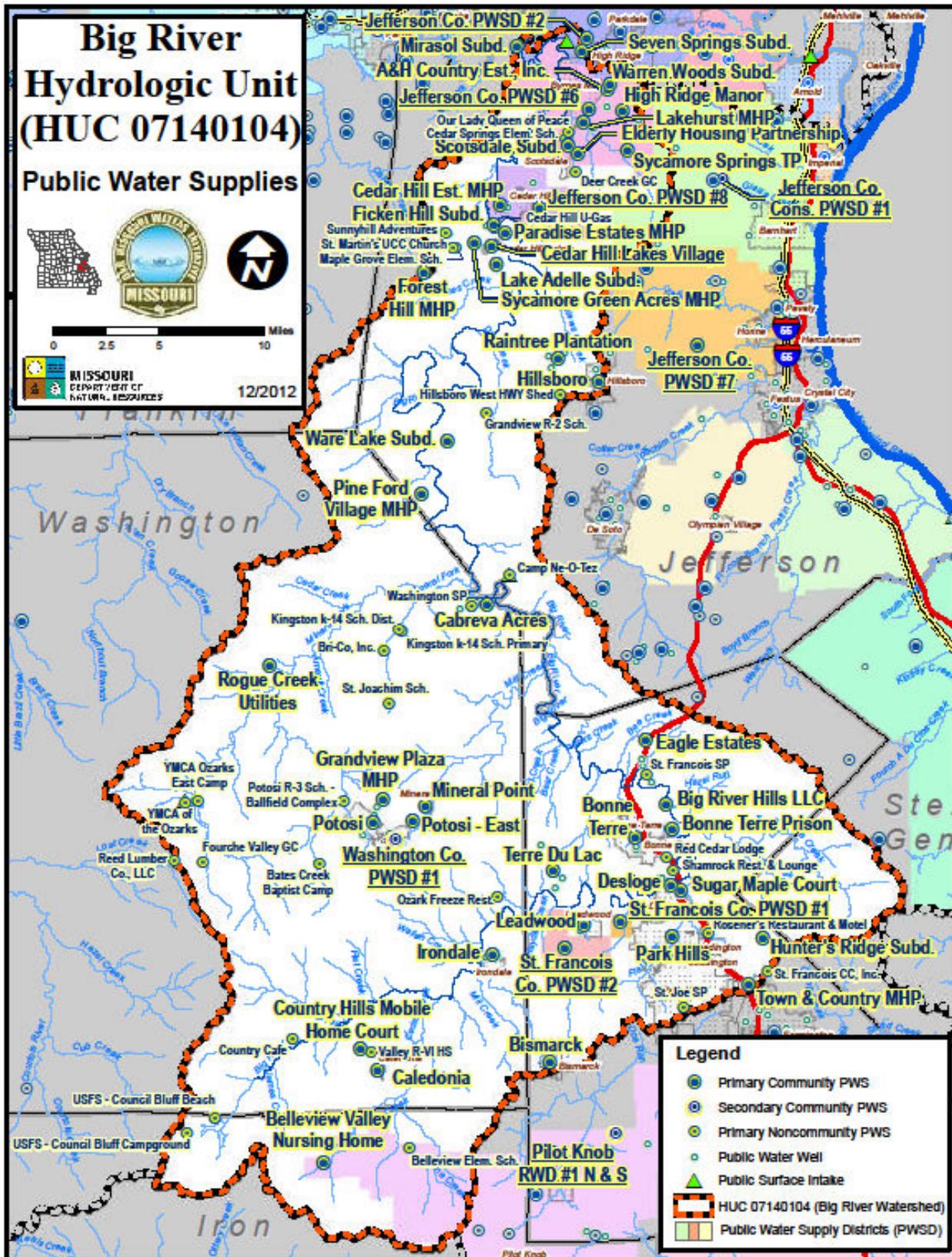


The aim of the Public Drinking Water Branch is to help keep citizens informed of the quality of Missouri's drinking water. On the department's website, [www.dnr.mo.gov](http://www.dnr.mo.gov), you'll find current information regarding rules, laws and standards, monitoring efforts, permits and engineering, compliance and enforcement, financial assistance opportunities and more.

- The Safe Drinking Water Act (SDWA) is the main federal law that ensures the quality of Americans' drinking water.
- Under SDWA, EPA sets standards for drinking water quality and oversees the states, localities, and water suppliers who implement those standards.
- SDWA was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply.
- The law was amended in 1986 and 1996 and requires many actions to protect drinking water and its sources: rivers, lakes, reservoirs, springs, and ground water wells (SDWA does not regulate private wells which serve fewer than 25 individuals).
- A public water system (PWS) is a system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if such system has at least fifteen service connections or regularly serves at least twenty-five individuals.
- The public drinking water systems regulated by U.S. EPA, and delegated states and tribes, provide drinking water to 90 percent of Americans.
  - These public drinking water systems, which may be publicly- or privately-owned, serve at least 15 service connections or 25 persons.
  - Private, individual household wells, are not regulated by the department.
- Providing safe drinking water is a partnership that involves U.S. EPA, the states, tribes, water systems and their operators.
- There are 77 public drinking water systems in the Big River Watershed. The majority of these rely on groundwater.
- Four public waters systems in the Big River Watershed have source water protection plans:
  - Irondale
  - St. Francois Co. PWSD #2
  - Mirasol Subdivision
  - Raintree Plantation
- There is one surface water supply in the Big River Watershed. It is the Jefferson County Public Water Supply District #2.

# Missouri Department of Natural Resources

## Public Water Supply Systems in The Big River Watershed



## Public Water Supply Systems in the Big River Watershed

PWSID	Name	Source	Pop	County	FedType	AvgDlyProd
MO6024295	JEFFERSON CO CONS PWSD C 1	SWP	35000	JEFFERSON	C	3500000
MO6024293	JEFFERSON CO PWSD 2	SW	20000	JEFFERSON	C	1300000
MO4010279	PARK HILLS	GW	8066	ST FRANCOIS	C	1015942
MO6024298	JEFFERSON CO PWSD 6	GW	7235	JEFFERSON	C	570000
MO6024299	JEFFERSON CO PWSD 7	GW	6100	JEFFERSON	C	509618
MO4011441	DESLOGE	GW	5000	ST FRANCOIS	C	
MO6024300	JEFFERSON CO PWSD 8	GW	4600	JEFFERSON	C	313000
MO4010087	BONNE TERRE	GW	3500	ST FRANCOIS	C	475000
MO4036059	TERRE DU LAC	GW	3250	ST FRANCOIS	C	218600
MO4061410	BONNE TERRE PRISON	GW	3100	ST FRANCOIS	C	300000
MO6010368	HILLSBORO	GW	3000	JEFFERSON	C	401925
MO6010659	POTOSI	GW	3000	WASHINGTON	C	487590
MO6069096	POTOSI EAST	GW	2000	WASHINGTON	C	93233
MO4010073	BISMARCK	GW	1470	ST FRANCOIS	C	124000
MO6036271	RAINTREE PLANTATION	GW	1300	JEFFERSON	C	47000
MO4010456	LEADWOOD	GW	1140	ST FRANCOIS	C	172000
MO4211606	ROSENER'S MOTEL	GW	1075	ST FRANCOIS	NC	
MO4191055	YMCA OZARKS SPRING	GU	1000	WASHINGTON	NC	60000
MO6171788	GRANDVIEW R 2 SCHOOL	GW	1000	JEFFERSON	NTNC	2500
MO4024539	ST FRANCOIS CO PWSD 2	GW	750	ST FRANCOIS	C	85000
MO6031523	MIRASOL SUBDIVISION	GW	750	JEFFERSON	C	56000
MO4241051	YMCA OZARKS EAST CAMP	GW	650	WASHINGTON	NC	60000
MO6171236	KINGSTON K 14 SCHOOL DISTRICT	GW	603	WASHINGTON	NTNC	71500
MO4020601	PILOT KNOB RURAL WD 1 N & S	GWP	600	IRON	C	42300
MO4031206	HUNTERS RIDGE SUBD	GW	585	ST FRANCOIS	C	

PWSID	Name	Source	Pop	County	FedType	AvgDlyProd
MO6171877	CEDAR SPRINGS ELEM SCHOOL	GW	560	JEFFERSON	NTNC	18000
MO6170130	MAPLE GROVE ELEM SCHOOL	GW	515	JEFFERSON	NTNC	27500
MO6036077	LAKE ADELLE SUBD	GW	500	JEFFERSON	C	39000
MO6048252	CEDAR HILL ESTATES WATER	GW	490	JEFFERSON	C	40000
MO6024633	WASHINGTON CO PWSD 1	GWP	475	WASHINGTON	C	14000
MO6010401	IRONDALE	GW	474	WASHINGTON	C	55000
MO4011123	MINERAL POINT	GW	385	WASHINGTON	C	21600
MO6036053	SEVEN SPRINGS SUBD	GW	300	JEFFERSON	C	20000
MO4202962	ST FRANCOIS COUNTRY CLUB INC	GW	250	ST FRANCOIS	NC	
MO6172825	OUR LADY QUEEN OF PEACE	GW	240	JEFFERSON	NTNC	
MO4036318	ROGUE CREEK UTILITIES	GW	200	WASHINGTON	C	13070
MO6036060	HIGH RIDGE MANOR SUBD	GW	175	JEFFERSON	C	10000
MO4069040	BELLEVIEW VALLEY NURSING HOME	GW	166	IRON	C	7000
MO4010003	CALEDONIA	GW	150	WASHINGTON	C	8000
MO4024538	ST FRANCOIS CO PWSD 1	GW	150	ST FRANCOIS	C	8800
MO4171180	BELLEVIEW ELEM SCHOOL	GW	143	IRON	NTNC	1800
MO4031203	EAGLE ESTATES	GW	137	ST FRANCOIS	C	
MO4120167	ST FRANCOIS STATE PARK	GW	125	ST FRANCOIS	NC	
MO6120173	WASHINGTON STATE PARK	GW	125	WASHINGTON	NC	
MO6036062	SCOTSDALE SUBD	GW	120	JEFFERSON	C	15000
MO4201034	FOURCHE VALLEY GOLF CLUB	GW	107	WASHINGTON	NC	
MO4172753	ST JOACHIM SCHOOL	GW	100	WASHINGTON	NTNC	
MO4228500	BATES CREEK BAPTIST CAMP	GW	100	WASHINGTON	NC	
MO6036148	WARE LAKE SUBD	GW	100	JEFFERSON	C	30000
MO6048040	LAKEHURST MHP	GW	100	JEFFERSON	C	10000
MO6102141	USFS COUNCIL BLUFF BEACH	GW	100	IRON	NC	500

PWSID	Name	Source	Pop	County	FedType	AvgDlyProd
MO6048200	A & H COUNTRY ESTATES INC	GW	87	JEFFERSON	C	4700
MO6010970	CEDAR HILL LAKES VILLAGE	GW	65	JEFFERSON	C	11000
MO6036084	WARREN WOODS SUBD	GW	60	JEFFERSON	C	8000
MO6048094	PARADISE ESTATES MHP	GW	58	JEFFERSON	C	4600
MO6079508	ELDERLY HOUSING PRTRNSHP OF HOUSE SP	GW	56	JEFFERSON	C	3000
MO6048248	GRANDVIEW PLAZA MHP	GW	51	WASHINGTON	C	2600
MO4258547	BRI CO INC	GW	50	WASHINGTON	NC	
MO6048052	SYCAMORE GREEN ACRES MHP	GW	50	JEFFERSON	C	
MO6180585	REED LUMBER COMPANY LLC	GW	50	WASHINGTON	NTNC	
MO4036173	BIG RIVER HILLS LLC	GW	47	ST FRANCOIS	C	2900
MO6036042	FICKEN HILL SUBD	GW	45	JEFFERSON	C	7200
MO6048354	PINE FORD VILLAGE MHP	GW	45	JEFFERSON	C	3000
MO4211659	RED CEDAR LODGE	GW	40	ST FRANCOIS	NC	14000
MO6048197	COUNTRY HILL MOBILE HOME COURT	GW	38	WASHINGTON	C	1600
MO4212819	OZARK FREEZE RESTAURANT	GW	35	WASHINGTON	NC	
MO6048085	FOREST HILL MHP	GW	30	JEFFERSON	C	2400
MO4040818	CABREVA ACRES	GW	28	WASHINGTON	C	1300
MO4122074	ST JOE STATE PARK	GW	25	ST FRANCOIS	NC	51800
MO4172516	KINGSTON K 14 SCHOOL PRIMARY	GW	25	WASHINGTON	NTNC	
MO4172863	POTOSI R III SCHOOLS BALLFIELD COMPLEX	GW	25	WASHINGTON	NC	
MO4210857	SHAMROCK REST & LOUNGE	GW	25	ST FRANCOIS	NC	
MO6048401	SYCAMORE SPRINGS TRAILER PARK	GW	25	JEFFERSON	C	17000
MO6102180	USFS COUNCIL BLUFF CAMPGROUND	GW	25	IRON	NC	
MO6162638	HILLSBORO WEST HIGHWAY SHED	GW	25	JEFFERSON	NTNC	
MO6171881	SUNNYHILL ADVENTURES	GW	25	JEFFERSON	NC	
MO6270498	ST MARTINS UCC CHURCH	GW	25	JEFFERSON	NTNC	



# Missouri Department of Natural Resources

## WPP-Public Drinking Water Branch

### The Missouri Source Water Protection Program:

*A Valuable Resource for Protecting the Big River Watershed*

The Big River Watershed is host to over **70 public water systems** that serve as many as **76,000 individuals** with safe, reliable drinking water. Most public water systems in the watershed utilize groundwater as their primary source of raw drinking water; however, as many as 20,000 individuals are served water from a single water district that draws water directly from the Big River. There are currently **four public water systems in the Big River Watershed that have Department endorsed source water protection plans.**

**The Missouri Source Water Protection Program**, administered by the Missouri Department of Natural Resources' (the Department)

Public Drinking Water Branch, is a voluntary program designed to provide tools and resources to community public water systems to foster and promote wellhead and source water protection planning. Although the concept is far from new, the fundamental objective of this type of protection planning is to protect the sources of drinking



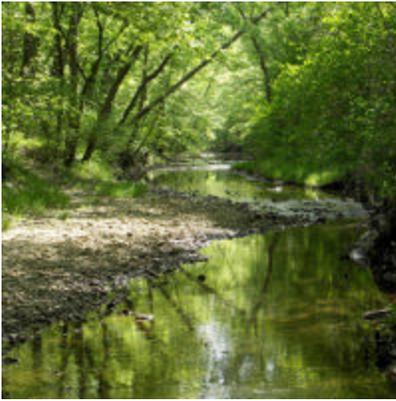
WHERE  
SAFE WATER  
BEGINS

water that these systems use from existing or potential contamination. Additional contamination of drinking water sources (or those areas that recharge drinking water sources) often requires a water system to increase the level of treatment that must be applied to raw drinking water to remove harmful pathogens, chemicals or other agents, and these increased costs typically must be absorbed by the greater community and consumers.

A basic source water protection plan includes several core elements. These include

- a delineation of the source water protection area (typically the areas surrounding a well or the drainage basin that feeds a surface source),
- an inventory of existing and potential contamination sources that occur within the protection area,
- an assessment of the vulnerability of the source water area to contamination from identified potential contaminants, and
- a management plan to prevent contamination from occurring.

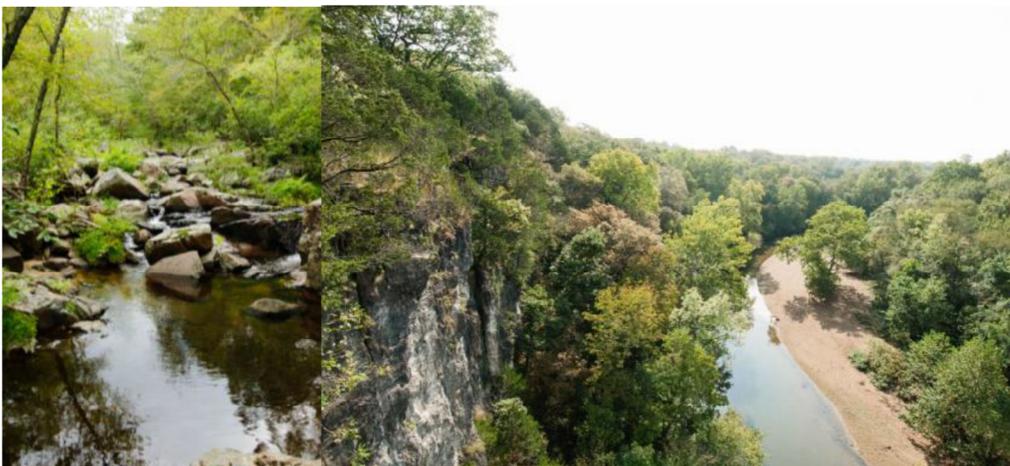
A local voluntary source water protection plan is intended to be unique and specific for each system.



**Key to the success of a source water protection plan is public participation and involvement.** The public water system usually must lay out the framework for a protection plan, but if they fail to engage the public in the planning and implementation of the plan it is likely to be less effective. It is critical for the water system to convey to the community at large that the community, itself, stands to benefit directly from instituting a source water protection program, rather than just the utility. From a regulatory perspective, public water systems are required to maintain compliance with drinking water quality standards regardless of the expenses required – it is a direct benefit for the community to do all that it can to keep water treatment costs as affordable as possible.

It is rare for a public water system or single community to be in a position to manage an entire watershed; however, the cumulative benefit that stems from each community in a watershed having a local, grass-roots protection program in place is of tremendous value towards achieving the goal of proper and effective watershed management. Additionally, there are dedicated funds available to community public water systems to implement source water protection strategies to protect their unique source of drinking water. Any one protection strategy may only make a slight contribution to the overall health of a watershed, but when utilized in concert throughout the entire watershed the potential for significant, tangible improvements is undeniable.

- Although there are relatively few active source water protection plans within the Big River Watershed today, the potential to expand and increase source water protection planning in this region has never been better.
- The Big River Watershed pilot project of the *Our Missouri Waters Initiative* represents a unique opportunity to showcase the value in leveraging programs such as the Missouri Source Water Protection Program with other water quality initiatives to achieve a common goal – a healthy watershed.
- Please do not hesitate to contact the Department’s Public Drinking Water Branch to find out more about the Missouri Source Water Protection Program and to find out how it can benefit your community – and your watershed, today.



# Missouri Department of Natural Resources Environmental Services Program



As part of the Division of Environmental Quality, the Environmental Services Program supports the other programs in the department that need accurate scientific data for their work. To obtain these data, the Environmental Services Program performs field work, conducts monitoring, collects samples and provides laboratory testing for environmental pollutants.

The Missouri Department of Natural Resources' Environmental Services Program's Water Quality Monitoring Section (WQMS) is responsible for collection and/or assessment of data to evaluate the health of Missouri's rivers, streams, and lakes. The WQMS is made up of the Aquatic Biological Assessment Unit and the Water Quality Monitoring Unit. The WQMS works in support of other Programs within the Department such as the Water Protection Program and Solid Waste Program. Projects include:

- **Biological Assessments**
  - Assessments are evaluations of the condition of water bodies using surveys and other direct measurements of resident biological organisms (macroinvertebrates, fish, and plants).
  - Biological assessment results are used to answer the question of whether water bodies support survival and reproduction of desirable fish, shellfish, and other aquatic species.
  - Assessments are conducted on 303(d) listed streams and those with anthropological impacts (such as Taum Sauk reservoir failure or industrial impacts such as mining, production or thermal releases).
  
- **Compliance Monitoring at Wastewater Treatment Facilities**
  - Composite, 24-hour samples are collected at National Pollutant Discharge Elimination System permitted outfalls.
  - Analytical results are submitted to the Water Protection Program to ensure compliance with permit requirements in accordance with EPA guidelines
  
- **Fish Tissue Monitoring**
  - Many waterbody contaminants will bio-accumulate in the tissue of various fish species.
  - Contaminants include various carcinogenic chemicals, lead and mercury.
  - Fish tissue is collected at monitoring locations and submitted to the EPA laboratory for analysis.
  - Analytical results are used by EPA, Dept. of Conservation, Dept. of Health and Senior Services as well as the Water Protection Program.
  - Results contribute to the fishing and health advisories published by MDC and DHSS, respectively
  
- **Landfill Monitoring**
  - Conduct quality assurance audits at solid waste landfills for both groundwater and methane gas.
  - Audits are conducted by observing contractors or landfill personnel as they conduct routine monitoring at groundwater monitoring wells or landfill gas monitoring probes.
  - Split samples are collected analyzed at the Environmental Services Program laboratory for comparison analysis. Audit results are reported to the Solid Waste Management Program.

# Missouri Department of Natural Resources Environmental Services Program (Continued)



- **Sediment Monitoring**
  - A large concentration of toxicants can exist in sediments.
  - Aquatic organisms that live or feed within sediments or at the sediment water interface can be affected by the contaminants in these sediments.
  - Chemical testing of the water column may not be indicative of the toxicity potential of a stream or lake.
  - Chemical testing of sediments represents a better option for characterizing the toxicity potential of sediments to the aquatic biota of the water body.
  - It is important to determine if levels of specific contaminants in sediments indicate the potential for toxicity to aquatic life.
- **State Parks Swim Beach E. coli Monitoring**
  - Conduct weekly E.coli analysis of water samples collected from 20 swimming beaches located in the Department's State Parks during the recreation season.
- **Volunteer Water Quality Monitoring (VWQM)**
  - The VWQM program is a part of the Missouri Stream Team program collaboratively supported by the Missouri Department of Conservation, Conservation Federation of Missouri and the Department of Natural Resources.
  - The VWQM program specifically trains volunteers to conduct water quality monitoring using various analytical kits and instruments.
  - Data is used to supplement Department data for assessment of water quality problems. Volunteer workshops are scheduled throughout the year.
- **Wadeable Stream Monitoring**
  - Smaller streams are both more numerous and often more susceptible to water quality problems due to a smaller volume of flow.
  - Sampling of these kinds of streams on a routine basis enables the Water Protection Program to assess impairment due to extensive stressors, define "background" water quality and assess nutrient levels for developing nutrient criteria for inclusion into the water quality standards.
- **Wasteload Allocation Studies**
  - Surveys are conducted on streams receiving effluent from a wastewater treatment facility.
  - Samples are collected above the facility, at the discharging facility and at three to five sites below the facility.
  - Analytical results are then used to calibrate and verify analytical models used for development of appropriate National Pollutant Discharge Elimination System permit limits.
  - Surveys are conducted during low flow conditions to most accurately portray effluent impacts.

## Missouri Department of Natural Resources Environmental Services Program (Continued)



- **Old Lead Belt Study**

- This is a special study for FY 2013 consisting sampling at five locations in the Old Lead Belt area.
- The five sites include: Tributary from Elvins chat pile at Old Hwy. 32; Flat River Creek just above Shaw Branch; Flat River Creek at St. Joe Drive; Big River at Vo-Tech Drive (Old Hwy. 67); Big River at Hwy. E.; and Eaton Branch just above confluence with Big River.
- Samples are analyzed for field measurements (flow, temperature, pH, dissolved oxygen, and specific conductance), calcium, magnesium, hardness, and dissolved metals, including cadmium, copper, nickel, lead, and zinc.



## **Soil and Water Conservation Program**

### **Mission Statement**

The mission of the Soil and Water Conservation Program is to administer the policies and general programs developed by the Soil and Water Districts Commission for the saving of Missouri soil and water through the soil and water conservation districts in their work with landowners.

The primary funding for these cost-share practices comes from the one-tenth-of-one-percent parks, soils and water sales tax, which is shared by the Department of Natural Resources' Soil and Water Conservation Program and the Division of State Parks

The Soil and Water Conservation Program, or SWCP, provides financial incentives to landowners to implement conservation practices that help prevent soil erosion and protect water resources. By promoting good farming techniques that help keep soil on the fields and waters clean, the program helps conserve the productivity of Missouri's working lands.

### **Cost-Share Program**

This program provides incentives for landowners to install [conservation practices](#) that prevent or control excessive erosion and protect water quality. Landowners can receive up to 75 percent of the estimated cost of the practice to be reimbursed after the practice has gone through a certification process.

### **Agricultural Nonpoint Source Special Area Land Treatment (AgNPS SALT) Program**

#### **District Grants**

- Each of the 114 [soil and water conservation districts](#) (SWCDs) in Missouri receives a district grant to hire personnel, fund technical assistance and provide information and education programs.
- The department's Soil and Water Conservation Program also provides funding for university research, district benefits and administrative costs. The program receives no general revenue funding for soil and water conservation efforts.
- Within the Big River Watershed there are 6 soil and water conservation districts (one in each county)

### **Mississippi River Basin Healthy Watersheds Initiative**

The Mississippi River Basin Healthy Watersheds Initiative, or **MRBI** is a 12-state effort funded by the USDA's [Natural Resources Conservation Service](#) to address nutrient loading in the Mississippi River Basin from its source in Minnesota to its mouth in the Gulf of Mexico. Among other water quality problems, agricultural runoff and other sources of nutrients ultimately contribute to a lack of oxygen downstream in the so-called "dead zone" near where the Mississippi River empties into the Gulf of Mexico.



# Missouri Department of Natural Resources

## Water Protection Program

### Non-point source pollution



#### History of the Section 319 Nonpoint Source Program

Recognizing the need for greater federal leadership to help focus States and local nonpoint source efforts, Congress amended the Clean Water Act in 1987 to establish the Section 319 Nonpoint Source Management Program. Under Section 319, States, Territories and Indian Tribes receive grant funding that support a wide variety of activities including technical assistance, financial assistance, education, training, technology transfer, demonstration projects and monitoring to assess the success of specific nonpoint source implementation projects.

**Nonpoint source water pollution** refers to contaminants that do not come from specific conveyances, such as pipes or other permitted sources. It includes contaminants carried in runoff from fields, roads, parking lots, etc., as well as more specific sources such as improperly functioning septic systems.

#### **What is the Difference Between Point Source and Nonpoint Source Pollution?**

- **Point source pollution** is generally treated wastewater that is discharged from the pipes of industrial facilities or domestic wastewater treatment plants into a receiving stream or water body.
- **Nonpoint source pollution**, on the other hand, is untreated pollution that generally cannot be traced back to a single source. Often, nonpoint source pollution is traced to multiples sources (both natural and manmade) within a watershed, such as stormwater runoff, agricultural practices, land disturbance and development activities, or ineffective onsite wastewater systems.

#### Missouri's Nonpoint Source Grant Program

The good news is that Nonpoint Source pollution can be reduced by becoming aware of how land-use relates to the quality of our rivers, lakes and streams.

- Nonpoint Source 319 implementation grants have accomplished significant results in the control and mitigation of Nonpoint Source pollution in Missouri.
- But, fulfilling the water quality protection mission of the Missouri Nonpoint Source Management Program can be accomplished only with the cooperation of other resource agencies and the citizens of the state.
- NPS grant funds are provided from U.S. Environmental Protection Agency through Section 319(h) of the Clean Water Act.



- Funds can be used to address Nonpoint Source pollution through a variety of activities such as, information, education, protection, planning, conservation, and restoration activities that focus on improving water quality.

**The overall goal of Missouri's grant program is to provide citizens with the knowledge and ability to improve their common land-use practices and to protect water quality.**

# Missouri Department of Natural Resources

## Water Protection Program

### Financial Assistance Center



The Water Protection Financial Assistance Center provides funding to communities for water and wastewater infrastructure.

- State Revolving Fund
  - The State Revolving Funds provide low-interest loans to municipalities, counties, public water and public sewer districts and political subdivisions for wastewater and drinking water infrastructure projects.
  - The State Revolving Fund is a federally capitalized, low-interest loan program.
  - Projects may be new construction or the improvement or renovation of existing facilities.
- There are several programs offered through State Revolving Fund:
  - The leveraged loan and interim direct loan program are offered to applicants having a larger population and good credit analysis.
  - The Direct Loan Program is offered to small communities that do not qualify for a leveraged loan program. Direct loans may be offered to larger communities on a case-by-case basis.
  - The Small Borrower Loan program is available only to communities or public sewer districts of less than 1,000 population or service area. Qualifying communities or public sewer districts may be considered for a direct loan for wastewater system improvements for up to \$100,000 with a maximum 20-year repayment term.
  - The Nonpoint Source Loan program is offered to qualifying individual farmers with animal waste treatment needs through the Missouri Agricultural and Small Business Development Authority.
- State Grant and Loan Programs
  - Pending sufficient state revenue sources, rural sewer grants, rural drinking water grants and 40 percent state construction grants may also be available.
  - An on-site loan program is currently under development. It would provide county or municipal governments with funding for addressing on-site wastewater treatment system concerns.

# Missouri Department of Natural Resources

## Financial Assistance provided to communities in the Big River Watershed

NAME_PROJECT	DATE	Assist_NAME	Loan Award	Disbursed	County
WASHINGTON-WW SYSTEM IMPROVEMENTS	06/16/92	LEVERAGED LOAN SRF	1,300,000	1,261,000.00	FRANKLIN
ST. CLAIR, CITY OF	06/03/99	LEVERAGED LOAN SRF	2,245,000	2,195,246.66	FRANKLIN
SULLIVAN - SULLIVAN HEIGHTS SEWER	06/03/99	LEVERAGED LOAN SRF	1,495,000	1,458,117.13	FRANKLIN
FRANKLIN CO. PWSO #1-KRAKOW SEWER	11/21/00	LEVERAGED LOAN SRF	1,700,000	1,583,081.04	FRANKLIN
SULLIVAN - HUGHES FORD ROAD SEWER	11/07/02	LEVERAGED LOAN SRF	700,000	710,372.53	FRANKLIN
PACIFIC WWTP IMPROVEMENTS	05/19/05	LEVERAGED LOAN SRF	2,100,000	2,103,316.49	FRANKLIN
BRUSH CREEK SEWER DISTRICT	06/03/05	40% STATE GRANT	1,000,000	1,000,000.00	FRANKLIN
BRUSH CREEK SEWER DISTRICT	06/03/05	RURAL SEWER GRANT	450,000	450,000.00	FRANKLIN
WASHINGTON CITY OF DAWN VALLEY	03/12/07	STORM WATER GRANT	18,585	18,585.00	FRANKLIN
FRANKLIN COUNTY - MASTER PLAN	03/20/07	STORM WATER GRANT	18,585	18,585.00	FRANKLIN
SULLIVAN CITY OF EUCLID ST	03/21/07	STORM WATER GRANT	5,000	5,000.00	FRANKLIN
NEW HAVEN CITY OF MILLER & ELTON	03/26/07	STORM WATER GRANT	18,585	18,585.00	FRANKLIN
ST CLAIR, CITY OF ORCHARD DR&PARK AV	03/30/07	STORM WATER GRANT	18,585	18,585.00	FRANKLIN
WASHINGTON-WWTP EXPANSION	11/15/07	LEVERAGED LOAN SRF	20,000,000	20,166,556.53	FRANKLIN
CALVEY CREEK S.D. - CRESTVIEW PH I-ARRA	10/26/09	ARRA GRANT	682,000	672,559.56	FRANKLIN
CALVEY CREEK S.D. - CRESTVIEW PH I-ARRA	10/29/09	ARRA LOAN	682,000	672,559.55	FRANKLIN
NEW HAVEN	09/14/10	RURAL SEWER GRANT	239,242	230,906.75	FRANKLIN
NEW HAVEN	09/14/10	DIRECT SMALL BORROWER LOAN	100,000	94,969.15	FRANKLIN
UNION WWTP	11/17/10	RURAL SEWER GRANT	500,000	500,000.00	FRANKLIN
ARCADIA RURAL SEWER GRANT	07/17/08	RURAL SEWER GRANT	70,747	70,746.50	IRON
PILOT KNOB	07/28/06	RURAL SEWER GRANT	300,000	300,000.00	IRON
IRONTON	05/01/07	LEVERAGED LOAN SRF	2,500,000	2,465,795.46	IRON
ARNOLD-WW SYSTEM IMPROVEMENTS	06/16/92	LEVERAGED LOAN SRF	1,270,000	1,228,059.06	JEFFERSON
ARNOLD-WW SYSTEM IMPROVEMENTS	09/08/93	LEVERAGED LOAN SRF	1,135,000	1,101,634.18	JEFFERSON
BYRNES MILL, CITY OF	09/08/93	LEVERAGED LOAN SRF	1,200,000	1,164,693.21	JEFFERSON
ROCK CREEK PUBLIC SEWER DISTRICT	05/04/99	DIRECT INTERIM LOAN SRF	8,585,000	8,585,000.00	JEFFERSON

NAME_PROJECT	DATE	Assist_NAME	Loan Award	Disbursed	County
ROCK CREEK PUBLIC SEWER DISTRICT	06/03/99	LEVERAGED LOAN SRF	8,775,000	8,595,330.00	JEFFERSON
ROCK CREEK S.D. PHASE 1,2,3 &KIMMSWIC	05/16/00	DIRECT INTERIM LOAN SRF	1,800,000	1,737,143.00	JEFFERSON
FESTUS-INTERIM DIRECT LOAN	06/08/01	DIRECT INTERIM LOAN SRF	730,000	536,781.06	JEFFERSON
BYRNES MILL	11/20/01	LEVERAGED LOAN SRF	185,000	184,521.61	JEFFERSON
ROCK CREEK S.D. PHASE 1,2,3 &KIMMSWIC	11/20/01	LEVERAGED LOAN SRF	16,780,000	17,377,107.28	JEFFERSON
ARNOLD, CITY OF - JUDY LANE	04/04/02	STORM WATER GRANT	23,241	23,241.20	JEFFERSON
CRYSTAL CITY WWTP	11/07/02	LEVERAGED LOAN SRF	3,575,000	3,668,267.43	JEFFERSON
FESTUS WWTP	11/07/02	LEVERAGED LOAN SRF	3,575,000	3,668,267.42	JEFFERSON
ARNOLD-PHASE II	09/03/03	STORM WATER GRANT	247,803	78,906.33	JEFFERSON
HERCULANEUM WWTP C295490-01	11/30/05	LEVERAGED LOAN SRF	6,000,000	6,059,243.52	JEFFERSON
ARNOLD - MSD CONNECTION	11/30/05	LEVERAGED LOAN SRF	6,125,000	6,174,398.76	JEFFERSON
ARNOLD - MSD CONNECTION	04/27/06	LEVERAGED LOAN SRF	2,875,000	2,903,937.78	JEFFERSON
BYRNES MILL-COLLECTION	07/13/06	RURAL SEWER GRANT	54,600	54,600.00	JEFFERSON
ARNOLD-WOODRIDGE ESTATES	03/07/07	STORM WATER GRANT	114,154	114,154.00	JEFFERSON
HILLSBORO - BELEWS CREEK	03/26/07	STORM WATER GRANT	53,401	53,401.00	JEFFERSON
GLAIZE CREEK SEWER DISTRICT-BARNHART HIL	07/07/08	RURAL SEWER GRANT	47,600	47,600.00	JEFFERSON
CEDAR HILL LAKES COLLECTION SYSTEM	10/09/08	RURAL SEWER GRANT	156,800	156,800.00	JEFFERSON
JEFFERSON COUNTY PWSO #13	08/03/10	RURAL SEWER GRANT	333,200	333,200.00	JEFFERSON
JEFFERSON COUNTY PWSO #13	08/03/10	40% STATE GRANT	1,346,374	1,346,374.00	JEFFERSON
NORTHEAST PSD OF JEFF CO- SALINE CREEK	06/05/12	SRF CASH FLOW DIRECT LOAN	12,000,000	4,145,485.06	JEFFERSON
FESTUS, CITY OF	11/20/01	LEVERAGED LOAN SRF	1,885,000	986,208.59	JEFFERSON
JEFFERSON COUNTY WATER AUTHORITY	11/20/01	LEVERAGED LOAN SRF	10,435,000	10,102,685.64	JEFFERSON
CRYSTAL CITY	05/08/02	LEVERAGED LOAN SRF	1,300,000	1,162,392.51	JEFFERSON
JEFFERSON COUNTY WATER AUTHORITY	05/08/02	LEVERAGED LOAN SRF	8,230,000	7,619,044.57	JEFFERSON
JEFFERSON CO. PWSO #12	11/10/08	RURAL SEWER GRANT	500,000	500,000.00	JEFFERSON
JEFFERSON CO. PWSO #8	07/09/09	RURAL SEWER GRANT	100,000	100,000.00	JEFFERSON
JEFFERSON CO. PWSO #5	07/15/10	RURAL SEWER GRANT	402,108	402,108.00	JEFFERSON
JEFFERSON CO. PWSO #7	07/15/10	RURAL SEWER GRANT	417,352	408,411.70	JEFFERSON
JEFFERSON COUNTY WATER AUTHORITY	07/25/12	SRF CASH FLOW DIRECT LOAN	751,000	546,441.50	JEFFERSON
JEFFERSON COUNTY WATER AUTHORITY	09/06/12	SRF GRANT	751,000	546,441.50	JEFFERSON

NAME_PROJECT	DATE	Assist_NAME	Loan Award	Disbursed	County
JEFFERSON CO. PWSD #8	11/29/12	SRF CASH FLOW DIRECT LOAN	260,000	223,425.69	JEFFERSON
JEFFERSON CO. PWSD #8	12/06/12	SRF GRANT	260,000	222,095.65	JEFFERSON
JEFFERSON CO. PWSD #12	05/22/13	SRF CASH FLOW DIRECT LOAN	866,000	199,387.67	JEFFERSON
JEFFERSON CO. PWSD #12	05/22/13	SRF GRANT	866,000	48,996.00	JEFFERSON
BONNE TERRE-WW IMPR., SECT.A&B	12/03/97	LEVERAGED LOAN SRF	3,190,000	3,121,131.05	ST. FRANCOIS
FARMINGTON-WEST WWTP EXPANSION	04/12/00	LEVERAGED LOAN SRF	4,950,000	4,861,955.23	ST. FRANCOIS
BONNE TERRE-WW IMPROVEMENTS	04/29/08	RURAL SEWER GRANT	500,000	500,000.00	ST. FRANCOIS
DESLOGE	09/27/12	SRF CASH FLOW DIRECT LOAN	782,000	417,482.92	ST. FRANCOIS
DESLOGE	10/04/12	SRF GRANT	782,000	417,482.92	ST. FRANCOIS
STE. GENEVIEVE RURAL SEWER GRANT	07/21/08	RURAL SEWER GRANT	198,215	198,215.00	STE. GENEVIEVE
STE. GENEVIEVE - C295627-01 ARRA	01/08/10	ARRA GRANT	647,500	647,500.00	STE. GENEVIEVE
STE. GENEVIEVE - C295627-01 ARRA	01/12/10	ARRA LOAN	647,500	647,500.00	STE. GENEVIEVE
STE. GENEVIEVE	01/08/10	ARRA GRANT	781,440	781,440.00	STE. GENEVIEVE
STE. GENEVIEVE	01/12/10	ARRA LOAN	781,300	781,300.00	STE. GENEVIEVE
WASHINGTON CO PWSD #4 (HOLIDAY SHORES)	02/25/08	40% STATE GRANT	520,585	520,585.00	WASHINGTON
WASHINGTON CO PWSD #4 (HOLIDAY SHORES)	03/06/08	RURAL SEWER GRANT	149,600	149,600.00	WASHINGTON
POTOSI	04/28/09	RURAL SEWER GRANT	457,540	446,913.27	WASHINGTON



## Land Reclamation Program Sand and Gravel Permitting

### In-Stream Sand and Gravel Mining

One of the most prevalent types of mining in Missouri, as far as the number of sites, is the **"in-stream" removal of sand and gravel**. Numerous operators across the entire state use sand and gravel deposits, called gravel or sand "bars", as a source of aggregate material.

During the 1990's this activity underwent several changes in regulatory control within Missouri.

- In the early 1990's, the Land Reclamation Program was the permitting and enforcement authority that both issued permits for this type of mining activity and also oversaw the proper removal of sand and gravel from Missouri's streams.
- In the mid 1990's, the regulation of this activity was taken up by the **Army Corps of Engineers** who basically took over the process of permitting and inspecting these mining facilities.
- The Army Corps of Engineers lost their jurisdiction over this activity in late 1998 owing to a ruling by the U.S. District Court of Appeals.
- The court found that "de-minimus" or incidental fall back of sand and gravel into the stream from which it was being excavated did not constitute the placement of fill by the mining operation. Hence, the court ruled that the Army Corps of Engineers had exceeded their authority in requiring a permit for this activity.
- In January 1999, the Land Reclamation Program resumed the former position of the regulatory authority over this type of mining activity and bases this authority upon the provision of the state's Land Reclamation Act. Approximately 150 permits were re-issued to the mining industry during the early months of 1999 by the Land Reclamation Program to take the place of the existing Army Corps of Engineer's permits. This responsibility continues to the present day on the part of the Land Reclamation Program with approximately 200 mining permits issued.

**Can you remove gravel for your own use?** (What are the rules regarding sand and gravel removal?)

**Yes, gravel can be removed for personal use only.**

**The rules that exempt an individual from obtaining a Land Reclamation Commission permit are located at 10 CSR 40-10.010(2)(B)1. and read:**

(2) Operations Not Required to Obtain a Land Reclamation Permit.

(A) These regulations do not apply to iron, lead, zinc, gold, silver, coal, water, fill dirt, natural oil or gas.

(B) Surface mining for industrial minerals may be conducted without a permit by any.

1. Individual for personal use only; and

2. Political subdivision including, but not limited to, county, city, state or branch of the military which uses its own personnel and equipment to obtain minerals for its own use.

## Land Reclamation Program Sand and Gravel Permitting

- If you plan to remove sand and gravel for your personal use, the department strongly encourages that individual to remove the sand and gravel consistent with the rules established for commercial operators, which is outlined below.
- If gravel removal for personal use only is not removed in a manner consistent with the established rules, that individual could face enforcement actions by the department and US Army Corps of Engineers.

### Examples of Environmental Damage Caused by In-Stream Sand and Gravel Operations

Eroded banks and shallow water in a stream.



Equipment travel and in-stream gravel mining caused erosion and no flowing water

Materials pushed into the bank vegetation will eventually cause vegetation to die and expose the banks to erosion, if not corrected.



**The rules to remove sand and gravel from Missouri's streams are found at 10 CSR 40-10.050**

**(14)(15) & (16) and read:**

**(14) In-Stream Gravel Removal Requirements.**

(A) Commercial operations that conduct sand and/or gravel removal within the stream banks must comply with the following requirements.

(B) The following requirements are designed to protect water quality while allowing for the excavation of sand and gravel from riparian environments. Upon request of the applicant, the program may establish site specific variances to address conditions that may occur at individual locations.

1. Excavation of sand or gravel deposits shall be limited to deposits in unconsolidated areas containing primarily smaller material (at least eighty-five percent (85%) of the material is less than three inches (3") in diameter) that is loosely packed and contains no woody perennial vegetation greater than one and one-half inches (1 1/2") in diameter, measured at breast height four and one-half feet (4.5').

2. An undisturbed buffer of ten foot (10') width shall be left between the excavation area and the water's edge of the flowing stream at the time of excavation. A buffer zone of adequate width to protect bank integrity should be left between the excavation area and the base of the high bank.

3. An undisturbed buffer of twenty-five feet (25') wide shall be maintained in an undisturbed condition landward of the high bank for the length of the gravel removal site. Disturbed areas in this riparian zone shall be limited to maintained access road(s) for ingress and egress only. No clearing within this riparian area is authorized in association with work authorized by this permit.

4. Sand or gravel shall not be excavated below water elevation at the time of removal, except:

A. If the stream is dry at the time of excavation, excavation shall not occur deeper than the lowest undisturbed elevation of the stream bottom adjacent to the site. Upon request of the applicant, excavation depth restriction may be modified if the staff director determines that a variance would not significantly impact the stream resource.

B. For wet stream reaches, excavation depth restriction may be modified if it is determined by the staff director that a variance would not significantly impact the stream resource based on the presence of bedrock to prevent head cutting, excessive bedload, gravel rich areas or any other appropriate reason.

5. Stream channels shall not be relocated, straightened, cut off, shortened, widened, or otherwise modified. A stream channel is defined as that area between the high banks of the creek where water is flowing, or in the case of a dry stream, where water would flow after a rain event.

6. Within thirty (30) days of the removal of excavation equipment from the site, streambank areas disturbed by the removal operation shall be revegetated or otherwise protected from erosion. For long-term operations (longer than thirty (30) days) or for sites that will be periodically revisited as gravel is deposited, access points shall be appropriately constructed and maintained such that stream banks and access roads are designed and constructed to minimize erosion.

7. Any aggregate, fines, or oversized material removed from the site shall be placed beyond the high bank, on a non-wetland site that has been approved by the landowner. No material, including oversized material, that results from excavation activity may be stockpiled or otherwise placed into flowing water or placed against streambanks as bank stabilization unless specifically authorized by a state or federal permit.

8. All sand or gravel washing, gravel crushing, and gravel sorting shall be conducted beyond the high bank, in a non-wetland area and away from areas that frequently flood, such that gravel, silt, and wash water that is warm, stagnant, or contains silty material cannot enter the stream or any wetland.

9. Vehicles and other equipment shall be limited to removal sites and existing crossings. Water shall be crossed as perpendicular to the direction of the stream flow as possible.

10. Fuel, oil and other wastes and equipment containing such wastes shall not be stored or released at any location between the high banks or in a manner that would enter the stream channel. Such materials shall be disposed of at authorized locations.

(15) Outstanding Resource Waters (10 CSR 20-7.031).

(A) In-stream sand and gravel operations are prohibited from those waters listed as Outstanding National Resource Waters.





# Missouri Department of Natural Resources

**Robert Hinkson**  
Remedial Project Management Unit Chief  
Missouri Department of Natural Resources  
Hazardous Waste Program  
Superfund Section

The goal of the Hazardous Waste Program is to protect human health and the environment from threats posed by hazardous waste. The program does the following to accomplish this goal:

- Encourages the reduction of hazardous waste generation.
- Regulates the management of hazardous waste.
- Oversees the cleanup of contamination
- Promotes property reuse.
- Removal and cleanup of petroleum storage tanks in the state.

The Department's **Superfund Section** is responsible for providing oversight in coordination with the EPA of environmental clean-ups under the federal Superfund Program also known as CERCLA. The Department generally plays the role of the "support agency" when it comes to environmental clean-ups under the federal Superfund Program as EPA is typically the lead agency on cleanup activities. Department staff review site related documents and provide input into the decision-making process to assure state interests are considered when making those decisions. Sites that are/have been worked on in the Big River Watershed include the following:

### Washington County:

Washington County Lead District

- Old Mines
- Richwoods
- Potosi
- Furnace Creek

State Project Manager:

**Jeremy Wall**

### St. Francois County:

Big River Mine Tailings/St. Joe Minerals Corp.

- Bonne Terre Mine Tailings Site
- Desloge (Big River) Mine Tailings Pile
- Leadwood Mine Tailings Pile
- National Mine Tailings Pile
- Federal Mine Tailings Pile
- Elvins Tailings Pile
- Doe Run Mine Tailings Pile

State Project Manager:

**Brandon Wiles**

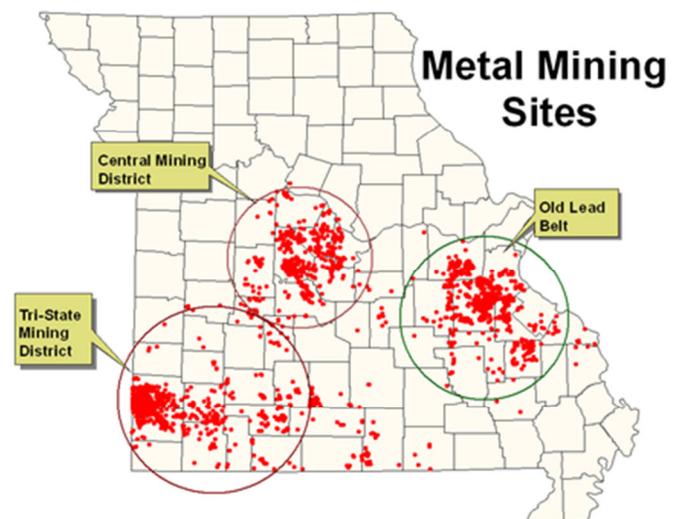
### Jefferson County

Southwest Jefferson County Mining

State Project Manager:

**Evan Kifer**

- Mine/mill/other related wastes impact Big River water, sediment, floodplain & ecological receptors
  - Heavy metals and particulates
  - DHSS fish advisories
- 3 of 5 largest tributaries & smaller tributaries contribute mine/mill waste to Big River sediment & floodplain





Big River Watershed  
Summit Fall 2013



**Partners in the  
Big River Watershed**



Big River Watershed  
Summit Fall 2013



**Local Efforts in  
the Big River Watershed**



## Local Efforts in the Big River Watershed

### Missouri Department of Natural Resources Our Missouri Waters Working with Partners in the Watershed



One of the keys to the Our Missouri Waters Initiative will be managing our water resources at the local watershed level – where specific water resource management needs are best addressed.

- The watershed-based approach will also allow a common understanding of the roles, priorities and responsibilities of all partners and citizens within a watershed.
- With the diverse hydrologic and multi-water-related resources to manage, it makes sense to be able to tailor our activities to the unique challenges and opportunities specific to each watershed.
- By coordinating the efforts of all the agencies and individuals who have an interest in the watershed, we can focus our staff and financial resources on priorities and on solving water resource problems.

There are many partners currently working in the Big River Watershed. These partners each have their own very important missions and yet we are working in the same areas, sometimes with the same goals. It makes sense to work together and share the resources (financial, technical assistance and manpower) necessary to accomplish all of the goals.

Working with these partners, the department will work to improve watershed planning, identify issues within watersheds and utilize tools that are best suited to address those watershed-specific issues.

Citizen participation and cooperation is crucial for successful watershed management. Local citizen participation is key to the success of Our Missouri Waters initiative. When citizens better understand the issues within their watershed, they become more invested in the future of their community and together we can develop the most effective solution to benefit the state's water resources for generations to come.

The following pages provide information on some of the partners at work in the Big River Watershed.



## **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.



Stream Teams are people with an interest and a passion for keeping Missouri streams clean and healthy.

Stream Team Volunteer Promise To:

- Remember that we live in a watershed and anything we do in that watershed can affect a stream positively or negatively.
- Learn all we can about Missouri streams.
- Engage in activities that promote and preserve the health of Missouri streams.
- Conduct ourselves in a professional manner so that our actions do not negatively impact our Stream Team, other Stream Teams, The Stream Team Program as a whole, or others.
- Consider the points of view of others on water resource issues; recognize that our state's waters serve many purposes, some of which may appear to conflict, and advocate for the health and values of Missouri streams based on good science and accurate data.
- Respect the property rights of landowners and always ask permission before entering private land.

You can find a Stream Team in nearly every county in the state. But, since Missouri has more than 56,000 miles of flowing waters within its borders there's always room for more people to get their feet wet!

Join a Stream Team and support the effort to protect Missouri's rich river heritage. It's a great way for a group of friends, co-workers, students, even families to get involved in water quality monitoring, protection and cleanups.

**There are many stream team volunteers actively participating in the Big River Watershed. For more information, visit [www.mostreamteam.org](http://www.mostreamteam.org).**

## Stream Teams in the Big River Watershed (by county)

Number	Sponsor	Stream Name	County
2892	Dale Hallatt Team	James Creek	Iron
3853	Belews Creek Watershed Partnership	Belews Creek	Jefferson
3208	Big Joachim Streamers	Big River	Jefferson
100	Big River Clean Stream	Big River	Jefferson
3495	Big River Litter Gitters	Big River	Jefferson
1368	Big River Outfitters	Big River	Jefferson
4047	Big River Streamers	Big River	Jefferson
3998	Boy Scout Troop 547	Big River	Jefferson
4508	BRTC	Big River	Jefferson
2934	BSA Troop 470 River Dragons	Big River	Jefferson
1314	Cherokee Landing	Big River	Jefferson
4119	City of Riverside	Big River	Jefferson
2415	DeSoto High School	Big River	Jefferson
342	George Patterson Team	Big River	Jefferson
1270	Gerald Campbell Team	Jones Creek	Jefferson
1184	Get 'er Done	Big River	Jefferson
1637	Grandview R-II	Big River	Jefferson
858	Harris Family	Big River	Jefferson
3538	Heads Creek Cleaning Coalition	Heads Creek	Jefferson
3554	Hillsboro High School Ecology Awareness Club	Belews Creek	Jefferson
1760	Jacqueline Short Team	Big River	Jefferson
3172	Joe Twellman Team	Big River	Jefferson
417	Joel Dee or April Speaks	Big River	Jefferson
2497	Josiah M. Cox and Douglas S. Bjornstad	Big River	Jefferson
421	King Family & Armon Family	Big River	Jefferson
1885	Lake Wauwanoka	Dry Creek	Jefferson
1755	Liz Diamond Team	Big River	Jefferson
1209	Lloyd Shaw Team	Big River	Jefferson
1758	Mariann Jones Team	Big River	Jefferson
1759	Melissa Hannick Team	Big River	Jefferson
136	Michael Strode Team	Big River	Jefferson
3500	Mike Dressel Team	Big River	Jefferson
250	Missouri Beards and Antlers	Big River	Jefferson
4305	Nick Catalana High School Senior Project	Big River	Jefferson
288	NORRA Northern Ozark Rivers Recreational Association	Big River	Jefferson
684	Our Lady of Queen of Peace Ecology Club	Heads Creek	Jefferson
31	Ozark Fly Fishers	Big River	Jefferson
1753	Peter Allen Team	Big River	Jefferson
1756	Rebecca Berghold Team	Big River	Jefferson
3039	Rich Sheldon Team	Belews Creek	Jefferson
3412	Robert Hoskins	Big River	Jefferson
802	Robert Senne Team	Big River	Jefferson
3881	Scout Troop 1004 & 3299	Dulin Creek	Jefferson

## Stream Teams in the Big River Watershed (by county)continued

Number	Sponsor	Stream Name	County
2866	Shari Koseck	Big River	Jefferson
4186	Stream Sweepers	Big River	Jefferson
1751	Sue Roslawski Team	Big River	Jefferson
1754	Tammi Kuhlmann Team	Big River	Jefferson
4230	Team Butterfly	Bear Creek	Jefferson
4495	Team Skull Bone	Skullbones Creek	Jefferson
2893	The Clark Family Farm	Heads Creek	Jefferson
2951	The Drifters	Big River	Jefferson
2361	The Hensleys	Big River	Jefferson
4365	The Kostro Family	Ditch Creek	Jefferson
2925	The Krautmanns	Sand Creek	Jefferson
3797	The Trashmainian Devils	Big River	Jefferson
1008	Twin River Rangers	Big River	Jefferson
4005	Washington Creek Cleanup	Heads Creek	Jefferson
2763	William Aho Team	Belews Creek	Jefferson
4298	Bone Haulers	Big River	Saint Francois
1430	Flat River	Flat River	Saint Francois
4520	Four Rivers Stream Team Association	Big River	Saint Francois
1914	Gary Williams Team	Big River	Saint Francois
505	Jefferson College	Flat River	Saint Francois
4464	Loveless Stream Team	Big River	Saint Francois
504	Mineral Area College	Flat River	Saint Francois
3548	No Trash Left Behind	Big River	Saint Francois
4393	Pack 455	Big River	Saint Francois
1628	Randy Wiseman Team	Big River	Saint Francois
168	S T R E A M	Big River	Saint Francois
3502	S.S. Guide Service, Osagian Canoes	Big River	Saint Francois
3550	St. Francois County Watershed/Big River Rats	Big River	Saint Francois
2900	St. Francois State Park Water Striders	Big River	Saint Francois
3904	The Bales Team	Big River	Saint Francois
997	The Cindy Skaggs Team	Big River	Saint Francois
2860	The Hensley Family	Big River	Saint Francois
2618	The LaPlant Team	Big River	Saint Francois
1843	The Water Bugs	Big River	Saint Francois
3489	Tom Fambrough	Big River	Saint Francois
284	Valles Mines Stream Team	Big River	Saint Francois
3893	Walmart Desloge #95	Big River	Saint Francois
2839	21 to 8 Crew	Big River S4	Washington
4468	American Pickers	Mill Creek	Washington
1700	Bass River Resort Big River Bandits	Big River S4	Washington
4169	Big River Baggers	Big River S7	Washington
3592	Chasity Crail Team	Big River S4	Washington
2573	Crawdads (The Kolisch Family)	Mineral Fork	Washington

## Stream Teams in the Big River Watershed (by county)continued

Number	Sponsor	Stream Name	County
1017	Ebo Ranch	Ebo Creek	Washington
3382	Fourche a Renault Water Bugs	Fourche a Renault Creek	Washington
4278	Gitter Dun	Clear Creek	Washington
1920	Jacktown 10	Mineral Fork	Washington
4487	Kahlers Kreek Kleaners	Cedar Creek	Washington
1170	Kingston H. S. Ecological Field Studies	Old Mines Creek	Washington
2513	LaBarque Confluence (The College School)	Mineral Fork	Washington
2675	McClain Family Stream Team	Cedar Creek	Washington
4499	Mill Creek Team	Mill Creek	Washington
509	Missouri Smallmouth Alliance	Mineral Fork	Washington
224	Organization for Outdoor Experience	Mineral Fork	Washington
1362	Science in Action Club	Mine a Breton Creek	Washington
4288	Show Me Clean Water	Mine a Breton Creek	Washington
4521	The Pickens Crew	Mineral Fork	Washington
3304	The Rademachers	Big River S4	Washington
4570	The River Dogs	Big River S4	Washington
1262	Tim Politte	Cedar Creek	Washington
34	Unfloaters	Fourche a Renault Creek	Washington
3675	Venturers Crew 2480	Mine a Breton Creek	Washington
3126	Washington State Park Canoe	Big River S7	Washington

## **Volunteer Water Quality Monitoring**

The Volunteer Water Quality Monitoring Program is one of the most popular activities of the Missouri Stream Team Program.

What is the Volunteer Water Quality Monitoring Program?

- It is an opportunity for citizens to learn about water quality and get involved in one of the Missouri Stream Team's most popular activities.
- The program provides each volunteer with training and equipment for monitoring the physical, biological, and chemical parameters of Missouri's rivers and streams.



A Water Quality Monitoring program includes:

- Informing and educating citizens about the conditions of our streams.
- Establishing a monitoring network.
- Generating water quality data.
- Enabling citizens.
- Halting degradation of Missouri streams.
- 

The volunteer program is flexible, offering different levels of involvement and commitment that build on each other.

Volunteers are expected to share the knowledge they gain with their community, periodically monitor a stream and submit collected data in a timely manner.

Volunteers begin by mapping their watershed, calculating stream discharge and submitting a site selection data sheet. This qualifies them to receive monitoring equipment so that they can submit macroinvertebrate data.

With further training volunteers can learn to collect for chemical and microbiological parameters. Volunteer data will be used to inform and educate Missouri citizens, establish baseline data on rarely sampled streams, locate emerging water quality problems and identify long term trends in stream conditions.

Highly trained volunteers will collect data that may supplement agency-collected data.

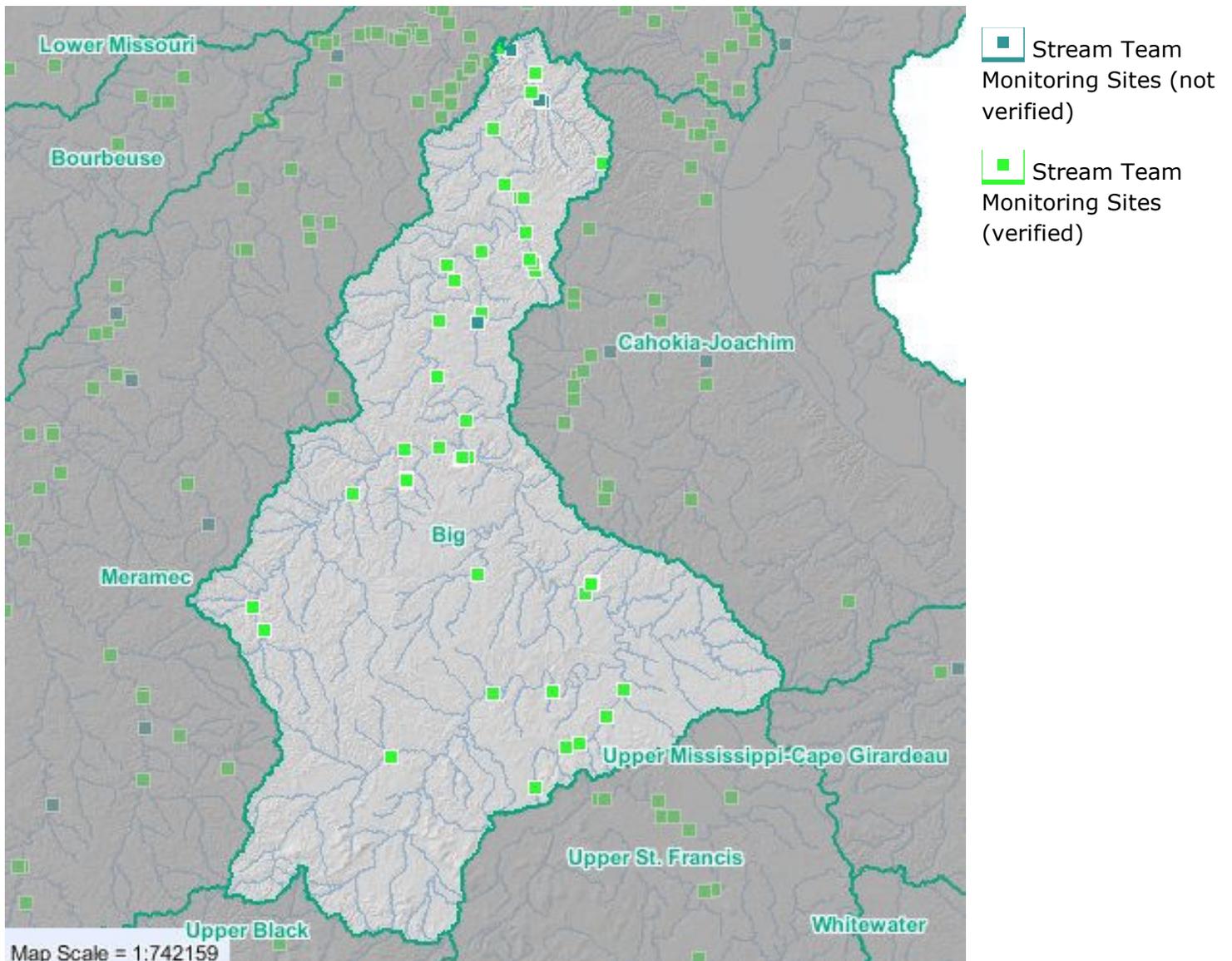
How do I become a volunteer?

- It's very simple, but requires some time and commitment on your part.
- The first step is to sign up for one of our Introductory workshops. Please note the registration deadline for each workshop. Space is usually limited for these training classes, so register early! (<http://www.dnr.mo.gov/env/wpp/vwqm.htm>)

# Local Volunteer Monitoring Sites Within the Big River Watershed

Volunteer Water Quality Monitoring completed by Stream Teams in the Big River Watershed

	Introductory Level	Level 1	Level 2	Level 3	Level 4	(blank)	Grand Total
<b>7140104</b>	<b>96</b>	<b>15</b>	<b>93</b>	<b>36</b>	<b>16</b>	<b>514</b>	<b>770</b>
Belews Creek	22	15	15	22	11	16	101
Big River	11		4	3		130	148
Coonville Creek	7					48	55
Dry Creek	1					13	14
Flat River			8	4		139	151
Fourche a Renault						16	16
Galligher Creek			2	7	5		14
Heads Creek						30	30
Mill Creek						11	11
Mineral Fork	55		64			40	159
Montgomery Creek						4	4
Old Mines Creek						67	67
<b>Grand Total</b>	<b>96</b>	<b>15</b>	<b>93</b>	<b>36</b>	<b>16</b>	<b>514</b>	<b>770</b>



## **Belews Creek Watershed Partnership**



The Belews Creek Watershed is a 26 square-mile area located in the central portion of Jefferson County, Missouri. The headwaters are formed by a natural spring located in Hillsboro, Missouri near the intersection of Elm Street and First Street, just off State Highway BB and almost across the street from the Governor Thomas C Fletcher House. The creek flows in a northwesterly direction for approximately 9 miles to the confluence with the Big River near the intersection of Three B's Road and State Highway BB near Cedar Hill, Missouri. Belews Creek watershed spans 3 to 4.5 miles in width and covers 16,500 acres, which includes Lake Tishomingo, Lake Bonodel and Raintree Lakes.

The watershed is characterized by rugged hills, except along Belews Creek itself. The rugged portions of the area are occupied by either woodland or low-density residential development. The floodplain along Belews Creek is largely farmland. The watershed is lightly populated with much of the land used for agricultural purposes; however, it has pockets of high-density population around its man-made lakes. Belews Creek Watershed Partnership

The Belews Creek Watershed Partnership mission statement is to implement a comprehensive and strategic watershed plan to prevent further degradation to the Belews Creek Watershed and to maintain the long-term quality of its water resources.' This watershed plan has been approved by Jefferson County and the City of Hillsboro, Missouri.

The Partnership is comprised of between 10-15 volunteers from the eight (8) different Management Units that make up the Belews Creek Watershed.

The Partnership believes it is essential to protect Belews Creek by actively implementing and maintaining management objectives that address the cause and impacts of pollutant sources, lack of and destruction of riparian corridors, increased development causing an increase in stormwater runoff, the floodplain and failing septic systems which are a threat to Belews Creek.

In order to acquire funding for projects such as signage of the watershed, reconstruction of riparian corridors, water quality monitoring of the creeks and lakes in the watershed, educating, repairing and replacing septic systems within the watershed, bank stabilization in several areas along Belews Creek, and informing residents and developers about ways to deal with sinkholes, the Partnership has applied for a nonpoint source implementation grant (319) to the Missouri Department of Natural Resources Water Protection Program. News of the awarding of this grant will be forthcoming in 2010, and funds will become available in 2011.



## **Operation Clean Stream**

Since 1967, The Open Space Council for the St. Louis Region has organized Operation Clean Stream, one of the country's largest and longest running river restoration projects.



The fourth weekend of every August, event volunteers take to the Meramec River and its tributaries, working to undo damage caused throughout the year by flooding, careless littering and the unlawful dumping of trash.

Volunteers participate both in canoes and boats, as well as on the shore, in nearby parks, and along nearby trails.

In 2012, more than 2,500 volunteers took to the Meramec River and its tributaries – The Big, Bourbeuse, Courtois and Huzzah Rivers.

Volunteers of all ages are encouraged to help with the ongoing restoration and conservation stewardship projects in the Meramec River Greenway. Volunteers may work as individuals or as part of an organization's team to remove trash and litter from both the river and public areas such as boat accesses, parks and trails. It is not necessary to have a boat or canoe to participate.



**2012 Tire Round-up on the Big River**



Big River Watershed  
Summit Fall 2013



## **Other Partners and Resources in the Big River Watershed**



# The East-West Gateway Council of Governments



## EAST-WEST GATEWAY Council of Governments

Creating Solutions Across Jurisdictional Boundaries

### Who We Are and What We Do

The East-West Gateway Council of Governments is a membership organization for local governments in the St. Louis metropolitan area, formed in 1965 to address problems that cross the region's many political boundaries. The agency also serves as the region's Metropolitan Planning Organization, empowered by local, state and federal governments to plan and approve transportation projects that involve the use of federal funds. A 24 member Board of Directors governs East-West Gateway. The Board is made up almost entirely of local elected officials.

East-West Gateway is the only governmental entity that spans the entire two-state, eight-county region and it serves as a forum for local elected officials to make regional decisions. East-West Gateway's planning and decision-making responsibility covers a wide range of regional concerns, most notably transportation, the environment, regional security and economic growth.

One of the Council's strengths, is its demographic and economic research that provides an understanding of the regional impact of local decisions. This research and analysis helps the agency engage and educate local leadership and citizens about the current problems and future prospects of the region. Effective public engagement is an essential part of the planning process and informs the decisions of the region's elected leaders.



# **The East-West Gateway Council of Governments (Continued)**

## **Water Resources Activities**

### **208 Water Quality Planning**

The 1972 Federal Water Pollution Control Act Amendments laid out a commitment to protect the rivers and streams of the U.S. The major goal was to attain “water quality which provides for the protection and propagation of fish, shell fish and wildlife and provides for recreation in and on the water.” Sections 208 and 201 of this act set forth requirements and procedures to achieve the delineated goals. An approved Section 208 water quality management plan was prerequisite for the 201 planning process to develop and implement community/district wastewater treatment plans. Under Section 208, Governors from each state designated planning agencies for their metropolitan areas. East-West Gateway was designated as one by the Governor of Missouri in 1975. Grants were available for the development of an areawide water quality management plan. The St. Louis, Missouri Water Quality Management Plan (208 Plan) provided a framework for establishing control strategies to solve point and non-point pollution problems. The 208 Plan identified the Lower Meramec River as a high priority stream and major regional asset. The plan detailed the capacity and location of regional and sub-regional wastewater treatment facilities and addressed non-point pollution problems and related issues. The 208 Plan was completed in 1978 and approved by the U.S. Environmental Protection Agency in 1979.

East-West Gateway has implemented the 208 Plan’s recommendations by: providing technical assistance to local governments and sewer districts; conducting studies on septic tank management and low impact development; performing Water Quality Management Plan updates; and facilitating the Regional Water Resources Committee. Most recently staff completed the Lower Meramec Watershed Plan: From Pacific to Valley Park.

### **Regional Water Resources Committee**

In 2001, East-West Gateway organized a Regional Water Resources Committee (WRC) for the Missouri portion of the St. Louis region. It serves as an advisory committee to the East-West Gateway Board of Directors. The membership of the WRC is composed of representatives from industry, water and sewer districts, communities, government agencies, universities, environmental groups and the general public and from all parts of the region. The overall mission of the WRC is to provide a forum for the sharing of ideas and discussion of major water quality issues facing the region’s communities and for developing a cooperation and collaboration of ideas and actions for addressing these problems. Presentations at WRC meetings highlight many significant areas for planning and actions to improve water quality.

### **To Contact Us:**

East-West Gateway Council of Governments

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314.421.4220 (from Missouri)

[www.ewgateway.org](http://www.ewgateway.org)

## **The Meramec Regional Planning Commission**

The Meramec Regional Planning Commission (MRPC) is a voluntary council of local governments that serves Crawford, Dent, Gasconade, Maries, Osage, Phelps, Pulaski and Washington counties and 36 communities within those counties in south central Missouri. MRPC was formed in 1969 and has served the local governments and citizens of the region for more than 40 years by providing professional staff and services.



The Meramec Regional Planning Commission provides a number of services to Washington County and its communities. This past year, MRPC:

- Provided a forum for cities and counties to come together monthly to discuss issues and find solutions to regional issues.
- Provided grant writing, planning and administration services.
- Provided administration and plan implementation for the Ozark Rivers Solid Waste Management District, which includes Washington County.
- Provided administration and technical assistance for the Meramec Regional Emergency Planning Committee including coordinating a tabletop exercise for Potosi and updating the hazardous materials emergency response plan.
- Coordinated an illegally dumped tire pick up in Washington County.
- Provided environmental educational opportunities to schools in the area.
- Provided recycling bins to Kingston K-14 School District.
- Developed and submitted a hazard mitigation plan for Washington County.
- Coordinate transportation planning for all eight counties, including prioritizing a list of transportation needs.
- Administered a Community Development Block Grant for a new water system to service PWSD #2 in Washington County.
- Administered a Community Development Block Grant for a new sewer system to serve PWSD #1 in Washington County.
- Administered a Community Development Block Grant for a water improvement project for the city of Irondale.
- Promoted Missouri Association of Councils of Government's On-site Wastewater Loan Program to residents of Washington County.



Meramec Regional Planning Commission  
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St. James, MO 65559  
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FAX: (573) 265-3550  
[www.meramecregion.org](http://www.meramecregion.org)



# Southeast Missouri Regional Planning and Economic Development Commission

The Southeast Missouri Regional Planning and Economic Development Commission (Commission or RPC) was created in 1968 to provide planning and economic development services to Bollinger, Cape Girardeau, Iron, Madison, Perry, St. Francois and Ste. Genevieve Counties.



The Commission has aided Iron, St. Francois and Ste. Genevieve Counties within the Big River Watershed with a multitude of projects. These counties participate in the Comprehensive Economic Development Strategy (CEDS) which provides a planning framework for a work program and activities through goals and objectives over a five year period. The information below describes some projects that have materialized in the watershed recently.

- Farmington received a public water project grant for a water line extension in to service a mobile home park.
- Public wastewater treatment projects include a sewer line extension in Farmington to remove residents from septic systems, staff wrote and administers a grant to rehabilitate the wastewater collection system and construct a new wastewater treatment facility in Bismarck. The RPC is currently conducting sewer system mapping in Park Hills and has completed sewer system mapping in Leadwood, Leadington and Bismarck. The sewer systems are mapped utilizing GPS technology by plotting the coordinates for each manhole and then the lines are coded by size and type in Geographic Information System. The RPC contributed to the Missouri Department of Natural Resources Community Wastewater Assessment for the 604(b) Statewide Wastewater Assessment. Leadington has received a grant to rehabilitate stormwater drainage.
- As a result of changes in Environmental Protection Agency regulations, the Commission has created an Air Quality Committee. The air quality work is based on the monitor in Bonne Terre and the Committee has developed a regional Clean Air Action Plan for the region. The RPC applies for and administers Diesel Emission Reduction Act grants for the region which included installing Diesel Oxidation Catalyst, Diesel Particulate Filters and Auxiliary Power Units on diesel powered vehicles that operate within region.
- The Commission administers Solid Waste Management District Region R for the State of Missouri. The SWMD grant funds have aided the Saint Francois County Environmental Corporation through the purchase of trailers and the Farmington Phase One Recycling Pickup Site. The RPC distributes information regarding the MACOG On-Site Wastewater Loan program to region residents struggling with a failing septic system.

*Southeast Missouri*  
**REGIONAL PLANNING & ECONOMIC  
DEVELOPMENT COMMISSION**

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# Missouri Department of Conservation

Mission: To protect and manage the forest, fish, and wildlife resources of the state and to facilitate and provide opportunities for all citizens to use, enjoy and learn about these resources.



## Goals:

- Ensure healthy and sustainable forest, fish, and wildlife resources throughout the state.
- Manage lands held in public trust and associated infrastructure to ensure continued benefit to citizens and to forest, fish, and wildlife resources.
- Ensure sound financial accountability and transparency in all areas of operation.
- Provide opportunities for active citizen involvement in services and conservation education in both rural and urban areas.
- Engage partners at all levels (individual, community, county, state, federal) to enhance natural resources and effective delivery of conservation services.

Recently the Missouri Department of Conservation has started looking at stream management more in terms of watershed management. This approach better describes where opportunities to improve our water resources exist. These resources include streams, lakes, reservoirs, groundwater, wetlands, springs, sinkholes, and all of the associated biotic and abiotic forms associated with them.

A watershed approach addresses the five elements of a watershed:

- The **uplands** shed water and sediment down the slopes and when fully functional, maintain a natural deliver rate of each to the stream.
- The **floodplain** is the portion of the valley floor submerged by flood waters during periods of heavy runoff; to be fully functional it should be sufficiently vegetated and available to the stream at high flow events.
- The **riparian (stream side) corridor** is a continuous strip of land that parallels both sides of the stream. This strip of land is very important because, when properly vegetated, it buffers the stream from the rest of the watershed and provides important fish and wildlife habitat functions. This is true even in headwater streams, which may not have a floodplain.
- Precipitation **infiltration** throughout the watershed recharges groundwater and reduces flooding during wet seasons. In turn, groundwater is essential to a watershed by providing base flows to some stream channels during dry periods.
- **Stream channels** convey water and sediment down the valley and if they and their watersheds are mostly unaltered, they provide natural habitats. The channels are the smallest portions of the watersheds but often receive the most attention, yet the condition of the stream channel is primarily a reflection of its watershed (uplands, floodplains, riparian corridors, and groundwater) and the activities occurring within it.



## **United States Environmental Protection Agency**

Significant cleanup progress has been made in Missouri over the past 20+ years on lead mining sites. Some of the highest priorities are to address risks to human health from lead-contaminated soil in residential yards and other high child-use areas such as day cares, schools, parks and play areas. These risks have been significantly reduced through removal and remedial actions. A significant portion of these cleanup efforts have been funded federally while responsible parties, such as the mining companies, have conducted cleanup actions as well. Over 1,000 contaminated residential properties have been cleaned up in the Big River watershed through these actions. However, over 6,000 properties remain to be sampled and it is estimated that several thousand more properties will need to be cleaned up within the area.

Typical yard remediation progression:

Past and ongoing releases of chat, tailings, and other mining wastes to the Big River have resulted in the contamination of sediment and floodplain soils with lead along over 90 miles of the Big River starting at Leadwood continuing to near its confluence with the Meramec River. Through ongoing work, the major mine waste piles in St. Francois County have either been stabilized (re-graded and covered with clean rock) or are in the process of being stabilized. This work will decrease the amount of lead contaminated material entering the watershed through erosion, cutting off the ongoing releases from many of the large source areas.



Historic abandoned lead mining, milling and smelting sites are primarily managed under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), more commonly referred to as the Superfund Law. CERCLA was enacted in 1980 in response to highly publicized sites like Love Canal in New York, and Times Beach, here in Missouri. It allows the Environmental Protection Agency (EPA) broad authority to clean up such sites and to compel responsible parties to perform cleanups or reimburse the government for EPA-lead cleanups. The law created a tax on the chemical and petroleum industries to fund such actions. However, Congress did not renew the Superfund tax and it expired in 1995. Today, monies to finance the federal Superfund Program come primarily from annual federal appropriations through the federal legislative process, and through settlements and penalties assessed against potentially responsible parties (PRPs).

The Superfund Law and the rules and regulations created to implement it are extremely complex. Additional detail on the Superfund process is available in a very informative series of interactive flow chart diagrams explaining how the superfund site discovery, assessment, removal and remedial processes work on this EPA webpage: <http://www.epa.gov/oswer/engagementinitiative/superfund.html>

## **United States Environmental Protection Agency (Continued)**

Several pilot projects and studies have been conducted or are underway with the purpose of characterizing the nature and extent of the lead contamination in the watershed and understanding the processes of sediment transport and storage in the channel and floodplain deposits of the Big River and its tributaries. One pilot project, conducted at an access point known locally as “The Bone Hole”, focused on quantifying the volume of sediment moving during small flood events. Contaminated sediments were excavated from behind a low water crossing and off of a gravel bar. Surveying conducted during the project revealed that all of the excavated sediment was replaced after one small flood event.

### **Surveying near the Bone Hole**

Additional pilot projects will be implemented in the future as funding and access to key points along the Big River become available.”



# United States Army Corps of Engineers

## The Corps of Engineers Feasibility Study with the Environmental Protection Agency

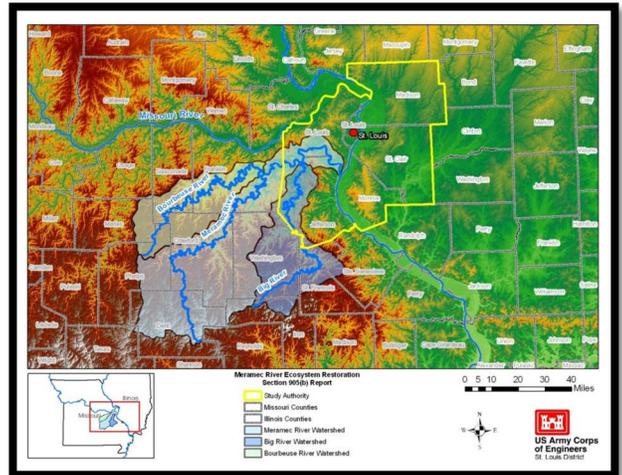
United States Army Corps of Engineers – St. Louis District (Corps) was granted the authority to study the Mississippi River and its tributaries in St. Louis City, St. Louis County, and Jefferson County, Missouri, and Madison County, St. Clair County, and Monroe County, Illinois by a 21 June 2000 Resolution by the Committee on Transportation and Infrastructure, U.S. House of Representatives, Docket 2642.

Missouri Department of Natural Resources (MDNR) has come to the Corps and expressed interest in the Meramec and Big River watersheds. The Corps investigated the St. Louis Riverfront, Missouri and Illinois-Meramec River Ecosystem Restoration Project and recently approved a Reconnaissance Report, dated June 28, 2013, for this project.

A feasibility study will commence in 2014 and 2015 to study the feasibility of conducting a joint project with United States Environmental Protection Agency – Region 7 (USEPA). The goals of the Feasibility Study are to ascertain the scope and budget for an ecosystem restoration project that would run parallel to the remediation effort being undertaken by USEPA. Partnering with USEPA will help to leverage federal resources and prevent duplicative spending. Ecosystem restoration measures may include sediment capture structures, wetland creation, riparian corridor restoration, mussel habitat restoration, stabilizing bed and banks, fish passage structures, and/or rock riffle structures.

Corps of Engineers Contact:  
Matthew Cosby  
Project Management Branch  
(314) 331-8129 (Office)  
(314) 331-8741 (Fax)

Mailing Address:  
United States Army Corps of Engineers (PM-F)  
St. Louis District  
1222 Spruce Street  
St. Louis, Missouri 63103







# Missouri Department of Health and Senior Services

**Vision:** Healthy Missourians for Life

**Mission:** To be the leader in promoting, protecting, and partnering for health.

Many things in the environment can affect our health. Hazardous substances found in the air, soil and water can originate from a variety of sources, such as agricultural and industrial activities, mining operations, landfills and leaky underground storage tanks. Health officials work with individuals, communities, government agencies and industries throughout the state to reduce or eliminate exposure to substances that could be harmful.

## Environmental Public Health

The Missouri Department of Health and Senior Services evaluates potentially hazardous substances and sites to determine their impact on the public's health. Health officials provide information to communities about exposure to hazardous substances and ways to reduce exposure until the risk is eliminated.

## Lead

Lead poisoning is one of the most common and preventable environmental health problems in Missouri. Lead exposure in children can cause learning and behavioral problems, lower IQ levels and interfere with growth and hearing. The only way to know if a child has lead poisoning is to have his or her blood tested.



## Septic Systems

Onsite wastewater treatment systems are used by about 25 percent of all homes in Missouri. Sewage systems that are not operating correctly can create a health risk. In most areas of Missouri, a permit to construct an onsite sewage system must be obtained from a local health department or the state Department of Health and Senior Services.

## Water Wells

Thousands of Missourians get their water from a private water supply, usually a well. Missouri's Private Water Program works to make sure that drinking water is safe. The program provides technical assistance to homeowners and local health agencies regarding water testing and treatment. The program also regulates private water supplies of hotels, motels and restaurants to make sure the water meets safe drinking water standards.

## Fish Advisory

All fish contain some small amount of chemical contaminants. In most instances and for most people, the health benefits of eating fish outweigh the potential health risks from contaminants. However, there are occasions when DHSS has determined that limited or even no consumption of fish is appropriate for some people.

Lead's potential to accumulate in fish makes fish consumption a risk in certain regions of Missouri, especially in mining areas. For the Big River (in St. Francois and Jefferson Counties) and Flat River (in St. Francois County from Highway B to six miles downstream where it enters Big River), the Missouri Fish Advisory makes the recommendation to **Do Not Eat**: carp, sunfish, redhorse, or other suckers due to lead. (Note: only five sunfish species are included in this advisory: longear sunfish, green sunfish, bluegill, warmouth, and rock bass.)



## Missouri Department of Health and Senior Services (cont)

### Missouri's Environmental Public Health Tracking

Missouri's Environmental Public Health Tracking (EPHT) involves the ongoing collection, integration, and analysis of data about environmental hazards, exposure to those hazards, and health effects potentially related to exposure to those hazards. The goal of EPHT is to protect communities by providing federal, state, and local agencies with information they can use to plan, apply, and evaluate environmental public health actions.

The EPHT portal includes data files, interactive mapping applications, analyses, resources, tools, and links specific to:

- Agricultural Chemical Usage;
- Water Contaminants including Halo Acetic Acids, Nitrates, & Trihalomethane; and
- Air Contaminants including Particulate Matters, Ozone, Lead, Carbon Monoxide, Sulfur Dioxide, and Nitrogen Dioxide.

### Indoor Air

Clean indoor air is vital to good health. Indoor air pollutants can contribute to asthma and allergic reactions, chemical poisoning and some types of cancer. The quality of indoor air is a significant health concern throughout the state, because Missourians spend an average of 90 percent of their time inside.

### Radon

Radon is a colorless, odorless and tasteless gas that poses a health risk to humans primarily when it is found inside homes and other buildings. Exposure to radon is the second leading cause of lung cancer. Homes can be tested for radon, and steps can be taken to reduce the level of radon in indoor air.

**United States Department of Agriculture**

NRCS in Missouri is designed for customer service and field office support. We have 100 field offices serving all 114 counties employing nearly 400 people. In addition to field offices, NRCS also has technical offices. These offices support soil survey, watershed projects, water quality, outreach, resource conservation and development and plant materials.

Our field offices are co-located with the USDA [Farm Service Agency](#), [Rural Development](#) and local soil and water conservation district staffs. The state is divided into four areas led by area conservationists. Those four areas are further divided into one-to-three county field office service areas (FOSAs), led by District Conservationists.

The Big River Watershed is contained within the NRCS Area 3, which covers the following counties:

Bollinger	Butler	Cape Girardeau	Dunklin	Franklin
Iron	Jefferson	Lincoln	Madison	Mississippi
New Madrid	Oregon	Pemiscot	Perry	Reynolds
Ripley	Scott	Shannon	St. Charles	St. Francois
St. Louis	Ste. Genevieve	Stoddard	Washington	Wayne

Iron Co. Soil & Water Conservation District (SWCD)  
250 S. Main Street, Ironton, MO 63650  
(573) 546-6518

Jefferson Co. NRCS Field Office/SWCD  
10820 Hwy. 21, Suite 203, Hillsboro, MO 63050  
(636) 789-2441 Ext. 3

Ste. Genevieve Co. NRCS Field Office/SWCD  
711 Pointe Basse Drive, Ste. Genevieve, MO 63670  
(573) 883-3566 Ext. 3

Washington Co. Soil & Water Conservation District (SWCD)  
103 N. Missouri Street, Potosi, MO 63664  
(573) 438-9214

Franklin Co. NRCS Field Office/SWCD  
1004 Vondera Avenue, Bldg. 1, Union, MO 63084  
(636) 583-2303 Ext. 3

St. Francois Co. NRCS Field Office/SWCD  
812 Progress Drive, Farmington, MO 63640  
(573) 756-6488 Ext. 3

**Missouri NRCS** offers voluntary programs to eligible landowners and agricultural producers to provide financial and technical assistance to help manage natural resources in a sustainable manner. Through these programs the agency approves contracts to provide financial assistance to help plan and implement conservation practices that address natural resource concerns or opportunities to help save energy, improve soil, water, plant, air, animal and related resources on agricultural lands and non-industrial private forest land.

**Our financial assistance programs include the following:**

- **Cooperative Conservation Partnership Initiative (CCPI)**  
A voluntary conservation initiative that enables the use of certain conservation programs along with resource of eligible partners to provide financial and technical assistance to owners and operators of agricultural and nonindustrial private forest lands.
- **Conservation Innovation Grants (CIG)**  
A voluntary program intended to stimulate the development and adoption of innovative conservation approaches and technologies while leveraging Federal investment in environmental enhancement and protection, in conjunction with agricultural production.
- **Conservation Stewardship Program (CSP)**  
A voluntary conservation program that encourages producers to address resource concerns in a comprehensive manner by undertaking additional conservation activities; and improving, maintaining, and managing existing conservation activities.
- **Environmental Quality Incentives Program (EQIP)**  
A voluntary program that provides financial and technical assistance to agricultural producers through contracts up to three years in length
- **Wildlife Habitat Incentive Program (WHIP)**  
A voluntary program for conservation-minded landowners who want to develop and improve wildlife habitat on agricultural land, nonindustrial private forest land, and Indian land.
- **Wetlands Reserve Program (WRP)**  
Landowners who choose to participate in WRP may sell a conservation easement to or enter into a cost-share restoration agreement with USDA to restore and protect wetlands. The program offers landowners three options: permanent easements, 30-year easements, and restoration cost-share agreements of a minimum 10-year duration. Landowners and NRCS develop a plan for the restoration and maintenance of the wetland.

**A sample of NRCS Conservation Practices eligible for financial assistance in the Big River Watershed**

- |   |                             |
|---|-----------------------------|
| • Access Control of livestock from riparian areas | Riparian Forest Buffer      |
| • Nutrient Management Plan                        | Prescribed Grazing          |
| • Forest Management Plan                          | Spring Development          |
| • Grazing Management Plan                         | Tree/Shrub Establishment    |
| • Conservation Cover                              | Field Border                |
| • No Till   | Wildlife Habitat Management |
| • Cover Crop                                      | Prescribed Burning          |
| • Critical Area Planting                          | Forest Stand Improvement    |
| • Fence   | Forage & Biomass Planting   |

## MISSOURI DEPARTMENT OF AGRICULTURE



### **Mission Statement**

"To serve, promote, and protect the agricultural producers, processors, and consumers of Missouri's food, fuel, and fiber products."

### **A Proud History**

Missouri has a proud agricultural tradition. In fact, the statue adorning the dome of the State Capitol—often mistaken as Lady Liberty—is that of Ceres, goddess of growing vegetation. The first farms in Missouri were established around 1725 by French settlers in the Ste. Genevieve area. In 1811 an event of great magnitude shook the small farming communities—the New Madrid earthquake (recorded as the worst earthquake in North American history). Devastated villagers petitioned congress for assistance and were granted land in the “Boone’s Lick” area that runs parallel to the Missouri River. The area proved prosperous, and Missouri agriculture became more productive and diverse. A decade later, in the 1820's, agricultural societies for the promotion and exhibition of agricultural products began to appear throughout Missouri’s counties.

By the 1860's Missouri’s rapidly expanding agricultural industry needed leadership and assistance. As a result, the precursor organization to the department was formed in 1865. Known as the Missouri State Board of Agriculture, the 10 member organization is best remembered for its “Farmer’s Institutes.” Similar to the work of the modern-day University Extension, the state board endeavored to reach out and educate farmers and farm families. The state board served in cooperation with the Missouri State Horticultural Society and later helped form the Missouri College of Agriculture. All three organizations worked to educate the agricultural community until the 1933 re-organization.

In 1933, the state board was abolished and a new era of agricultural leadership began in Missouri. The State Department of Agriculture (MDA) was formed, with responsibility for regulatory functions, while the College of Agriculture was given primary responsibility for research and education.

Today, the MDA sets agriculture policy and provides assistance to farmers throughout the state. While the department maintains its regulatory functions, its expanded duties include consumer protection, public health roles, environmental advocacy, agricultural marketing, public information and awareness, and promoting new technology and new uses for Missouri’s agricultural goods.

In addition to its multiple regulatory functions, within the Big River Watershed basin, MDA has assisted with the opening of approximately eight local Farmers Markets for selling fresh fruits, vegetables & agricultural products and the Missouri Grape & Wine Program operated within MDA has assisted with the establishment of nearly a dozen vineyards/wineries within the basin.





## Southeast Missouri Ozarks Regional Restoration Plan

### Contact Information:

#### Missouri Department of Natural Resources

PO Box 176  
Jefferson City, MO 65102  
Attn: Tim Rielly

Telephone:

573- 526-3353

Toll Free:

800-361-4827

Email:

tim.rielly@dnr.mo.gov

Web address:

<http://dnr.mo.gov/env/hwp/sfund/nrda.htm>

#### U.S. Fish & Wildlife Service

101 Park DeVille Dr.,  
Suite A

Columbia, MO 65203

Attn: John Weber

Telephone:

573-234-2132 (x177)

Email:

John\_S\_Weber@fws.gov

Web address:

<http://www.fws.gov/midwest/es/ec/nrda/SEMONRDA/index.html>

#### U.S. Forest Service

401 Fairgrounds Road  
Rolla, MO 65401

Attn: Katie Lajeunesse

Connette

Telephone:

573-875-5341 (x223)

Email:

klajeunesse@fs.fed.us

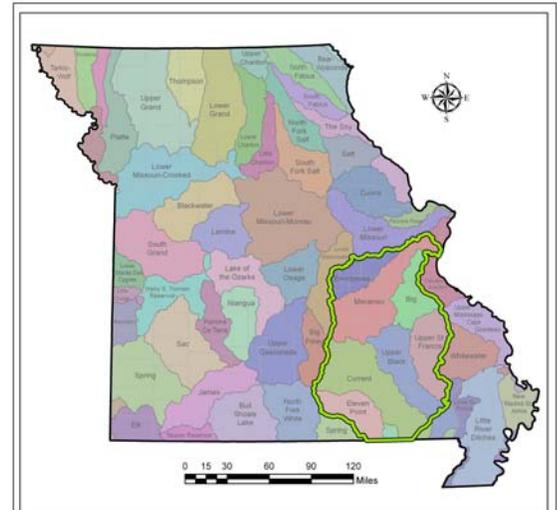
### What is a Southeast Missouri Ozark Regional Restoration Plan?

The Missouri Department of Natural Resources, the U.S. Forest Service and U.S. Fish & Wildlife Service are Trustees for the assessment and restoration of natural resources. These agencies have developed a regional restoration plan to restore southeast Missouri's natural resources injured by hazardous substances released from current and historic mining operations.

The objective of the plan is to compensate the public, through environmental restoration, for losses of natural resources that have been injured by releases of hazardous substances into the environment. Natural resource funds received must be used to restore, rehabilitate, replace and/or acquire the equivalent of the injured natural resources.



New Hoffman Mill, St. Joseph Lead Co., St. Francois County, MO. Historic mining activities in southeast Missouri may have led to the potential injuries of the natural resources.



Missouri Mines State Historic Site in Park Hills, MO

### What Are the Goals of the Plan?

1. Identify the natural resources and services potentially injured by the release of hazardous substances in the Southeast Missouri Ozarks;
2. Develop a request for proposal process to evaluate and select compensatory restoration projects to achieve restoration strategies;
3. Identify types and examples of primary restoration projects that will be implemented by the Trustees and/or their contractors;
4. Gain efficiencies in the natural resource damage assessment and restoration process; provide for consistency and predictability by detailing the process, thereby minimizing uncertainty to the public; and,
5. Expedite restoration of potentially injured natural resources and lost services with existing restoration funds.



## Summary of Restoration Alternatives

The selected alternative must restore, rehabilitate, replace and/or acquire the equivalent of those natural resources and their services potentially injured by the releases of hazardous substances within the Southeast Missouri Ozarks:

*Alternative A:* No Action

*Alternative B:* Primary Restoration of Injured Natural Resources

*Alternative C:* Compensatory Restoration

***Alternative D:* Tiered Project Selection Process  
Evaluating the Feasibility of Primary Restoration, Compensatory Restoration, and Acquisition of Equivalent Resources (Preferred)**

## Restoration Project Evaluation Criteria

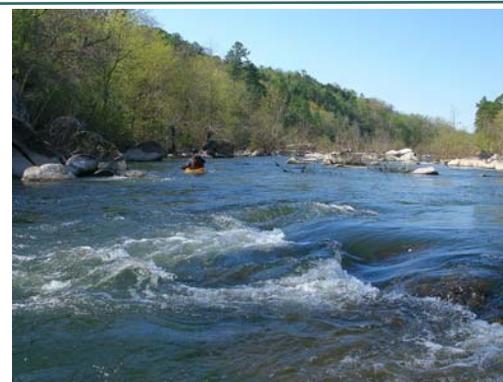
There are two components to the project evaluation process. They are:

1. Acceptability Criteria: These criteria evaluate the initial project and whether it is achievable.
2. Project Ranking Criteria:
  - ◆ Location
  - ◆ Preferred resources & services
  - ◆ Scope of Benefits
  - ◆ Time required for restoration
  - ◆ Adverse environmental effects from actions
  - ◆ Cost-effectiveness
  - ◆ Evaluation component
  - ◆ Technical feasibility

## Copies of the Plan Are Available

Copies of the plan can be viewed online and copies are also available for on-site review at:

- **U.S. Fish & Wildlife Service,**  
101 Park DeVille Dr. Suite A, Columbia, Missouri  
<http://www.fws.gov/midwest/es/ec/nrda/SEMONRDA/index.html>
- **Missouri Department of Natural Resources,**  
1730 E. Elm St., Jefferson City, Missouri  
<http://dnr.mo.gov/env/hwp/sfund/nrda.htm>



St. Francis River at Silver Mines Recreation Area, Madison County, Missouri

## Existing Settlements in the Southeast Missouri Ozarks

Settlement	Settlement Date	Available Restoration Funds (approx.)
ASARCO: Big River Mine Tailings	12/15/2009	\$33,376,090
ASARCO: Madison County	12/15/2009	\$1,648,155
ASARCO: West Fork Mine and Mill	12/15/2009	\$1,227,292
ASARCO: Sweetwater Mine and Mill	12/15/2009	\$2,472,249
ASARCO: Glover Smelter	12/15/2009	\$2,454,584

### Additional Information

The Missouri Department of Natural Resources, the U.S. Forest Service and the U.S. Fish & Wildlife Service invites the public to review the *Southeast Missouri Ozarks Regional Restoration Plan and Environmental Assessment*. The Missouri Department of Natural Resources, the U.S. Forest Service and the U.S. Fish & Wildlife Service are committed to helping the citizens of Missouri by providing information and assistance. Please contact any of these agencies with questions you may have regarding the natural resource damages process.



# United States Department of the Interior

FISH AND WILDLIFE SERVICE  
Missouri Ecological Services Field Office  
101 Park DeVille Drive, Suite A  
Columbia, Missouri 65203-0057  
Phone: (573) 234-2132 Fax: (573) 234-2181



The Mission of the U.S. Fish & Wildlife Service (USFWS) is working with others to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. In Missouri, the USFWS has focused on the Meramec River, as one of our priorities due to the rich diversity of animal and plants species—a number of which are endangered—and cooperative conservation opportunities that exist in the watershed. The Big River is a major tributary of the Meramec and home to several species of endangered freshwater mussels. Consequently, the USFWS is committed to working with others to assist in its recovery and restoration.

## **The Role of the U.S. Fish & Wildlife Service in the Big River Watershed**

When hazardous substances enter the environment, fish, wildlife, and other natural resources can be injured. The USFWS, along with other State and Federal partners, act as "trustees" for these resources. The U.S. Fish and Wildlife Service has responsibility for National Wildlife Refuges, endangered species, migratory birds, and interjurisdictional fishes. Trustees seek to identify the natural resources injured, determine the extent of the injuries, recover damages from those responsible, and plan and carry out natural resource restoration activities. These efforts are underway in the Big River watershed and other areas of southeast Missouri.

## **Assessing and Restoring the Resources**

The first step in the process is to conduct a damage assessment to determine the extent of injury to natural resources caused by the hazardous substance release. This information is used to determine the amount of restoration that is needed. In the Big River and surrounding areas, the USFWS and our contractors have conducted studies on many natural resources including: freshwater mussels, crayfish, riffle fish, sediment toxicity, migratory songbirds, sediment and floodplain soil contamination, bank stability, and vegetative communities, among others which are planned or ongoing. Once the studies are completed and the extent of the problem is determined, the trustees then negotiate a settlement with the responsible parties for the cost of restoration, loss of use of the land or natural resources by the general public, and money spent to assess damages. Once a settlement has been reached, the trustees can take action to restore the injured resources.

Assessing and restoring natural resources injured by releases of hazardous substances is particularly important in southeast Missouri due to the presence of the largest historic and current lead and zinc mining districts in the country. These mines contaminate tens of thousands of acres of land and hundreds of miles of streams with heavy metals that have impacted fish, wildlife, and their habitat. More information on the USFWS study plans and roles at lead mining sites in southeast Missouri can be found at: <http://www.fws.gov/midwest/semonrda> .

## **Current Status**

Currently, the USFWS and our co-trustees are completing studies, negotiating settlements, and planning restoration projects to implement. The trustees have already received over \$30 million in settlements associated with the Big River watershed and are actively planning to spend those restoration funds over the next several years to restore the affected natural resources.

## **Benefiting the Fish, Wildlife and the Public**

The primary benefit of the restoration is that injured natural resources can be restored *at no cost to taxpayers*. Instead, the responsible parties pay for the restoration. When restoration projects are implemented in the Big River watershed people will once again be enjoying rivers and lands that are healthy and teeming with fish and wildlife, and public places that are safe for recreation and other uses.

For more information about the USFWS' activities, plans, and goals in the Big River and southeast Missouri please contact Mr. Dave Mosby by telephone at 573-234-2132 x113 or at [Dave\\_Mosby@fws.gov](mailto:Dave_Mosby@fws.gov).





Big River Watershed

Summit Fall 2013

## **Frequently Asked Questions**



Big River Watershed  
Summit Fall 2013



**Links**



Missouri Department of Natural Resources

[www.dnr.mo.gov](http://www.dnr.mo.gov)

Big River Watershed Summer Newsletter 7/27/2012

<http://content.govdelivery.com/accounts/MODNR/bulletins/489b25>

Volunteer Water Quality Monitoring Program

<http://www.dnr.mo.gov/env/wpp/vwqm.htm>

Water Protection Program

<http://www.dnr.mo.gov/env/wpp/index.html>

Missouri Department of Conservation

<http://mdc.mo.gov/>

Missouri Canoe & Floaters Association

-Big River <http://www.missouricanoe.org/river-maps/big.html>

Missouri Department of Health and Senior Services

<http://health.mo.gov/index.php>

US Army Corp of Engineers St. Louis District

<http://www.mvs.usace.army.mil/>

USGS Water Data (Missouri)

<http://waterdata.usgs.gov/mo/nwis/>

US Forest and Wildlife Service

<http://www.fws.gov/>

-Long Term Monitoring

<http://www.fws.gov/midwest/es/ec/nrda/SEMONRDA/documents/bigriverlongtermmonitoringmethods.pdf>

Big River (Missouri)

[http://en.wikipedia.org/wiki/Big\\_River\\_\(Missouri\)](http://en.wikipedia.org/wiki/Big_River_(Missouri))

EPA -Clean Water Act [http://cfpub.epa.gov/npdes/cwa.cfm?program\\_id=45](http://cfpub.epa.gov/npdes/cwa.cfm?program_id=45)

-Watershed Profile [http://cfpub.epa.gov/surf/huc.cfm?huc\\_code=07140104](http://cfpub.epa.gov/surf/huc.cfm?huc_code=07140104)

Missouri State Parks

<http://mostateparks.com/>

St. Joe State Park <http://mostateparks.com/park/st-joe-state-park>

Washington State Park <http://mostateparks.com/park/washington-state-park>

St. Francois State Park <http://mostateparks.com/park/st-francois-state-park>

Missouri Mines Museum <http://mostateparks.com/park/missouri-mines-state-historic-site>

Southeast Regional Planning Commission

<http://semorpc.org/>

Meramec Regional Planning Commission

<http://www.meramecregion.org/>

East West Gateway Council of Governments

<http://www.ewgateway.org/>

Our Missouri Waters Initiative

<http://www.ewgateway.org/pdffiles/library/wrc/presentations/mowaterinitiative-modnr-feb2013.pdf>

Missouri Public Utilities Alliance

<http://www.mpua.org/>

Missouri Rural Water Association

<http://www.moruralwater.org/>

University of Missouri

<http://missouri.edu/>

University of Missouri – Jefferson County Extension

-Big River Watershed Master Planning Process: Interim Finding Report - Fall 2012

<http://extension.missouri.edu/jefferson/documents/Master%20Plan%20Interim%20Findings%20Draft%20November%202012%20-%20revised%20January%202013.pdf>

St. Francois County

<http://www.sfcgov.org/>

Washington County

<http://www.washingtoncountymo.us/>

Jefferson County

<http://www.jeffcomo.org/>

Missouri Stream Team Program

<http://www.mostreamteam.org/>

Belews Creek Watershed Partnership

<http://www.belews-creek.com/>

Operation Clean Stream – Open Space Council

<http://www.openspacestl.org/programs/operation-clean-stream>

Big River Watershed  
Summit Fall 2013



## **Glossary of Terms**



# Watershed Glossary

## Definition of Terms

**Alluvial soil** - Soil deposits resulting directly or indirectly from the sediment transport of streams, deposited in river beds, flood plains, and lakes.

**Aquifer** - An underground layer of porous, water-bearing rock, gravel, or sand.

**Benthic** - Bottom-dwelling; describes organisms which reside in or on any substrate.

**Benthic macroinvertebrate** - Bottom-dwelling (benthic) animals without backbones (invertebrate) that are visible with the naked eye (macro).

**Biota** - The animal and plant life of a region.

**Biocriteria monitoring** - The use of organisms to assess or monitor environmental conditions.

**Channelization** - The mechanical alteration of a stream which includes straightening or dredging of the existing channel, or creating a new channel to which the stream is diverted.

**Concentrated animal feeding operation (CAFO)** - Large livestock (ie.cattle, chickens, turkeys, or hogs) production facilities that are considered a point source pollution, larger operations are regulated by the MDNR. Most CAFOs confine animals in large enclosed buildings, or feedlots and store liquid waste in closed lagoons or pits, or store dry manure in sheds. In many cases manure, both wet and dry, is broadcast overland.

**Confining rock layer** - A geologic layer through which water cannot easily move.

**Chert** - Hard sedimentary rock composed of microcrystalline quartz, usually light in color, common in the Springfield Plateau in gravel deposits. Resistance to chemical decay enables it to survive rough treatment from streams and other erosive forces.

**Cubic feet per second (cfs)** - A measure of the amount of water (cubic feet) traveling past a known point for a given amount of time (one second), used to determine discharge.

**Discharge** - Volume of water flowing in a given stream at a given place and within a given period of time, usually expressed as cubic feet per second.

**Disjunct** - Separated or disjointed populations of organisms. Populations are said to be disjunct when they are geographically isolated from their main range.

**Dissolved oxygen** - The concentration of oxygen dissolved in water, expressed in milligrams per liter or as percent.

**Dolomite** - A magnesium rich, carbonate, sedimentary rock consisting mainly (more than 50% by weight) of the mineral dolomite ( $\text{CaMg}(\text{CO}_3)_2$ ).

**Endangered** - In danger of becoming extinct.

**Endemic** - Found only in, or limited to, a particular geographic region or locality.

**Environmental Protection Agency (EPA)** - A Federal organization, housed under the Executive branch, charged with protecting human health and safeguarding the natural environment — air, water, and land — upon which life depends.

**Epilimnion** - The upper layer of water in a lake that is characterized by a temperature gradient of less than 1°C per meter of depth.

**Eutrophication** - The nutrient (nitrogen and phosphorus) enrichment of an aquatic ecosystem that promotes biological productivity.

**Extirpated** - Exterminated on a local basis, political or geographic portion of the range.

**Faunal** - The animals of a specified region or time.

**Fecal coliform** - A type of bacterium occurring in the guts of mammals. The degree of its presence in a lake or stream is used as an index of contamination from human or livestock waste.

**Flow duration curve** - A graphic representation of the number of times given quantities of flow are equaled or exceeded during a certain period of record.

**Fragipans** - A natural subsurface soil horizon seemingly cemented when dry, but when moist showing moderate to weak brittleness, usually low in organic matter, and very slow to permeate water.

**Gage stations** - The site on a stream or lake where hydrologic data is collected.

**Gradient plots** - A graph representing the gradient of a specified reach of stream. Elevation is represented on the Y-axis and length of channel is represented on the X-axis.

**Hydropeaking** - Rapid and frequent fluctuations in flow resulting from power generation by a hydroelectric dam's need to meet peak electrical demands.

**Hydrologic unit (HUC)** - A subdivision of watersheds, generally 40,000-50,000 acres or less, created by the USGS. Hydrologic units do not represent true subwatersheds.

**Hypolimnion** - The region of a body of water that extends from the thermocline to the bottom and is essentially removed from major surface influences during periods of thermal stratification.

**Incised** - Deep, well defined channel with narrow width to depth ratio, and limited or no lateral movement. Often newly formed, and as a result of rapid down-cutting in the substrate

**Intermittent stream** - One that has intervals of flow interspersed with intervals of no flow. A stream that ceases to flow for a time.

**Karst topography** - An area of limestone formations marked by sinkholes, caves, springs, and underground streams.

**Loess** - Loamy soils deposited by wind, often quite erodible.

**Low flow** - The lowest discharge recorded over a specified period of time.

**Missouri Department of Conservation (MDC)** - Missouri agency charged with: protecting and managing the fish, forest, and wildlife resources of the state; serving the public and facilitating their participation in resource management activities; and providing opportunity for all citizens to use, enjoy, and learn about fish, forest, and wildlife resources.

**Missouri Department of Natural Resources (MDNR)** - Missouri agency charged with preserving and protecting the state's natural, cultural, and energy resources and inspiring their enjoyment and responsible use for present and future generations.

**Mean monthly flow** - Arithmetic mean of the individual daily mean discharge of a stream for the given month.

**Mean sea level (MSL)** - A measure of the surface of the Earth, usually represented in feet above mean sea level. MSL for conservation pool at Pomme de Terre Lake is 839 ft. MSL and Truman Lake conservation pool is 706 ft. MSL.

**Necktonic** - Organisms that live in the open water areas (mid and upper) of water bodies and streams.

**Non-point source** - Source of pollution in which wastes are not released at a specific, identifiable point, but from numerous points that are spread out and difficult to identify and control, as compared to point sources.

**National Pollution Discharge Elimination System (NPDES)** - Permits required under The Federal Clean Water Act authorizing point source discharges into waters of the United States in an effort to protect public health and the nation's waters.

**Nutrification** - Increased inputs, viewed as a pollutant, such as phosphorous or nitrogen, that fuel abnormally high organic growth in aquatic systems.

**Optimal flow** - Flow regime designed to maximize fishery potential.

**Perennial streams** - Streams fed continuously by a shallow water table and flowing year-round.

**pH** - Numeric value that describes the intensity of the acid or basic (alkaline) conditions of a solution. The pH scale is from 0 to 14, with the neutral point at 7.0. Values lower than 7 indicate the presence of acids and greater than 7.0 the presence of alkalis (bases).

**Point source** - Source of pollution that involves discharge of wastes from an identifiable point, such as a smokestack or sewage treatment plant.

**Recurrence interval** - The inverse probability that a certain flow will occur. It represents a mean time interval based on the distribution of flows over a period of record. A 2-year recurrence interval means that the flow event is expected, on average, once every two years.

**Residuum** - Unconsolidated and partially weathered mineral materials accumulated by disintegration of consolidated rock in place.

**Riparian** - Pertaining to, situated, or dwelling on the margin of a river or other body of water.

**Riparian corridor** - The parcel of land that includes the channel and an adjoining strip of the floodplain, generally considered to be 100 feet on each side of the channel.

**7-day Q10** - Lowest 7-day flow that occurs an average of every ten years.

**7-day Q2** - Lowest 7-day flow that occurs an average of every two years.

**Solum** - The upper and most weathered portion of the soil profile.

**Special Area Land Treatment project (SALT)** - Small, state funded watershed programs overseen by MDNR and administered by local Soil and Water Conservation Districts. Salt projects are implemented in an attempt to slow or stop soil erosion.

**Stream Habitat Annotation Device (SHAD)** - Qualitative method of describing stream corridor and in-stream habitat using a set of selected parameters and descriptors.

**Stream gradient** - The change of a stream in vertical elevation per unit of horizontal distance.

**Stream order** - A hierarchical ordering of streams based on the degree of branching. A first order stream is an unbranched or unforked stream. Two first order streams flow together to make a second order stream; two second order streams combine to make a third order stream. Stream order is often determined from 7.5 minute topographic maps.

**Substrate** - The mineral and/or organic material forming the bottom of a waterway or water body.

**Thermocline** - The plane or surface of maximum rate of decrease of temperature with respect to depth in a water body.

**Threatened** - A species likely to become endangered within the foreseeable future if certain conditions continue to deteriorate.

**United States Army Corps of Engineers (USCOE) and now (USACE)** - Federal agency under control of the Army, responsible for certain regulation of water courses, some dams, wetlands, and flood control projects.

**United States Geological Survey (USGS)** - Federal agency charged with providing reliable information to: describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect the quality of life.

**Watershed** - The total land area that water runs over or under when draining to a stream, river, pond, or lake.

**Waste water treatment facility (WWTF)** - Facilities that store and process municipal sewage, before release. These facilities are under the regulation of the Missouri Department of Natural Resources