Status of the Watershed 2016

OZARKS WATER WATCH

The Upper White River in Arkansas and Missouri

Summarizing 2015 Water Quality in the Upper White River Basin

Clear streams, rivers and lakes are the signature resource in the Upper White River region of the Ozarks, providing for unique wildlife, safe drinking water, recreation, economic growth and tourism. It's not a stretch to say that our region's quality of life is a direct reflection of the health of our waters. This report highlights our water resources by sharing annual water quality data which we collect from a variety of sources including county, city, state and federal agencies, university programs, private organizations and volunteers who take regular samples at their local streams.

Because the data comes from various sources, it is a challenge to present it in a way that is both comparable and reasonable while offering the reader a sense of how water quality is faring across the watershed. Since this report only looks at data taken from sites within the Upper White River watershed, we also do not describe water quality at individual sites as being "Good" or "Bad", but instead we compared the sites and identified water quality as being "Higher" or "Lower", relative to all the data in the watershed. Sites rated as Lower are not necessarily bad, they simply have shown lower water quality than other sites.

David L. Casaletto

President/Executive Director
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Above: Table Rock Lake Shoreline Cleanup volunteers

Cover: (Top) Darlene Haun and Lawrence Ireland on Roark Creek, (Bottom) volunteers training for StreamSmart, our Beaver Lake watershed monitoring program

Historic flooding across the Ozarks and the Upper White River during December 2015 has impacted water quality in the streams, rivers and lakes which is expected to last through 2016 and longer. While the water quality data covered in this report is from 2015 and does not reflect most of the water quality data from the historic December rainfall, we wanted to highlight some of its effects and possible ongoing impacts on water quality in the Upper White River watershed.

The highly unusual heavy rainfall from December 26-29 alone dropped 7.5-10 inches of rain on much of the watershed. In addition, the soils were already saturated following the wettest November on record and another widespread heavy rain event on Dec 13-14. Rivers and streams reacted quickly to the late December rains and flash flooding was widespread.

Above: Beaver Lake at Prairie Creek after historic rainfall in late December, 2015

Occurrence of this excessive rainfall during the leaf-off season caused tremendous amounts of sediment (soils and debris) to wash into the streams, rivers and lakes. Extreme sediment loading was visible in the brown and rusty color of the rivers and lakes which lasted well into early spring of 2016. As water receded, this mud layer became exposed to wind and wave action which re-suspended the sediment in the water. Many residents and visitors to the lakes had never seen the volume and extent of sediment deposition which occurred with this event. This murkiness was also widespread throughout the entire length of the lakes, rather than primarily where rivers enter the lakes which is normally the case. As the lakes began to turn over (a natural occurrence as seasonal temperatures change) the cloudiness of the water was extended and the settling of sediment was interrupted by the mixing of water layers in the lakes.

The increased soil and sediment entering the watershed brought with it a tremendous amounts of plant nutrients such as nitrogen and phosphorus. This has caused excessive growth of diatoms initially in the cooler spring season, followed by proliferation of suspended algae. Diatoms are generally harmless, microscopic creatures that have glass (silica) shells that are a brownish color and therefore cause the water to have a brownish "tea" color. Diatoms are eaten by tiny hatchling fish and are a necessary part of aquatic food chains in lakes and streams.

As the water warms up in summer, green and blue-green algae may thrive in the nutrient-rich waters. This algae can become harmful if it occurs in dense enough concentrations to cause oxygen depletion in the water. Excessive growth of diatoms and other algae, especially the blue-green or suspended algae, can cause extreme fluctuations of dissolved oxygen levels which can cause fish kills and odor issues.

The effects of the late 2015 historic rainfall on the Upper White River watershed may be seen for years to come.

Above: Cape Fair, MO sediment deposition after historic rainfall in December, 2015

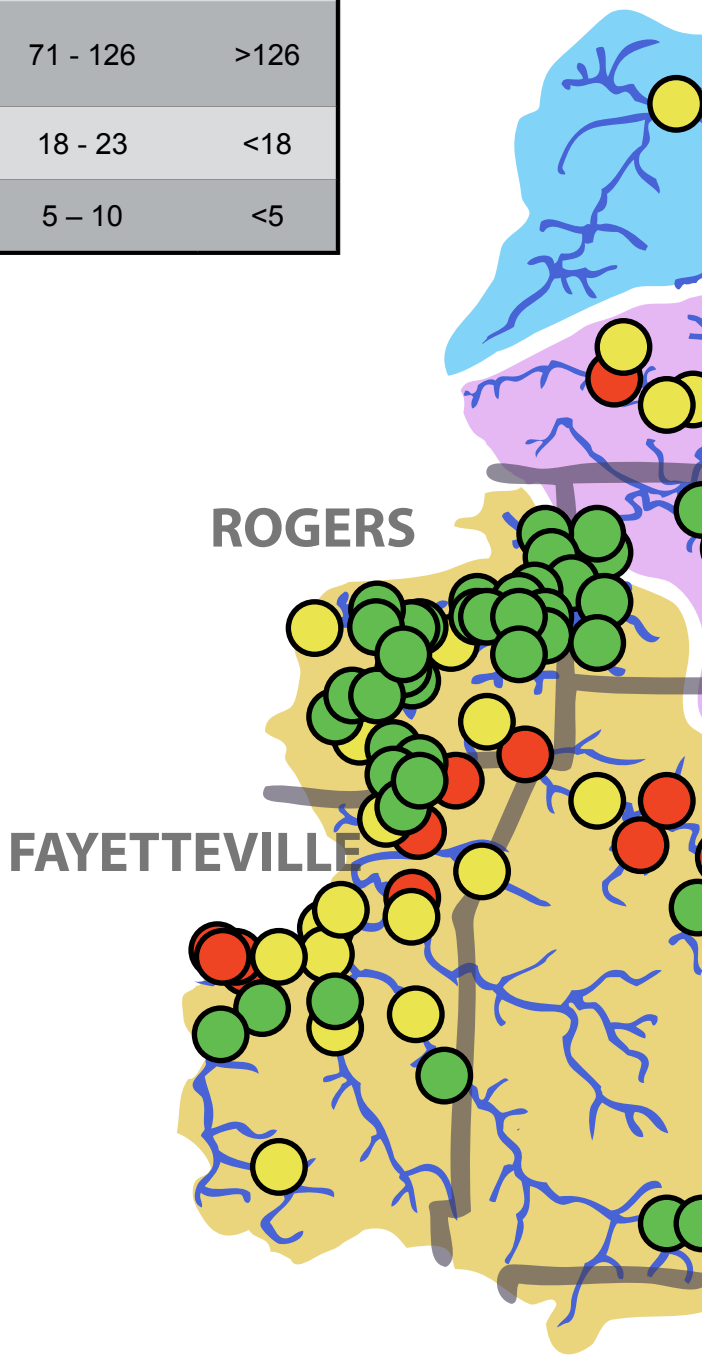
How We Assessed Water Quality

Parameter	Evaluation Method	Water Quality Assessment		
		HIGH	MID	LOW
Dissolved Oxygen	% of samples with >5 mg/L but less than 110% saturation	>75	50 - 74	<50
Total Nitrogen	Geometric mean of all values in mg/L	<0.500	0.501 – 0.900	>0.900
Total Phosphorus	Geometric mean of all values in mg/L	<0.020	0.021 – 0.035	>0.035
E. coli	Geometric mean of colony forming units per 100mL	<70	71 - 126	>126
Invertebrates	Missouri Stream Team Score	>23	18 - 23	<18
Lake Water Clarity	Geometric mean of all values in feet of clarity	>10	5 – 10	<5

WHAT WAS MEASURED IN 2015?

- 695 Dissolved oxygen values
- 917 Total nitrogen values
- 961 Total phosphorus values
- 168 E. coli counts
- 49 Invertebrate scores
- 251 Water clarity readings

The scores in this report show how the numerous monitoring sites in the region compare to one another and are not intended to define “good” or “bad” water quality. What this report attempts to do is show where the highest and lowest *relative* water quality is. Identifying these sites will help us to focus our efforts where they are needed and let us allocate our limited resources accordingly.



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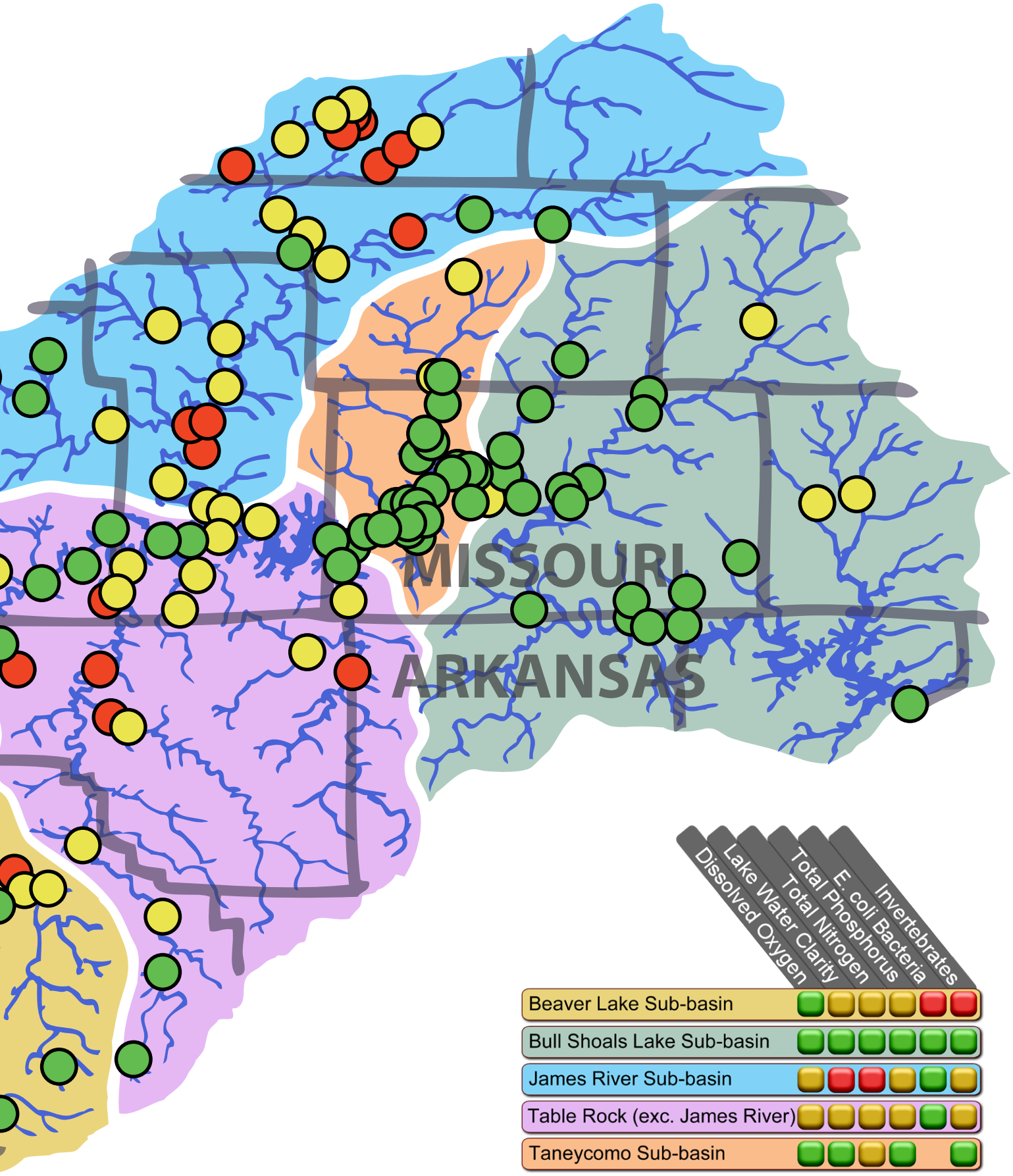

MISSOURI
ARKANSAS
Invertebrates
E. coli Bacteria
Total Phosphorus
Total Nitrogen
Water Clarity
Lake
Dissolved Oxygen
Beaver Lake Sub-basin
Bull Shoals Lake Sub-basin
James River Sub-basin
Table Rock (exc. James River)
Taneycomo Sub-basin

There are many ways to measure water quality. Depending on what is measured, one can determine if a lake or stream can support the many life forms within it. Measurements can also help us ascertain if a lake or stream is likely to have problems in the future, has experienced a problem in the past or is unsafe for humans to swim in. We looked at six such water quality parameters to help us rank water quality in the region.

Oxygen and water clarity show current water quality. The nutrients, nitrogen and phosphorus, show the potential for future problematic algae blooms. Aquatic invertebrates are used to estimate the historical water quality. E. coli is an indicator of pontential danger to human health.

Dissolved Oxygen - Essential for aquatic life

Above: Bluegill require Dissolved Oxygen

We humans can breathe oxygen directly from the air around us. Aquatic organisms like fish and invertebrates have to extract Dissolved Oxygen (DO) from the water they live in. Certain pollutants can reduce DO, making water unsuitable for aquatic life. Sometimes, due to excessive algae growth, DO levels are too high. This is also bad for aquatic life.

The DO levels were a concern at about a quarter of the 85 sites where they were measured. In most cases where DO concentrations are a concern, the actual values were higher than desired, suggesting excess algae are producing the oxygen via photosynthesis.

Phosphorus and Nitrogen - Nutrients that drive algae growth

High nutrient levels lead to higher than normal algae growth. Changes in algae growth can alter the natural aquatic communities in our lakes and streams.

Among the 107 sites monitored for nitrogen, the highest levels were primarily located around the urban areas of the Beaver and James River regions.

Total phosphorus concentrations at 78 (of 140) sites in the watershed were generally low. The sites with the highest phosphorus concentrations were typically stream and river sites located near urban areas and lake sites located in the upper portion of tributary arms.

Right: Ronna and Don testing for nitrate at Pond Fork

Secchi Transparency - A measure of water clarity

The Secchi disk is a small plate-like device that is lowered into lakes to determine water clarity. Poor water clarity is usually caused by algae or sediment in the water.

Secchi was measured at 73 sites in the watershed. The sites with the least clarity tended to be near inflowing streams. Because of their proximity to sediment and nutrient sources, it is expected that these sites would have lower water clarity than sites in the main lake channels.

Left: Secchi disk in water. Linda Kittle photo

Aquatic Invertebrates - Living indicators of stream health

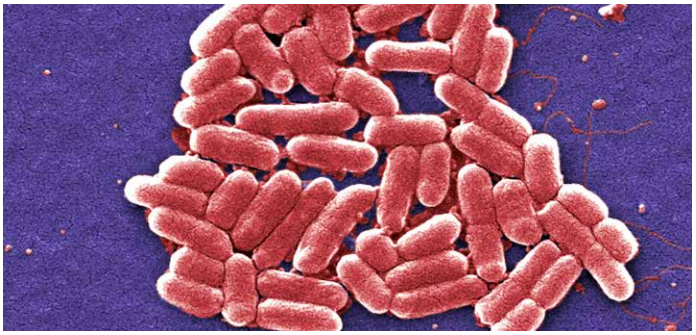
Invertebrates are simply animals without spines. Many insects (one goup of invertebrates) commonly seen around lakes and streams begin their life in the water. Dragonflies, mayflies and caddisflies spend most of their lives in the water, eventually emerging to mate and die. Other invertebrates, like mussels and crayfish, may live their entire lives under water.

Some stream invertebrates are very sensitive to pollution, while others are very tolerant of pollution. The presence of certain invertebrates in the stream provide insight to a stream's health, both short and long-term.

Most of the 37 invertebrate collection sites were in the James River region. The sites with the lowest scores were within the city of Springfield. Urban runoff will usually have a negative effect on invertebrate communities.

Above: A Dragonfly larva.

E. coli - Bacteria associated with fecal matter



While some strains of E. coli can be harmful to humans, these bacteria are used as an indicator of other harmful organisms associated with human fecal contamination. Low background levels are common, due to the presence of natural wildlife in the watershed.

Levels of E. coli in the basin's waterways were low in 2016. Only five sites had E. coli counts of concern.

Left: E. coli bacteria. CDC photo

White River Valley Electric Cooperative

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Ozarks Water Watch would like to thank White River Valley Electric Cooperative for their generous support of this report.

Ozarks Water Watch volunteers collected total nitrogen and total phosphorus samples at 18 Missouri stream sites.

Missouri Stream Team volunteers monitored 33 sites in the Upper White River Basin (UWRB). This report features their dissolved oxygen and invertebrate data.

The Lakes of Missouri Volunteer Program volunteers monitored 31 lake and 2 stream sites in the UWRB. Their total nitrogen, total phosphorus and water clarity data are featured in this report

Stream Smart volunteers monitored 18 stream sites in the UWRB. Included in this report are their total nitrogen and total phosphorus data.

Secchi Day on Beaver Lake volunteers sampled at 41 Beaver Lake sites. This report features their total phosphorus and water clarity data.

Beaver LakeSmart volunteers sampled at 5 sites on Beaver lake. This report features their Secchi, total phosphorus and total nitrogen data.

United States Geologic Survey (USGS) monitored 11 sites for total nitrogen, total phosphorus, dissolved oxygen and E. coli bacteria.

Arkansas Water Resources Center measured total nitrogen and total phosphorus at 8 sites.

Arkansas Department of Environmental Quality (ADEQ) measured total nitrogen, total phosphorus and dissolved oxygen at 21 sites.

Taney County monitored 27 sites for concentrations of dissolved oxygen.

Beaver Water District measured total nitrogen, total phosphorus, dissolved oxygen and E. coli bacteria at 7 locations.