Citizen Volunteer Water Monitoring on the Locust Fork River

River Facts and Figures

The Locust Fork River is one of two major tributaries of the Black Warrior River, the other being the Mulberry Fork. The Locust Fork flows from the sandstone, shale and coal-bearing strata of the Southern Appalachian Plateau in a southwestern direction for 158 miles to join the Mulberry Fork, forming the Black Warrior River at Bankhead Lake in southern Walker County. The Locust Fork Watershed covers an area of 1,209 square miles and drains portions of five Alabama counties – Marshall, Etowah, Blount, Jefferson and Walker.

Nationally known for its premiere whitewater, the Locust Fork is the second longest free-flowing river in Alabama. Whitewater enthusiasts come from all over the Southeast and beyond to enjoy the thrill of the Locust Fork's class III and IV rapids. The Locust Fork is home to a multitude of historic covered bridges (like Swann Bridge near Cleveland, AL, pictured to the right), fishing holes, swimming and picnicking areas, and remarkably beautiful sandstone cliffs and waterfalls. All of these tourist attractions yield great aesthetic and economic benefits to Blount County and to the entire state of Alabama. The Locust Fork River is also home to an abundance of aquatic life (including 74 species of fish), wildlife and unique flora indigenous to the area. Several threatened and endangered species call this river home: the flattened musk turtle, many types of mussels and snails, the Cahaba shiner and the Vermillion darter. This darter, a small bottom-dwelling fish, is found exclusively in a five-mile stretch of Turkey Creek near the town of Pinson in northern Jefferson County.

AWW water quality sample sites in the Locust Fork Watershed: FLFR (●), RSVP/Marshall Co. (▲), BWR (●) and FMCAC (★)

Citizen monitors from several groups have tested water in the Locust Fork Watershed as a part of Alabama Water Watch (AWW). They have taken over 1,500 water quality measurements, which have been entered into the AWW statewide database.

Four local citizen groups currently monitor the waters of the Locust Fork Watershed and account for 95% of all water quality measurements. The Friends of Locust Fork River (FLFR) has been the most active group in the watershed, and is the featured group in this report. Since 1993, FLFR monitors have taken 700 water chemistry and bacterial measurements at 16 sites on the middle section of the Locust Fork River (see map at left).

The Retired and Senior Volunteer Program of Marshall County (RSVP/Marshall Co.) has monitored 10 sites and taken 590 measurements in the upper watershed. Two other citizen groups - the Black Warrior Riverkeepers (BWR) and the Five-Mile Creek Action Committee (FMCAC) monitor significant tributary streams of the Locust Fork. Many other citizen groups continue working to preserve and protect the Locust Fork Watershed.
Shooting Cornelius Falls on the Locust Fork

Collecting aquatic critters from the river

AWW training volunteer monitors at the community of Hydrangea to test water chemistry in the Locust Fork Watershed

Colorful inhabitant of the Locust Fork, the Warrior Darter (Etheostoma bellator)

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**Time Line of AWW and FLFR**

**1991**
- FLFR organizes to preserve the Locust Fork River
- FLFR conducts first annual river clean-up

**1992**
- AWW Program begins

**1993**
- First AWW Workshop to train citizen monitors in water chemistry testing
- AWW Association forms
- Five AWW monitoring groups form
- FLFR members get certified as AWW water chemistry monitors and begin water quality monitoring on the Locust Fork River
- FLFR begins monthly Adopt-A-Stream clean-ups at AL Highway 79 bridge

**1994**
- FLFR sponsors First Annual Locust Fork River Festival
- EPA approves AWW water chem. protocols
- AWW receives 1,000th water chem. record

**1995**
- First AWW Training of Trainers Workshop
- FLFR launches website: www.flfr.org

**1996**
- AWW introduces *E. coli* testing
- AWW develops BIO-ASSESS game

**1997**
- AWW launches AWWareness listserve

**1998**
- AWW launches website (see page 8)
- AWW receives 10,000th water chem. record

**1999**
- EPA approves AWW bacteria protocols
- 1st AWW Reservoir Series Report published, featuring Smith Lake
- FLFR sponsors the First Annual *Day on the River* to promote environmental education

**2000**
- Auburn University offers Continuing Education Units for AWW workshops
- FLFR begins sponsoring the Locust Fork White Water Classic and Locust Fork Invitational canoe and kayak races

**2001**
- AWW develops relational database for online data entry and data access

**2004**
- AWW develops MacroMania game
- AWW receives 30,000th water chem. record
- AWW completes five volumes of *Citizen Guide to Alabama Rivers*

**2005**
- AWW initiates 6-page Waterbody Reports
- AWW conducts its 1000th workshop
- FLFR conducts its first 2-day river clean-up
An Example of Citizen Action on the Locust Fork

In January, 1991 The Birmingham News revealed that the Birmingham Water Works Board (BWWB) was planning to build a municipal water supply reservoir on the Locust Fork River. The reservoir dam would be located at the Jefferson County - Blount County line. The article also stated that BWWB had been buying land in Blount County secretly through a third party. A small group of concerned citizens of Blount County met to discuss the proposed reservoir and how it would affect the natural integrity of this free-flowing river and the lifestyle of the community surrounding it.

After discussing the issue, the gathering of local citizens unanimously decided that the river needed to be protected. Thus, the Friends of the Locust Fork River (FLFR) was formed, and the official campaign to preserve the Locust Fork River in its free-flowing state began. In just a few short months, this determined group of citizens secured support from local environmental organizations, paddlers, and a wide range of stakeholders who were not willing to see their river become a lake to benefit Birmingham's interests. Concern for the river and membership in FLFR (currently at about 900 people) remain strong to this day. Citizen volunteers are active in river protection and preservation on several fronts:

- Several FLFR volunteers have attended one or more AWW workshops to become certified monitors of water quality. In the workshops, participants learn simple techniques for measuring various chemical, physical and biological characteristics of water, such as water temperature, dissolved oxygen (DO), alkalinity, hardness, turbidity, pH and bacterial concentrations. Monitors attend refresher courses to maintain proper sampling techniques and replenish their test kits with fresh chemical reagents.

- Volunteer monitors assist the AWW program in maintaining accurate water quality data and presenting the information to watershed residents, regulatory agencies, policy makers and other interested citizens. The AWW citizen data set has become one of the most important sources of water quality information for the Locust Fork River and for Alabama.

- In addition to water quality monitoring, FLFR volunteers participate in:
  - Maintaining a website at www.flfr.org
  - Publishing a quarterly newsletter
  - Sponsoring a monthly river-crossing cleanup
  - Monitoring water quality at several points along the river, as well as several tributary streams that flow into the Locust Fork
  - Building public awareness of the value of the river through public meetings
  - Sponsoring an annual river cleanup during the National River Cleanup Week
  - Hosting annual Alabama Cup canoe/kayak races that draw contestants from across the Southeast
  - Sponsoring an annual Day on the River education program (pictured to the left)
Long-term Trends in River Water Chemistry

Citizen monitors began monitoring the waters of the Locust Fork in May of 1993. Below are water quality trends measured by local monitors from three different groups at sites in the upper, middle and lower Locust Fork watersheds.

- **Upper Watershed.** The graph below is a six-year trend of water temperature (red line) and DO (blue line) at a RSVP/ Marshall County sample site on Slab Creek, which joins the Locust Fork near Snead, AL (see map on page 5). Since 2000, local monitors have measured frequent summertime DOs below 5 ppm (violet dashed line) at this site. All fish and most other aquatic creatures depend on oxygen from the water. Oxygen dissolves better in cold water, so its concentration tends to be naturally higher in winter and lower in summer. The Alabama Department of Environmental Management (ADEM) requires an oxygen level of at least 5 parts per million (ppm) in streams, lakes, and rivers that are use-classified for “Fish and Wildlife,” as is the Locust Fork. The upper Locust Fork is 303(d)-listed by ADEM for low DOs resulting from organic enrichment from agricultural nonpoint sources (runoff from fields, pastures, animal feedlots, see page 7). These low DO levels stress fish and may result in reduced aquatic biodiversity.

- **Middle Watershed.** The graph below is a 12-year trend of water temperature (red line) and DO (blue line) at a FLFR sample site on the Locust Fork River (see map on page 5). Waters of the river show a recovery, relative to the low DOs of the upper watershed, to ‘healthy’ levels of DO. Although local monitors have measured ‘healthy’ levels of DO (above 5 ppm, violet dashed line) at this site since 1993, the long-term trend in DO (blue dashed line) is declining.
The trend in turbidity (blue dashed line below) for this site shows that the river’s turbidity is on the rise. Many rivers and lakes throughout Alabama are experiencing increasing turbidity from soil erosion and/or nutrient enrichment, both of which can adversely affect fish and other aquatic life as well as interfere with lake recreational uses and the quality of drinking water. This section of the Locust Fork River is 303(d)-listed by ADEM as impaired because of siltation from unidentified sources (see page 7). The most likely sources of this turbidity are eroded soils washing off disturbed lands within the watershed upstream of this site.

**Lower Watershed.** Some of the parameters that citizen monitors measure can be viewed as indicators or substitutes for more sophisticated and expensive laboratory measurements (metals, herbicides, pesticides, chlorophyll). In several locations around the state, monitors have recorded large differences between alkalinity and hardness of some streams. In a natural, unpolluted stream, alkalinity and hardness should be roughly equal because dissolved limestone is the primary source for both of these parameters. Great divergence between hardness (80-200 mg/L, red line) and alkalinity (30-75 mg/L, blue line) seen in the graph of water chemistry (below) of a Black Warrior Riverkeepers site on Five Mile Creek (see map above) is often an indicator of unnatural industrial pollution in the stream. Five Mile Creek flows out of the city of Birmingham and into the lower Locust Fork River, which was 303(d)-listed by ADEM for impairment from urban point sources (pollution that comes out of a pipe) such as storm sewers or industrial discharges.

Industrial effluent may introduce chemicals into rivers and streams that cause a large divergence between alkalinity and hardness.
Long-term Trends in River Bacteria Levels

Bacteriological monitoring has become an important part of AWW since its introduction in 1996. In 1999, AWW developed a standardized method for quantifying the fecal bacterium *Escherichia coli* (*E. coli*) and other coliforms. AWW bacteria testing does not identify the source of *E. coli*, which can be human, livestock or wildlife feces. AWW was one of the first citizen monitoring programs in the U.S. to receive EPA endorsement for bacteriological monitoring.

- As with chemical monitoring, consistent sampling over several weeks or months can determine the general condition and trend of bacteriological contamination at a site. Normally three water samples (replicates) are collected at a site for bacterial testing, incubated (see plate below), and the average *E. coli* level is calculated.

- The bar graphs below reveal times when sites on the Locust Fork had safe (green), marginal (yellow) or unsafe (red) *E. coli* levels, based on "whole body contact" (swimming, etc.) standards of ADEM and the AL Department of Public Health.

- Unsafe levels of *E. coli* (above 600 colonies/100 mL of water, red bars) have been measured numerous times in the Locust Fork River at the Old Warrior Bridge (top graph below) from 1997 through 1999, and at Taylor Ford Shoals (bottom graph) from 1999 through November of 2004, when the highest concentration during 8 years of monitoring was measured (18,800 colonies/100 mL of water). Zeros (in blue) on both graphs indicate samples when *E. coli* levels were zero.

![E. coli testing of the Locust Fork River at Old Warrior Bridge (FLFR site 10001003)](image)

![E. coli testing of the Locust Fork River at Taylor Ford Shoals (FLFR site 10001001)](image)

*E. coli* testing of the Locust Fork River at Old Warrior Bridge (FLFR site 10001003)

*E. coli* testing of the Locust Fork River at Taylor Ford Shoals (FLFR site 10001001)

Citizen monitors: Nancy Jackson and Susan Finley
Impacts to the River and What’s Being Done About It

Long-term trends generated from volunteer citizen monitors throughout the Locust Fork Watershed indicate that impacts to the river’s water quality are occurring in the upper, middle and lower watersheds. Examination of the land use map below shows that the upper and middle watersheds are highly agricultural (yellow areas), whereas the lower watershed is heavily influenced by ever-expanding urban/suburban developments (large red area) of the Greater Birmingham Metropolitan area.

- **Agricultural Impacts** – according to the Soil and Water Conservation Committee, the upper and middle watersheds of the Locust Fork River are home to over 6 million chickens and 12,800 cattle. What can be done to minimize the impacts of current agricultural practices, especially poultry production and cattle grazing, which contribute to the degradation of stream and river water quality?

- **Urban Impacts** – will implementation of Phase I/II Storm Water Programs provide adequate protection for river water quality? How much more urban expansion can the river sustain?

- **Mining Impacts** – how can problems such as acidification and heavy metal precipitation in streams draining from numerous old mines (black areas on land use map) in the Locust Fork Watershed best be corrected?

- **Six tributary streams, Bayview Lake, and about half of the Locust Fork River (in red on map) are on ADEM’s 303(d) list of impaired waters** (see Alabama’s 2002 Water Quality Report to Congress-305(b) Report, at [www.adem.state.al.us](http://www.adem.state.al.us)). The lower Locust Fork (index # 22, circled in red on the map to the left) was removed from the 303(d) list in 2004 because of improved water quality.

- **In the agricultural upper watershed, causes of impairment include ammonia, nutrients (nitrogen and phosphorus), siltation, organic enrichment, low DOs and habitat alteration.**

- **In the urbanized lower watershed, causes of impairment shift to urban runoff, storm sewer flows, industrial spills, mine residues and abandoned subsurface mining.**

- **The Black Warrior River Basin Clean Water Partnership and various stakeholder groups are currently addressing these challenges through the development of watershed management plans.**
Alabama’s Rich Water Resources and AWW

Alabama has over 75,000 miles of streams, including more navigable river miles than any other U.S. state. If these streams could be connected end-to-end, they would extend three times around the Earth! Alabama streams and rivers convey about 8% of the surface water that flows through the continental United States.

Not only are our streams and lakes abundant, but they also vary tremendously in both physical and biological characteristics. Alabama’s waters cut through Appalachian valleys and ridges, prairie soils of the Black Belt, sandy soils of the Coastal Plain and other physiographic provinces. All this physical diversity leads to an impressive biological diversity. Alabama streams have been described as a “biodiversity hotspot” because they have some of the largest variety of fishes, snails, mussels and other “aquatic critters” in the world. Some of these organisms are endemic, meaning that they occur only in Alabama.

Human health, environmental health and quality of life are increasingly threatened by pollution. Many citizens feel it is their right and responsibility to become actively involved in protecting and restoring Alabama’s water resources. Since 1993, more than 240 groups have participated in AWW and have collected data from about 700 water bodies statewide.

The goal of this report series is to feature AWW groups, describe their activities and concerns, document the importance of their water data and invite you, the reader, to join in community-based action strategies for management and protection of your watershed.

Concerned citizens now have a powerful, new tool to answer the fundamental questions of water testing: Is my water body getting better or worse, and why? Hundreds of summary graphs and maps of water data, training opportunities, special meetings and other aspects of water monitoring are available via the AWW website at www.alabamawaterwatch.org. Certified monitors can enter their data online, and custom graphs and statistical trends of statewide water quality data can be easily generated. Timely dissemination of quality-assured data in clear and meaningful ways is a vital element of a successful volunteer monitoring program. It is important to apply water quality information collected by citizen volunteers to local activities such as environmental education, protection and restoration activities, and development of watershed management plans. You are welcome to become a part of AWW and a local water-monitoring group.

Alabama Water Watch is a citizen volunteer water quality monitoring program that provides training, data management, information exchange and other means of support for the public to become personally involved in water issues. AWW is funded in part by the U.S. Environmental Protection Agency (Region 4), the Alabama Department of Environmental Management, the Alabama Agricultural Experiment Station and the Alabama Cooperative Extension System.

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This publication was produced by AWW staff and funded by FLFR, the Black Warrior River Basin Clean Water Partnership and the Alabama Water Watch Association. Unlabeled photos and graphics are from Alabama Water Watch. This and other AWW publications are available digitally at the AWW website.