

Chapter 3: Learning More - Monitoring to Secure New Data

3.1 Introduction

There are two main goals of watershed planning: protect good water quality and improve poor water quality. *The Red River Gorge Restoration and Watershed Plan Project* is working toward both of these goals. The work presented in Chapter 2 created an inventory of available information about the project area and its sub-watersheds. Now additional data and in-depth analysis are needed to identify current pollutant sources and guide implementation projects to places where they will have the most benefit.

3.2 Existing Data

Existing data about the watershed were presented in Chapter 2. This is valuable information, providing a background on the conditions of the four focus streams of the project. Swift Camp Creek and an unnamed tributary are impaired waterways.

The existing data include water quality data collected for the Total Maximum Daily Load study on Swift Camp Creek by the Kentucky Division of Water (KDOW) in 2003-2004 (see Appendix B). There are no Kentucky River Watershed Watch sites within the project area. The existing data from KDOW and Daniel Boone National Forest are used in the analysis with the new data as described in Chapter 4.

3.3 New Data

The purpose of collecting new data is to create a better understanding of the current conditions in each stream. Data were collected specifically for this project at twelve sites for one year, from July 2011 to June 2012. Sites were selected based on their proximity to pertinent land use features, tributary confluences, and available access in order to better isolate sources of pollution and areas for protection (see Figure 3.1 and Tables 3.1 and 3.2).

Additional data collection was conducted in Campton in an effort to isolate sources of bacteria called microbial source tracking. These data may provide more insight into the sources and thus, potential solutions to bacteria issues in Swift Camp Creek and the Red River.

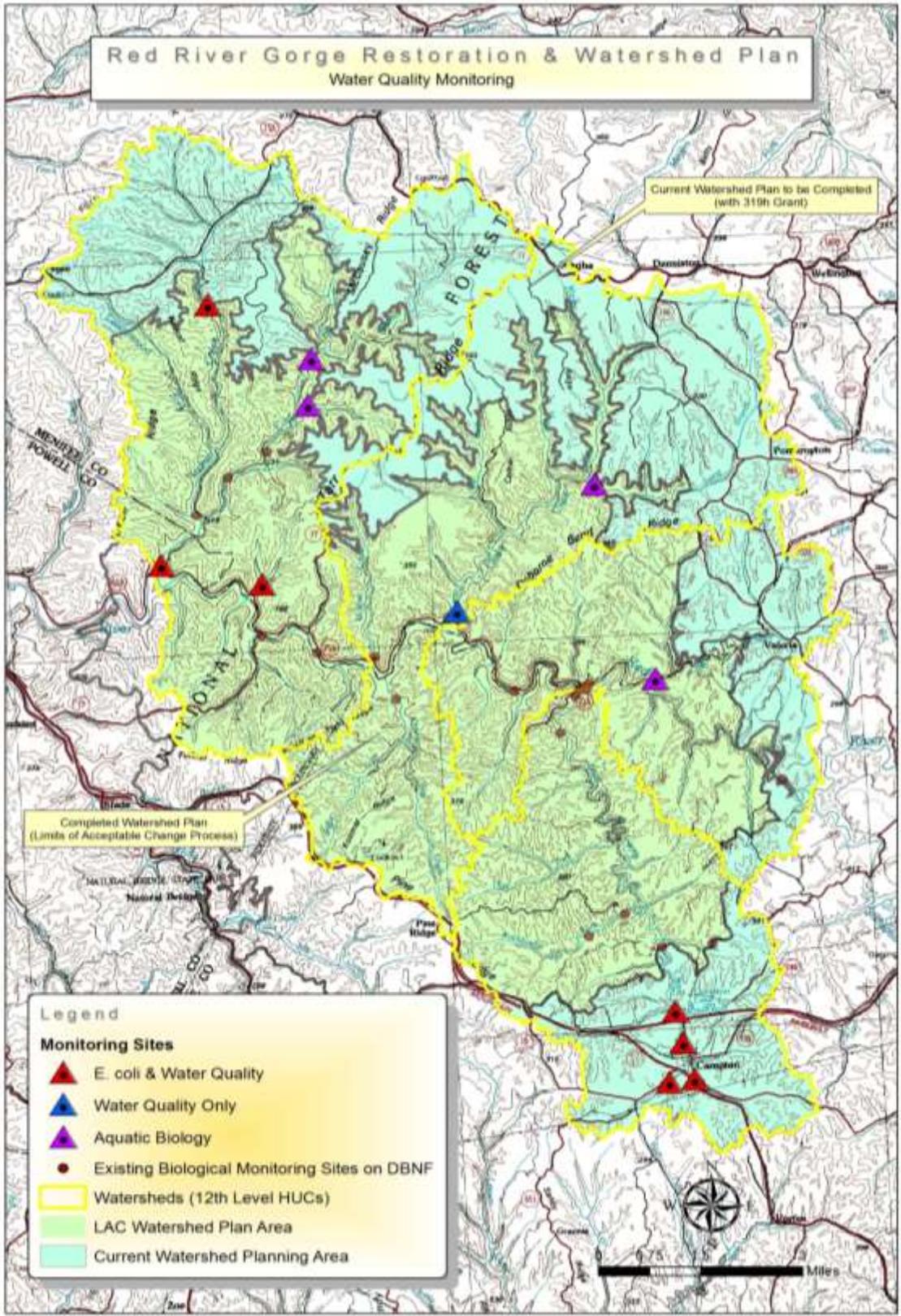


Figure 3.1: Water quality monitoring sites in the project area (USFS 2012).

The new data for this project were collected by three entities: Rita Wright Consulting, the Daniel Boone National Forest, and Third Rock Consulting. Sampling was conducted according to guidelines in the *Watershed Planning Guidebook for Kentucky Communities*, first edition (see Table 3.2) and the Quality Assurance Project Plan (see Appendix D). In order to better understand the implications of these data, they must be examined within the context of the relevant watershed area.

General information about water quality, what each parameter means and how it is collected, can be found in the *Watershed Planning Guidebook for Kentucky Communities*. The “Watershed Basics” section reviews watershed planning, regulatory issues, and the science behind water quality testing. It can be viewed online: www.kwalliance.org.

Water quality and bacteria

The water quality and bacteria sampling was conducted by Rita Wright Consulting from July 2011 until June 2012. Sampling was done over the course of one year, collected monthly, to capture different conditions and environmental situations such as during wet weather and dry weather conditions. Wet weather samples are intended to capture information about runoff pollution; wet weather is defined as “a seven-day antecedent dry period (in which no more than 0.1 inch of precipitation occurs) followed by visible run-off conditions” (*Watershed Planning Guidebook for Kentucky Communities*). Samples were taken after rain events that did increase instream flow, but failed to create run-off conditions. Thus, none of the samples reported in Chapter 4 are considered wet weather samples, however samples collected under higher flow conditions are addressed in Chapter 4. Bacteria (*E. coli*) samples were processed at the Morehead State University Lab, and the rest of the samples were processed by Fouser Lab in Versailles, Kentucky. Field data such as water temperature, flow, and pH were measured onsite at each visit with an Orion Field Meter.

For bacterial (*E. coli*) testing, 7 sites were each sampled 16 times - once a month for 1 year plus 5 times in 30 days in May 2012. Eight sites were sampled for water quality parameters 12 times (once a month for one year).

Biology

Biological sampling in the Swift Camp Creek sub-watershed was conducted by Third Rock Consulting in the summer of 2011 to establish the biological and habitat conditions. The survey was conducted at four sites on in Campton. DBNF personnel conducted biological sampling at sites in the Indian, Creek, Gladie Creek, and Clifty Creek sub-watersheds (see Table 3.1) in the summer of 2011. All of these data are used in the biological analysis in Chapter 4.

Table 3.1: Sampling sites and parameters for data collection for the Red River Gorge Restoration and Watershed Plan project.

Sampling Sites and Parameters

Swift Camp Creek sites

These four sites were sampled for water quality parameters, bacteria, and biology:

- DOW04043010 – Unnamed Tributary off State Road 15
- DOW04043014 – Off KY 15; Between Family Dollar and the Car Wash
- DOW04043018 – Campton WWTP (sample taken upstream of outfall*)
- DOW04043013 – Below Hiram Branch, lake, and WWTP; off unpaved road to oil well **

Indian Creek sites

These two sites were sampled for water quality parameters and bacteria:

- DOW04042017 –Off Bear Branch Road, on what was once a Forest Service Jeep Trail
- DBF04015 – At the mouth of Indian Creek at the road 613 Bridge

These three sites were sampled for biology only:

- DBF0404022 - New Site on Edwards Branch, above 613 Road
- DBF04042024 – East Fork Indian Creek, downstream from Hall Sink Branch
- DBF04042021 – Little East Fork, just upstream of East Fork Indian Creek

Gladie Creek sites

This site was sampled for biology only:

- DBF04042025 – Gladie Creek (upstream), downstream of Browns Branch

This site was sampled for water quality parameters only:

- DOW04042011 – Gladie Creek (downstream), 0.25 miles upstream of HWY 746 Bridge.

Clifty Creek site

The site was sampled for biology only:

- DBF0404023 - New Site downstream of Osborne Branch.

*Note: Site DOW04043018 was sampled at the same location in 2003 and 2012. In 2008 the Waste Water Treatment Plant (WWTP) moved downstream making the 2012 sample site above the WWTP).

**Note: Since the Lake flows intermittently, DOW04043013 serves as the 2012 “below WWTP” monitoring site.

Table 3.2: Watershed Plan Monitoring Guidelines

Group	Parameter	Monthly	5X/30days May or June	1X/year May or June	Every Time	Standard Operating Pro.
Bacteria	<i>E. coli (Escherichia coli)</i>	x	x			DOWSOP03017
Chemistry	NO3/ NO2 (Nitrate/Nitrite)	x				DOWSOP03015
	NH3-N (Ammonia – Nitrogen)	x				DOWSOP03015
	TKN (Total Kjeldahl Nitrogen)	x				DOWSOP03015
	TP (Total Phosphorous)	x				DOWSOP03015
	OP (Orthophosphate)	x				DOWSOP03015
	BOD5* (Biochemical Oxygen Demand)	x				DOWSOP03015
Sediment	TSS (Total Suspended Solids)	x				DOWSOP03015
Flow	Stream Discharge				x	DOWSOP03019
Field Data	Turbidity (actual or estimated)				x	DOWSOP03014/ DOWSOP0315
	pH				x	DOWSOP03014
	DO (Dissolved Oxygen)				x	DOWSOP03014
	Conductivity				x	DOWSOP03014
	% Saturation (Percentage of DO)				x	DOWSOP03014
	Temperature				x	DOWSOP03014
Habitat	Habitat Assessment			x		DOW SOPs
Biology	Biological Assessment			x		DOW SOPs

*BOD5: the amount of dissolved oxygen consumed in five days by biological processes breaking down organic matter.

The Watershed Planning Guidebook for Kentucky Communities, first edition (2010), page 83.

The State of Kentucky has criteria for certain water quality parameters, either numeric or narrative. Numeric water quality criteria include the parameters listed in Table 3.3. Narrative water quality criteria include provisions that surface waters shall not be aesthetically or otherwise degraded by substances that:

- Settle to form objectionable deposits;
- Float as debris, scum, oil, or other matter to form a nuisance;
- Produce objectionable color, odor, taste, or turbidity;
- Injure, are chronically or acutely toxic to or produce adverse physiological or behavioral responses in humans, animals, or fish and other aquatic life;
- Produce undesirable aquatic life or result in the dominance of nuisance species; or
- Cause fish flesh tainting.

Table 3.3: Numeric Criteria: Warm water Aquatic Habitat, Primary/Secondary Contact Recreation.

Parameter	Values
Dissolved Oxygen	5.0 mg/L Daily Average; 4.0 mg/L Instantaneous
pH	6.0 – 9.0 Standard Units
Temperature	89°F Instantaneous; 84°F 30-Day Summer Average (31.7° and 28.9° C, respectively)
Total Dissolved Solids	No adverse effects on indigenous aquatic community
Total Suspended Solids	No adverse effects on indigenous aquatic community
Settleable Solids	No adverse effects on indigenous aquatic community
Ammonia	< 0.05 mg/L after mixing
Fecal Coliform (Primary Contact Recreation)	200 CFU / 100 ml geometric mean for 5 samples over 30 days, 5/1 – 10/31. 20% of samples must not exceed 400 CFUs.
Escherichia Coli (Primary Contact Recreation)	130 CFU / 100 ml geometric mean for 5 samples over 30 days, 5/1 – 10/31. 20% of samples must not exceed 240 CFUs.
Fecal Coliform (Secondary Contact Recreation)	1000 CFU / 100 ml geometric mean for 5 samples over 30 days, year-round 20% of samples must not exceed 2000 CFUs.

Source: Kentucky Water Quality Standards (401 KAR 10:031).

Table 3.3 covers Warmwater Aquatic Habitat. Swift Camp Creek is designated for Coldwater Aquatic Habitat. There are different standards for temperature and dissolved oxygen for Coldwater Aquatic Habitat:

(2) Cold water aquatic habitat. The following parameters and criteria are for the protection of productive cold water aquatic communities and streams that support trout populations, whether self-sustaining or reproducing, on a year-round basis. The criteria adopted for the protection of warm water aquatic life also apply to the protection of cold water habitats with the following additions:

(a) Dissolved oxygen.

1. A minimum concentration of six and zero-tenths (6.0) mg/L as a twenty-four (24) hour average and five and zero-tenths (5.0) mg/L as an instantaneous minimum shall be maintained.

2. In lakes and reservoirs that support trout, the concentration of dissolved oxygen in waters below the epilimnion shall be kept consistent with natural water quality; and

(b) Temperature. Water temperature shall not be increased through human activities above the natural seasonal temperatures (401 KAR 10:031).

Benchmarks

Phosphorus, nitrogen, and conductivity are important parameters to consider in overall stream health, but there are no Kentucky water quality standards for them. In lieu of state standards, KDOW created benchmarks based on data collected on Reference Reach Streams (Table 3.4). Reference Reach streams are representative streams with higher quality water in a given ecoregion or bioregion. Water quality levels in these streams can be used to set target levels, or benchmarks. These benchmarks are a guide for understanding water quality data. See Appendix E for more information about benchmarks.

Table 3.4: Parameter benchmarks for the Red River Gorge Restoration and Watershed Plan Project.

Parameter	Benchmark Value
Nutrients:	
Total Phosphorus	0.020 mg/L
Total Kjeldahl Nitrogen	0.500 mg/L
Nitrate-Nitrite	0.200 mg/L
Total Nitrogen	0.600 mg/L
Non-Nutrients:	
Ammonia-N	<0.050 mg/L
Unionized Ammonia	0.0002 – 0.0007 mg/L
Sulfate	20.0 mg/L
Specific Conductance	218 (µS/cm)
Alkalinity	72.2 (mg/L as CaCO ₃)
Total Suspended Solids*	6.0 mg/L
Turbidity*	5.9 NTU

*For TSS and Turbidity, these reference benchmarks are only to compare normal April-October flow conditions and not high flow events or winter samples. Benchmarks provided by KDOW 2012.