

**SECTION 3**  
**WATER QUALITY SAMPLING**

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### 3.01 WATER QUALITY SAMPLING

To develop a comprehensive Watershed Plan (WP), the condition of the watershed must be well-documented through water quality data. Existing water quality data was compiled and reviewed by the WP Internal Project Team and considered insufficient for developing a WP. For additional information on existing water quality data compiled and reviewed for the WP, see the Curry's Fork Water Quality Data Report (WQDR) in Appendix D. Thus, a Curry's Fork Watershed Sampling Program was developed, approved, and conducted specifically for the development of the WP. The WP data collection effort included bacteria, physicochemical parameters, biology and habitat assessments, and a sediment and geomorphic assessment collected by Strand Associates, Inc.<sup>®</sup> (Strand), Third Rock Consultants, LLP (Third Rock), and University of Louisville (UL). An existing mussel study performed by Kentucky Division of Water (KDOW) was also used in the development of the WP.

Results from the WP Sampling Program were used to identify potential pollutant sources, priority areas for protection and restoration, probable causes, and solutions for remediating water pollution problems in Curry's Fork. The WP Sampling Program ensured water quality data collected were recent enough to be used for planning purposes and were collected using KDOW-approved sampling plans, sampling methods, or procedures to confirm accuracy and reduce risks of contaminating samples. The Quality Assurance Project Plan (QAPP) used for the WP Sampling Program is shown in Appendix D.

The following subsections briefly discuss sampling data collected by Strand, Third Rock, and UL for the WP Sampling Program including the types of data collected, why it was collected, the time frame of data collection, and the quantity of data. Refer to each subsection for a list of sampling sites and sampling locations. See the WQDR in Appendix D for all data reviewed and collected for the WP. A summary of sampling sites for the WP Sampling Program is shown in Table 3.01-1. Please note that sampling sites in the Asher's Run were referred to with Site IDs that began with "TB" in the beginning stages of the field data.

Site ID	Stream	Site Description	Data Type(s)	Latitude	Longitude
CF1	Curry's Fork	Project Site	PC, B, H, P	38.30588	-85.45044
CF2	Curry's Fork	Project Site	PC, P	38.30938	-85.45159
CF3	Curry's Fork	Project Site	PC, P	38.35554	-85.44050
Station #21	Curry's Fork	KDOW Site	B	38.30750	-85.45080
AR1	Asher's Run	Project Site	PC, B, H, P	38.30894	-85.44429
AR1a	Asher's Run	Project Site	PC, P	38.33167	-85.41222
Station #22	North Curry's Fork	KDOW Site	B	38.37720	-85.42750
NC1	North Curry's Fork	Project Site	PC, B, H, P	38.35926	-85.43942
NC1a	North Curry's Fork	Project Site	PC, P	38.37722	-85.42750
NC1b	North Curry's Fork	Project Site	PC, P	38.38872	-85.39703
NC2	North Curry's Fork	Project Site	PC, P	38.40033	-85.36715
SC1	South Curry's Fork	Project Site	PC, B, H, P	38.35679	-85.43863
SC2	South Curry's Fork	Project Site	PC, P	38.36812	-85.37460

Data Type Notes: PC = Physicochemical; B = Biological; H = Habitat; P = Pathogen

**Table 3.01-1 Curry's Fork WP Sampling Sites**

**3.02 PHYSICOCHEMICAL SAMPLING DATA**

Parameter	Analysis Type
Temperature	Field Data
pH	Field Data
Dissolved oxygen	Field Data
Conductivity	Field Data
Stream depth	Field Data
Stream velocity	Field Data
Fecal coliform	Laboratory Data
Total suspended solids	Laboratory Data
Nutrients	Laboratory Data
Sulfate	Laboratory Data
Ammonia	Laboratory Data
5-Day biochemical oxygen demand	Laboratory Data

**Table 3.02-1 Physicochemical Data Summary**

Table 3.02-1 summarizes the physicochemical parameters measured for the WP Sampling Program.

**A. Data Sources**

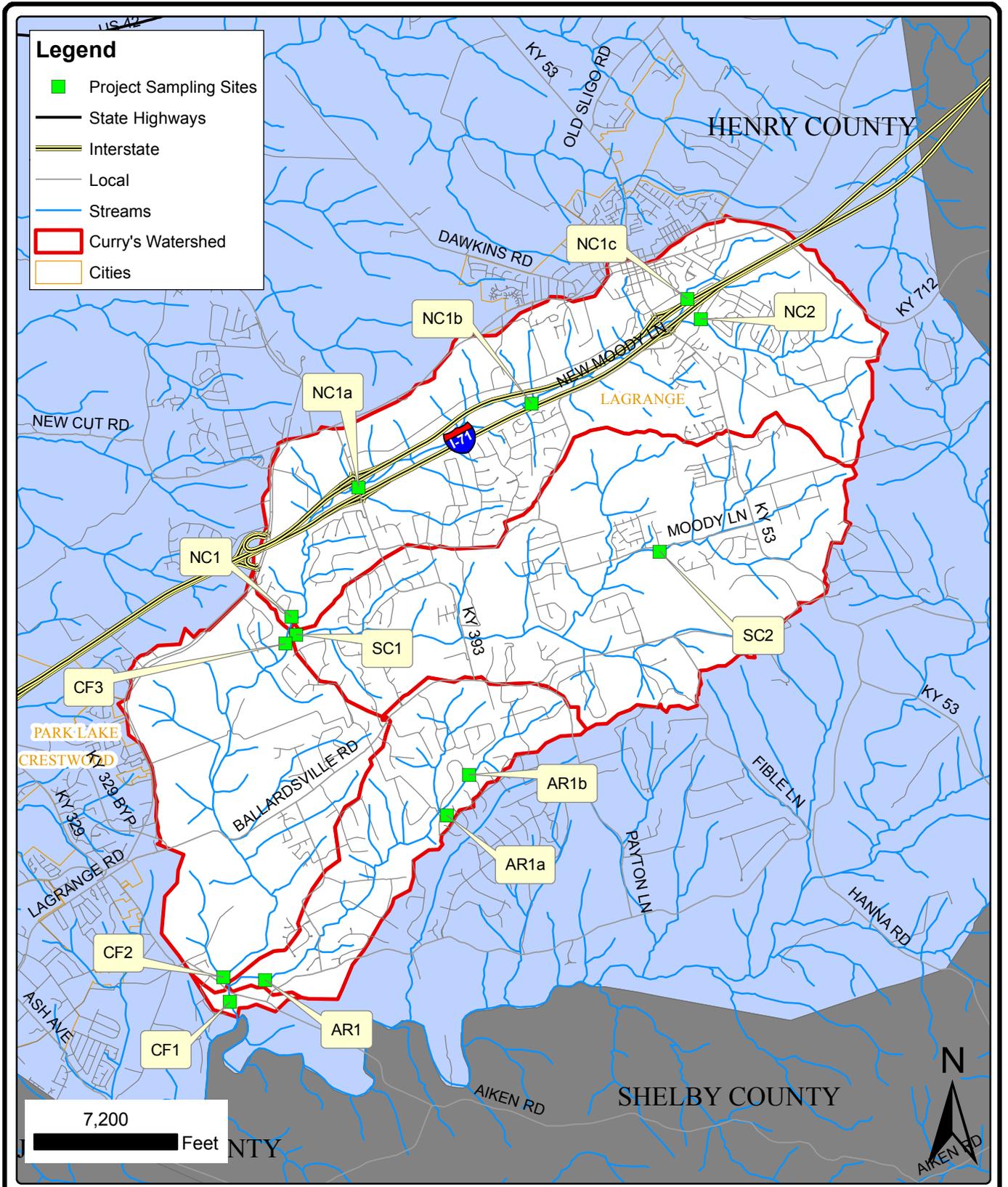
Physicochemical data sources include sampling conducted by Strand, Third Rock, and UL. Figure 3.02-1 shows the primary bacteria and physicochemical sampling site locations. UL collected physicochemical data at numerous other sampling sites as part of its geomorphic assessment. See Appendix D for additional information.

Strand's physicochemical portion of the WP Sampling Program provided baseline conditions in the Curry's Fork watershed and was used by the Water Quality Data Analysis Team (WQDAT) and the Technical Committee (TC) to identify pollutants of concern, priority protection and restoration areas, pollutant sources, and pollutant causes to develop pollutant loads for select parameters and select appropriate solutions and best management practices (BMPs).

Physicochemical water quality samples were collected as part of the WP Sampling Program during the 2007 primary contact recreational season at eight sampling sites within Curry's Fork. Four of the eight initial sampling sites had portable automatic samplers with flow metering equipment installed to take continuous flow velocity and depth measurements; these sites were NC1, SC1, AR1, and CF2. See Figure 3.02-1 for the location of these sites. Physicochemical water quality samples were taken approximately every other week for a total of 12 sampling dates. Samples were taken as close to the same day each week as possible regardless of weather conditions.

Sampling sites AR1a and NC1c are headwater sampling sites in Asher's Run and North Curry's Fork. These sampling sites were sampled to attempt to identify pollutant sources in the upstream reaches of their respective watersheds. These sampling sites did not yield results significantly different than sites regularly sampled and were only sampled one time. Therefore, results of these sites are not included in results tables or sampling data result discussions. As indicated in Table 3.01-1, sites AR1a and NC1c had physicochemical and pathogen samples taken the one time they were sampled.

As a result of drought conditions observed in May through September 2007 and the subsequent missed sampling events because of low flow or no flow conditions in streams, the physicochemical water quality sampling conducted in 2007 was repeated in 2009 with the addition of three sampling sites. The area in and around Curry's Fork typically receives 19.26 inches of rainfall between May and September [Ohio River Valley Sanitation Commission (ORSANCO, 1994)]. Between May and September of 2007, Curry's Fork received 15.66 inches of rainfall according to the Jeffries Farm rain gauge (Jeffries Farm has a privately-owned weather station that was used to provide local weather conditions for this report)



**PRIMARY BACTERIA AND PHYSICOCHEMICAL SAMPLING SITES**

**CURRY'S FORK WATERSHED PLAN  
 OLDHAM COUNTY FISCAL COURT  
 OLDHAM COUNTY, KENTUCKY**



**FIGURE 3.02-1  
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located in South Curry's Fork, which is 3.6 inches or approximately 19 percent less than average. The three additional sites were added in consultation with KDOW and others to further aid identification of pollutant sources based on 2007 sampling results. The QAPP was updated to reflect changes made to the sampling program in 2009. Curry's Fork received 32.42 inches of rain between May and September of 2009.

Two storm events were also sampled intensively during the recreational contact season in 2009 to obtain additional wet weather sampling data, one on September 20, 2009, and one on October 30, 2009, to obtain pollutant load information over rain-influenced hydrograph. Samples were taken at Hour 0 (start of the storm), Hour 4 (4 hours after the start of the storm), and Hour 12 (12 hours after the start of the storm) to determine wet weather influences on stream water quality. Storm event samples were taken at all WP project sites except NC1a, NC1b, and NC2 for safety reasons.

#### B. Normal vs. Rain Influenced Events

To differentiate between normal and rain influenced WP sampling events during 2007 and 2009 physicochemical water quality sampling, sampling dates were compared with rainfall information obtained from the Jeffries Farm rain gauge located in the South Curry's Fork watershed. It is important to identify which sampling events were affected by stormwater/runoff conditions so that the types and sources of pollutants are determined throughout the watershed.

Rainfall and stream flow conditions (depth and velocity) were also used to help determine if an event was dry weather or wet weather. Initially, any sampling event that occurred within 24 hours of a precipitation event (defined for this evaluation as > 0.1 inches from the Jeffries Farm rain gauge) was tagged as a potential wet weather event.

Stream flow conditions were then reviewed for each potential wet weather event. If stream flow conditions were elevated and indicative of runoff conditions in response to rainfall, the event was considered a wet weather event. If stream flow conditions were indicative of base flow conditions (dry conditions), the rainfall had not impacted the stream and the event was considered a dry weather event. This process was repeated for each sampling event.

### **3.03 BACTERIA DATA**

Fecal coliform bacteria data was collected as part of the WP sampling program. Fecal coliform and *E. coli* bacteria data is collected for many water quality sampling programs because it is an indicator organism. Indicator organisms, while not pathogenic themselves, may indicate the presence of waterborne pathogens. Indicator organisms are typically used in water quality monitoring because testing for the pathogens themselves is impractical. There are many types of pathogens, and they typically require a specific test with special materials or equipment, making the cost for directly monitoring pathogens expensive. Testing for indicator organisms can identify areas of concern in a watershed but at a fraction of the cost. Therefore, the term pathogen is used to reference data and discussion related to fecal coliform bacteria.

A. Primary Data Sources

Fecal coliform bacteria data was collected at the same time as physicochemical data at project sites during biweekly sampling and the two storm events described in Subsection 3.02. See Figure 3.02-1 for sampling site locations.

**3.04 GEOMORPHOLOGIC DATA**

Geomorphological data was collected by UL as part of the WP sampling program.

UL conducted a sediment and geomorphic assessment to assess and quantify water pollutant loads being contributed from different sources within the watershed. The three objectives of the assessment were to calculate loads of fine sediment from the four subwatersheds, evaluate the relative contributions of different sediment sources, and interpret possible links between sediment production and Warm Water Aquatic Habitat (WAH) impairment.

The assessment comprised three main activities: measurement of sediment yields at the mouth of each subwatershed, assessment of sediment production along stream reaches and uplands within each subwatershed, and a geomorphic assessment to identify potential causes of WAH impairment. UL utilized numerous instream measurements and modeling software to perform the sediment and geomorphic assessment. Sampling site selections, data collection, and data analysis methods are described in the WQDR shown in Appendix D.

The four sampling sites installed with portable samplers mentioned in Subsection 3.02 collected total suspended solids (TSS) and flow data to support the geomorphology study. Between November 2007 and July 2008, the portable samplers were programmed to collect samples at specified time intervals once the stream depth reached a specified value such as a flow depth indicative of wet weather flow. The samples were used to determine TSS loads throughout the length of a storm event.

Table 3.04-1 summarizes the number of events sampled by the portable samplers.

Event Date	NC1	AR1	CF2	SC1
November 22, 2007			1	
November 26, 2007	1	1		
December 9, 2007	1	1	1	
February 5, 2008		1	1	
February 12, 2008	1			
March 4, 2008		1		1
March 18, 2008	1	1	1	1
March 27, 2008	1	1	1	1
April 3, 2008	1			1
April 11, 2008			1	
May 3, 2008	1			
May 11, 2008	1			1
May 14, 2008	1	1		1
June 3, 2008		1		
July 31, 2008		1		
<b>Total Events Sampled</b>	<b>9</b>	<b>9</b>	<b>6</b>	<b>6</b>

**Table 3.04-1 Portable Sampler Event Summary**

### 3.05 BIOLOGICAL AND PHYSICAL HABITAT DATA

Aquatic, biological, and physical habitat data conducted or used as part of the WP sampling program included mussels, benthic macroinvertebrates (visible bottom-dwelling invertebrates), fish, algae, and instream and near stream physical habitat assessments. Biological and physical habitat assessments were performed at sites CF2, AR1, SC1, and NC1. Mussel surveys were performed at Station #21 and Station #22. Refer to Figure 3.05-1 for the locations of biological and physical habitat assessments sites.

Biological and physical habitat assessments were performed to evaluate the biological and physical habitat condition of surface water using biological surveys, stream surveys, and other direct measurements. These assessments integrate the collection and analysis of algal, mussel, macroinvertebrate, fish, habitat, and water chemistry data to arrive at conclusions on the health of the surface water and the subwatersheds of Curry's Fork.

#### A. Data Sources

Biological and physical habitat data sources used to develop the WP include sampling conducted by Third Rock and KDOW.

##### 1. Third Rock

Biological and habitat assessments were performed in the summer of 2007 at four sampling sites within Curry's Fork; these sites are NC1, SC1, AR1, and CF2. Sampling data was collected as part of the WP sampling program.

##### 2. KDOW

KDOW conducted a qualitative mussel survey for Floyds Fork during the summer and fall of 2003. Twenty-three sites were surveyed during this study and results were compared to a previous study conducted in 1978 to provide updated mussel information and to document the changes in mussel population. Curry's Fork is a tributary of Floyds Fork and two of the 23 project sites are located in the Curry's Fork watershed. See Figure 3.05-1 for the location of mussel survey sites within Curry's Fork and the Appendix of the WQDR (see Appendix D of this report) for a copy of the study.<sup>15</sup>

