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Bear Creek,
Big Creek, and
Roaring Paunch
Creek
Watershed Plan
Final Report

Report

McCreary County

Water District, KY

December 2013



Report for McCreary County Water District

Bear Creek, Big Creek, and Roaring Paunch Creek Watershed Plan Final Report

USEPA Grant No.: C9994861-06

Application Title: Watershed Based Planning in Three Impacted
Subwatersheds of Big South Fork–Source Water for McCreary County
Water District

KDOW Application No.:

Memorandum of Agreement No.:

Project Period: July 1, 2006 through September 30, 2013

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EXECUTIVE SUMMARY

McCreary County contains one of the most valuable water resources within Kentucky: the Big South Fork (BSF) of the Cumberland River. BSF is one of eight Kentucky Waters classified as an Outstanding National Resource Water (ONRW).

The watershed plan (WP) developed for BSF focused on three subwatersheds: Bear Creek, Big Creek, and Roaring Paunch. Bear Creek, Big Creek, and Roaring Paunch are located in McCreary County in Southern Kentucky. The headwaters of Break Creek and Roaring Paunch are located in northern Tennessee in Scott County. These watersheds were selected by Kentucky Division of Water (KDOW) to receive 319(h) Nonpoint Source Funding to address impairments. Historically, the water quality in BSF has been impacted by resource extraction activities, primarily mining. However, many stakeholders in BSF have recently focused on improving water quality. Significant progress has been made on various tributaries, but some tributaries still remain on the Kentucky 2008 303(d) List and Tennessee 2008 303(d) List as first priority impaired streams. Roaring Paunch and Bear Creek are listed as first priority impaired streams on the Kentucky 303(d) List (KDOW, 2008); Big Creek is not listed. Bear Creek is listed as impaired on the Tennessee 303(d) List (TDEC, 2008).

PROJECT GOALS AND OBJECTIVES

The nine elements of a WP plan established by United States Environmental Protection Agency (USEPA) served as the primary objectives of developing the WP. Stakeholders also established seven specific project goals for the WP. The specific project goals are as follows.

1. Protect endangered species.
2. Meet "Swimmable/Fishable" water quality standards (WQS).
3. Protect drinking water sources.
4. Identify areas in need of sewer service and/or septic tank installation.
5. Maintain/enhance existing water quality.
6. Engage community (adults and children) in the WP.
7. Create a sustainable plan with shared participation from vested partners.

WATER QUALITY DATA

A comprehensive WQS program was conducted for the BSF WP. The sampling program was conducted to identify pollutants, various stream conditions, and subwatersheds and tributaries contributing to the impairments. The sampling program included taking samples every other week during the recreational contact seasons (May through October) of 2008 and 2009 at 11 sampling sites. Samples were measured for temperature, pH, conductivity, dissolved oxygen (DO), 5-day biochemical oxygen demand (BOD₅), and fecal coliform. These parameters were based on suspected nonpoint pollution sources within BSF, such as septic systems. One metals scan of all the sample locations was conducted in 2009.

RESULTS AND CONCLUSIONS

The extensive water quality was used along with input from the community and Technical Committee to identify pollutants of concern and prioritize areas for Best Management Practice (BMP) implementation. BMPs were identified to protect and enhance water quality according to the specific threats of each area.

**SECTION 1
ACKNOWLEDGEMENTS**

1.01 ACKNOWLEDGEMENTS

The following partners and stakeholders participated in the development of the Bear Creek, Big Creek, and Roaring Paunch Creek Watershed Based Plan.

1. McCreary County Water District
2. McCreary County Fiscal Court
3. McCreary County Soil Conservation District
4. McCreary County Disaster Emergency Services
5. McCreary County Cooperative Extension
6. McCreary County School District
7. McCreary County Health Department
8. McCreary County Public Library
9. McCreary County Solid Waste
10. The McCreary County Voice
11. The McCreary County Record
12. Eastern Kentucky PRIDE
13. Kentucky Division of Water
14. Kentucky Rural Water Association
15. Kentucky PRIDE
16. Kentucky Division of Abandoned Mine Lands
17. Unites States Geological Survey
18. United States National Park Service
19. United States Fish and Wildlife Service
20. United States Army Corps of Engineers
21. Oneida, Tennessee Water and Wastewater
22. Huntsville Utility District
23. Strand Associates, Inc.®
24. Numerous Private Citizens

SECTION 2
INTRODUCTION AND BACKGROUND

2.01 PROJECT BACKGROUND

McCreary County contains one of the most valuable water resources within Kentucky: the Big South Fork (BSF) of the Cumberland River. BSF is one of eight Kentucky Waters classified as an Outstanding National Resource Water (ONRW). The ONRW ranking is the highest classification given to waters in the United States. In addition, BSF is unique because a significant portion crosses the state line in Tennessee.

The watershed plan (WP) developed for BSF focused on three subwatersheds: Bear Creek, Big Creek, and Roaring Paunch. Bear Creek, Big Creek, and Roaring Paunch are located in McCreary County in Southern Kentucky. The headwaters of Break Creek and Roaring Paunch are located in northern Tennessee in Scott County. These watersheds were selected by Kentucky Division of Water (KDOW) to receive 319(h) Nonpoint Source Funding to address impairments. Historically, the water quality in BSF has been impacted by resource extraction activities, primarily mining. However, many stakeholders in BSF have recently focused on improving water quality. Significant progress has been made on various tributaries, but some tributaries still remain on the Kentucky 2008 303(d) List and Tennessee 2008 303(d) List as first priority impaired streams. Roaring Paunch and Bear Creek are listed as first priority impaired streams on the Kentucky 303(d) List (KDOW, 2008); Big Creek is not listed. Bear Creek is listed as impaired on the Tennessee 303(d) List (TDEC, 2008). Figure 2.01-1 shows the location of the focus subwatersheds. Figure 2.01-2 shows the listing and location of the impaired streams on the 303(d) list within Roaring Paunch and Bear Creek.

2.02 PURPOSE, GOALS, AND OBJECTIVES

The nine elements of a WP plan established by United States Environmental Protection Agency (USEPA) served as the primary objectives of developing the WP. Stakeholders also established seven specific project goals for the WP. The specific project goals are:

1. Protect endangered species.
2. Meet “Swimmable/Fishable” water quality standards (WQS).
3. Protect drinking water sources.
4. Identify areas in need of sewer service and/or septic tank installation.
5. Maintain/enhance existing water quality.
6. Engage community (adults and children) in the WP.
7. Create a sustainable plan with shared participation from vested partners.

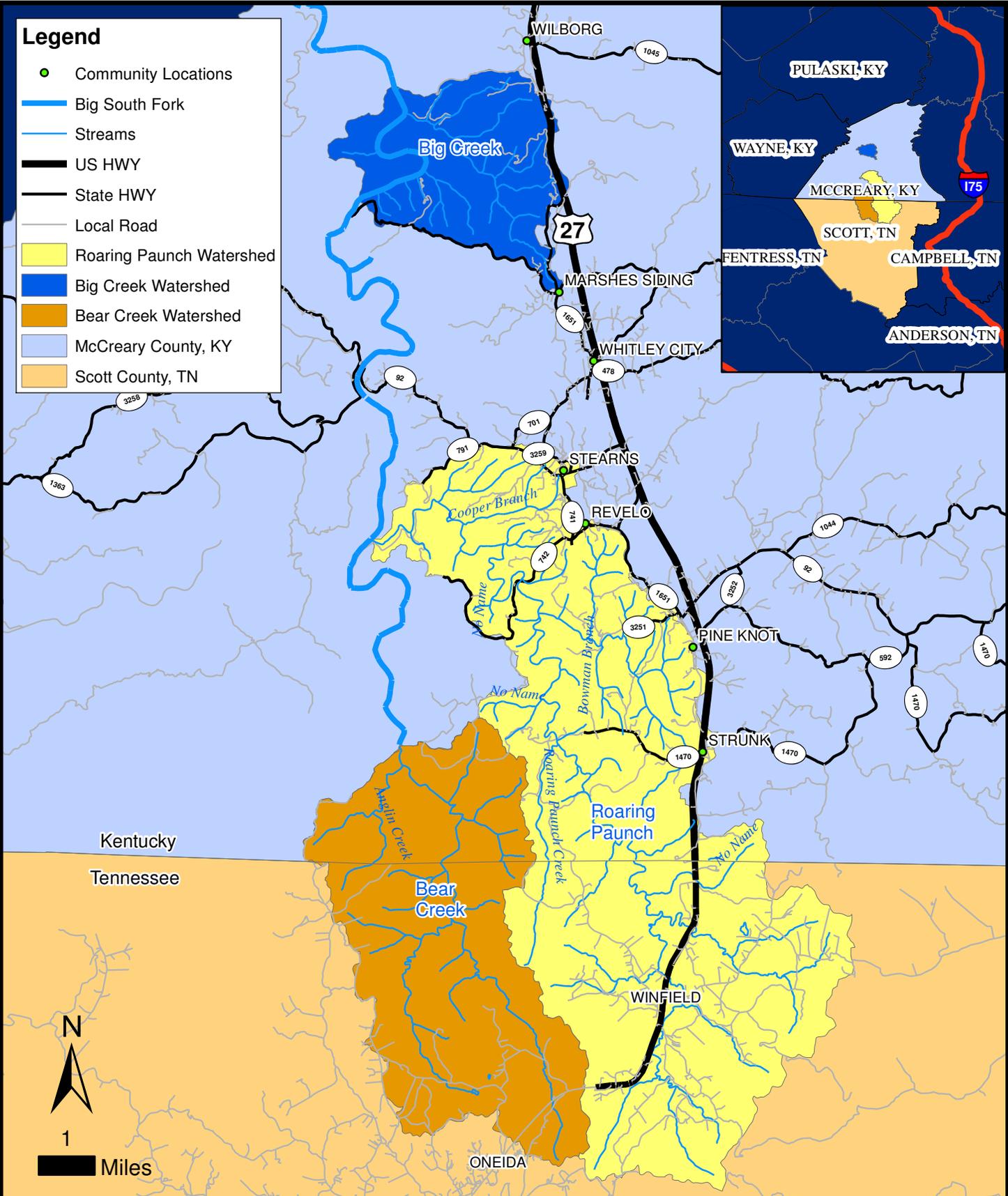
2.03 PERTINENT WORK

One of the primary tasks associated with this grant was the completion of the BSF WP. Fourteen solutions and best management practices (BMPs) were identified to improve water quality in BSF. These solutions were selected through a series of 18 meetings and reviews of available water quality data over the course of the project. See Section 5 of the WP for additional information.

A number of BMPs have already been implemented or are in the process of implementation as a result of the completion of the WP.

Legend

- Community Locations
- Big South Fork
- Streams
- US HWY
- State HWY
- Local Road
- Roaring Paunch Watershed
- Big Creek Watershed
- Bear Creek Watershed
- McCreary County, KY
- Scott County, TN

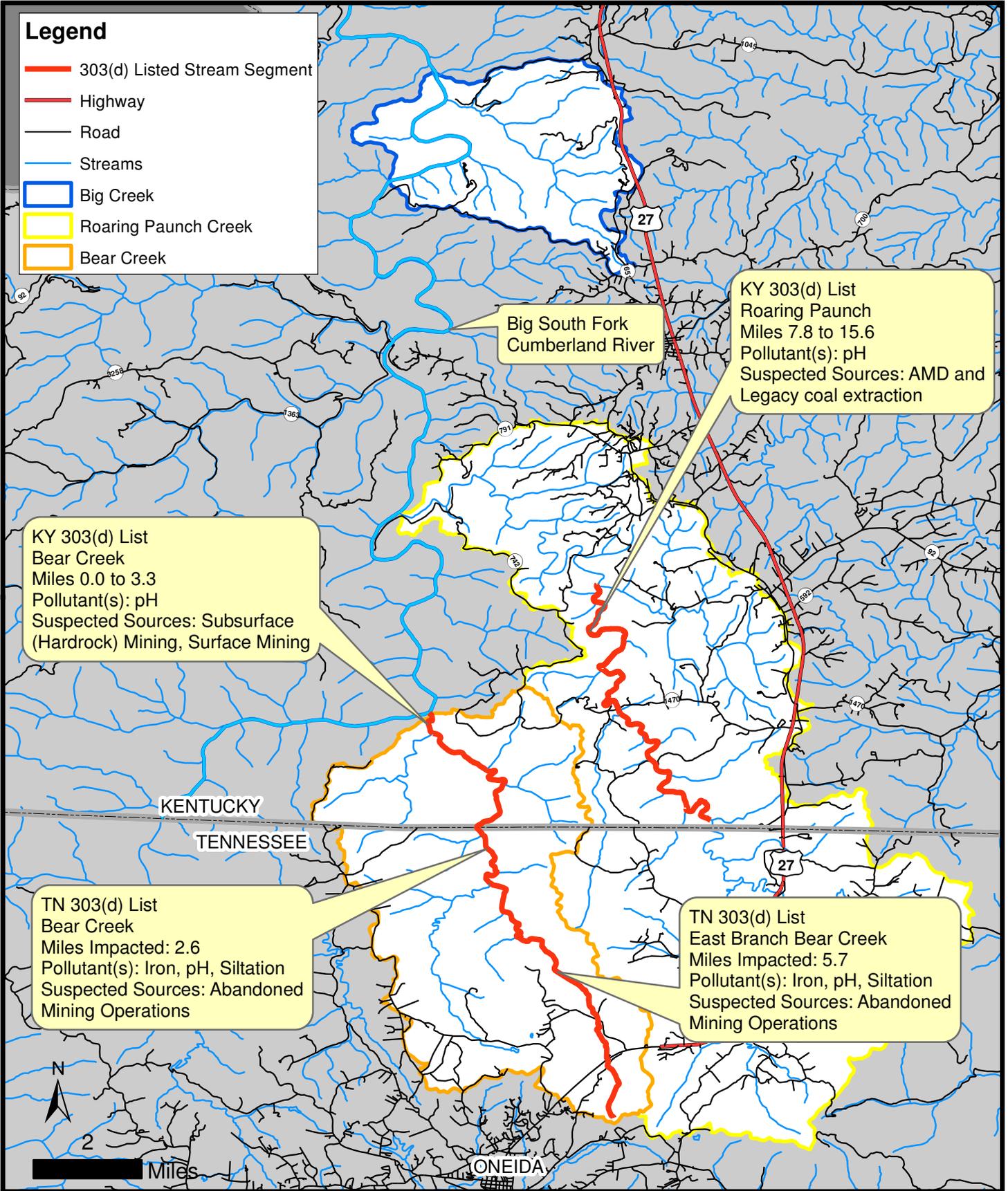


FOCUS SUBWATERSHED LOCATIONS

**BEAR CREEK, BIG CREEK, AND ROARING PAUNCH CREEK
WATERSHED BASED PLAN CLOSE OUT REPORT
MCCREARY COUNTY WATER DISTRICT
WHITLEY CITY, KENTUCKY**



**FIGURE 2.01-1
5108.100**



KENTUCKY AND TENNESSEE 303(D) LISTED STREAMS

**BEAR CREEK, BIG CREEK, AND ROARING PAUNCH CREEK
WATERSHED BASED PLAN CLOSE OUT REPORT
MCCREARY COUNTY WATER DISTRICT
WHITLEY CITY, KENTUCKY**



**FIGURE 2.01-2
5108.100**

A. Watershed Education and School Curriculum

McCreary County Water District (MCWD) worked in cooperation with stakeholders and teachers within McCreary County to develop an extensive water quality curriculum for elementary and middle school students. The curriculum covers all aspects of water and water quality. Additional information is included in Section 5 of the WP. Lesson plans and additional curriculum information can be found at <http://mccrearywater.com/funzone.html>.

B. Investigation of Potential Areas with Failing Septic Systems

Areas suspected of having failing septic systems were inspected to determine their conditions. Areas and properties with failing system or no systems were prioritized and addressed.

SECTION 3
MATERIALS AND METHODS

3.01 DESCRIPTION OF PROJECT AREA

A. Project Area

The three focus subwatersheds for the WP are located in southern Kentucky and Northern Tennessee within the Upper Cumberland River Basin. Figure 2.01-1 shows the location of the three focus subwatersheds.

B. Project Boundaries

Table 3.01-1 lists the subwatersheds and their associated Hydrologic Unit Code (HUC) number and drainage area. Figure 2.01-1 shows the subwatershed delineations of the three focus subwatersheds.

Name	HUC	Area (sq. miles)
Big Creek	05130-104-250-190	9.9
Roaring Paunch	05130-104-270	49.9
Bear Creek	05130-104-240	23.3

Table 3.01-1 Subwatershed Areas

Further detailed discussion on the hydrology, landscape, and other physical and natural features of the BSF-focus subwatersheds is included in Section 2 of the WP.

C. Monitoring Locations

A comprehensive WQS program was conducted for the BSF WP. The WP data collection effort included bacteria, physiochemical parameters, and metals. Supplementary data was also compiled from various data collection efforts that had already taken place within the focus subwatersheds for reference and historical data comparisons. Additional discussion regarding sampling program and data results is found in Section 3 and Section 4 of the WP.

D. BMP Locations

Upon completion of the BSF WP, the next step was to initiate BMP implementation. This section describes those BMPs with locational information.

1. Watershed Education and School Curriculum

The Watershed Education and School Curriculum was implemented at three schools (Pine Knot Intermediate School, Pine Knot Primary School, and Whitley City Elementary).

2. Investigation of Potential Areas with Failing Septic Systems

Nine properties were determined to have failing or nonexistent wastewater systems and were connected to the MCWD sewer system. Figure 3.01-1 shows the addresses and locations of the properties.

3.02 WQS PROGRAM MATERIALS AND METHODOLOGY

A comprehensive WQS program was conducted for the BSF WP. The sampling program was conducted to identify pollutants, various stream conditions, and subwatersheds and tributaries contributing to the impairments. The sampling program included taking samples every other week during the recreational contact seasons (May through October) of 2008 and 2009 at 11 sampling sites. Samples were measured for temperature, pH, conductivity, dissolved oxygen (DO), 5-day biochemical oxygen demand (BOD₅), and fecal coliform. These parameters were based on suspected nonpoint pollution sources within BSF, such as septic systems. One metals scan of all the sample locations was conducted in 2009.

See Section 3 and 4 of the BSF WP for additional information about the WQS program.

3.03 WATERSHED PLAN DEVELOPMENT AND DECISION MAKING PROCESS

A. Planning Guides

Two primary planning guides were used in the development of the WP: (1) USEPA's *Handbook for Developing Watershed Plans to Restore and Protect our Waters* and (2) Kentucky Waterways Alliance (KWA) and KDOW's *Draft Watershed Planning Guidebook for Kentucky Communities*. These two guidebooks provide information to help communities meet the Section 319(h) grant requirements and the required nine key elements of a WP as defined by the USEPA.

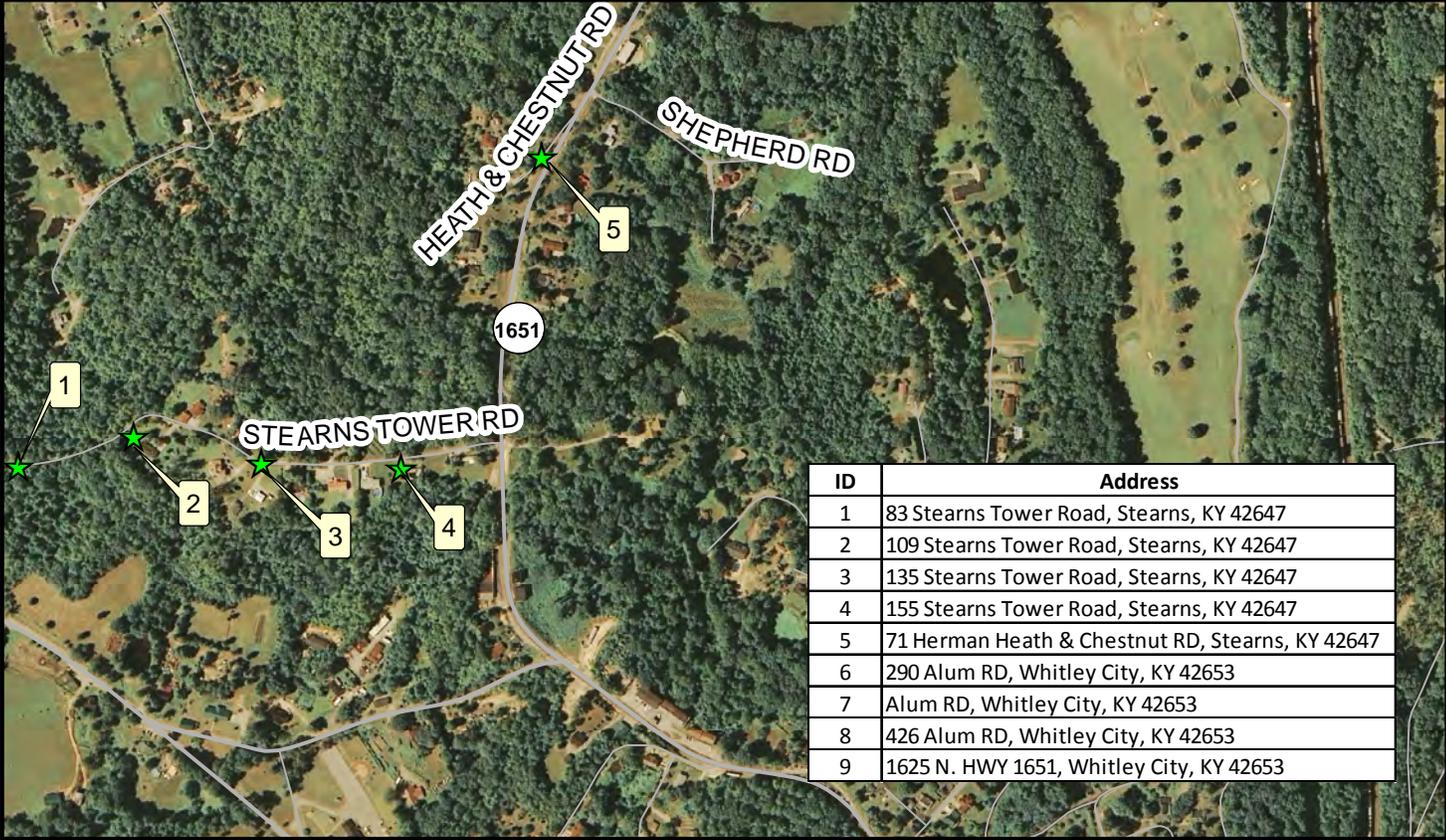
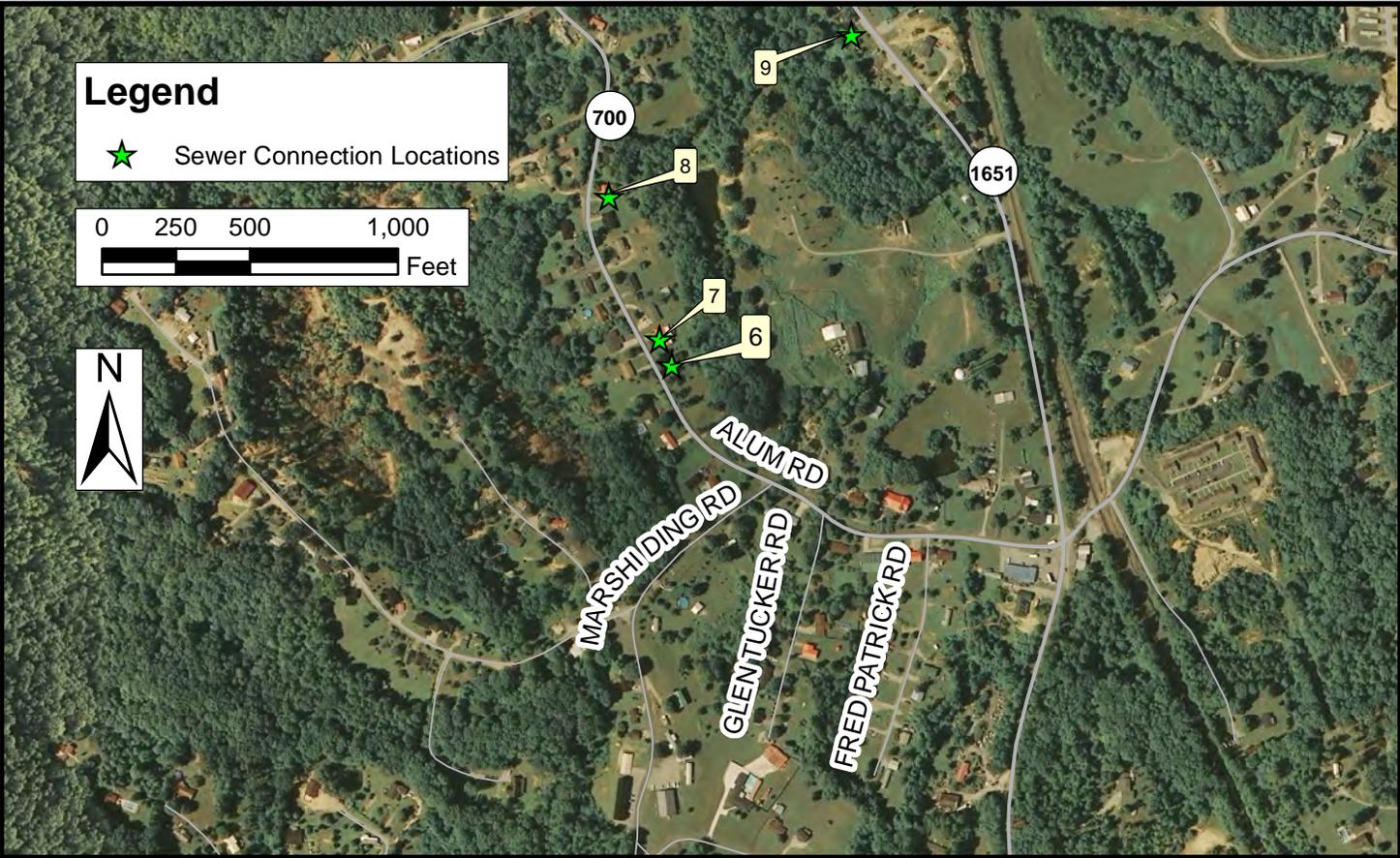
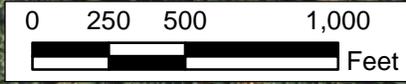
B. Decision Making Process

MCWD was the lead organization for the development of the WP. MCWD was responsible for creating draft recommendations for the planning and implementation process using local knowledge of the community and the watershed. Strand Associates, Inc.[®] (Strand) provided technical support and recommendations. The draft recommendations from MCWD and Strand were vetted through stakeholder groups, technical committees, and the community to discuss applicability, feasibility, and effectiveness of the WP process. This decision-making process allowed decisions made to be supported by the community so that proper action items were being pursued.

C. Water Quality Data Analysis Team Approach

A team approach was taken to review sampling results, identify pollutants of concern, and identify pollutant sources to ensure that data conclusions were unbiased and that the decision-making process was balanced among data types.

Legend
 ★ Sewer Connection Locations



ID	Address
1	83 Stearns Tower Road, Stearns, KY 42647
2	109 Stearns Tower Road, Stearns, KY 42647
3	135 Stearns Tower Road, Stearns, KY 42647
4	155 Stearns Tower Road, Stearns, KY 42647
5	71 Herman Heath & Chestnut RD, Stearns, KY 42647
6	290 Alum RD, Whitley City, KY 42653
7	Alum RD, Whitley City, KY 42653
8	426 Alum RD, Whitley City, KY 42653
9	1625 N. HWY 1651, Whitley City, KY 42653

SEWER CONNECTION LOCATIONS

BEAR CREEK, BIG CREEK, AND ROARING PAUNCH CREEK
 WATERSHED BASED PLAN CLOSE OUT REPORT
 MCCREARY COUNTY WATER DISTRICT
 WHITLEY CITY, KENTUCKY



First, MCWD personnel collected the raw sampling data according to the project sampling plan. Samples were sent to the lab for analysis and results were provided to Strand to compile, organize, and compare against current water quality standards. Sampling results were organized so that each parameter could be reviewed for pollutants of concern. Strand also compiled the geographic information system (GIS) data used for the development of Section 2 of the BSF WP.

After sampling data was compiled, the data was vetted through the technical group and the stakeholder group. The technical group reviewed data compiled by Strand to help identify pollutants of concern, identify pollutant sources, and recommend and prioritize appropriate BMPs. Data compiled by Strand was presented to the technical group at nine technical group meetings over the course of the WP development. The technical group included data expertise from the following disciplines: engineers, watershed managers, biologists, geologists, hydrologists, and park service habitat specialists. Having water quality data professionals from various areas of specialization was invaluable during the review of available data.

The pollutants of concern, potential pollutant sources, and BMPs identified by the technical group were presented to the stakeholder group. The stakeholder group consisted of a number of members from local agencies and organizations; refer to Section 1 for a full list. The stakeholder group used its local knowledge of the watershed to determine if the pollutants of concern and potential pollutant sources were reasonable and if BMP recommendations were feasible and accepted by the local community.

Overall, 18 meetings were held between the technical group and stakeholder group. The knowledge and expertise of these groups provide data conclusions and BMP selections that are feasible and cost-effective and will provide cost-effective water quality benefits.

3.04 BMP IMPLEMENTATION MATERIALS AND METHODS

A number of BMPs have already been implemented or are in the process of implementation as a result of the completion of the WP. The following discusses the implementation materials and methods associated with the BMPs.

A. Watershed Education and School Curriculum

Over the course of several months, local teachers collaborated with staff of MCWD and Strand to develop the curriculum. Guidance and reference material was used from the USEPA, the Commonwealth of Kentucky, and other sources. The participating teachers took the material that was developed and promoted among the other teachers at their respective schools (Pine Knot Intermediate School, Pine Knot Primary School, and Whitley City Elementary School). Twenty-five teachers at three schools used the curriculum to reach several hundred students.

B. Investigation of Potential Areas with Failing Septic Systems

This BMP was implemented through the connection of homes with failing septic systems and/or straight pipes to MCWD's sewer system.

Locations for BMP implementation were identified through a windshield survey of the Big Creek Watershed. The Big Creek Watershed was chosen because of the existence of MCWD sewer lines throughout the watershed that could be used to connect residences with failing or nonexistent on-site systems. Properties were identified based on the topology and size of the property. Properties with high slopes and/or small areas were categorized as having a high likelihood of failing or nonexistent on-site systems. Other indicators of failing or nonexistent on-site systems such as isolated patches of green grass and odors were used to help identify potential properties.

The individual residences that had BMPs implemented on their property were determined through a ranking process to achieve the most cost-effective water quality benefit. Homeowners were engaged through introductory letters and in-person meetings to explain the project and document the condition of the existing wastewater system at the property. Homeowners selected for the project were involved through education on how their on-site wastewater system works and their role and responsibilities to maintain it.

The selection process considered the following:

1. Willingness of property owner to participate in the program and commit to maintaining its portion of the BMP.
2. Existence of a straight pipe, a nonfunctional septic system, or a failing septic system at the property. Properties with straight pipes will be ranked higher than nonfunctional septic systems which, in turn, will be ranked higher than properties with failing septic systems.
3. Proximity to waterways.

Once the evaluation process were completed, the sites were ranked and the most desirable one(s) were be implemented. Figure 3.01-1 shows the addresses and locations of the properties.

SECTION 4
RESULTS AND DISCUSSION

4.01 WATER QUALITY DATA ANALYSIS

As discussed in Section 3, MCWD approached the water quality data analysis as a team with a number of the stakeholders. The local knowledge and expertise the technical group and stakeholder group provided was invaluable during the development of the BSF WP.

Further discussion of the data analysis approach can be found in Section 3 and Section 4 of the WP.

4.02 WATER QUALITY MONITORING

A. Summary of Results

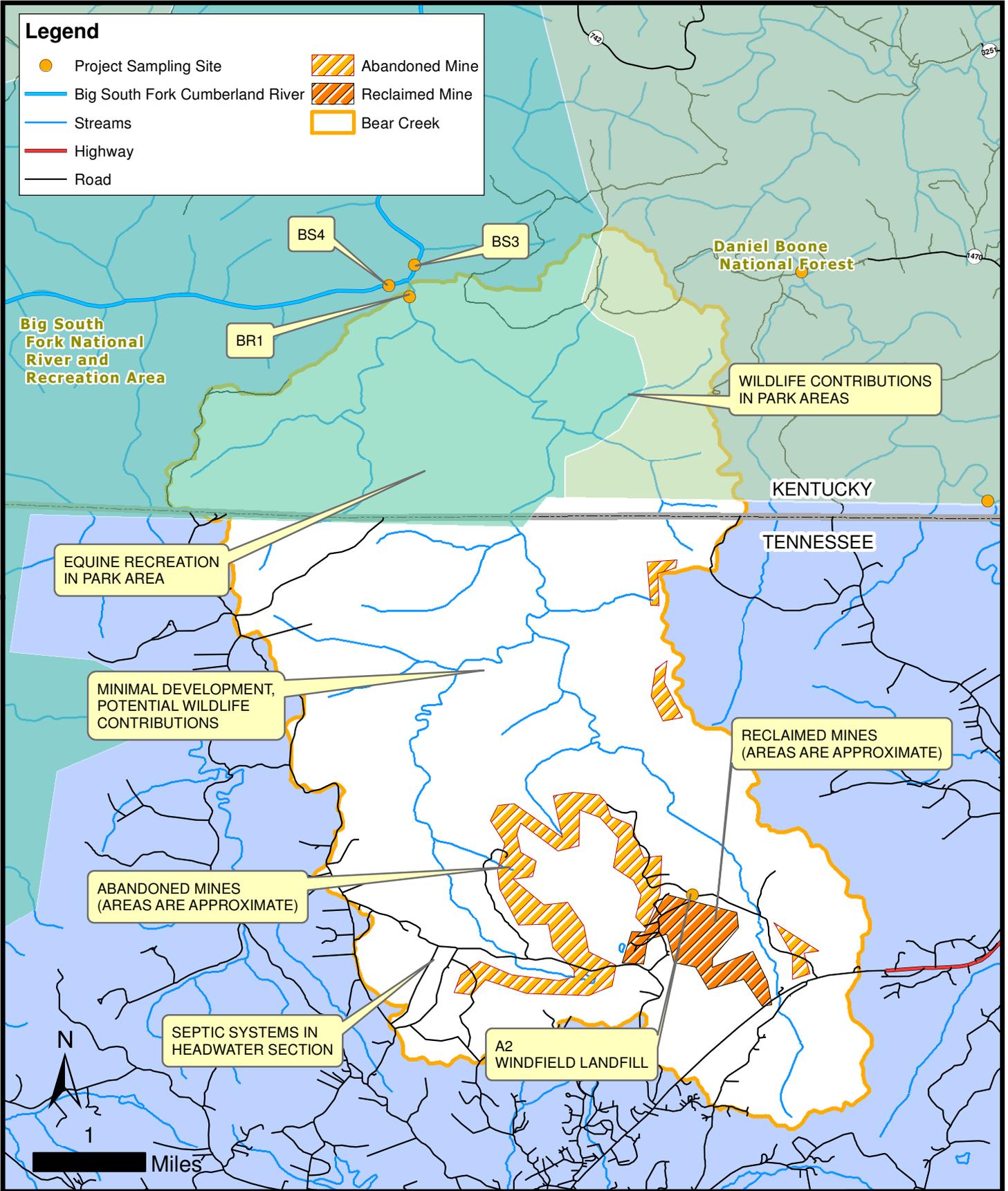
Tables 4.02-1 summarizes the pollutants of concern and pollutant sources that were determined through the WP development process and water quality data collection program. Figures 4.02-1, 4.02-2, and 4.02-3 show the specific pollutant sources for the Bear Creek, Big Creek, and Roaring Paunch subwatersheds, respectively. Additional information regarding the water quality monitoring results is discussed in Section 4 of the WP.

Watershed	Pollutants of Concern	Pollutant Sources
Big Creek	Bacteria pH	Failing septic systems Straight pipes Acid mine drainage Mining operations Wildlife
Bear Creek	Bacteria pH	Failing septic systems Straight pipes Equine recreation Windfield landfill leachate Acid mine drainage Mining operations Wildlife
Roaring Paunch	Bacteria pH Metals	Failing septic systems Straight pipes Acid mine drainage Mining operations Wildlife KPDES permitted facilities

Table 4.02-1 Pollutant Summary

B. Quality Assurance Project Plan

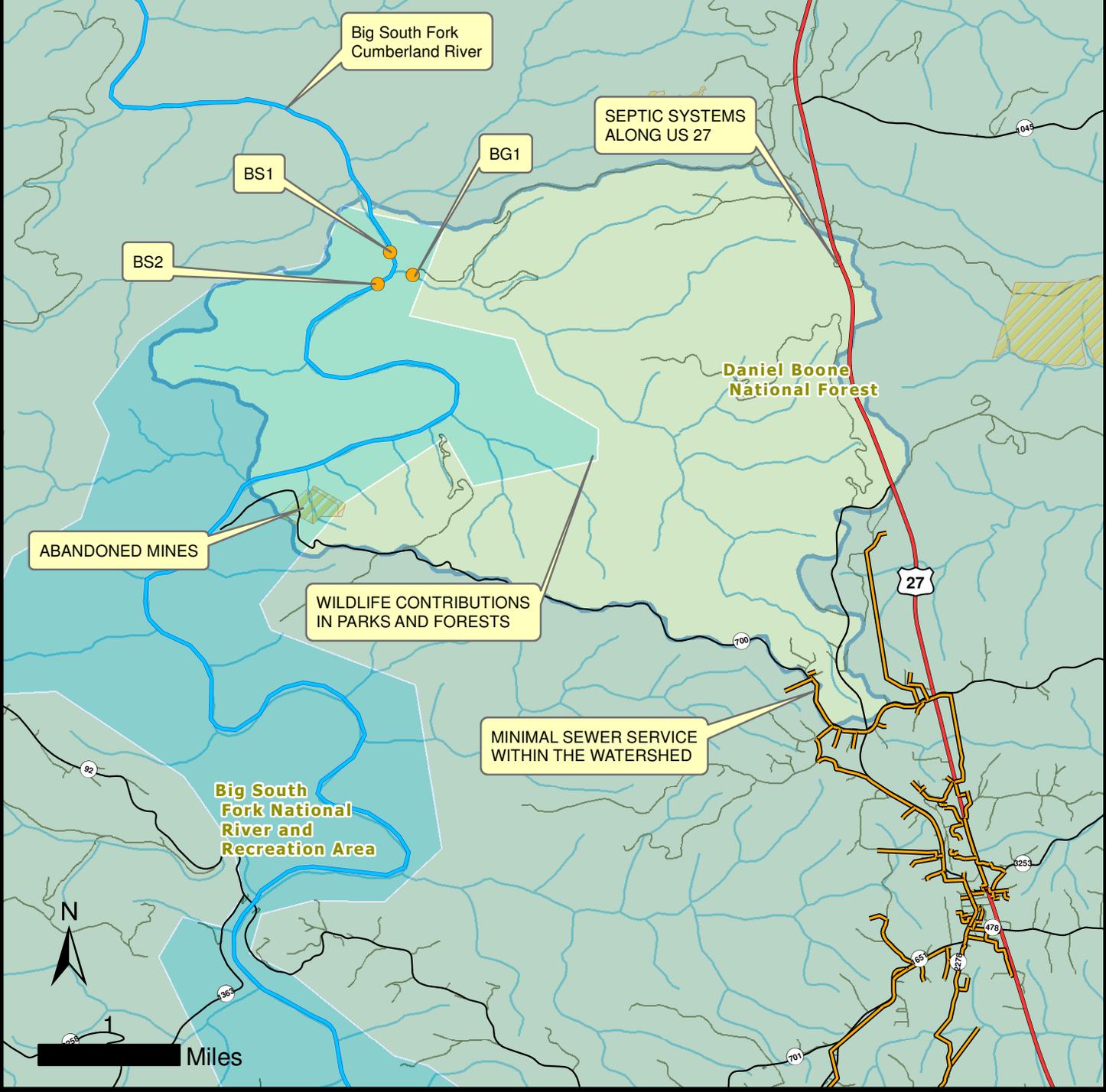
A Quality Assurance Project Plan (QAPP) was developed for the WP in 2005 with revisions in 2006 and 2009 to include the new sampling sites and additional recreational contact season sampling in 2009. The QAPP details the quality assurance measures used to conduct the monitoring plan.



**BEAR CREEK
POTENTIAL POLLUTANT SOURCES
BEAR CREEK, BIG CREEK, AND ROARING PAUNCH CREEK
WATERSHED BASED PLAN CLOSE OUT REPORT
MCCREARY COUNTY WATER DISTRICT
WHITLEY CITY, KENTUCKY**

Legend

- Project Sampling Site
- Big South Fork Cumberland River
- Streams
- Highway
- Road
- Sewer Line
- ▨ Abandoned Mine
- Big Creek



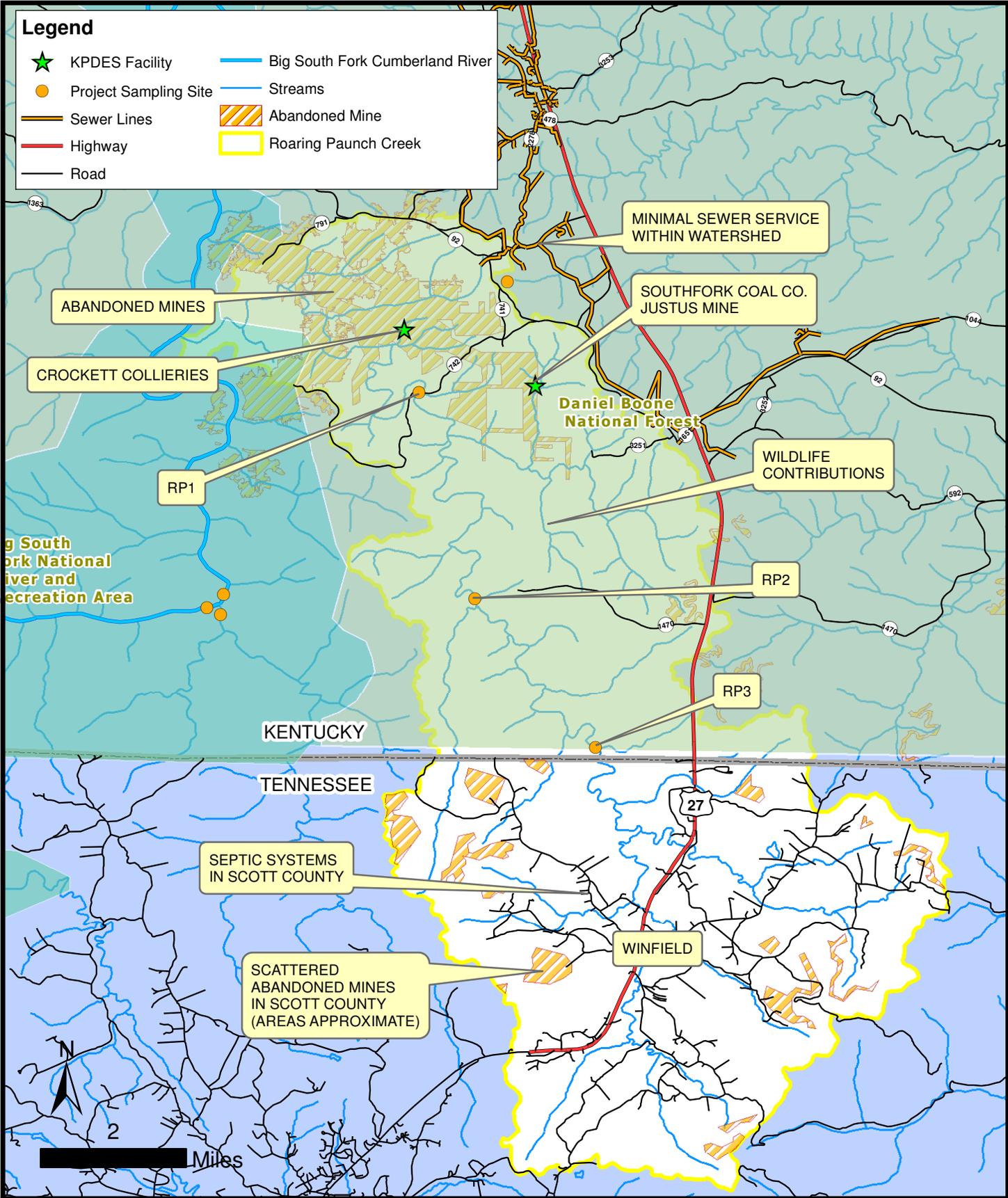
**BIG CREEK
POTENTIAL POLLUTANT SOURCES
BEAR CREEK, BIG CREEK, AND ROARING PAUNCH CREEK
WATERSHED BASED PLAN CLOSE OUT REPORT
MCCREARY COUNTY WATER DISTRICT
WHITLEY CITY, KENTUCKY**



**FIGURE 4.02-2
5108.100**

Legend

- ★ KPDES Facility
- Project Sampling Site
- Sewer Lines
- Highway
- Road
- Big South Fork Cumberland River
- Streams
- Abandoned Mine
- Roaring Paunch Creek



**ROARING PAUNCH CREEK
POTENTIAL POLLUTANT SOURCES
BEAR CREEK, BIG CREEK, AND ROARING PAUNCH CREEK
WATERSHED BASED PLAN CLOSE OUT REPORT
MCCREARY COUNTY WATER DISTRICT
WHITLEY CITY, KENTUCKY**



**FIGURE 4.02-3
5108.100**

1. Sampling Training and Certification

As indicated in the QAPP, all sampling technicians who took part in the monitoring program for the WP were given training and instruction on the proper collection of environmental samples by a trained sampling technician.

A certified laboratory was used for all water samples taken for the project. The lab indicated all appropriate notes on the results page. No indication was given by the lab that any of the established quality objectives and criteria were not met. This includes laboratory blanks, matrix spikes, precision and recovery, calibration of equipment, and other QA/QC measures.

2. Documents and Records

All appropriate records identified in the QAPP have been maintained for the water quality monitoring program.

3. Sampling Methods

All sampling technicians involved in the water quality monitoring program familiarized themselves with the sampling methods identified in Section 2 of the QAPP and were properly trained in the identified sampling methods by a trained sampling technician. All samples were also given proper preservatives and were delivered to the certified laboratory within the hold times specified in the QAPP. Chains of custody were filled out by the sampling technicians and lab personnel. Sampling labels and field data sheets were filled out in accordance with the QAPP to identify the sampling location, sampling technician, and other field conditions identified in the QAPP.

4.03 BMPs

Results of the monitoring plan were discussed in detail with the stakeholders and the community. BMP tables with milestones developed for this project are located in Section 5 of the WP.

1. Watershed Education and School Curriculum

Over the course of several months local teachers collaborated with staff of MCWD and Strand to develop the curriculum. Guidance and reference material was used from USEPA, the Commonwealth of Kentucky, and other sources. Twenty-five teachers at three schools used the curriculum that was developed over several months from numerous sources to reach several hundred students at Pine Knot Intermediate School, Pine Knot Primary School, and Whitley City Elementary School.

2. Investigation of Potential Areas with Failing Septic Systems

Nine properties were determined to have failing or nonexistent wastewater systems and were connected to the MCWD sewer system. Figure 3.01-1 shows the addresses and locations of the properties.

5.01 CONCLUSIONS

This section provides an overview of the measures of success as outlined in the project application and the WP.

A. Identify Impaired Waters and Causes/Sources of Impairments

A comprehensive water quality monitoring program was established and successfully executed for the development of the WP. The monitoring program along with extensive existing data that was compiled from previous monitoring program allowed MCWD to identify baseline conditions in each of the focus subwatersheds and identify pollutants of concern and pollutant sources. Section 3 and Section 4 of the WP includes additional information regarding identifying pollutants of concern and pollutant sources. This data was further used to identify appropriate BMPs for implementation.

B. Identify Threats to Other Waters

1. Existing Data

Existing data was acquired and reviewed in coordination with KDOW and other local agencies and organizations that work within the focus subwatersheds. Existing data was reviewed to see whether it could be used for pollutant source identification and BMP selection. Existing data reviewed for the BSF WP is discussed in further detail in Sections 3 and 4 of the WP.

2. Additional Water Quality Data

A comprehensive water quality monitoring program was established and successfully executed for the development of the WP. Additional information about the WQS program can be viewed in Section 4 and in Appendix D of the WP.

C. Identify Point Source Controls and Nonpoint Source Management Measures Needed to Attain and Maintain Water Quality Standards

Fourteen solutions were identified to improve water quality in BSF.

1. Planned Activities

Planned activities from agencies and organizations working within the Curry's Fork watershed were identified and documented in Section 2 of the WP. All agencies and organizations within the Curry's Fork watershed were encouraged to participate in the development of the WP by being part of the Technical Committee.

2. Additional Activities

Comprehensive lists of the prioritized BMPs identified to implement in the Curry's Fork watershed to improve water quality are shown in Section 5 of the WP. These tables identify

BMPs and solutions that were prioritized based on their anticipated impact to reduce pollutant loads from point and nonpoint sources.

D. Identify Who will be Responsible for the Implementation of Controls and measures

For each of the 14 identified BMPs and solutions for the BSF WP, responsible parties for implementation were identified. In addition, each of the solutions also lists technical assistance resources that can be contacted to aid in the implementation. See Section 5 of the WP for additional information.

E. Estimate Load Reductions that will be Achieved

Load reductions for BMPs and solutions identified in the WP are discussed in detail in Section 5 of the WP.

F. Provide an Implementation Schedule with Interim Milestones

Interim milestones have been developed for all BMPs and solutions selected for implementation. Interim milestones are shown in the tables in Section 5 of the WP.

G. Estimate Implementation Costs and Identify Financing Sources

BMP and solution tables in Section 5 of the WP indicate the estimated implementation costs and potential funding sources or funding mechanisms for each BMP or solution.

H. Identify Technical Assistance, Outreach, and Education Needed

1. Technical Assistance

The need for technical assistance, especially for analyzing the sampling program results, was identified early within the WP development process. A technical group was formed to aid in reviewing sampling data and identifying other technical assistance needs. The technical group included data expertise from the following disciplines: engineers, watershed managers, biologists, geologists, hydrologists, and park service habitat specialists. The data analysis approach for the WP is discussed in further detail in Section 4 of the WP.

2. Outreach

The WP allocated resources to a number of successful outreach programs. Involving interested stakeholders, the formation of the technical group, and the continued meetings of the Technical Committee significantly improved the WP. The Technical Committee was a venue for the Internal Project Team to educate the Technical Committee on water quality basics and analysis to allow the technical group to make informed decisions about the results of the monitoring program based on its local knowledge of the watershed.

3. Education

Education for middle and elementary school students was determined to be a need in the watershed. An education curriculum was developed that targeted students and used in three schools within the watershed.

I. Establish a Monitoring Program and Adaptive Implementation Process

1. Postconstruction Monitoring

A number of BMPs and solutions included in the WP involve continued monitoring of various sampling sites and areas of concern within the watershed. Postconstruction monitoring is a vital part of any WP to determine the impact of BMPs that have been implemented. Section 5 and Section 6 of the WP include additional information regarding postconstruction monitoring associated with the WP.

2. Adaptive Implementation

Adaptive implementation is a vital part to any WP to make sure BMPs and solutions are improving conditions in the watershed as intended. The phased monitoring approach, outcome indicators, outreach, and corrective actions discussed in Section 6 of the WP are all examples of adaptive implementation and management.

J. Create and Involve a Stakeholder Group Throughout the Project

1. Identify

Potential members for a stakeholder group were identified early in the WP development process to form the stakeholder group and the technical group. By the end of the project, more than 50 individuals from over a dozen organizations participated in the stakeholder and technical groups. Members came from a variety of professional backgrounds, including water quality, habitat, and biology experts, to contribute to the development of the WP.

2. Meet

The stakeholder group and technical group have been involved in the project and development of the WP from the beginning. These groups were involved early in the development process and took part in a series of 18 meetings over the course of the project to provide their local knowledge and input into the WP.

K. Develop and Implement Public Outreach and Education

Public outreach and education primarily focused on an extensive elementary and middle school curriculum that was developed as part of the WP. Additional information is included in Section 5 of the WP. Lesson plans and additional curriculum information can be found at <http://mccrearywater.com/funzone.html>.

L. Develop and Implement a School Program

MCWD worked in cooperation with stakeholders and teachers within McCreary County to develop an extensive water quality curriculum for elementary and middle school students. The curriculum covers all aspects of water and water quality. Additional information is included in Section 5 of the WP. Lesson plans and additional curriculum information can be found at <http://mccrearywater.com/funzone.html>.

M. Implement Selected BMPs Within the Scope of the Project Budget

One of the primary tasks associated with this grant was the completion of the BSF WP. A total of fourteen solutions and BMPs were identified to improve water quality in BSF. These solutions were selected through a series of 18 meetings and reviews of available water quality data over the course of the project. See Section 5 of the WP for additional information.

Nine properties were determined to have failing or nonexistent wastewater systems and were connected to the MCWD sewer system. Figure 3.01-1 shows the addresses and locations of the properties.

5.02 RECOMMENDATIONS AND LESSONS LEARNED

A. Technical Group

Coordination with the technical group throughout the development of the WP has benefited the project significantly and is highly recommended for any similar projects. The technical group input on potential pollutant sources and identification of feasible BMPs that would work within the watershed was invaluable. Also, active technical group involvement in the development of the WP ensured that implementation programs were not duplicated, but rather that existing programs were expanded, supplemented, or supported. As the technical group representatives would be actively implementing many solutions and BMPs, it was imperative that they were involved in the decision making process.

Encouraging active engagement and discussion among technical group representatives was an important aspect. While it is necessary for 319(h) project managers to keep technical group representatives apprised of project progress with presentations, it is equally or more important to actively involve the technical group with decision-making.

B. Community Involvement

Involving the community was an important part of the WP development process, especially involving the school district. MCWD feels strongly that providing education and outreach opportunities to students and children now will provide long lasting benefits to the watershed and to the community. MCWD will continue to educate students within the community about water and water quality.

C. Data Analysis Team Approach

The team approach taken to review sampling results, identify pollutants of concern, and identify pollutant sources was also a success. It would have been very difficult for one person or organization to

review all data associated with the WP and make unbiased decisions based on the results. The data analysis team approach provided invaluable insight in identifying pollutant sources and feasible BMPs to implement.

**SECTION 6
LITERATURE CITED**

6.01 LITERATURE CITED

2008 Integrated Report to Congress on the Condition of Water Resources in KY, Vol II, 303(d) List of Surface Water, Kentucky Division of Water, 2008.

Year 2008 303(d) List, Tennessee Department of Environment and Conservation, 2008.