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Project Final Report Watershed Plan for Crafts Colly, Sand Lick, and Dry Fork

Kentucky Water Resources Research Institute

Project Final Report
Watershed Plan for Crafts Colly, Sand Lick, and Dry Fork

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Executive Summary

The North Fork: Whitesburg Tributaries Watershed Plan, developed under this project, provides a path to improve waterbodies impacted by poor wastewater treatment, coal mining, and encroachments on floodplain by housing and roadways.

Crafts Colly, Sand Lick, and Dry Fork are tributaries to the North Fork of the Kentucky River. They are located just north of the City of Whitesburg, in Letcher County, which is in the coalfields of southeastern Kentucky. The three watersheds encompass 18 square miles of primarily forested lands and about 30 miles of streams, most of which are entrenched. Because of the steep mountain terrain, most of the houses are constructed adjacent to the stream with roadways crisscrossing streams frequently. Most of the watershed area is unsewered and failing septic systems and straight pipes are a source of bacterial contamination for waterways. The riparian corridor of most (87%) streams have been impacted to some level by development, with heavy riparian impacts on over half of the streams. Coal mining has left its mark on the waterbodies, with 13 legacy mine drainage sites, two large coal refuse piles, and three active mines.

Monitoring conducted in support of this project found that warmwater aquatic habitat use was either non-supported or partially supported by these streams. *E.coli* measurements showed the primary contact recreational use (swimming) was not supported at any stream, and the secondary contact use (wading / fishing / boating) was impacted in the headwaters of Dry Fork and along Crafts Colly. These impacts are due primarily to human wastewater, causing elevated nitrogen and phosphorus as well. Surveys identified severe erosion on 1.32 miles of streams, primarily related to channelization due to road construction or placement. Stream pH was neutral, but iron and cadmium concentrations were above regulatory criteria for aquatic life use in several locations.

Survey results showed that the community believed the greatest impacts to water quality are from failing septic systems or straight pipes, trash in streams, and mining runoff. The community also believed water quality improvements were important and supported funding for this need. Low income levels and lack of property ownership does discourage some implementation action, and some fear lingers that the economy will be affected if water quality issues are publicized.

The watershed implementation plan identifies 57 best management practices including ten for bacteria impacts, six related to trash, seven related to mining impacts, 21 related to education and outreach, and 13 related to habitat improvement and erosion controls.

1. Introduction & Background

The goals of this project included activities to assist in developing a Watershed Plan document for Crafts Colly Creek, Sand Lick Creek and Dry Fork, including direct involvement in water quality data analysis and interpretation, and the development of an implementation plan for appropriate best management practices. KWRRI also assisted Headwaters and other local Letcher County partners by participating in watershed team meetings and supporting public outreach and education activities.

To assist in the development of the watershed plan, KWRRI 's objectives included collection of background information and preparation of Chapter 1 (Background Information) and Chapter 2 (Watershed Characterization), composing Chapter 3 (Monitoring) and Chapter 4 (Data Analysis), and assisting with the development of Chapter 5 (BMP Implementation Plan) and 6 (Strategy) of the Watershed Plan.

Prior to this project, KWRRI had been directly involved with water quality analysis and support in the headwaters of the North Fork of the Kentucky River since 2000. Through this long-term commitment, KWRRI has partnered with several entities in Letcher County, including Headwaters, Kentucky River Watershed Watch, Eastern Kentucky PRIDE, Letcher County schools and others, and has fostered lasting relationships with local citizens working toward common water improvement goals.

In 2000, KWRRI conducted water quality sampling and prepared an associated report on the water quality effects of straight pipes and acid mine drainage on streams in Letcher County. Fecal coliform, fecal streptococcus, metals, and field chemistry were assessed, indicating high pathogen levels at many sites and acid mine drainage impacts at some sites, especially on Crafts Colly Creek.

In 2008, KWRRI conducted water quality sampling to assess the impacts of a Clean Water Action Plan project aimed to reduce the number of straight pipes and failing septic systems in the North Fork Kentucky River watershed. The subsequent report from KWRRI concluded that pathogen values remained high, with no improvements shown in Letcher County following the targeted management efforts. In addition to straight pipe and septic system contributions, discharges from non-compliant package treatment plants were noted as contributing to continuing pathogen problems.

Beginning in 2004, KWRRI helped provide grant funding to various groups in the upper North Fork Kentucky River through the Kentucky River Authority (KRA) Watershed Grant program. A total of 11 KRA grants have been awarded to Letcher County projects, totaling over $30,000. These projects include local efforts to provide water quality education and outreach, focused water sampling efforts, and the sponsorship of a Volunteer in Service to America (VISTA) program Watershed Coordinator. KRA funding helped support the VISTA watershed coordinator position for seven years of service between 2006 and 2017, during which time Headwaters was able to elevate their engagement with water issues to the current level of coordinating a watershed-based planning effort.

Additionally, as a major partner in Kentucky River Watershed Watch, KWRRI staff have been engaged with volunteer water samplers at over 70 sites in Letcher County since 1999. Sampling continues at several locations in the county, creating a long-term record of additional water quality data. Water samples taken throughout Crafts Colly Creek, Sand Lick Creek, and Dry Fork consistently showed high *E. coli* levels (>1,000 CFU/100 ml), high metals (aluminum, beryllium, iron, lead, nickel, zinc), and high sulfates (>250 mg/l). There are also consistently high conductivity readings (>500 µs/cm) and low pH levels (<6).

The Crafts Colly, Sand Lick, and Dry Fork watersheds were selected from Letcher County as an ideal, focused area for beginning intensive water quality assessment and improvement in the North Fork

Kentucky River headwaters region. Letcher County is located in the Appalachian coalfields of southeastern Kentucky. The receiving segment of the North Fork Kentucky River (miles 145.5 to 162.0) was listed in the 2014 Integrated Report to Congress on the Condition of Water Resources in Kentucky as non-supporting for Primary Contact Recreation (PCR) and Warm Water Aquatic Habitat (WAH) due to fecal coliform and sedimentation/siltation respectively. The segment of the North Fork of the Kentucky River (miles 132.0 to 145.5) that receives flow from Dry Fork was listed on the 2014 Integrated Report as non-support for PCR due to fecal coliform. Additionally, these segments are included in the approved Total Maximum Daily Load "Removing Fecal Pollution from the North Fork Kentucky River Drainage" report from 1994.

KWRRI saw the watershed planning project as a natural progression from years of sampling and outreach activities in the headwaters region of the North Fork Kentucky River. In addition to the favorability of the three focus subwatersheds with regard to geographic area and documented water quality concerns, these watersheds also present an ideal starting point due to their central location near the community of Whitesburg, which has displayed strong, ongoing interest in water quality improvements.

2. Materials & Methods

a. Project Area Description

Crafts Colly, Sand Lick, and Dry Fork are tributaries to the North Fork of the Kentucky River. Each tributary flows southward into the North Fork within or near the City of Whitesburg, in Letcher County, which is found in the coalfields of southeastern Kentucky (Figure 1). Crafts Colly, Hydrologic Unit Code (HUC) number 051002010103, has a drainage area of 7.6 square miles. Sandlick Creek, HUC 051002010103, has a drainage area of 4.9 square miles and Dry Fork, HUC 051002010104, is a 5.3 square mile drainage basin. Together, the three watersheds encompass a drainage area of 17.8 square miles.

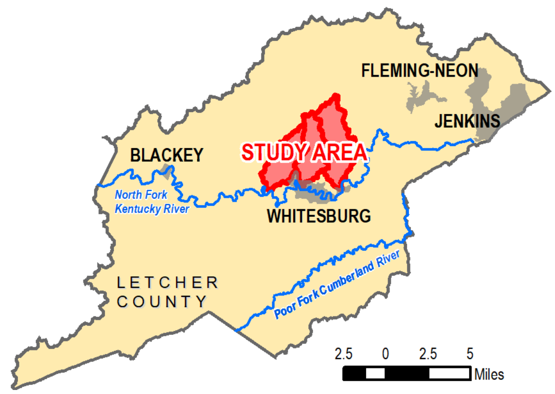


Figure 1 - Study Area

A total of about 30 miles of stream are in these three watersheds, including approximately 13 miles in Crafts Colly Creek, 9 miles in Sandlick Creek, and 8 miles in Dry Fork. Due to the mountainous terrain, there is rapid surface runoff, so streams are primarily ephemeral in nature. Stream flow in the main tributaries are augmented by shallow groundwater flow.

The following summarizes some of the major findings from the watershed characterization.

- <u>Geomorphic stream conditions:</u> Streams in these watersheds tend to be incised, entrenched, and over-widened. These entrenched streams contribute to increased erosion and sedimentation. This also increases the frequency of dry streams and the severity of downstream flood events.
- <u>Houses along the floodplain:</u> Much of the development in the watershed has occurred near the streams and waterways due to the steepness of the surrounding terrain. Almost all roadways crisscross along streams in the area. The location of these properties and infrastructure may make stream restoration efforts challenging.
- <u>Riparian Buffers:</u> Over half of the streams have a heavily impacted riparian buffer of less than 10 feet on either bank. These buffers are important for habitat, water quality protection, stabilization, and detrital input. In many parts of the watersheds, buffer zones are nonexistent as

roads are crumbling into streams. The majority of stream reaches, 87%, have been impacted to some level by development.

- Mine drainage and permitted facilities: 13 mine drainage locations have been identified in the watershed area. AMD can contribute to impairments in waterbodies, so finding treatment solutions for these sources will be an important part of implementation planning. Three coal companies and one auto repair shop are permitted to discharge and are all located in the Sandlick Creek watershed. Of these facilities, two have exceeded their permit limits in the past three years, Sapphire Coal Company and Raven Energy Inc.
- Land cover: The land cover distributions for the three watersheds are very similar. They are about 75% deciduous forest, 9% grassland, 6% developed open space, and 10% other.
- Septic Systems and Straight Pipes: Most of the watershed area is unsewered. A recent sewer project extended sanitary sewer service to part of Crafts Colly. However, another $3.3 million would be required to extend service to Crafts Colly tributaries in the lower half of the watershed and to residences in Sandlick Creek. Additional projects would be required to address Dry Fork and the headwaters of Crafts Colly and Company Branch. Soils are "very limited" for septic tank absorption suitability and straight pipes are known to occur throughout the area. Failing septic system and straight pipes are a source of bacterial contamination for waterways.
- Pet ownership and Wildlife: Large pet and wildlife populations may contribute to bacteria loadings in the watershed.

The Kentucky Division of Water performed monitoring of this watershed at eight locations shown in Figure 2.

b. Methods and Materials

The objective of this section is to describe the methods utilized to develop the watershed plan. In general, the guidance provided in the *Watershed Planning Guidebook for Kentucky Communities* (2010) was followed. The sections below provide detail for areas in which the guidebook is unclear or there might be variation in the approaches utilized to characterize the watershed and the pollutant sources.

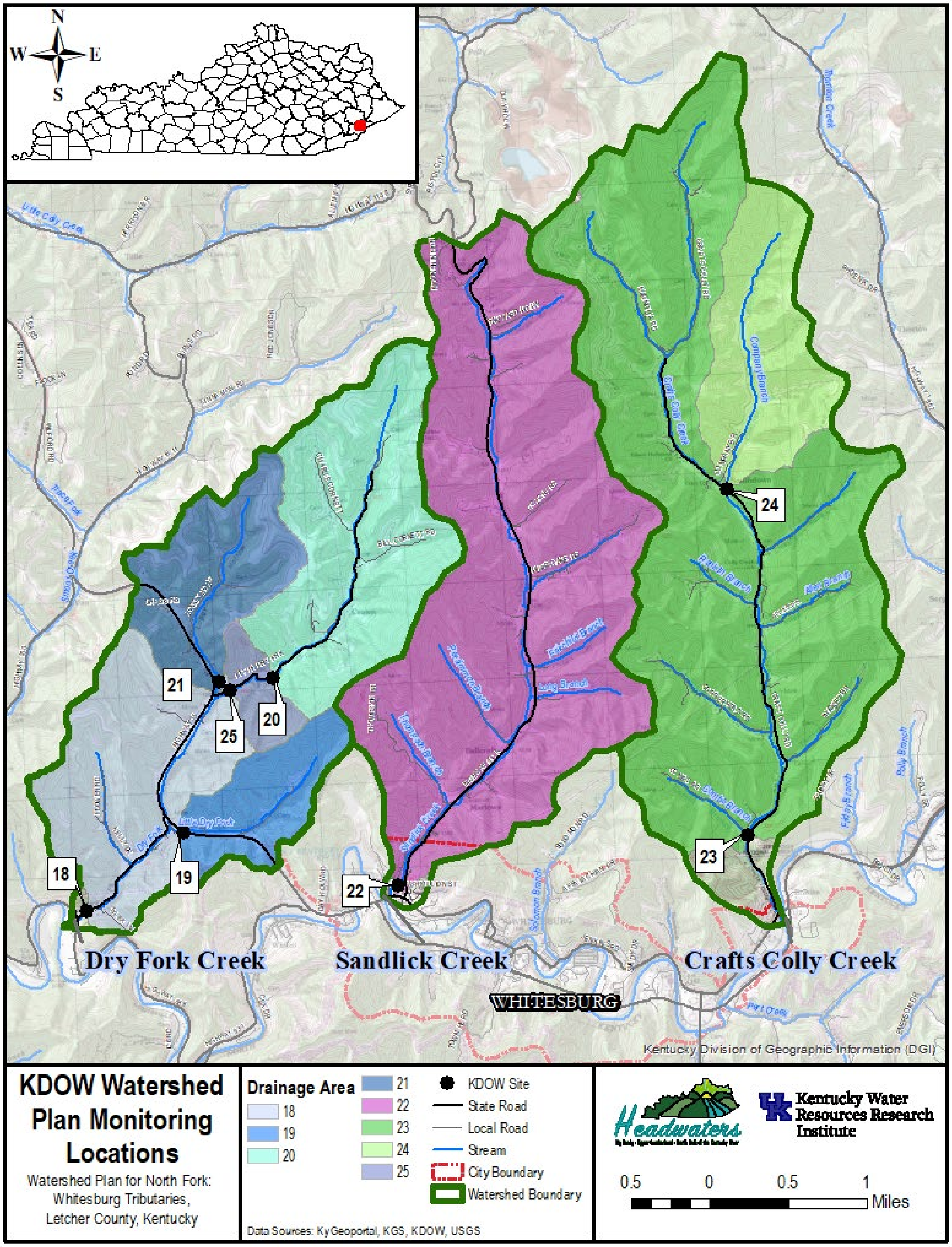
i. Riparian Zone Analysis

An analysis of aerial imagery was conducted to determine the riparian widths of the streams in the watersheds. Satellite imagery was further compared against the minimum recommended buffer width for various stream functions. Streams with riparian widths of greater than 120 feet (60 feet each side) are labeled as "non-impacted," riparian widths of 20 to 120 feet (10 – 60 feet each side) are "moderately impacted", and riparian widths less than 20 feet (less than 10 feet each side) are "heavily impacted." In areas in both banks were not equally impacted, the label for the more impacted of the two bank labels was utilized, or the "moderately impacted" label was used if one bank was non-impacted and the other was "heavily impacted." The results of this analysis are described in Chapter 2.

ii. Severe Erosion

All streams in the North Fork Whitesburg Tributaries watersheds with accessibility by road were visually surveyed by Dr. Alice Jones of Eastern Kentucky University and Alex Beer and Garth Adams of Headwaters, Inc. on August 25, 2018. The assessment was conducted using the Maryland Stream Corridor Assessment Survey Protocols (Yetman 2001). Only areas of severe erosion, defined as erosion that exceeds average reach conditions or threatens property and infrastructure, were assessed.

Figure 2 - Monitoring Locations



iii. Monitoring Data

Water quality monitoring was conducted by the Kentucky Division of Water staff on 21 dates from May 2017 to November 2018 at the locations shown in Figure 2. Seven sites were monitored for *E. coli* during five events in May 2017 and monthly from June to October 2017. Water chemistry was tested at seven sites during six events from May 2017 to October 2017. One site was tested for metals, alkalinity, and acidity only during these events. To supplement the metals dataset, four sites were sampled during an additional five events during 2018. Flow and field chemistries were measured during all events except under extenuating circumstances. This data was utilized for load analysis with historical datasets utilized to provide supplemental support about contributing sources.

iv. Pollutant Load Assessment

Pollutant loads are calculated by multiplying the concentration by the flow and a conversion factor to generate a mass of pollutant over time. For this plan, annual loads were calculated by multiplying the geometric mean concentrations by the median flow of the USGS Gage on North Fork of Kentucky River just upstream of Whitesburg scaled using linear regression equations developed from field flow measurements. These loads were then compared to benchmark loads to determine the required reductions.

v. Community Survey and Stakeholder Feedback

To get feedback from the community on best management practices, three major approaches were utilized: 1) a stakeholder survey was developed and distributed through various events, 2) one-on-one meetings were held with stakeholders to allow for private feedback and questions, and 3) a public meeting was held to inform the community of water quality monitoring results.

The community survey form was developed by KWRRI and utilized by Headwaters staff to obtain feedback. Headwaters performed all data entry of the survey results. Additionally, they performed one-on-one interviews with stakeholders. A community forum was held on October 14, 2019 at the Southeast Community and Technical College in Whitesburg. The event was advertised in the local paper and covered by WYMT television. The community forum delivered information on prior sampling efforts and some best management options to be considered by community members and stakeholders.

3. Results & Discussion

a. Water Quality Data Analysis

i. Biological Assessment

The biological assessment data indicated that the warmwater aquatic habitat use was either non-supported or partially supported on these streams. The macroinvertebrate biotic index (MBI) scores were rated “fair” or “poor” at all sites as were the rapid bioassessment protocol (RBP) habitat scores. Narrow riparian corridors and embedded riffles were the primary contributors to low habitat scores.

ii. Severe Erosion

The assessment by Eastern Kentucky University and Headwaters identified about 1.32 miles (4.4%) of the streams as having severe erosion. They found that almost all erosion issues were related to channelization due to road construction or placement. In several cases, the streams had washed out embankments and culverts or were undercutting roads and threatening collapse.

iii. Water Quality

A summary of the percentage that each site exceeded benchmarks is found in Table 1, with colors indicating the rate of exceedance from never (blue) to always (red).

Table 1: Percent of Samples Exceeding Water Quality Criteria by Site and Parameter

Parameter	Criteria[1]	Limit	% Exceedance by Site							
			Dry Fork	Little Dry Fork	Dry Fork	Dry Fork UT	Sand-lick Creek	Crafts Colly Creek	Company Branch	Dry Fork
			18	19	20	21	22	23	24	25
E. coli	SCR	676 CFU/100mL[2]	20%	0%	60%	30%	20%	44%	80%	N/A
	PCR	240 CFU/100mL	50%	0%	80%	70%	70%	78%	100%	N/A
Conductivity	Narrative	300 µS/cm	100%	100%	100%	89%	100%	100%	100%	100%
Total Dissolved Solids	Narrative / DWS	250 mg/L	100%	100%	100%	100%	100%	100%	100%	N/A
Total Nitrogen	Narrative	0.7 mg/L	33%	100%	33%	40%	50%	18%	0%	N/A
Total Phosphorus	Narrative	0.025 mg/L	0%	50%	83%	0%	0%	0%	33%	N/A
Fluoride	DWS	4 mg/L	0%	0%	0%	0%	0%	0%	0%	50%
Sulfate	DWS	250 mg/L	100%	100%	0%	80%	100%	83%	100%	N/A
Iron	Acute	4 mg/L	0%	33%	9%	0%	0%	0%	0%	83%
	Chronic	1 mg/L	9%	100%	18%	10%	0%	0%	18%	83%
	DWS	0.3 mg/L	73%	100%	18%	80%	33%	17%	100%	83%
Arsenic	DWS	10 µg/L	0%	0%	9%	0%	0%	0%	0%	40%
Cadmium	Acute	5.2-9.0 µg/L[3]	0%	0%	0%	0%	0%	0%	0%	17%
	Chronic	0.51-0.77 µg/L[3]	0%	0%	9%	0%	0%	0%	0%	17%
	DWS	5 µg/L	0%	0%	0%	0%	0%	0%	0%	17%
Copper	Acute	32-53 µg/L[3]	0%	0%	9%	0%	0%	0%	0%	17%
	Chronic	20-31 µg/L[3]	0%	0%	9%	0%	0%	0%	0%	17%
Lead	Chronic	9.6-19.2 µg/L[3]	0%	17%	9%	0%	0%	0%	0%	17%
Mercury	Fish	0.051 µg/L	0%	0%	9%	0%	0%	0%	0%	17%
Thallium[4]	Fish	0.47 µg/L	0%	0%	9%	0%	0%	0%	0%	0%
	DWS	0.24 µg/L	0%	0%	9%	0%	0%	0%	0%	0%
Zinc	Acute	250-433 µg/L[3]	0%	0%	9%	0%	0%	0%	0%	0%
	Chronic	250-433 µg/L[3]	0%	0%	9%	0%	0%	0%	0%	0%

[1]Criteria are abbreviated as follows: primary contact recreation (PCR), secondary contact recreation (SCR), warmwater aquatic habitat criteria protective based on one-hour exposure (Acute), warmwater aquatic habitat criteria protective based on 96 hours of exposure (Chronic). Drinking water supply source criteria (DWS). Non-numeric criteria translated using watershed specific criteria (Narrative).
[2]Conversion of fecal coliform criteria to E.coli based on Akasapu and Ormsbee, 2011.
[3]Based on geomean of hardness values for individual sites sampled during KDOW project using equations provided in 401 KAR 10:031. Exceedances were compared individually to 401 KAR 10:031 in data analysis, but these values are provided as a summary for quick reference.
[4]Thallium laboratory reporting limit is 0.5 µg/L which is above the fish and drinking water supply benchmarks. Any detected concentration was considered an exceedance.

E. coli was found to routinely exceed the primary contact recreation criteria at six of the seven sites, and the geometric mean exceeded the secondary contact criteria at four sites. The primary source for this impairment is human waste due to straight pipes and / or failing septic systems, with dogs and wildlife providing other contributing sources.

For metals, iron and cadium were present at levels that required load reductions at one or more sites. However, two sites in the Dry Fork watershed had exceedances for numerous metals. For Site 20, many of the exceedances were linked to a rain event with high suspended solids, but for Site 25, it was unrelated to flow levels. Mine drainage and coal waste pile runoff are the most probable source for these metals. Because the pH was found to be neutral during all sampling events at all sites, these drainages are expected to be metalliferous but not acidic.

Six of the seven sites had exceedances of the watershed specific numeric interpretation of narrative benchmark (provided by KDOW) for nitrogen, with four sites at levels requiring a load reduction. Site 19 had the highest concentration due to high levels of ammonia possibly due to the production of methamphetamines at an upstream location. Human wastewater is likely the source for the high nitrogen at the other sites. Phosphorus exceeded the narrative benchmark provided by KDOW of 0.025 mg/L at three sites, with two having geometric means above the benchmark.

Table 2 provides a summary of the pollutant load reductions that would be required in the incremental watershed drainage areas for each site along with the percentage reduction required for the existing load.

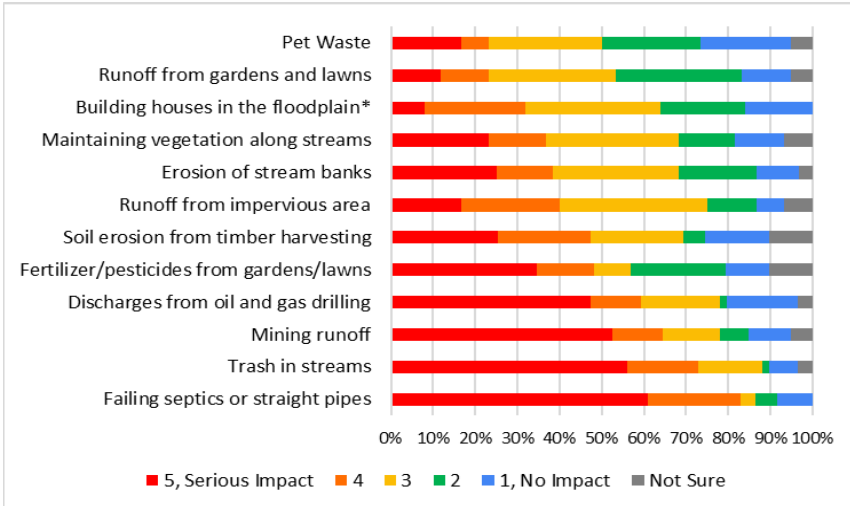
Table 2: Summary of Annual Load Reductions to Meet Most Stringent Benchmarks

			Incremental Load Reduction by Site (% / Amount)							
Site			18	19	20	21	22	23	24	25
Parameter	Unit / Year	Criteria	Dry Fork	Little Dry Fork	Dry Fork	Dry Fork UT	Sand-lick Creek	Crafts Colly Creek	Company Branch	Dry Fork
E.coli	Trillion	PCR	72% 12.11	0%	95% 13.31	81% 1.14	77% 13.07	82% 15.83	83% 4.40	N/A
Nitrogen	Lbs	narrative	1% 80	46% 900	17% 160	2% 5	0%	0%	0%	N/A
Phosphorus	Lbs	narrative	0%	17% 7.6	59% 41.2	0%	0%	0%	0%	N/A
Dissolved Solids	Million Lbs	narrative /DWS	68% 4.28	67% 0.761	34% 0.144	60% 0.168	70% 3.88	50% 1.49	55% 0.354	N/A
Sulfate	Million Lbs	DWS	20% 0.500	27% 0.139	0%	8% 0.010	37% 0.980	17% 0.300	21% 0.078	N/A
Iron	Million Lbs	DWS	21% 0.640	93% 6.365	0%	33% 0.068	0%	0%	45% 0.284	90% 15.42
Cadmium	Lbs	Chronic	0%	0%	0%	0%	0%	0%	0%	17% 0.71

b. Community Feedback

A total of 62 individuals completed a community survey with the results providing some insights about the perceptions of water quality concerns in the area, as shown in Figure 3. The greatest impacts to water quality in the area were perceived to be failing septic systems or straight pipes, trash in streams, mining runoff, and discharges from oil and gas; the last of which was shown not to be the case in our focus watersheds. Most people did not see a strong impact from pet waste, runoff from gardens and lawns, or building houses in the floodplain.

Figure 3 - Water Quality Concerns in Letcher County



NOTE: Concerns are ranked from least to greatest, based on degree of perceived impact to water quality on a scale from 1 to 5, with 5 being a "serious impact" and 1 is "no impact at all." Result shown as percentage of responses in each category.

Most survey respondents had strong positive opinions on the value of water quality to the community. A strong majority thought government spending to improve water quality was worthwhile and that improving water quality should be a priority for the community. They were concerned about aquatic life impacts and were optimistic about making improvements. However, almost 30% of respondents thought that bringing attention to water quality issues might have negative economic effects. Residents were supportive of environmentally responsible management of their yard and are in favor of more environmental education in schools.

Survey respondents indicated that septic systems (61%) were the most common method of treating sewage, with 27% connected to the public sanitary sewer system. Straight pipes were used by 5% of respondents, and 6% were not sure how their sewage was treated. For those with septic systems or straight pipes, 46% were installed during the 1990s or prior. This is notable because until 1992, properties with 10 or more acres weren't required to have an approved onsite system, and in 1998 a state law was passed requiring a properly installed septic system before the power company could turn on electric service for new construction. Therefore, many of these systems may be failing or inadequate.

Discussions in community meetings and in one-on-one meeting with stakeholders provided some interesting feedback:

- The charge for sanitary sewer is currently 150% of the drinking water bill. These costs often deter residents from tapping on to sewer even if it is available. Enforcement is difficult for a variety of factors. Community resistance to additional fees may torpedo various sanitary solutions, and community analysis of ability to support additional services rates may be needed.
- Many residents in the area are on a fixed income, and small rate or tax increases (as low as 2%) are perceived as having a devastating effect on residents. Further, it is often difficult for renters to find financial assistance.
- Several past environmental court cases in the area in which pollution occurred and caused health impacts but the culprits were not deemed rightly punished have caused public mistrust of responses to environmental concerns, including those related to water resources.

- The challenges of the mountainous terrain often do not always make sanitary sewers the best option for sewage treatment due to the high cost of maintenance and the need for lift pumps.
- "Ditching" efforts by transportation agencies to reduce flooding of streams and tributaries may be removing habitat and increasing their channelization.

c. Best Management Practices by Impairment Cause

The causes of impairment in the Whitesburg tributary watersheds were found to be primarily due to 1) human sewage, 2) legacy mine drainage, and 3) habitat and erosional impacts due to residences in the floodplain. Therefore, potential BMPs related to these causes were proposed.

i. Human Sewage

Providing adequate treatment for human wastewater is important to protect human health from threats from waterborne bacterial and viral disease risks. Sanitary sewers, properly maintained septic systems, or other onsite sewage treatment options are available practices to treat sewage. Figure 4 details the bacteria load reduction needs in the area, as well as focus areas for septic system improvements. These focus areas are highlighted because no plans for sanitary improvements have been proposed and *E. coli* reductions are needed.

Dry Fork has sanitary sewer lines along a small portion of the tributary of Little Dry Fork along KY-15. Crafts Colly has limited sewer service in the lower portion of the watershed, and Sandlick Creek does not have any sewer infrastructure. The Whitesburg Sandlick Area Sewer Extension project has been proposed to reach 105 of the 254 residences along Sandlick Creek at a cost of $2.053 million, or about $15,000 per customer. The Crafts Colly Sewer Extension Phase II is proposed to connect 79 additional residences on Crafts Colly at a cost of $1.215 million, or about $19,000 per customer. These projects do not include costs to connect residences to the public sewer (tap-on fees), which vary by distance and bedrock depth.

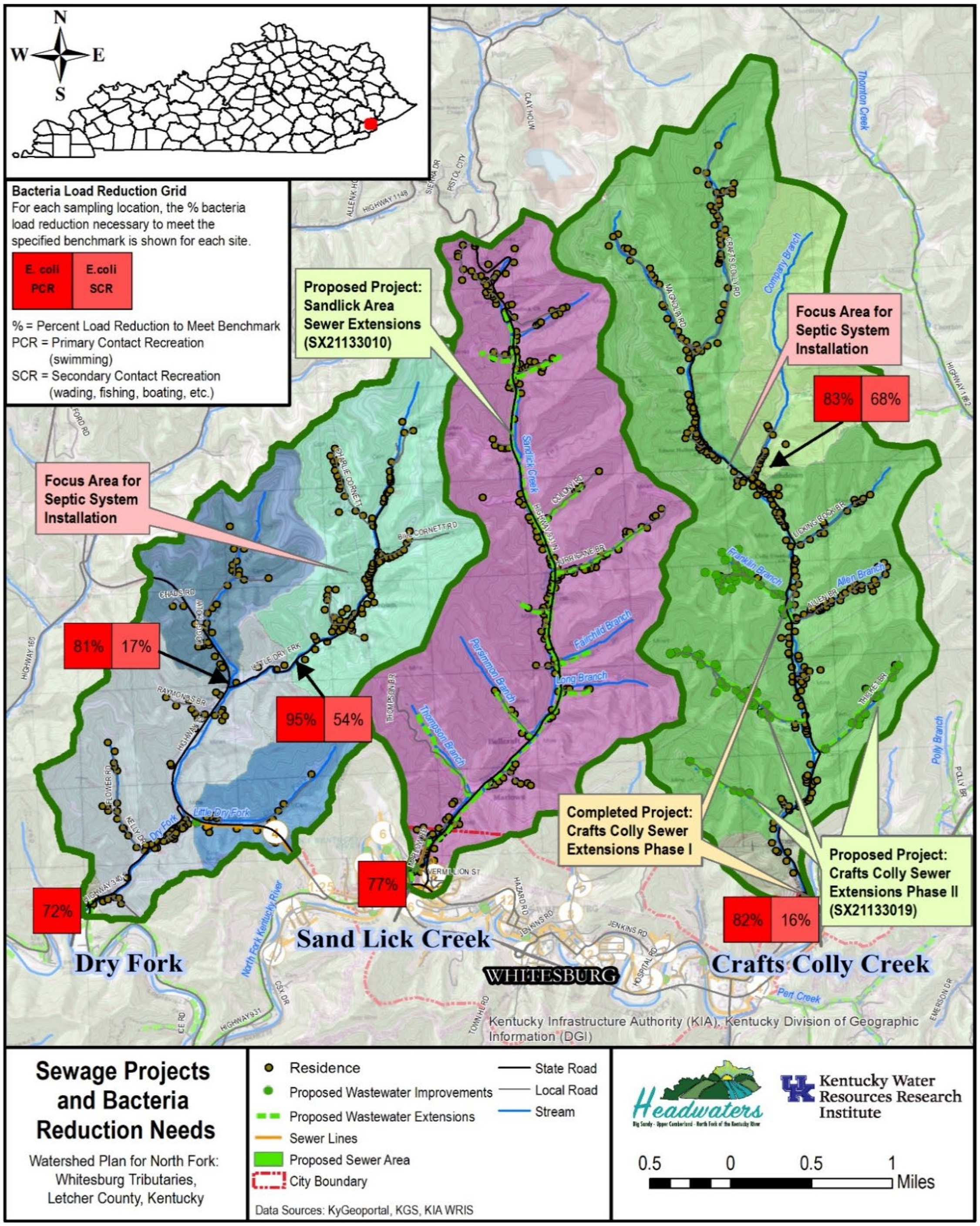
The high cost for installation and maintenance due to the steep terrain are drawbacks to sanitary sewer expansion. Further, there is no guarantee that homeowners will tap-on if the lines are run to the area and enforcement is difficult, particularly in low-income situations. Non-point source grant assistance (USEPA 319h) is potentially available to defray the cost of tap-on fees. An additional concern is homeowners' ability and willingness to pay monthly sewer service costs.

Properly maintained septic systems can effectively treat human waste at individual residences. For some residences, repair and maintenance of existing septic systems may restore proper function. Septic systems with traditional gravel bed leach fields can be used in areas with enough space, but alternatives such as leaching chambers, leaching chamber beds, drip irrigation, and constructed wetland cells can be used in confined areas. Clustered systems may be suitable in some areas where residences are close together and can share a leach field. Grant funding may be available to assist homeowners with system replacement or repair or the installation of a shared cluster system.

ii. Legacy Mine Drainage

Most of the mine drainage impacts to the Whitesburg tributaries are due to legacy drainage from pre-law, abandoned coal mines. Heavy metals from mine drainage are transported through waterways. Therefore, it is crucial to divert, prevent, and control the flow of contaminated waterways before they impact human health or aquatic flora and fauna. The Abandoned Mine Land (AML) Reclamation Program, funded by fees on coal production, addresses the hazards and environmental degradation from legacy mine issues. However, these projects are prioritized based on risk and human health impact.

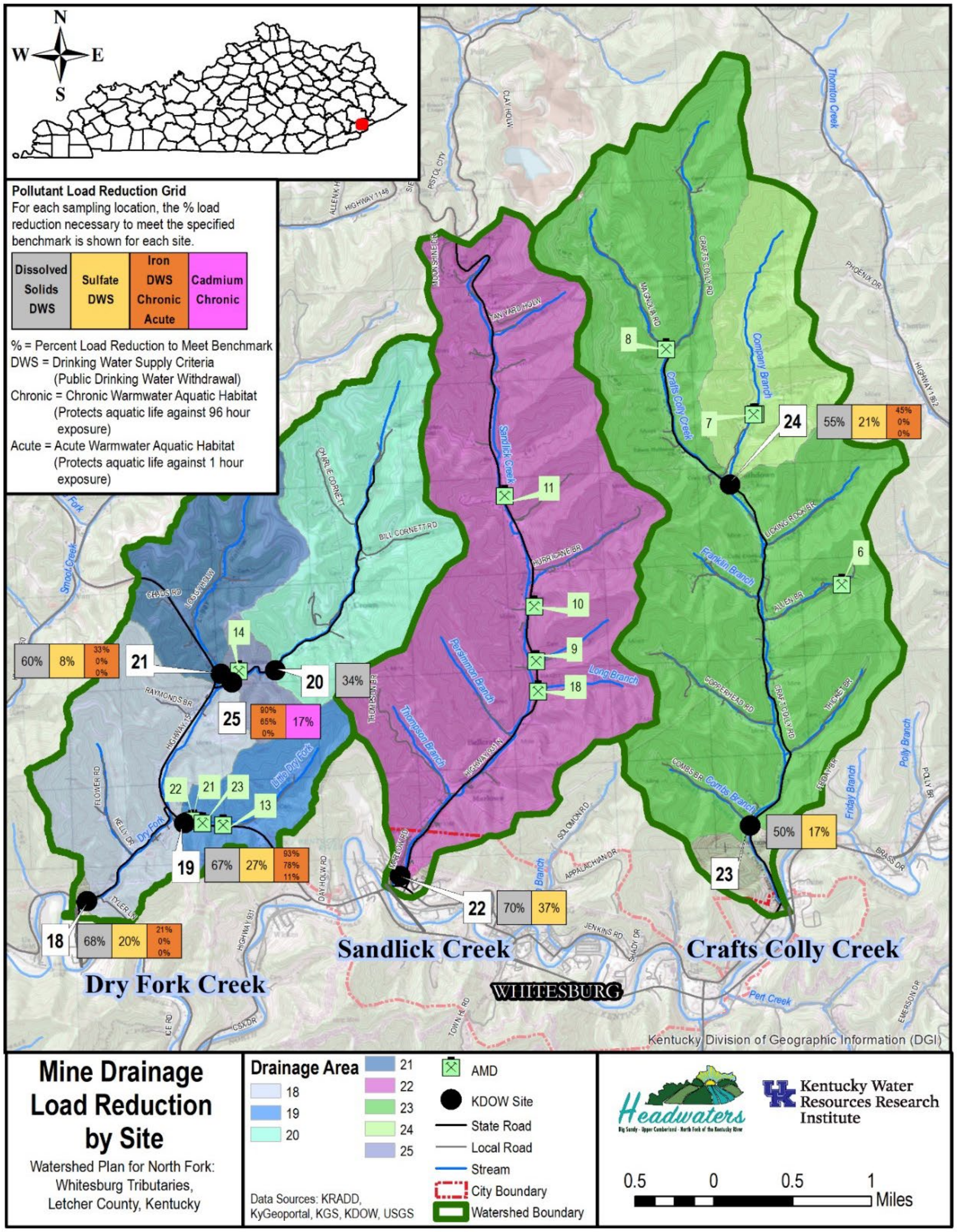
Figure 4 - Sewage Projects and Bacterial Reduction Needs



Passive treatment for mine drainage typically involves one or more of the following BMPs: 1) aerobic settling ponds, 2) constructed wetlands, 3) anoxic limestone bed, 4) anaerobic vertical flow wetlands, and

5) drainable limestone beds. Passive treatments have the drawback of requiring a large amount of space which can exceed the amount of land available. Therefore, the treatment may not be feasible for all drainages. In some cases, the aesthetics may make these practices undesirable for property owners, whose permission would be necessary for implementation. The locations in need of remediation are shown in Figure 5. In addition to passive treatment of drainage, removal of old spoil piles in the watershed would reduce runoff pollution of metals and other contaminants from these sources.

Figure 5 - Mine Drainage Load Reduction by Site



iii. Habitat and Erosional Impacts

The habitat impacts and erosion issues in the focus watershed areas are interrelated. Erosion and sedimentation occur where stream channelization and increased impervious surfaces in the watershed have led to greater stormwater runoff volume and velocity. The hydrologic changes reduce the available habitat for aquatic and semi-aquatic wildlife through downcutting of the stream beds and the collapse of eroding stream banks. Flooding becomes more common, impacting infrastructure placed within the floodplain, such as roads and buildings. Under dry weather conditions, the amount of sustained baseflow in the streams decreases.

Figure 6 shows areas with opportunities to improve habitat. To do so, trees and shrubs can be planted along the stream banks where feasible, ideally creating vegetated buffers of 50 feet, to improve stream habitat. These riparian vegetated buffers also help slow runoff and soak in the water before it reaches the streams. Invasive species would need to be cleared from these areas prior to planting to prevent competition and enable successful establishment of native species.

Three key approaches should be utilized to reduce the storm flow volume and velocity in the area: 1) slow water down, 2) spread it out, and 3) soak it in. Water may be slowed by adding step pools in steeper tributaries (vertical variance). Streamside detention basins or floodplain wetlands can be included in open areas to expand floodwater storage and allow the water runoff to spread out. Additionally, rain barrels or rain gardens can be installed at individual residences to capture rainwater. Stream restoration by natural channel design principles and streamside wetland construction should be implemented where feasible. Some areas with erosion may require stabilization and armoring to prevent infrastructure damage or additional erosion. Figure 7 shows locations with opportunities for these BMPs.

4. Conclusions

a. Measures of Success

The initial project proposal contained two goals with a total of six objectives, three per goal. The deliverables associated with each objective are discussed below.

i. Goal 1: Provide support to Headwaters and attend local watershed team meetings.

The first goal was to provide technical support to Headwaters, Inc. in their community outreach efforts. Three objectives were identified to achieve this goal:

Objective 1: Assist Headwaters with data compilation and interpretation.
Objective 2: Assist Headwaters with data presentation to team members and public.
Objective 3: Attend watershed meetings.

In support of Objective 1, KWRRI gathered and compiled historical data from the following sources: Kentucky River Watershed Watch, Eastern Kentucky PRIDE, EKU, KWRRI, AMEC Engineers, KDOW FOIA request, Kentucky GeoNet, Kentucky Geological Survey, and Kentucky Mining Geoportal. A series of Brownfield investigation reports were also obtained from the Letcher County Conservation District. These were utilized to write chapters 3 and 4 of the watershed plan. Additionally, boxplots and loading calculations were performed on all KDOW data collected to support the watershed plan and included as Appendix C of the Watershed Plan (the watershed plan and its appendices are Appendix A of this document).

Figure 6 - Potential Riparian Planting Areas

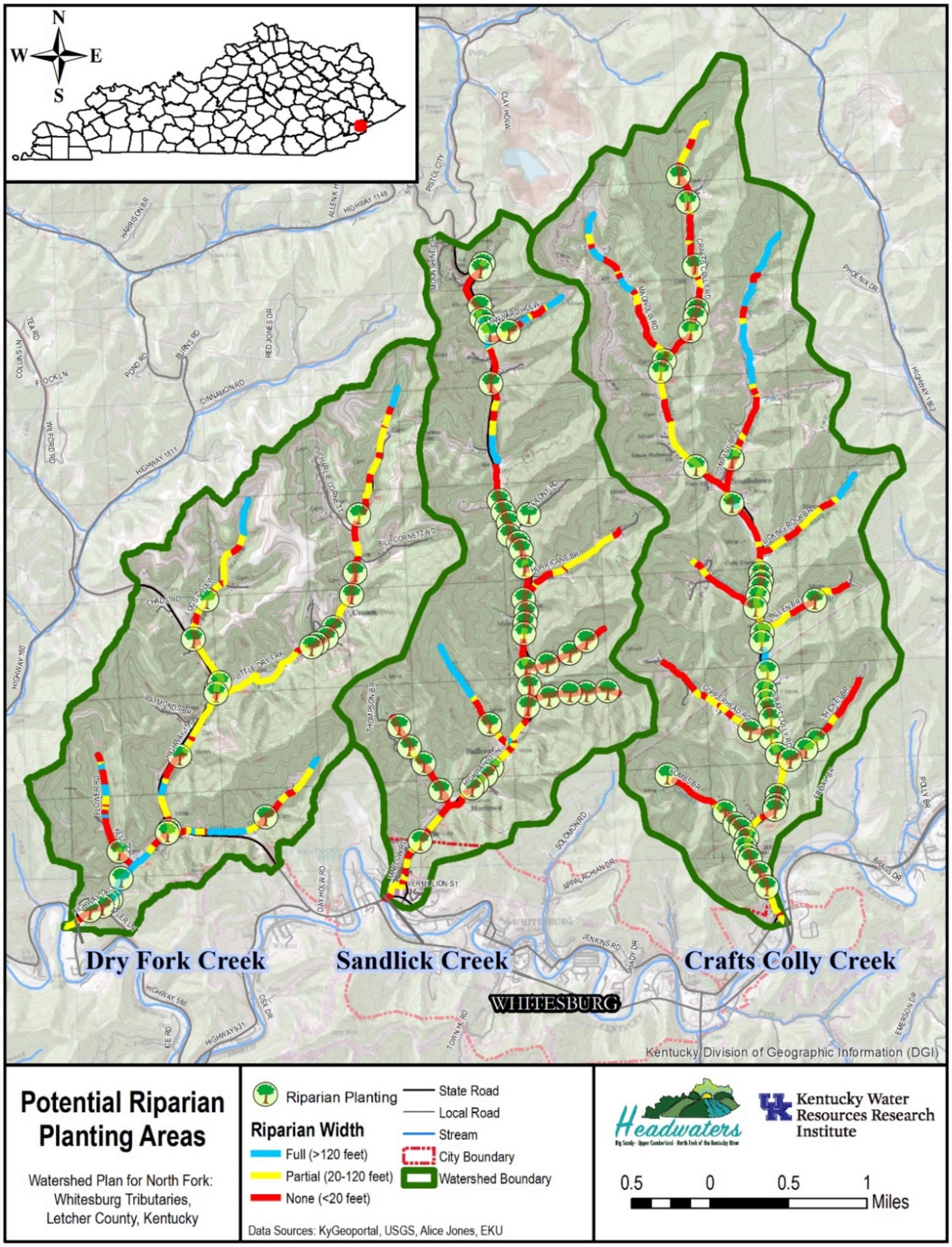
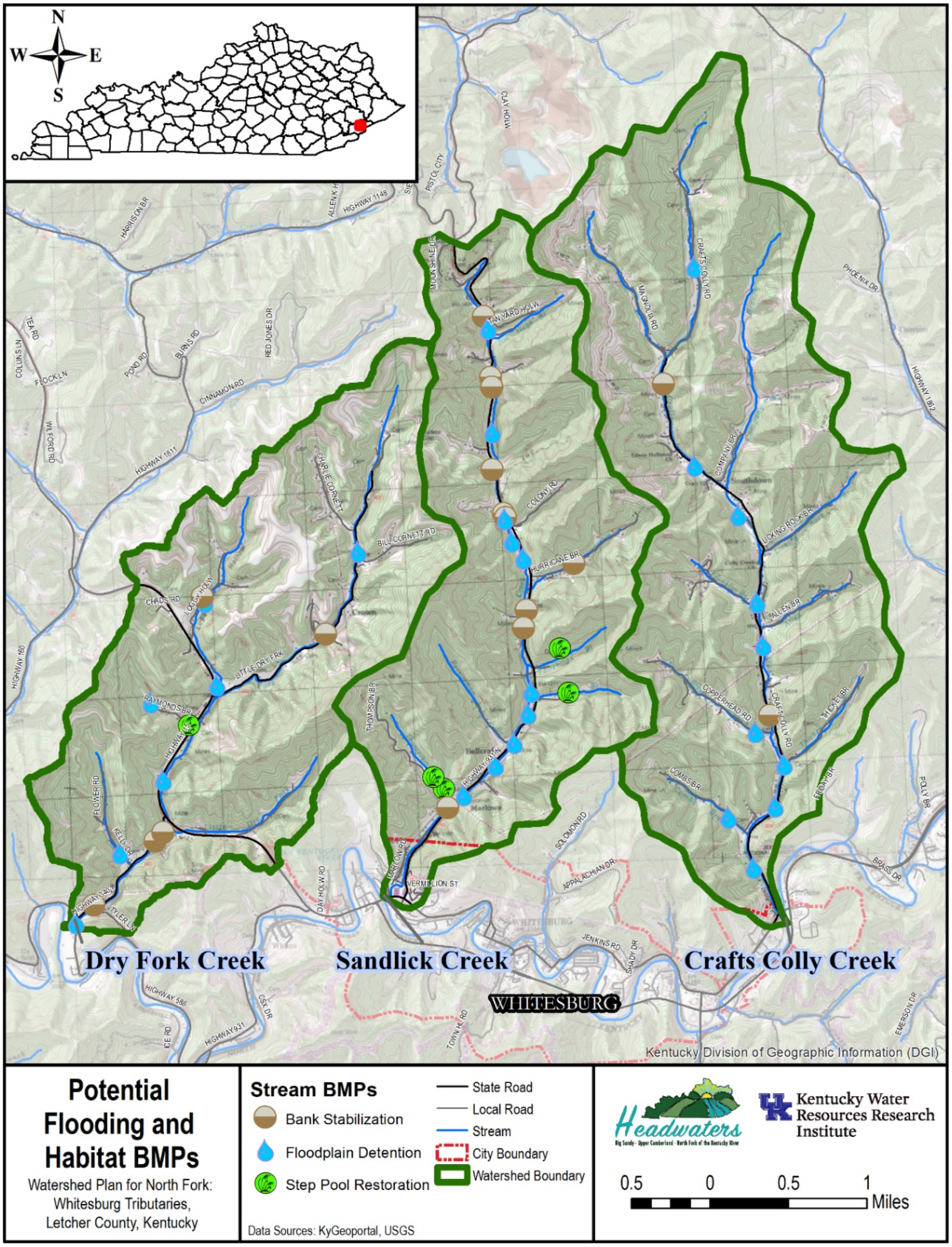


Figure 7 - Potential Flooding and Habitat BMPs



Three PowerPoint presentations were also developed to summarize results for various audiences including those who participated in the project team, the community meeting, and general watershed education. A copy of the most comprehensive of these presentations is provided in Appendix B.

In support of Objective 2, KWRRI prepared all GIS maps in the watershed plan as well as the following:

- A poster sized (44" x 25.5") map of Letcher County's Water Resources for Headwaters outreach efforts;
- A series of maps, along with suggested graphics and text, to be used for forthcoming watershed educations signs to be installed in downtown Whitesburg. Initial drafts of these signs;
- Submissions of items for quarterly meetings and helping to plan the agenda for the community meeting;
- Review and revision of a series of brochures developed by Headwaters on BMPs and water quality impacts;
- Development of a short overview of key findings of the watershed plan;
- Posting of the watershed plan on the KWRRI webpage;
- Regular interfacing with Headwaters, Inc to develop meeting agendas; and
- Providing a short interview to WYMT for a news story on the watershed plan.

In support of Objective 3, KWRRI attended the following meetings and public presentations:

- Kickoff meeting - October 9, 2017.
- Quarterly meetings: 2018 - February 7, May 9, August 8, November 14, 2018.
- Quarterly meetings: 2019 - February 13, May 15, July 23, Sept 10, December 9, 2019.
- Quarterly meetings: 2020 - February 24, 2020.
- AML Staff Meeting - August 5, 2019.
- Project team community planning meetings - August 23 and September 26, 2019.
- Community Meeting - October 14, 2019 at Southeast Community and Technical College, Whitesburg Campus. 18 stakeholders in attendance. Meeting was advertised in local paper and radio by Headwaters. Interviewed by WYMT news and featured on evening news.
- Public Presentation - November 18, 2019 "Watershed Planning: A Case Study from Letcher County, Kentucky" was presented at the William T. Young Library as part of University of Kentucky Water Week. https://appalachiancenter.as.uky.edu/water-week-0
- CEDIK Workshop Planning Conference Call – February 15, 2020.
- Project team conference call - April 13, 2020.
- Project presentation – June 17, 2020. Headwaters presented to researchers via a UK-CARES Zoom Meeting. The presentation was entitled, "Headwaters' Watershed Plan for the North Fork of the Kentucky River." KWRRI provided support for technical questions.

ii. Goal 2: Develop and review watershed plan components, in coordination with Headwaters and KDOW.

The second goal of the project was to develop and / or review the watershed plan components. Three objectives were identified to fulfill this goal:

Objective 1: Assist with collection of background information and preparation of Chapters 1 and 2 of Watershed Plan.
Objective 2: In coordination with KDOW, compose Chapters 3 and 4 of the Watershed Plan.
Objective 3: Assist with the development of Chapters 5 and 6 of the Watershed Plan.

Table 3 provides a summary of the development timeline for the watershed plan chapters. In should be noted that several unexpected events delays in the watershed plan development past the initially proposed milestones. First, after the completion of the monitoring in October 2017, KDOW decided that additional sampling for metals was necessary to support a potential impairment listing. This monitoring was not completed until November 2018, and the data was not available for use until January 2019. Thus, work on the development of chapters 4-7 were delayed by over a year. Second, several transitions of key staff at Headwaters and KDOW as well as medical issues for KWRRI caused project delays. These included coordination on input from stakeholders and analysis of feedback (Chapters 5 and 6) and feedback from KDOW on submitted drafts of chapters (1-3). Finally, the onset of COVID-19 pandemic in March 2020 delayed stakeholder participation and chapter completion.

Table 3: Summary of Watershed Plan Development Milestones by Chapter

Chapter	Lead Author Organization	Development Period	Draft Submitted to KDOW	Feedback Received / Final Approval
1: Introduction	Headwaters	Dec 2017 – Dec 2018	Dec 2018	March 2020[2]
2: Watershed Information	KWRRI / Headwaters	May – June 2018	Aug 2018	March 2020[2]
3: Monitoring	KWRRI	Nov– Dec 2017, Jan – May 2018	May 2018	March 2020[2]
4: Analysis[1]	KWRRI	Apr – June 2019	June 2019	March 2020[2]
5: Best Management Practice Selection and Feasibility Concerns.[1,2]	KWRRI / Headwaters	July 2019 – Apr 2020[3]	Apr 2020	April 2020
6: Implementation Plan[1,2]	KWRRI / Headwaters	Dec 2019 – Apr 2020[3]	Apr 2020	April 2020
7: Strategy for Success[1]	KWRRI	Dec 2019 – Mar 2020[3]	Mar 2020	April 2020

[1]Delay due to additional monitoring.
[2]Delay due to personnel transitions and/or medical leave.
[3]Delay due to COVID-19 pandemic.

For Objective 1, KWRRI played a supporting role in the writing of Chapter 1 (Introduction) and Chapter 2 (Watershed Information) of the watershed plan. To assist in this process, KWRRI initially submitted a template for these chapters to Headwaters as well as maps specific to the watershed area, including floodplains, geology, topography, soils, riparian zones, water supply, mining, and land use.

Chapter 1 was developed independently by Headwaters. For Chapter 2, KWRRI wrote the following sections: Watershed Location, Climate, Hydrology and Geomorphology, Groundwater-Surface Water Interaction, Flooding, Geology, Ecoregion and Topography, Soils, Riparian Ecosystem, Fauna and Flora, Water Supply, Permitted Dischargers, Demographics, and Regulatory status of the waterways. Headwaters focused on the “Non-Point Sources and Land Use” and “People and Communities” sections of the chapter with KWRRI providing review and technical feedback.

For Objective 2, KWRRI was responsible for leading in the composition of Chapters 3 (Monitoring) and 4 (Analysis) of the plan.

Three UK College of Engineering student interns were utilized to assist in the data gathering and analysis under the supervision of KWRRI staff. In fall 2017, Mac Hall worked through a large database of historical monitoring studies that had been compiled by Headwaters and was scattered in numerous files and folders. From this data inventory, seven different studies were identified and generally described. In spring 2018, Colton Pugh worked to further statistically describe these datasets in Chapter 3, developed a master list of the sampling site locations for GIS plotting and described an additional dataset received from the Letcher County Conservation District. The third intern, Cole Crankshaw, performed data analysis in the spring and summer of 2019 supporting Chapter 4 by developing boxplots for all KDOW sampling data and providing estimates of pollutant load by developing stream flow curves for each sampling site. Therefore, the project provided valuable real-world, educational experience for three students.

In January 2018, KWRRI received the initial sampling conducted by the KDOW and formatted it for data analysis. The remainder of the data for data analysis and load allocations was received on January 31, 2019. In September 2018, data and mapping of severe erosion areas was completed by Dr. Alice Jones of Eastern Kentucky University in conjunction with Headwaters, and a final report on erosion was received in April 2019.

For Objective 3, KWRRI decided to use a three-chapter division instead of two. Chapter 5 focused on Best Management Practice Selection and Feasibility Concerns. Chapter 6 provided the Implementation Plan including goals and objectives, individual BMPs, and funding sources. Chapter 7 the strategy for evaluation successful implementation. KWRRI was to initially to assist Headwaters in the drafting of these chapters but took a leadership role in the writing as the project progressed.

Collaboration between Headwaters and KWRRI on these chapters began in July 2019, after the completion of the load allocation. Headwaters developed a rough draft of Chapter 5/6 in December 2019 as well as drafted the results of the community survey. This document primarily focused on the community survey data and the feasibility of implementing different types of BMPs. They also provided their notes for individual stakeholder meetings. Together this information was repackaged as chapter 5 by KWRRI and reviewed and approved by the Watershed Planning Team.

For Chapter 6, KWRRI developed a Google Earth point file identifying potential BMP areas based on aerials and Streetview in December 2019, and Headwaters conducted a driving survey of the watershed to verify these locations and identify additional ones in March 2020. Further, they met with their board, stakeholders, and potentially involved parties to identify opportunity areas. In the first quarter 2020, these BMP layers were developed into three maps of potential implementation areas.

KWRRI utilized some of the skeleton projects identified by Headwaters in their December 2019 rough draft as well as other projects that had emerged out of discussions with the community groups and the Watershed Planning Team and assembled a table matrix linking the BMPs to the goals and objectives. This table also provided the target audiences, potential partners, cost estimates, and estimated timeframes. Headwaters worked with individual potential partners to confirm their interest and to estimate review time frames, but this process was limited due to the COVID-19 pandemic. KWRRI and Headwaters worked together to develop cost estimates. Through this method, the 57 BMPs listed in the plan were developed. Headwaters provided an extensive list of funding sources from which they were currently or had previously applied for funding, and brief summaries were added to these funding sources by KWRRI to round out Chapter 6.

As Chapter 7 followed a similar format as previously developed plans, KWRRI led in the authoring of this chapter.

Because all the objectives of the project were met, the project should be deemed a success, particularly in light of the numerous hurdles encountered throughout the course of the project.

b. Recommendations and lessons learned

The North Fork: Whitesburg Tributaries Watershed Plan is, in many ways, the first watershed plan of its kind in Kentucky. The plan is the first in the state to address watersheds with mining-impacts. It also is unique in that most of the residents are unsewered with the mountainous terrain making the extension of sewerage challenging. Further, most of the development in this watershed occurred near streams creating challenges in stream restoration and flood risks to property owners. Finally, the watershed poised a somewhat unique challenge due to the instability of the internet connections in the area.

Because of these unique circumstances, the following sections provide some reflection on lessons learned from working in these areas and recommendations for future planning efforts in similarly situated areas.

i. Virtual Collaboration in Remote Areas

The partnership between KWRRI and Headwaters proved effective for the project, but it was not without challenges. With around 150 miles of distance and a 6-hour roundtrip between Lexington and Whitesburg, in person meetings were an effort. Initially, KWRRI attended all quarterly meetings in person to establish personal relationships with the local community and get to know their needs and interests. These relationships are essential for watershed planning. However, as the project continued virtual meetings became more valuable for time and cost efficiency and became essential during the COVID-19 pandemic.

KWRRI began to use Zoom as an online meeting platform in April 2018 and expanded its capacity for interaction in November 2018 through purchase of a Meeting Owl which provides a 360 degree view of meeting participants with a focused camera view of up to two potential speakers. This technology can provide great opportunities for remote collaboration efforts and workshops; however, such technology is contingent upon a strong internet connection.

Conference calls were utilized throughout the process when participants could not be present for the meeting, but it is difficult to do much more than listen when active conversation is occurring among meeting participants who are present in-person for the meeting. Beginning in August 2019, Zoom virtual meetings were attempted to allow for increased remote participation. However, because the internet connections in the meeting location and local offices were not strong, the connection would regularly cut out and valuable information would be missed.

For future collaborations in more remote areas, it is recommended that the local community organizations identify a meeting location with strong internet connection to support video conferencing to increase the participation of stakeholders.

Secondly, the geographic distance between partners required online collaboration on planning documents through Cloud based services. The watershed plan chapters are graphic heavy which leads to large files that cannot be transmitted via email. For much of the project, Google Docs was utilized to allow multiple partners to collaboratively work on documents in real time. This is strongly recommended for future collaboration efforts. However, during the final phases of the plan development, the chapters were formatted within Microsoft Word to provide a consistent header / footer, section headings, figure numbering, etc. During this final phase of the editing and review process, when passing documents back and forth some corruption in the formatting and text occurred and it required significant revisions to identify and replace the proper formatting. Further, some of the comments between partners were not seen and properly addressed. In troubleshooting these issues, it was discovered that not all partners had access to Microsoft products, and therefore the documents were being converted back and forth between formats. For future projects, it is recommended that partners verify the platform for file sharing and access to the same software to support productive collaboration.

Finally, in reflecting on the partner collaboration, it is recommended that future watershed planning projects utilize some sort of project management software to better track progress on tasks. In recent years, numerous free project management software such as Trello, Slack, Asana, Teamwork, Sharepoint, Microsoft Teams, and other platforms have emerged to provide for more productive remote collaboration efforts and project and task tracking. Such software was not utilized during this process, but it is thought that this might have helped reduce some of the delays in the collaboration process during this project.

ii. Challenges of Unsewered Areas in Mountainous Terrain

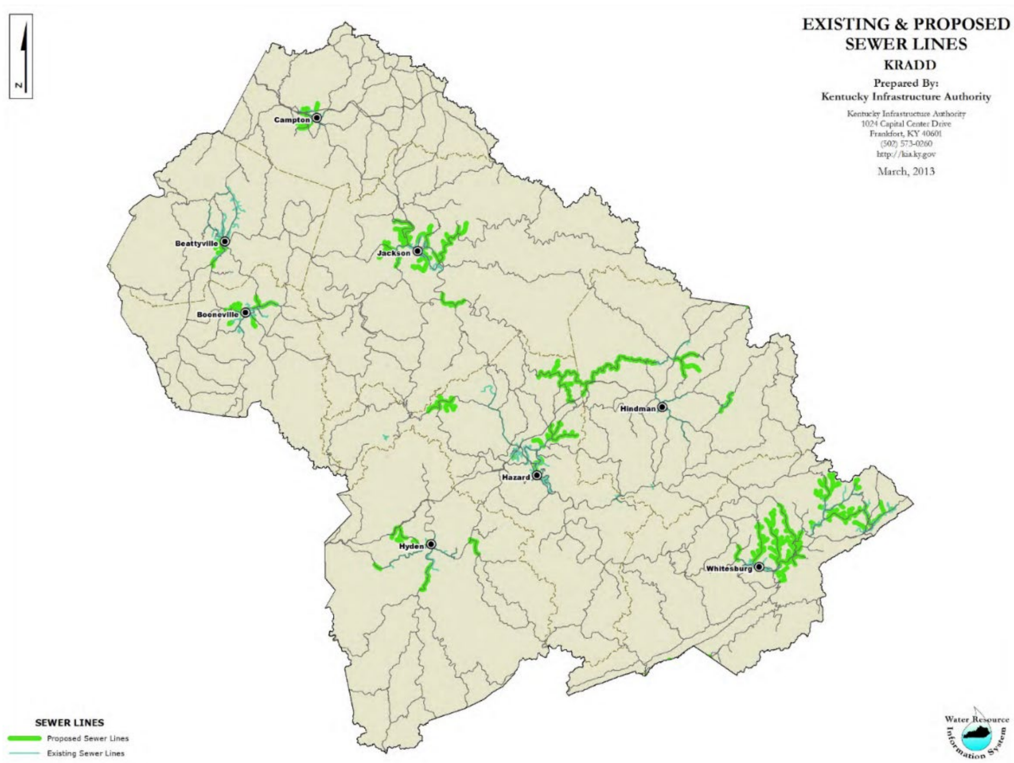
The watershed plan details the challenges and expenses of extending sanitary sewers to households located in mountainous terrain. Straight pipes and failing septic systems are known to occur throughout the region, so it is expected that many other streams would be impacted for recreational use upon assessment therefore BMPs to improve human wastewater treatment would be necessary throughout the region.

The cost to extend sanitary sewer service to 184 households on Crafts Colly and Sandlick Creek averages about $17,750 per household, not including tap-on fees. Local health department personnel indicate that a traditional septic system installation is typically around $4,500 per residence. This local cost estimate is in line with EPA's estimates of the national average for installation of between $3,000 and $15,000 for traditional septic systems and $10,000 to $30,000 for alternative and advanced treatment systems. This gap in costs may indicate a need to shift strategic planning for wastewater infrastructure in the region away from sewer projects and towards onsite and decentralized systems. This is particularly apparent when looking beyond the Whitesburg tributary watershed to the region as a whole.

For instance, according to the Kentucky Infrastructure Authority's Kentucky Wastewater Management Plan (February 2015), only 22% of the households in the eight counties of Kentucky River Area Development District are serviceable for sanitary sewer. The plan projects that infrastructure projects would only increase the serviceability to 30% if all projects were implemented. Further, as shown in Figure 8, extending sanitary sewer to the rest of area would require the construction of numerous wastewater treatment plants due to the distance of the residences from current infrastructure. Thus, the cost projections for extending sanitary sewer to households in the areas of the Whitesburg tributaries are lower than projections to extend lines to other more remote areas in the region.

Expanding from the Kentucky River Development District to the Appalachian region as a whole, we can begin to estimate the magnitude of the regional need for strategic wastewater infrastructure alternatives to sanitary sewer. According to an ad hoc report (2020) developed by the KIA on the Shaping our Appalachian Region (SOAR) study area, public sewer is currently available to approximately 36% of the study area's 568,374 households based on 2010 census counts. The $940 million dollars of planned infrastructure projects currently in KIA's database for the next 10 years would add 1,257 miles of sewer line as well as rehabilitation of hundreds of miles of existing sewer lines. But these projects, would only increase the households serviced by 38,516, bringing the total to 46% serviceable based on 2020 census projections. This would leave 283,752 households unserviced by public sewer, or 54% of the households in the Appalachian region.

Figure 8 - Existing and Proposed Sewer Lines for Kentucky River Area Development District (from the KIA's Kentucky Wastewater Management Plan (2015).



Of course, not all of these unserviced households would have failing septic systems or straight pipes. However, Massachusetts, which has the most comprehensive program to identify septic system failures, found a 20% failure rate during time of transfer home inspections (US EPA 2002). Assuming this 20% failure rate would also apply to Kentucky's systems, then over 48,500 households would be failing in this region. Sanitary surveys would be required to obtain more exact numbers.

The costs of addressing these wastewater needs are not currently captured in the state's wastewater infrastructure needs assessment because no projects have been proposed to address this widespread but diffuse problem. Regional strategic plans need to be developed to identify the best method to prioritize, fund, and ensure regular maintenance of wastewater treatment throughout this region. Assuming a cost of $4,500 for replacement of a septic system (the rate provided by the local health department), the cost to address this course estimate of failing systems throughout Appalachia individually would approach $220 million. Improved strategic planning and funding mechanisms are necessary to address this large need.

One method to address these needs may be to package together a number of septic system replacement projects in a county into a state revolving fund application, and then manage the ongoing maintenance through a monthly fee to a sanitation district which would be responsible for scheduled pump outs at regular maintenance intervals. This would be a novel structure in Kentucky but could provide a potential, more cost-effective solution to the widespread wastewater issues in the region than sanitary sewer systems.

iii. Habitat Improvement Challenges for Appalachian Streams

During the process for developing the habitat improvement BMPs, it became clear that efforts fell into two categories: 1) efforts volunteers or citizens could implement; and 2) efforts requiring engineering services. For the first effort, nonprofit organizations, such as Headwaters, can develop workshops and work with property owners to improve the riparian zone or to install rain barrels. However, the second effort is more challenging for rural counties, such as Letcher County, because there is not a city or county engineer. This means that for flooding or stream restoration projects, they must rely on the area development district staff, a hired consultant, or another partner to provide conceptual engineering plans to spearhead efforts. Thus, although there are needs for large-scale efforts to restore the hydrogeomorphology of the streams, finding a champion and the technical expertise for these efforts may prove difficult.

iv. Developing an Outreach Campaign Strategy

Watershed education and outreach has been ongoing for 20+ years in the Whitesburg area, through Headwaters, watershed coordinators, VISTA staff, high school teachers and others. Based on the local interest and key community partners that this generated, the Headwaters organization decided to encourage their watershed coordinator to pursue 319 funding for a more formalized watershed planning effort that could lead to demonstrable water quality improvements in the community.

During this watershed planning effort, the project goals and milestones were initially set up such that the development of the watershed plan occurred in chronological order – first characterizing the partners and watershed (Chapters 1 and 2), then the monitoring data and loading calculations (Chapters 3 and 4), and finally the selection of BMPs and development of the implementation plan (Chapters 5-7). Under this structure, the education and outreach strategic plan were considered within the implementation plan and therefore were not addressed in a significant way until the project was over halfway completed due to the lag in the completion of the project monitoring. This was due in part to unforeseen circumstances, but also in part due to the types of outreach milestones that were established.

It has already been described how the delay in obtaining the monitoring data for the project delayed the plan development for over a year. This compressed the timeline for implementation planning, including education and outreach efforts considerably. Also personnel transitions significantly impacted the process.

After two years of service in the community and successfully initiating a funded watershed planning project, the Headwaters watershed coordinator decided to leave to pursue an advanced degree, resulting in the transition of the coordinator position mid-way through the project. This significantly disrupted local outreach activities as the new coordinator had to learn the issues and re-establish contacts in the community. The trusted relationships established by the previous coordinator also took time to rebuild. These trust-based relationships are particularly important in the region due to prevailing distrust of outside experts and government projects and historic disappointment on promises of assistance.

Another setback was the retirement of a Letcher County High School teacher who had provided years of water-related educational activities related to the North Fork and its tributaries. She also served on the Headwaters board and sampled multiple stream sites as a Watershed Watch volunteer for nearly 20 years.

Her departure from the community made it much more difficult to reach local students through classroom and field trip activities.

Ultimately, the Watershed Advisory Council struggled to find ways to align water quality issues with prevailing local concerns. Based on stakeholder feedback, the council was beginning to integrate the major local concerns of drinking water safety and flooding impact with water quality findings and goals. It is believed that making these connections will better engage community members and encourage practices that achieve improvements in these overlapping areas.

But, having stated these project-specific caveats, experience has shown that most watershed planning efforts in Kentucky have followed a similar course. A group of stakeholders gets together and is motivated to improve water quality. They develop a partnership and begin to meet and get acquainted with the issues of the area, and they decide to obtain 319(h) funding to develop a comprehensive plan. Then, they must wait a year or more to collect the water quality data, in which time they characterize the watershed and engage in education and outreach efforts through traditional avenues. However, the monitoring can often run long and the interest from the stakeholders can wane over this time. The North Fork: Whitesburg Tributaries Watershed Plan was no exception to this general rule.

To maintain stakeholder engagement and more efficiently utilize time, it is recommended that watershed planners characterize their target audience during monitoring data collection.

The EPA Getting in Step Guide for Conducting Watershed Outreach Campaigns (2010) lists 6 steps in developing an Outreach Campaign:

- Step 1: Define the driving forces, goals, and objectives
- Step 2: Identify and analyze the target audience
- Step 3: Create the message
- Step 4: Package the message
- Step 5: Distribute the message
- Step 6: Evaluate the outreach campaign

Steps 1 and 2 involve setting the goals and objectives and identifying the target audience for the outreach campaign. This involves community surveys, focus groups, one-on-one interviews, and partner feedback. Much of this work can be completed in parallel with the water quality monitoring providing a strong characterization of the views and perspectives of the people in the watershed while the current state of pollution is also being characterized.

With a better understanding of the target audiences prior to the completion of the monitoring, watershed planners will have a better foundation to begin to create messages, package, and distribute the data by the time the load data has been compiled.

Because of the short time frame for the development of the BMP implementation near the end of this project, the education and outreach efforts were developed in a more ad hoc fashion, rather than with an overarching outreach strategy. Thus, the education and outreach are geared more toward awareness than behavior change, and an overarching strategy for why specific audiences are targeted is less fully developed.

It is recommended that the completion of the six steps of the EPA Getting in Step Guide be required as part of future watershed planning efforts and that Steps 1 and 2 of this process be initiated during the data collection period.

Literature Cited

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Appendices

Appendix A. Financial and Administrative Closeout

Appendix B. Watershed Plan

Appendix C. Public Announcements, News Articles, and Press Releases

Appendix A. Financial and Administrative Closeout

1) Application Outputs

All project related outputs are included as part of the Watershed Plan (Appendix B of this report) and its appendices. The initial expectation on Project Milestones as well as their actual completion are detailed in Table 1 below:

Table 1 - Project Milestones

	Project Milestone	Expected		Actual	
		Begin	**End**	**Begin**	**End**
1	Submit all draft materials to DOW for review and approval before public distribution.	*Duration*		*Duration*	
2	Report on progress of all milestones and status of each deliverable for each invoice and progress report	*Duration*		Apr-17	Sep-20
3	Attend quarterly watershed team meetings	*Duration*		Oct-17	Aug-20
4	Attend community meetings as necessary to discuss WSP and water quality (2/year)	*Duration*		Oct-19	Sep-20
5	Attend, participate in, and present at public meetings and programming hosted by local government, agencies, and nonprofits, as needed	*Duration*		Oct-19	Sep-20
6	Review handouts, online information, public service announcements as needed	*Duration*		May-19	Sep-20
7	In coordination with DOW, analyze and interpret historical and new data from KDOW water quality monitoring	Nov-17	Apr-18	Oct-17	Mar-18
8	In coordination with DOW, calculate pollutant loads from each sampling location, determine load reductions to meet water quality standards	Dec-17	Jun-18	Mar-18	Jun-19
9	Assist with collection of background information and composition of Chapters 1 and 2	Jan-18	May-18	Dec-17	Dec-18
10	Compose Chapters 3-4	Jan-18	Aug-18	Nov-17	Jun-19
11	Assist with composition of Chapters 5-7 with collaboration from Headwaters, local government and project partners	May-18	Sep-18	Jul-19	Apr-20
12	Assist with development of Best Management Practices Implementation Plan and Strategy for Crafts Colly, Sand Lick and Dry Fork watersheds	May-18	Sep-18	Jul-19	Apr-20
13	Assist with development of measurable milestones and evaluation criteria for determining the long-term success of watershed planning and implementation	May-18	Sep-18	Jul-19	Apr-20
14	Assist with finalization of WSP	Oct-18	Nov-18	Feb-20	Jun-20
15	Assist with WSP edits and continued finalization (in case process is longer than expected)	Jan-19	Jul-19	Feb-20	Jun-20
16	Submit Annual Report to NPS Program Staff	Upon Request		Jun-20	Sep-20
17	Submit quarterly invoices at a minimum to KDOW	*Duration*		Oct-17	Sep-20
18	Develop project final report and financial closeout and submit to KDOW for approval	May-20	Jul-20	May-20	May-20

2) Budget Summary

The original budget in the budget proposal is summarized in Table 2. The budget was revised in April 2019, as shown in Table 3.

Table 2 - Original Project Budget

Budget Categories	Federal §319(h)	Non-Federal Match	Total Budgeted
Personnel	$77,191	$21,955	$99,146
Supplies	$4,146	$0	$4,146
Travel	$4,100	$0	$4,100
Operating Cost	$12,816	$44,102	$56,918
TOTAL	$98,253	$66,057	$164,310

Personnel: A total of $77,191 in federal funds were requested in support of personnel for the project. A total of $21,955 in matching funds were provided by these same personnel.

Supplies: A total of $4,146 in federal funds were requested for materials and supplies associated with stakeholder engagement materials, presentations and written reports.

Travel: A total of $4,100 in federal funds were requested for travel in support of the project.

Operating Costs: A total of $12,816 in federal funds were requested in support of indirect costs. This amount was based on a negotiated indirect rate of 15% and is calculated using a total direct cost basis of $85,437. The indirect for research at the University of Kentucky is 53%, and was utilized to calculate the original budget.

A total of $44,102 in indirect costs was pledged as a match to the project. A total of $11,636 in indirect costs is provided in match associated with the $21,955 of match in direct costs. A total of $32,466 in forfeited indirect costs is provided as match associated with the $85,437 requested in federal direct costs.

Table 3 - Revised Budget as of April 2019

Budget Categories	Federal §319(h)	Non-Federal Match	Total Budgeted	Final Expenditures
Personnel	$77,191	$37,182	$114,373	$113,118
Supplies	$4,146		$4,146	0
Travel	$4,100		$4,100	$930
Operating Cost	$12,816	$28,875	$41,691	$38,374
TOTAL	$98,253	$66,057	$164,310	$152,422

The reason for the budget revision was a discrepancy between our original budgeted indirect rate (53% for on campus research) and the correct rate (34% for "other" on campus projects). The UK Office of Sponsored Projects Administration indicated that our originally budgeted cost share rate was incorrect.

The correct rate (34%) was applied to the budgeted scope and the remainder of the cost share reallocated to personnel salary and benefits.

In the final expenditure, KWRRI was reimbursed $91,406 for the project. $6847 remains unspent for the project due to an internal University policy about allowable cost share expenses that caused the federal funds to be reduced in proportion.

Travel expenses were reduced due to virtual collaboration, and supply costs for printing materials were difficult to charge due to equipment and logistical limitations. Therefore, these expenditures were allocated toward personnel.

3) Equipment Summary

No equipment was purchased for this project.

4) Special Grant Conditions

There were no special conditions placed on this project by USEPA.

Appendix B. North Fork: Whitesburg Tributaries Watershed Plan with Appendices

Appendix C: Public Announcements, News Articles, and Press Releases

Field day announcements, press releases, brochures, news articles or workshop agendas.