Bacon Creek Watershed Plan Implementation

319(h) Nonpoint Source Implementation

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to September 30, 2013

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Kentucky Waterways Alliance

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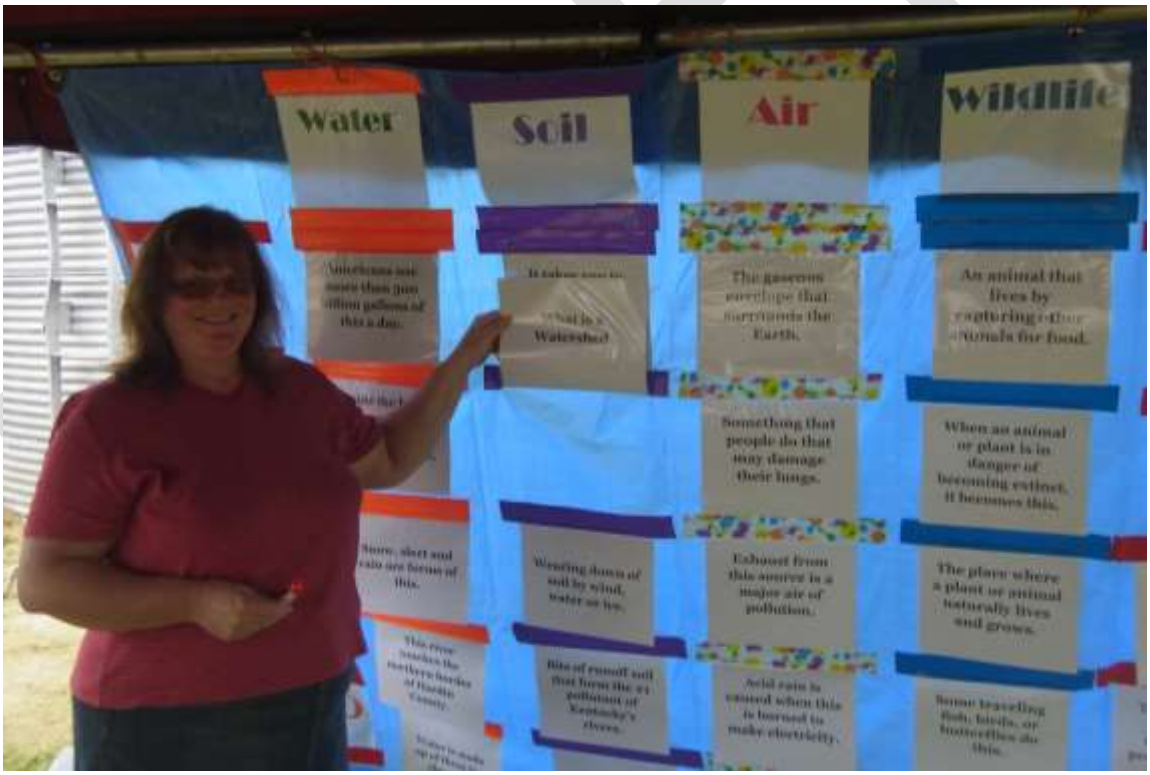

Figure 1: Bacon Creek Watershed Council member at the Farm Field Day 2013.

Contents

Page

List of Figures

List of Tables

Executive Summary

The Bacon Creek Watershed is situated in the Upper Green River Basin and the Turnhole Bend Karst Basin. It lies predominantly in Hart County, but also extends into Hardin and Larue Counties (see Fig. 2). The entire 31.2 mile length of Bacon Creek has been on the 303(d) list of impaired streams, due to pathogens, since 1996. The watershed is comprised of seven sub-watersheds, this project focused on the six upper sub-watersheds, collectively known as the Upper Bacon Creek Watershed.

The goals of this project were to reduce bacteria in Upper Bacon Creek, update the existing Bacon Creek Watershed Plan, and increase the capacity of the Bacon Creek Watershed Council. These goals were accomplished through implementing agricultural and residential best management practices (BMPs), raising community awareness on water quality issues, and working with the Bacon Creek Watershed Council to update the watershed plan.

Project BMPs were designed to reduce pathogen loading in the watershed by offering a financial incentive for residential (septic issues) BMPs and agricultural (animal nutrient issues) BMPs. The residential BMPs, which included both septic tanks pump outs and septic system repair or replacement, were successful. In total, 13 septic tanks were pumped out, and 6 failing septic systems were completely replaced. A maintenance agreement was signed by each participant in the BMPs program to encourage regular cleaning and proper maintenance of septic systems. Septic system educational materials were created and disseminated throughout the watershed and at public meetings. Additionally, a guest speaker from the Kentucky Onsite Wastewater Association addressed the Bacon Creek Watershed Council about septic system siting, function, and maintenance.

The agricultural BMPs were also successful. An agricultural coordinator was employed to reach out to area farmers about water quality issues, the BMP program, and Kentucky Agricultural Water Quality plans. To be eligible for project BMP funds, applicants were required to update or complete an initial Agricultural Water Quality Plan and apply for state cost-share funding. Four types of BMPs were implemented on four farms: two watering facilities, three heavy use area protections, one stream crossing, and over 10,000 feet of fencing (on three of the farms) to keep livestock out of Bacon Creek and farm ponds. Five Agricultural Water Quality Plans were completed or updated with the assistance of the Agricultural Coordinator.

Twelve months of water quality data were collected and analyzed, and pollutant loads and pollutant load reductions were calculated. Data indicate that six of the eight sample sites require an *E. coli* load reduction. Issues with the validity of the nutrient data led to its exclusion

from analysis. The plan was updated to comply with the format of the *Watershed Planning Guidebook for Kentucky Communities* and to include bacteria and sediment data. Outreach materials were created including a newsletter, educational flyers, specific materials on watershed issues and BMP programs, and a video about the Bacon Creek Watershed Council. The Bacon Creek Watershed Council hosted several guest speakers throughout the course of the project to promote awareness of watershed issues. Thanks to these outreach efforts, there was more community involvement, and new members were added to the Council.

Nonpoint source pollution is a huge threat to water quality. In rural areas, especially, it truly takes community engagement to make a difference. There is a real need for updated septic system and/or expanded sewer infrastructure and funding for agricultural BMPs in the area. Partnerships with local health departments, conservation districts, Natural Resource Conservation Service (NRCS) offices, local governments, and other community groups are a good way to reach a broader audience and build trust and support in the watershed.

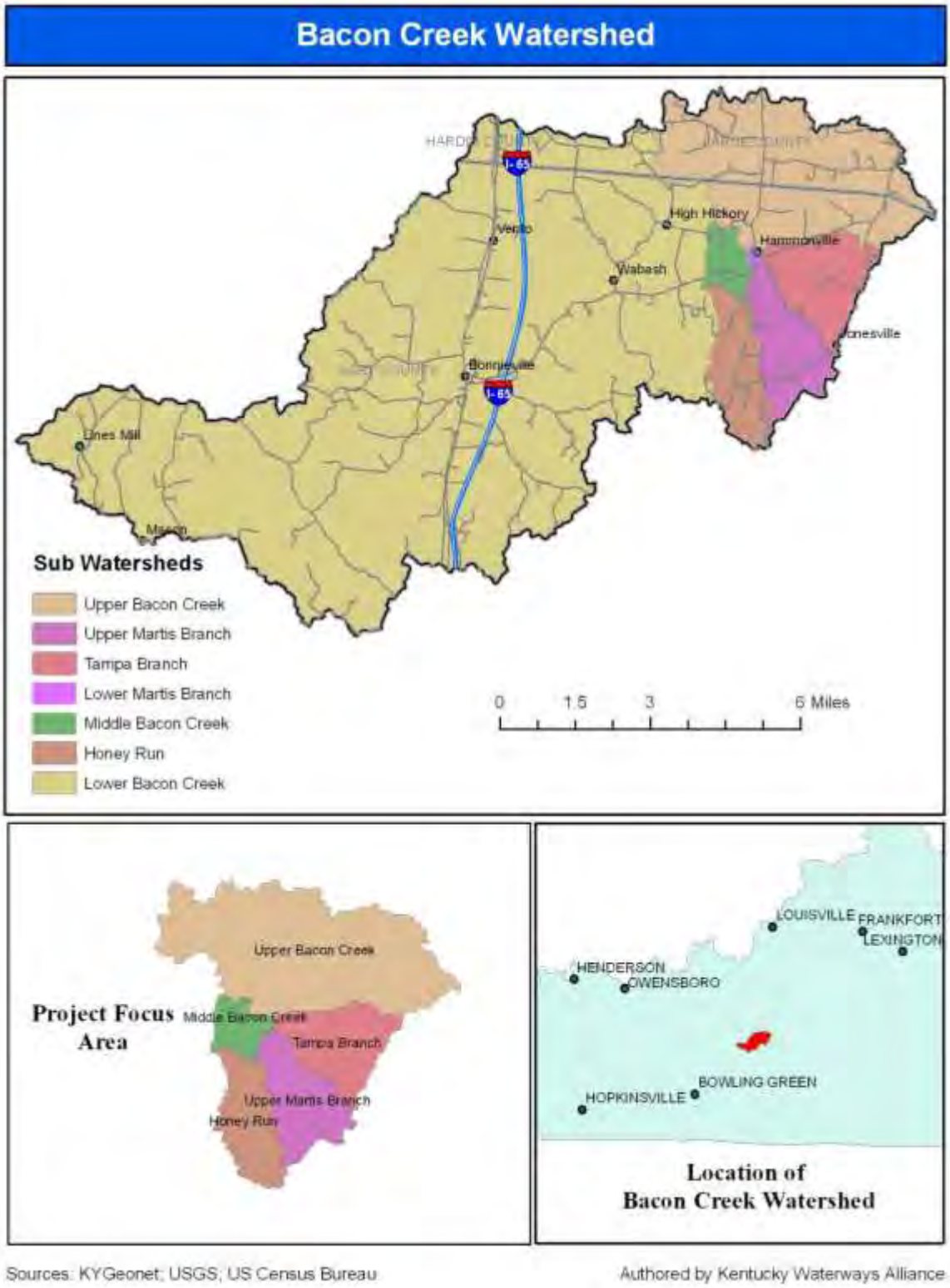

Figure 2: Upper Bacon Creek with delineated sub-watersheds (KWA 2011).

Introduction & Background

The entire 31.2 mile length of Bacon Creek has been on the 303(d) list of impaired streams, due to pathogens, since 1996. The watershed is comprised of seven sub-watersheds: the six upper (headwater) sub-watersheds and the Lower Bacon Creek Watershed, which includes the mouth of Bacon Creek. This project focused on the six upper sub-watersheds including Upper Bacon Creek, Honey Branch, Tampa Branch, Middle Bacon Creek, Lower Martis Branch, and Upper Martis Branch. The Bacon Creek Watershed Council has been active since 2000.

Project History

The Bacon Creek Watershed Council was organized with a group of active citizens in early 2000 with the help of a previous Kentucky Division of Water (KDOW) 319(h) grant to foster watershed groups in underserved areas. The first meeting was held on April 11, 2001. The group's initial goal, in cooperation with the Bonnieville City Council and other partners, was to plan, fund, and construct sewer lines to Bonnieville. The sewer system became a reality in late 2007. The simultaneous efforts to eliminate straight pipes and failing septic systems within the city limits of Bonnieville and efforts to establish a Watershed Council created synergy around the cleanup of Bacon Creek. A Watershed Action Plan was written by KDOW Green River Basin Coordinator Dale Reynolds in 2005, and it has served as a reference material and guide in writing the original watershed-based plan completed in 2010.

In the original conception of the previous 319 (h) grant project, agricultural BMP implementation and post-implementation monitoring were planned. There was not enough local interest to go forward with BMP implementation at that time, and post-implementation monitoring became irrelevant. It was decided, instead, to conduct a round of bacterial source tracking monitoring to further delineate the sources of bacteria in the Upper Bacon Creek sub-watersheds. The experience of the KDOW Basin Coordinator and the Bacon Creek Watershed Council guided the selection of nine data collection sites. Figure 3 displays the monitoring sites and results for this bacterial source tracking data collection that occurred on four dates (two wet weather, two dry weather dates) in April and June of 2010.

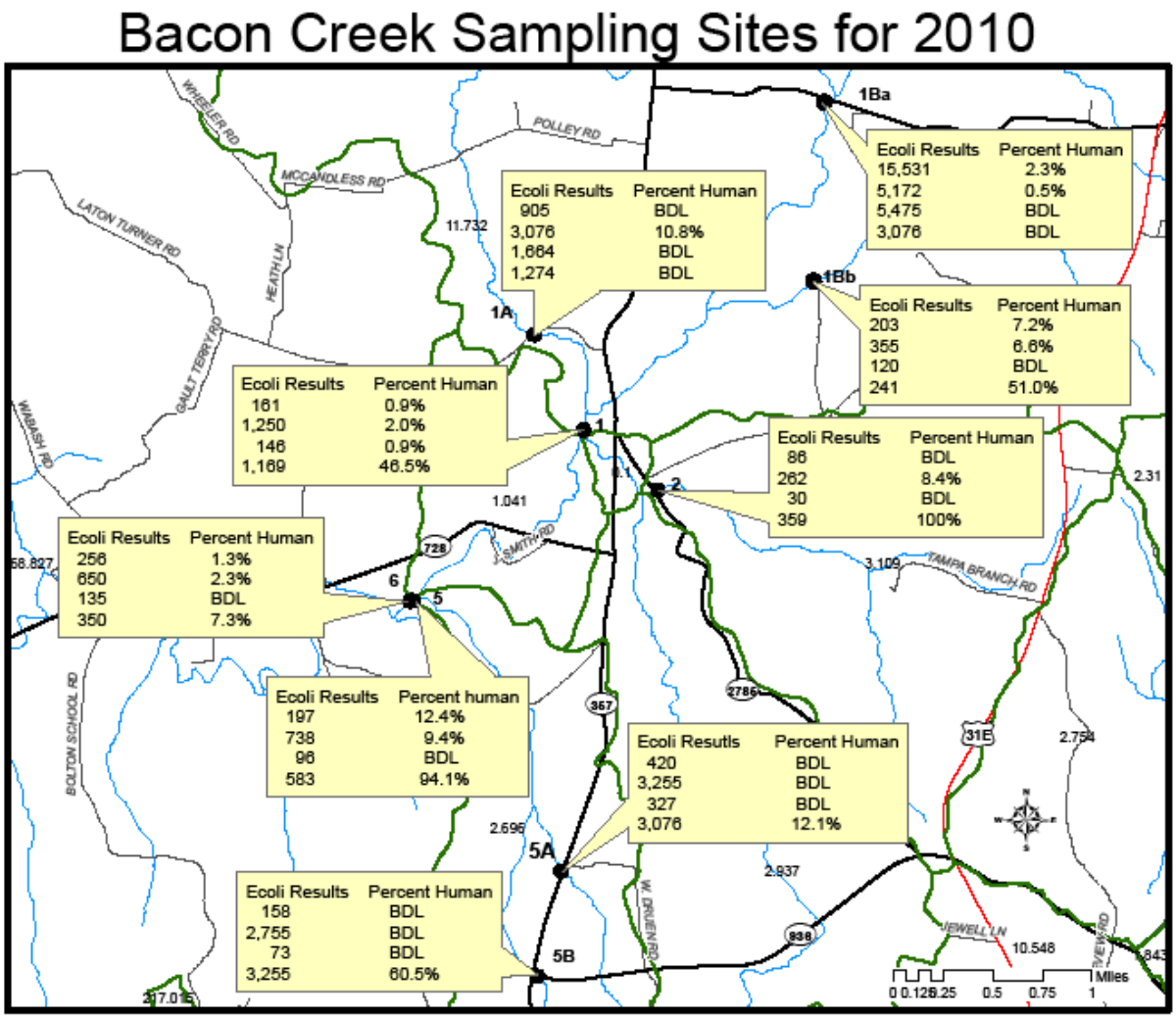

Figure 3: Bacterial Source Tracking sample sites and results (WKU Center for Water Resources 2010).

Results from this testing indicate that the Upper Bacon Creek sub-watershed has high levels of *E. coli* contamination and that a large percentage of those bacteria do not come from humans. Further, data indicate that the Honey Run sub-watershed has high levels of *E. coli* contamination and that a large percentage of those bacteria come from humans. This testing only differentiated between human bacteria and other animals. It did not further break down the "other" category into different animal species or wild versus domesticated animal.

With the advice and input from the Bacon Creek Watershed Council, the Basin Coordinator, and WKU Center for Water Resources, it was decided that the Upper Bacon Creek sub-watershed was a good candidate for farm management BMPs, and the Honey Run sub-watershed was a good candidate for improved septic system management BMPs. A grant application for BMP funding and watershed plan update was submitted to the Division of Water nonpoint source section and awarded in 2010.

Materials and Methods

Description of the project area

The Bacon Creek Watershed is in the Upper Green River Basin. It is connected to the Turnhole Bend Karst Basin; the entire area exhibits numerous karst features. The watershed is mainly in Hart County, extending across the edges of Hardin and Larue Counties. The creek is just over 31 miles long and drains a 90.466 square mile area into the Nolin Reservoir. The creek is impaired for fecal coliform bacteria along its entire 31.2 mile length and for sediment and siltation from mile point 17.2 to mile point 26.3 (2010 Integrated Report to Congress). The watershed is rural and mostly agricultural.

The Upper Bacon Creek Watershed, the headwaters of the watershed, is the focus area of this project. It contains six smaller (HUC 14) sub-watersheds: Upper Bacon Creek, Tampa Branch, Upper Martis Branch, Lower Martis Branch, Honey Run, Middle Bacon Creek (see Figure 1). Delineating the watershed in this manner was based on the findings of the 2005 Watershed Action Plan (Reynolds 2005) that recommended focusing attention in the upper portion of the watershed due to the consistent field measurements of elevated fecal coliform counts in that area. This upper watershed area encompasses 13,193 acres and covers over 20 of the total 90 square miles of the entire Bacon Creek Watershed (see Table 1). There are extensive areas of pasture and cultivated lands in the Upper Bacon Creek Watershed area. Agriculture represents over 60% of the Upper Bacon Creek Watershed acreage, with over four times as much pastureland as cropland.

For the purposes of this plan, Lower Martis and Middle Bacon Creek have been combined and are referred to as “Lower Martis” on maps. Thus, there are five sub-watersheds referenced on maps and in text throughout the watershed plan.

Table 1: Square mileage of Upper Bacon Creek sub-watersheds

Sub-watershed name	Square mileage	HUC-14 Number
Upper Bacon Creek	11.73	HUC 05110001150010
Middle Bacon Creek	1.04	HUC 05110001150050
Upper Martis	2.93	HUC 05110001150020
Lower Martis	0.1	HUC 05110001150040
Honey Run	2.69	HUC 05110001150060
Tampa Branch	3.10	HUC 05110001150030
Total	**21.59**	

The bulk of industry in the watershed is agricultural. There are no confined animal feeding operations registered. There is one US Geological Survey gaging station on Bacon Creek near Priceville, Kentucky. The Kentucky Pollution Discharge Elimination System has no active permitted dischargers in the drainage area. Spring Park Mobile Home Community has the only package treatment facility in this watershed. There are no sewer lines in the Upper watershed, and most households use onsite septic systems.

Public water supply for the watershed is the Green River Valley Water District, which withdraws water from the Green River. Bacon Creek is a tributary to the Nolin River, which discharges into the Green River several miles below the intake for the water district. There are domestic groundwater wells in the watershed, but they're not generally used for human consumption.

Annual precipitation averages around 46 inches. Soils within the watershed tend to be thin (3-4 feet deep) and vary from prime farmland to marginal pastureland, having a tendency to be sandy and/or silty in nature. The predominant soil types have moderate to high tendency to erode. Riparian buffers tend to be thin to non-existent and slopes vary from 0-10 percent. The rolling topography of the watershed is underlain by the lower members of the Girkin Formation (Reynolds 2005). Karst features such as numerous large sinks and springs are present. While the predominant flow patterns for the watershed are determined by surface topography, karst features introduce some variations that ignore topographic gradients. Bacon Creek is one of the only surface waterways in the area.

There is no evidence of stream channel alteration, man-made diversions, dams, or significant withdrawals from this water body. Despite near total removal of the riparian buffer, the stream has a fairly diverse aquatic assemblage.

A Total Maximum Daily Load was completed for Bacon Creek in 2011. The sample sites for the study were in the lower watershed area, downstream of the current project area.

A description of all methods used to obtain the results for your project

<u>Community</u>

A crucial step in creating a successful watershed-based plan is to organize a group of local leaders and citizens who are dedicated to cleaning up their waterway. This happened when the Bacon Creek Watershed Council first met in April 2001.

The Bacon Creek Watershed Council met regularly (on average, once a month) and developed events and outreach tools. These include a general handout about watershed planning and the Bacon Creek Watershed Council, a specialized project map, several issues of *The News from*

Bacon Creek newsletter, and septic system educational materials (see Appendix B). The watershed plan itself is an outstanding educational and outreach tool (see Appendix C).

The Bacon Creek Watershed Council hosted guest speakers throughout the project including a Kentucky Onsite Wastewater Association (KOWA) speaker on proper septic system maintenance, a KY Fish and Wildlife speaker on the Fees-in-lieu-of program, and KWA Executive Director who led a workshop on the Clean Water Act (see Appendix B). Additionally, the Watershed Council spoke to other groups about watershed issues and the planning project.

Best Management Practices

There were two types of BMPs installed during the course of this project: agricultural BMPs to addresses animal sources of *E. coli* and residential BMPs to addresses human sources of *E. coli* from failing septic systems. BMPs were implemented according to the KDOW-approved BMP Implementation plans written for this project (see Appendix D). All recipients of grant funding completed an application including a maintenance agreement and photo disclosure. All of the agricultural and septic system BMPs were implemented according to recommended guidelines from the NRCS or health department standards, respectively.

Agricultural BMPs

The Upper Bacon Creek sub-watershed was the target for agricultural BMPs. Initial program goals were to install four agricultural BMPs and promote Kentucky's Agricultural Water Quality Plan. A community outreach meeting was held in Magnolia, Kentucky to advertise the program to area farmers and address their concerns. The Agricultural Coordinator spent time talking with farmers about prospective BMPs, state cost-share funding, and water quality plans. BMP implementation was offered at a 75-25% cost share. Participants could cover their 25% with in-kind labor and/or supplies or cash match.

An Agricultural Water Quality Plan "open house" was held to help landowners update or complete a plan. Two Farm Field Days were held to highlight the practices installed. Both of these events took place on a farm that implemented BMPs and were open to the public.

Residential BMPs

Originally, the residential BMP program was only for septic tank pump outs in the Honey Run sub-watershed. The program area was later extended to the whole watershed. Additional funding was obtained to add septic system repair or replacement to the program.

Outreach materials were developed explaining how properly maintained septic systems are better for community health and safety and the water quality of Bacon Creek. A guest speaker from KOWA addressed the Bacon Creek Watershed Council and community members at the start of the project. She spoke of the importance in maintaining a septic system, including inspecting and pumping out the tank every three to five years. A project packet was developed including an application, a photo disclosure, and a fact sheet on how septic systems work, maintenance requirements, and the impacts of bacteria on human health and the environment (see Appendix D). Tank pump outs were offered at an 85% reduction in cost to homeowners. Local certified waste haulers charged $225 per tank which put the cost to homeowners at only $30. An agreement with Caveland Environmental Authority allowed certified sewage haulers to discard the pumped out waste at cost. Postcards were created and mailed to each resident of Honey Run advertising the program (see Appendix B).

A need for complete septic system replacements throughout the watershed became evident as the project progressed. A septic system repair or replacement program was then funded with additional monies requested by Kentucky Waterways Alliance. An application packet was created and sent to interested parties along with a basic fact sheet about septic systems. The application included a "Maintenance agreement" whereby the applicant agreed to adhere to the recommended inspection and pump out schedule of every three to five years. The upgrades were offered at an 80% - 20% cost share. The average cost of project was $6,205, and the average cost to homeowners was $1,240.

Methods for both of these BMPs were standard wastewater system methods and met local health department guidelines. Sewage removed from tanks was taken to Caveland Environmental Authority. Local county health departments and KOWA offered technical advice.

Data

With a KDOW-approved Quality Assurance Project Plan (QAPP), data were collected at eight sites, once a month for one year (see Appendix E). This included wet weather and dry weather samples as well as five *E. coli* samples in the months of May and June. Parameters sampled were those outlined in the *Watershed Planning Guidebook for Kentucky Communities* (KWA 2010). Pollutant loads and load reductions were calculated. Field analysis included the following observations:

- Flow,
- Dissolved Oxygen (DO),
- pH,
- Specific Conductivity,
- Water Temperature,

- Air Temperature,
- Weather,
- Last Known Rainfall,
- Water Appearance,
- Odors,
- Biological Activity,
- Stream Profile (stream width and stream depth at five points) and other related notes (nearby pollutants, riparian zone, etc.).

In addition to field parameters, grab water samples were collected from each site and delivered to the water quality lab at WKU for additional testing. Lab analysis was conducted for:

- *E. coli*,
- Total Suspended Solids (TSS),
- Biochemical Oxygen Demand (BOD),
- Ammonia-Nitrogen (NH_3-N),
- Nitrate and Nitrite (N-N)
- Total Kjeldahl Nitrogen (TKN),
- Orthophosphate,
- Total Phosphorus (TP),
- Total Organic Carbon (TOC), and
- Atrazine

Sampling Sites

The sampling sites were the same sites that were used in previous water quality sampling in the upper watershed. This was for ease of comparison and access (see Figure 4). The site in Lower Martis was not included, however, because field technicians were denied access to the site.

Upper Bacon Creek Sub-watershed - Four sampling sites are located in the Upper Bacon Creek subwatershed: 1Ba, 1Bb, 1A, and 1.

- Site 1Ba is located most upstream Bacon Creek, near a roadway and downstream of farms.
- Site 1Bb is on private property along a tributary that feeds into Bacon Creek.
- Site 1A also feeds into Bacon Creek, but is between private property and a roadway.
- Site 1 is at the mouth of the Upper Bacon Creek subwatershed. It is located directly on Bacon Creek behind a large agricultural field on private property.

Tampa Branch Sub-watershed - Site 2 is located at the mouth of the Tampa Branch subwatershed, located near a roadway.

Lower Martis Branch Sub-watershed - Site 3 is along a roadway.

Honey Run Sub-watershed - Site 5 is at the mouth of the Honey Run subwatershed. Sites 5 and 6 are in close proximity, but are located in separate subwatersheds

Middle Bacon Creek Sub-watershed - Site 6 is at the mouth of Middle Bacon Creek, on the main stem of Bacon Creek, farthest downstream of all eight sampling sites.

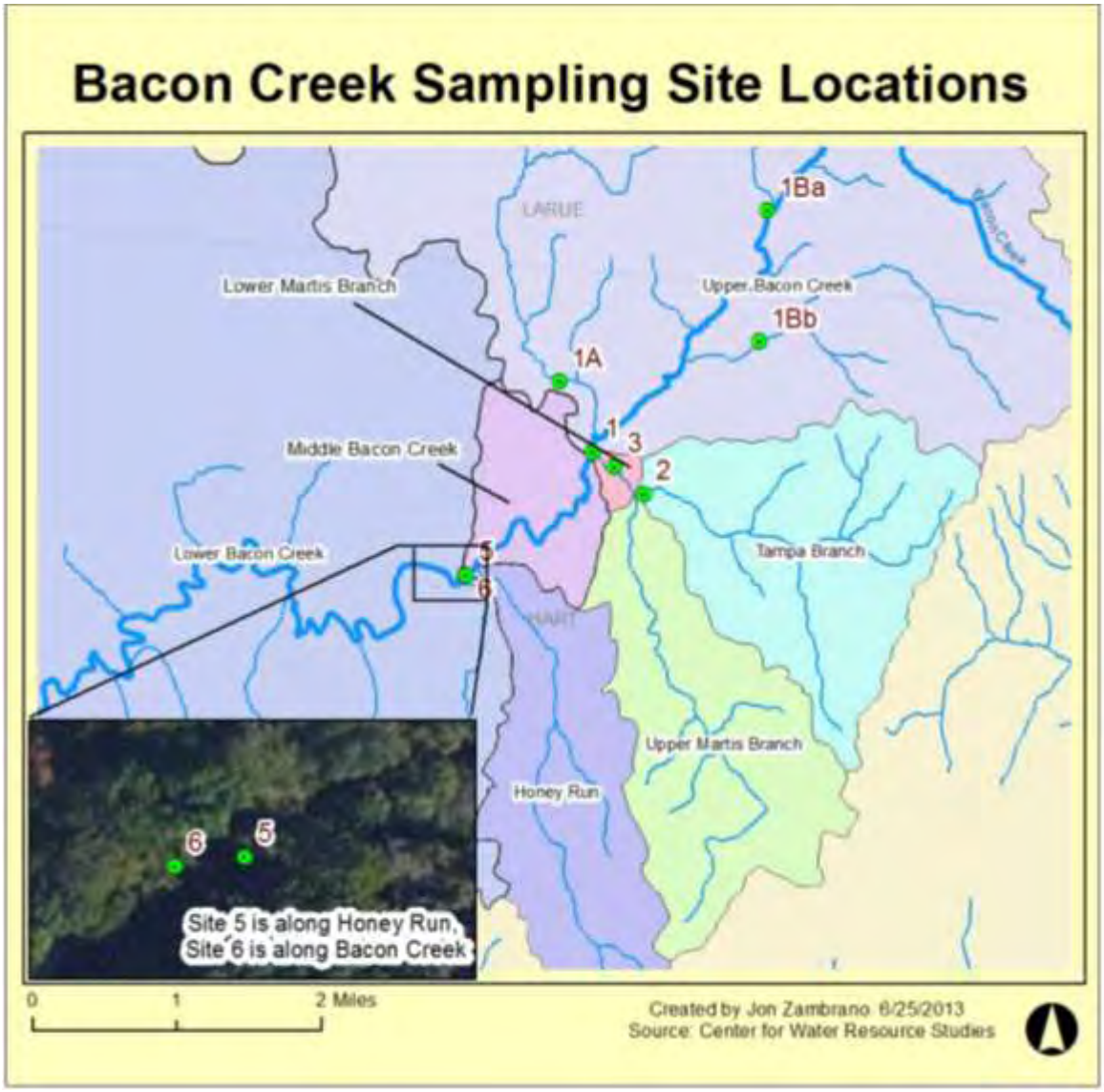

Figure 4: Sampling sites for 2012-2013 water quality sampling (WKU Center for Water Resources 2013).

A description of any specialized materials used in the collection of data for the project.

Community

No specialized materials were used in working with the Bacon Creek Watershed Council or the community at large.

BMPs

No specialized materials were used in BMP implementation. Agricultural and septic system BMPs were implemented according to the KDOW-approved BMP Implementation plans written for this project. All of the agricultural and septic system BMPs were implemented according to recommended guidelines from the NRCS or health department standards, respectively. Outreach materials for each program were created by the Bacon Creek Watershed Council.

Data

There were no specialized materials used in the collection of data for the project. Standard field and lab equipment were used by WKU Center for Water Resources to collect water quality samples, as specified by the QAPP (see Appendix E).

Results and Discussion

Community

One result of the work of the Bacon Creek Watershed Council was an increase in awareness of watershed issues in the community. This is not a measureable outcome, but is marked as a success by the number of participants in the BMP programs and watershed council events. Another success is the relationships being developed through the work of the Agricultural Coordinator. The previous watershed planning project in Bacon Creek did not receive any support or interest from the farming community. Project managers believe much of the success this time was due to the Agricultural Coordinator's ties to the community and hard work.

BMPs

Project BMPs were successful. Collaboration with local health departments, conservation districts, and other community groups helped to support project goals and will facilitate future work in the watershed (see Appendix F for BMPs Implemented Summary). Estimated pollutant load reduction for BMPs implemented in 2013 can be seen in Table 2. These included 9,774 feet of exclusion fencing, one heavy use area protection, one stream crossing, six septic tank pump outs, and six septic system replacements (see Table 3).

Table 2: Estimated load reductions for all BMPs in 2013 based on StepL output.

Name of 12-digit HUC	Calculation Method/Model	Pollutant Type	2013 Estimate	Units
Upper Bacon Creek	StepL	Nitrogen	4,151.9	Pounds/year
Upper Bacon Creek	StepL	Phosphorus	769.3	Pounds/year
Upper Bacon Creek	StepL	BOD	12,434.4	Pounds/year
Upper Bacon Creek	StepL	Sediment	342.5	Tons/year

Table 3: Details on residential and agricultural BMPs installed in 2013.

BMP with units	Lat/Long of BMP	Name of 12 digit HUC	12 digit HUC Number	Watershed Area (Acres)
Exclusion fencing 3540 ft.	37 27 28/85 46 39	Upper Bacon Creek	051100011101	13,193
Heavy Use Area Protection 2100 sq. ft.	37 25 54/85 49 40	Upper Bacon Creek	051100011101	13,193
Exclusion fencing 3584 ft.	37 25 54/85 49 40	Upper Bacon Creek	051100011101	13,193
Stream Crossing	37 25 21/85 45 21	Upper Bacon Creek	051100011101	13,193
Exclusion fencing 2650 ft.	37 25 21/85 45 21	Upper Bacon Creek	051100011101	13,193
Septic Tank Pump Out 1	37 31 11/85 46 03	Upper Bacon Creek	051100011101	13,193
Septic Tank Pump Out 2	37 31 11/85 46 03	Upper Bacon Creek	051100011101	13,193
Septic Tank Pump Out 3	37 20 03/85 51 03	Upper Bacon Creek	051100011101	13,193
Septic Tank Pump Out 4	37 20 03/85 51 03	Upper Bacon Creek	051100011101	13,193
Septic Tank Pump Out 5	37 23 40/85 52 13	Upper Bacon Creek	051100011101	13,193
Septic Tank Pump Out 6	37 23 42/85 52 10	Upper Bacon Creek	051100011101	13,193
Septic System Repair or Replacement 1	37 23 03/85 55 55	Upper Bacon Creek	051100011101	13,193
Septic System Repair or Replacement 2	37 21 46/85 56 40	Upper Bacon Creek	051100011101	13,193
Septic System Repair or Replacement 3	37 22 00/85 56 33	Upper Bacon Creek	051100011101	13,193
Septic System Repair or Replacement 4	37 20 53/85 54 34	Upper Bacon Creek	051100011101	13,193
Septic System Repair or Replacement 5	37 26 19/85 46 19	Upper Bacon Creek	051100011101	13,193
Septic System Repair or Replacement 6	37 23 09/85 46 04	Upper Bacon Creek	051100011101	13,193

Residential BMPs

The septic tank pump out program got a slow start. Health department officials believe that some residents were apprehensive to have the septic system inspected fearing it would reveal larger issues. The geographic boundary was expanded to encompass the entire watershed, and interest in the program gradually increased. In total, 13 septic tanks were pumped out. The septic system repair or replacement program was met with immediate interest, and there were more applicants than project funding could accommodate. In total, six systems were installed (see Figure 5); each case was an example of genuine need and will provide a boon to the water quality of Bacon Creek. One other system was inspected, but did not need repairs.

A conservative estimate of daily wastewater flow for a single home with 2.5 occupants is 150 gallons per day (Mayer et al. 1999). An estimate of fecal coliform in raw wastewater reaching the stream (US EPA "Onsite Wastewater Treatment Systems Manual" 2002) is 10,000,000 cfu per 100 ml. Removing a failing system that flows into a surface water by replacing it with a working system will remove 56,781,176,700 fecal coliform colonies per day per home. This equates to 13,056,831,582,165 *E. coli* cfu/year for each septic system remediated (McKee et al 2012). Replacing the six septic systems combined potentially decreased the bacteria load in Bacon Creek by over 78 trillion *E. coli* cfu per year.

Agricultural BMPs

The agricultural BMPs implemented included over 10,000 feet of fencing (NRCS code 382), three heavy use area protections (NRCS code 561), four watering facilities (NRCS code 614), and one stream crossing (NRCS code 578). Site locations can be seen in Figure 5. The NRCS specifications were used to plan and install the BMPs. The Agricultural Coordinator worked with the farmers to help ensure proper siting and installation of BMPs. He called on local conservation district offices for technical advice when needed. Also, five KY Agricultural Water Quality Plans were updated. Estimated load reductions for these BMPs can be seen in Table 4.

Table 4: Estimated load reductions and expected efficiencies from implemented BMPs.

BMP	Indicator	Estimated Load Reduction*	Expected Efficiency**
Ag. Water Quality Plan	Number of plans completed or updated	not measurable	not measurable
Fence (containment)	Bacteria count	50-90%	Moderate to Substantial Improvement
Watering Facility	Bacteria count	n/a	n/a
Heavy Use Area Protection	Bacteria count	85%	Moderate to substantial improvement
Stream Crossing	Bacteria count	40-60%	Slight to moderate improvement

* Estimated Load Reduction: provides a gross estimate of practice effectiveness as reported in research literature. The actual effectiveness of a practice will depend on site-specific variables such as soil type, crop rotation, topography, tillage, and harvesting methods.
http://water.epa.gov/polwaste/nps/guidance.cfm
** Effectiveness: These values are based on NRCS conservation practice physical effects (CPPE) documents and EPA National Management Measures to control nonpoint source pollution. Due to the general nature of these sources and site variability, results may differ.
www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/econ/data
http://water.epa.gov/polwaste/nps/agriculture/agmm_index.cfm

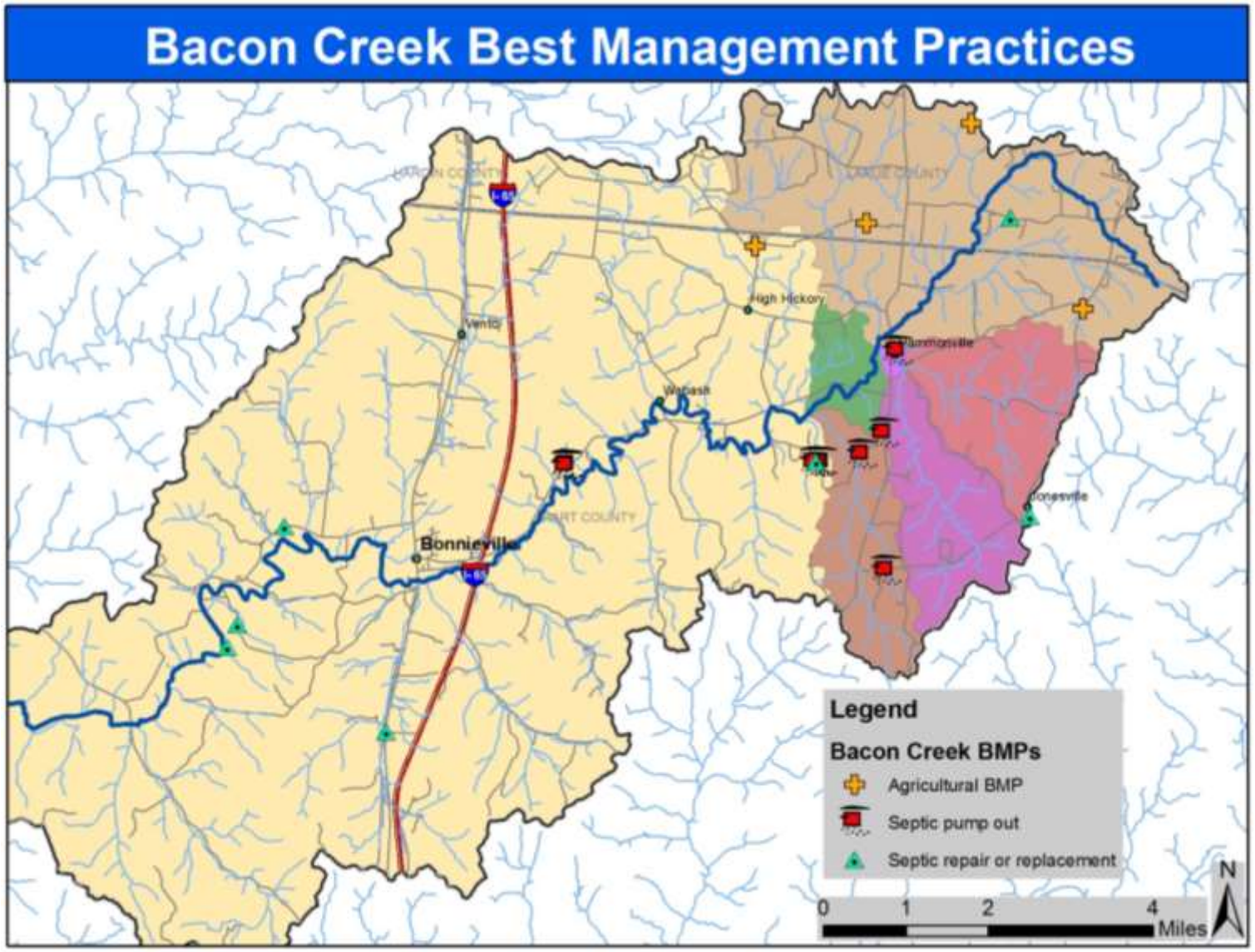

Figure 5: Locations of the Best Management Practices installed in the Bacon Creek Watershed Implementation project. Note: Some of the locations were so close geographically that they do not appear as separate icons at the scale used for this map.

Data

Water quality sampling was conducted by WKU Center for Water Resources. KDOW staff reviewed the data and found the nutrient data unacceptable due to field and laboratory errors. On multiple occasions, total phosphorus and/or nitrate-nitrite sample field or lab blanks failed to meet requirements. The *E. coli* and TSS data were accepted. KDOW performed data analysis and authored the analysis write up for the watershed plan (see Appendix F for project data).

Data analysis indicates that bacteria loads are high; six of the eight sites requiring *E. coli* load reductions (see Table 5). Analysis did not indicate a TSS impairment, and no site requires a TSS load reduction (see Table 6). Because the recommended TSS benchmark was developed for the months of April through October and base flow conditions only, only samples that met these criteria were used in calculating load and yield. Atrazine concentrations were also high at many sites, and riparian areas are degraded in many places in the watershed.

Table 5: *E. coli* annual load and yield for sub-watersheds. Negative values signify loads below target value.

Site	Load*	Target Load*	Annual Load Reduction Needed*	Percent Reduction Needed	Yield**
Site 1	58	32	26	44.8	11
Site 1a	8.5	5.4	3.1	36.5	2.9
Site 1Ba	48	5	43	89.6	2
Site 1Bb	6.2	6.1	0.1	1.6	2.24
Site 2	2.7	4.4	-1.7	-63.0	3.1
Site 3	52	13	39	75.0	3
Site 5	2.4	3.8	-1.4	-58.3	2.7
Site 6	91	56	35	38.5	13

*units of trillion cfu/100 mL/yr.

**units of trillion cfu/100 mL/yr/mile^2

Table 6: TSS annual load and yield for sub-watersheds. Negative values signify loads below target value.

Site	Load*	Target Load*	Annual Load Reduction Needed	Percent Reduction Needed	Yield**
Site1	125387	200242	-74855	-0.60	11919
Site1a	10653	25548	-14895	-1.40	3686
Site1Ba	12133	24181	-12048	-0.99	6036
Site1Bb	18277	29101	-10825	-0.59	8159
Site2	7140	21997	-14857	-2.08	2303
Site3	53368	57188	-3820	-0.07	17555
Site5	8051	17073	-9022	-1.12	2982
Site6	216779	263782	-47003	-0.22	16936

*units of lbs/yr

**units of lbs/yr/mile^2

The primary contact season in which sampling occurred was marked by drought, and therefore few wet weather sampling events occurred. However, a comparison of flow with indications of precipitation and measurements can give an indication of wet weather versus dry weather levels of pathogens. The exceedances at several sites in May and June of 2012 occurred during dry weather, indicating that impacts may be occurring from sources that discharge regularly, such as septic systems, straight pipes or livestock in the stream. Site 1Ba shows the strongest signature for point sources. Rain events following a dry period produced spikes in *E. coli* values (October 2012 and January 2013). This pattern indicates that *E. coli* levels in the stream were heavily influenced by runoff pollution generated by stormwater runoff from the surrounding watershed area.

Human and livestock are the most common sources of *E. coli,* and both are likely contributors to the impairment found. The Bacon Creek Watershed area in this study is entirely rural. Sewage hookups are not available, so septic systems and possibly straight-pipes are used for human waste. A high percentage of human bacteria during wet weather are a signature of failing septic systems or flushing out of pooled straight pipe waste. See the watershed plan in Appendix B for more detail on data issues, data analyses, and pollutant loads.

Conclusions

The following measures of success exhibit the scope of the grant project and the strides made toward involving local communities in watershed planning:

Measures of Success:

The overall project goals (as expressed in the grant application) were to reduce pathogens in the five upper HUC 14 watersheds in Bacon Creek, update and improve Bacon Creek Watershed-based Plan, and increase capacity and effectiveness of the Bacon Creek Watershed Council. These goals were articulated in the following objectives:

1. Raise awareness of human and livestock contributions to pathogens in Bacon Creek.

-An educational campaign was conducted to raise awareness about septic system and waste water problems in the watershed. Educational brochures, newspaper articles, watershed newsletter, and a video were produced.

-Septic tank pump outs at reduced rates were performed at 13 households.

- An agricultural coordinator was hired to provide one-on-one assistance and outreach to farmers in the watershed. He provided information on cost-share programs and other financial

assistance available as well as facilitated completion or updating of Agricultural Water Quality plans.

-Septic and agricultural BMPs were installed to improve the water quality in Bacon Creek. A total of 13 septic systems were pumped out, six failing septic systems were replaced, and nine agricultural BMPs were implemented on four farms.

-Partnership with the Watershed Council was maintained to continue community outreach and commitment to improve water quality in Bacon Creek.

-A speakers committee of Watershed Council members and KWA staff was created to speak to area civic organizations and local government about the project.

2. Provide better detail about causes and sources of pathogens

- GIS maps were used to provide a better understanding of land use in the watershed.

- Bacterial source tracking data produced at the end of the FFY05 grant were used in data analysis.

-WKU CWRS conducted monitoring in the watershed to supplement the available data.

- The watershed plan was reorganized to meet all requirements for 319 (h) watershed plans.

- Load reduction estimates were updated in the watershed plan.

3. Increase membership in Council

- Training was provided to the Watershed Council through guest speakers and a Clean Water Act 101 training workshop.

- Assistance was provided for regular meetings, activities, and outreach.

- A speakers committee was created to help publicize the efforts of the Watershed Council.

- Watershed newsletter *News from Bacon Creek* was mailed to Council and community members, extra copies given to council members to use as outreach tool.

4. Provide useable, understandable information to the public about the project and the water quality in Bacon Creek

- KWA project manager worked with Bacon Creek Watershed Council to customize and disseminate brochures, newsletters, and flyers.

- KWA project manager and communications director worked with Watershed Council to produce a video about the creek, the Council, and its clean-up efforts

- Two community roundtables about the project and the watershed plan were held.

Final Conclusion

Watershed planning is iterative. Throughout the course of the grant project, local community residents have been interested and involved in cleaning up the Bacon Creek Watershed. Building relationships and developing trust with residents and farmers is a huge step in integrated watershed planning.

Water quality data collection was ultimately unsuccessful for many parameters and leaves potential nutrient issues in the watershed undefined. Bacteria data show that *E. coli* continues to be a problem in most of the watershed. Additional bacterial source tracking data may help to further direct future BMP implementation. TSS data analyses indicate that Upper Bacon Creek is not currently impaired for sediment. Atrazine levels are high, and riparian buffers are degraded or nonexistent in much of the watershed. A biological study was not conducted, but there were positive anecdotal signs of wildlife in the data field notes.

Continued BMP implementation and community outreach and education will serve the populace of the watershed well. Traditional septic systems are not an ideal solution for the residential sources of *E. coli* as the watershed soils are mostly unsuitable for them. However, taking into account local economies and culture, septic systems may still be the most feasible treatment of wastewater in Bacon Creek. It is encouraging that there were so many applicants for the septic system repair and replacement program. Careful siting and installation and additional measures such as double chamber tanks or double tank systems can help ensure proper function of systems. Agricultural BMPs will continue the work of this project in building relationships and giving farmers the extra support needed to implement good, sustainable practices in all areas. The Agricultural Coordinator's work was instrumental in farmer involvement and BMP implementation. A move toward whole farm planning through the continuation of his work and the use of Agricultural Water Quality Plans will be critical for greater reductions in pollutant loads and long term sustainability.

At a basic level, watershed planning is about education. It is the collective, daily actions of individuals that impact water quality the most. Knowledge leads to awareness, and awareness leads to stewardship. The Bacon Creek Watershed Council and participants in project BMPs serve as examples of a small group of people making a big difference on a local level.

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Appendix A: Financial and Administrative Close-out

Appendix A: Financial and Administrative Close-out

1. Application Outputs

The following outputs were generated by the project during 2010-2013:

- Created Bacon Creek Watershed webpages, January 2011- September 2013
- Bacon Creek Watershed Planning flyer, January 2011
- Focus area map and project goals handout, March 2011
- Hire Bacon Creek Agricultural Coordinator, April 2011
- BMP Implementation Plan for Septic Tank Pump Out program, October 2011
- BMP Implementation Plan for Agricultural BMP program, October 2011
- The Bacon Creek Watershed Plan, January 2011- September 2013
- Create and distribute *News from Bacon Creek* newsletter, May 2012 – May 2013
- BMP Implementation Plan for Septic System replacement program, June 2012
- Summary of BMPs Implemented, August 2013
- Bacon Creek Watershed Council Video, September 2013

Table 6: Final milestones for the Bacon Creek Watershed Plan Implementation project.

Milestone	Date Started	Date Finished
1. Update project partners	1/3/11	1/19/11
2. Submit draft news articles, brochures, videos, newsletter articles and other education, outreach materials to NPS Program staff for approval	1/3/11	9/30/13
3. Conduct regular Watershed Council meetings (approx. every 6 weeks)	1/19/11	9/23/13
4. Develop Speakers Committee for outreach	10/11/11	8/31/13
5. Create and maintain webpage for the project	1/3/11	9/30/13
6. Develop and submit a BMP Implementation Plan to NPS Program staff for approval	8/24/11	10/25/11
7. Install at least 4 agricultural BMPs	10/11/11	9/18/13
8. Submit on-site wastewater incentive program brochure to NPS Program for approval	10/24/11	10/27/11
9. Begin septic system incentive program	8/4/11	9/9/13
10. Submit advance written notice to NPS Program staff for Watershed Roundtables, Field Days and all educational public meetings (ongoing)	2/2/11	9/3/13

11. Plan and host 1st Watershed Roundtable	1/3/11	2/17/11
12. Develop and submit new QAPP to NPS Program staff for approval	7/8/11	4/05/12
13. Meet with KDOW to review proposed monitoring strategy	7/29/11	8/25/11
14. Submit an Annual Report to NPS Program staff by December of each year	11/15/12	
15. Hold 2 field days and/or similar outreach activities to showcase BMP installations	7/1/12	7/30/13
16. Plan and host 2nd Watershed Roundtable	4/22/13	9/23/13
17. Submit updated Watershed-based Plan to NPS program staff for approval	6/26/13	9/30/13
18. Submit 3 hard copies and 1 electronic copy of Final Report and 3 hard copies and 1 electronic copy of all products produced by this project	6/3/13	9/30/13
19. Complete work of the Septic Repair and Replacement Program	9/5/12	8/30/13
New data analyzed by Western Kentucky University Center for Water Resources	4/23/13	8/12/13

2. Budget Summary

Original Approved Budget			
Budget Categories (Itemize all Categories)	§319(h) (60% of funds)	Non-Federal Match (40% of funds)	TOTAL
Personnel	78,943	13,931	92,874
Supplies	11,000	15,620	26,620
Equipment	30,000	30,000	60,000
Travel	2,429	4,343	6,772
Contractual	88,113	7,615	95,728
Operating Cost	15,996	5,545	21,541
Other	29,472	93,581	123,053
TOTAL	255,953	170,635	426,588

Approved Budget Revision #1	Approved August 8, 2012		
Budget Categories (Itemize all Categories)	§319(h) (60% of funds)	Non-Federal Match (40% of funds)	TOTAL
Personnel	78,943	13,931	92,874
Supplies	11,000	15,620	26,620
Equipment	30,000	30,000	60,000
Travel	2,429	4,343	6,772
Contractual	113,113	24,282	137,395
Operating Cost	15,996	5,545	21,541
Other	29,472	93,581	123,053
TOTAL	280,953	187,302	468,255

This budget amendment added an additional $25,000 in federal BMP funding to repair/replace septic systems in the watershed and $16,667 in matching funds to the Contractual Line Item. No other changes were made to the original budget. The Division of Water approved this budget revision in August 2012.

Approved Budget Revision #2	Approved June 26, 2013			September 30, 2013 TOTAL AMOUNTS
Budget Categories (Itemize all Categories)	§319(h) (60% of funds)	Non-Federal Match (40% of funds)	TOTAL	Final Expenditures
Personnel	83,943	10,700	94,643	99,246
Supplies	0	0	0	0
Equipment	0	0	0	0
Travel	3,030	1,148	4,178	3702
Contractual	178,926	58,481	237,407	240,435
Operating Cost	15,054	2,851	17,905	16,036
Other	0	114,122	114.122	108,836
TOTAL	280,953	187,302	468,255	468,255

Explanation of changes included in Budget Revision #2. The Division of Water approved this budget revision in June 2013.

1. In the originally approved budget and budget amendment #1 amounts for WKU monitoring were included under a number of line items including: supplies, travel, contractual, operating costs and other. These amounts have now all been included under contractual costs. The total amount for monitoring has not changed.
2. We budgeted for and anticipated the agricultural coordinator working three years at 20/hr per week, but it took several months to hire the coordinator; and then it took several months to really get the agricultural BMP sign-up program going so we did not use the entire $60,000 allocated for the coordinator.
3. We did not anticipate the $100,000 in match from the Land Heritage Conservation Fund Board when we wrote the grant. The approval of these funds for match allowed us to accept much lower match amounts for a number of line items, in particular for both the agricultural and septic BMPs.
4. We did not include an amount for data analysis in the original budget. But after discussing the expectations for the data analysis with our technical advisor, we determined that we needed to add a data analysis contract to the budget.
5. The remaining minor changes were our best estimates so that all funds were used and the grant closed out in a timely manner.

Final grant expenditures

Kentucky Waterways Alliance, Inc. was reimbursed $280,953.00. All dollars were spent; there were no excess project funds to reallocate.

Equipment Summary
No equipment was purchased for this project.

Special Grant Conditions
There were no special grant conditions for this project.

Appendix B: Community Outreach and Education Materials

Electronic files on CD used to save paper for lengthier submissions:

1. Watershed planning flyer
2. Bacon Creek watershed planning and map handout
3. Bacon Creek kickoff Roundtable flyer
4. *News from Bacon Creek* newsletters for June 2012, October 2012, and May 2013
5. Clean Water Action Workshop Presentation
6. Farm Field Day poster, Sept. 29, 2012
7. Farm Field Day poster, July 30, 2013
8. Septic tank pump out post card advertisement
9. Bacon Creek Watershed Council video

Appendix B: Bacon Creek Watershed Council flyer

Bacon Creek Watershed Council

Kentucky Waterways Alliance

What is the Bacon Creek Watershed Council?

In 2001, a group of concerned citizens in Bonnieville and surrounding areas came together to form the Bacon Creek Watershed Council. Members of the community from all walks of life began the process of returning Bacon Creek to a healthy creek. Their work, in conjunction with Kentucky Waterways Alliance, consisted of learning and teaching others about the creek, otherwise known as "watershed planning."

Today the Council is working on updating the Bacon Creek Watershed Plan, implementing Best Management Practices on local farms and residences, hosting creek cleanups and festivals, and getting the word out about how special Bacon Creek is.

Agricultural Best Management Practices are being installed on farms to help increase productivity and protect water quality. Practices like fencing cows out of the creek or creating a vegetation buffer along the creek can greatly improve water quality and protect farm resources at the same time. The Septic Best Management Practices program offers Honey Run residents a reduced rate (only $30!) to have their septic tank serviced. This simple step can help keep bacteria out of Bacon Creek.

Please consider joining the Council – no prior experience necessary. The more local participation, the better. Everyone is welcome at our events and meetings.

Why Should I Take Care of Bacon Creek?

The quality of our water directly affects the quality of our lives. Polluted water endangers health -- of family, pets, and livestock. Clean surface water -- streams, rivers, ponds, and lakes -- can increase the value of our property. Even though much progress has been made to help restore Bacon Creek, it still has some serious impairment issues that need to be addressed. Currently, the creek is not safe for swimming or wading due to high levels of bacteria. The bacteria originate from failing septic systems and agricultural runoff. The creek also has a problem with too much sediment. Too much sediment (or soil) in the water can adversely affect the fish and other aquatic life that rely on the creek for habitat.

What Can I Do for a Healthier Bacon Creek?

What if everyone living in the Bacon Creek Watershed made one change to help protect the creek? Imagine how much this would improve the productivity and beauty of the land. Before we can ask folks to make changes that promote better water quality, we must first be aware of the issues and inspire change. We need you to be a part of the solution by joining the Bacon Creek Watershed Council. The Council typically meets once a month, on the fourth Monday of each month. Your time is worth its weight in gold!

Resources – please do not hesitate to contact us with questions about the project or meeting dates.

Mark Howell, Bacon Creek Agricultural Coordinator
Phone: (270) 766-9955
E-mail: mark.howell.ky5@gmail.com

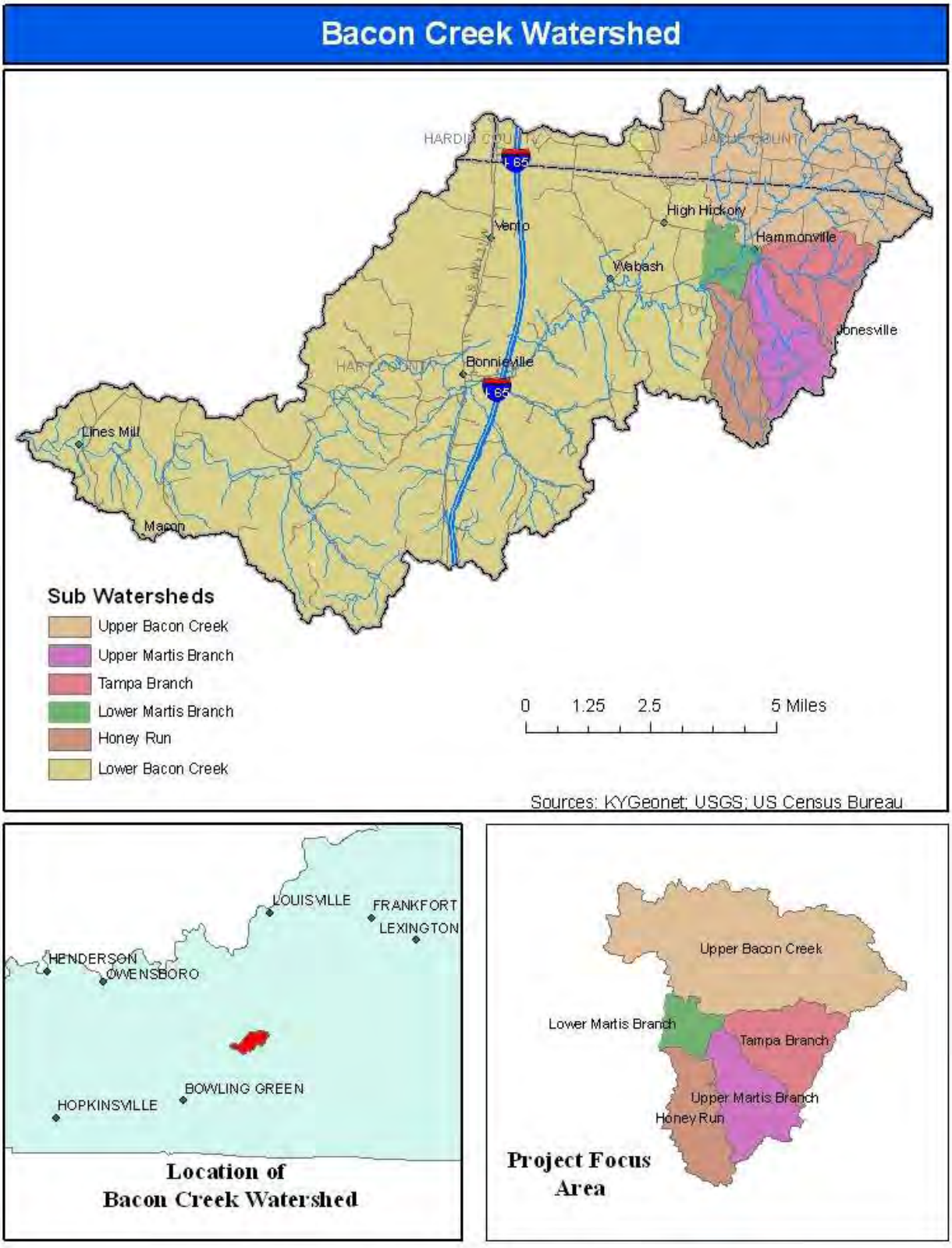
Tessa Edelen, KWA Watershed Program Director
Phone: (502) 589-8008
Email: tessa@kwalliance.org

Angie Wingfield, KY Division of Conservation Program Coordinator
Phone: (502) 573-3080
Email: Angie.Wingfield@ky.gov

Kentucky KWA Waterways Alliance
Healthy waterways. Healthy communities.

Funding for this project was provided in part by a grant from the U.S. Environmental Protection Agency through the Kentucky Division of Water, Nonpoint Source Section and the Kentucky Division of Conservation. Kentucky Waterways Alliance is authorized by the Clean Water Act Amendments of 1987, Section 319(h) Nonpoint Source Grant #C-99948611-10.

Appendix B: Bacon Creek watershed planning and map handout:



Funding for this projectwas provided in part by a grant from the U.S. Environmental Protection Agency through the Kentucky Division of Water, Nonpoint Source Section and the Kentucky Division of Conservation Kentucky Waterways Alliance as authorized by the Clean Water Act Amendments of 1987, Section 319(h) Nonpoint Source Grant #C-999461-10.

Appendix B: Bacon Creek kickoff Roundtable flyer:

Bacon Creek Roundtable

Date: February 17, 2011

Time: 6 to 8 p.m.

Place: Bonnieville City Hall, Bonnieville, KY

Join us as we discuss ways to act on behalf of Bacon Creek including possible grant funding for agricultural and septic projects and a local Ag. coordinator position. You're invited to get involved to keep our creek clean and safe. This free event includes a light dinner.

Featured speakers include Judy Petersen of KWA, Alanna Malone of WKU, Dale Reynolds of KY Division of Water, and Angie Wingfield from KY Division of Conservation.

Everyone welcome!

To RSVP or for more info contact: Tessa (502) 589-8008 or Tessa@KWAlliance.org

Find KWA on Facebook and look for the Roundtable event!

Kentucky KWA Waterways Alliance
Healthy waterways.
Healthy communities.

Funding for this project was provided in part by a grant from the U.S. Environmental Protection Agency through the Kentucky Division of Water, Nonpoint Source Section and the Kentucky Division of Conservation to Kentucky Waterways Alliance as authorized by the Clean Water Act Amendments of 1987, Section 319(h) Nonpoint Source Grant #C-9994861-10.

Appendix B: *News from Bacon Creek* newsletters for June 2012, October 2012, and May 2013

(see disc)

Appendix B: Clean Water Action Workshop Presentation

(see disc)

Appendix B: Farm Field Day poster, Sept. 29, 2012

Appendix B: Farm Field Day poster, July 30, 2013

Appendix B: Septic tank pump out and Repair and Replacement program post card advertisements:

Appendix B: Bacon Creek Watershed Council video

(See separate disc)

Appendix C: Bacon Creek Watershed Plan

September 30, 2013

Electronic file on CD used to save paper.

Appendix D: Best Management Practices Implementation Plans

Bacon Creek Septic Best Management Practices
Implementation Plan
Kentucky Waterways Alliance

List of technologies to be installed
BMP:
- Pump out of septic system

Selection process
• How the BMPs have been selected:
Septic BMPs were selected based on their potential impact on water quality of Bacon Creek. The main goal of the septic BMPs is to reduce the bacteria load originating from residential sources in the Honey Run subwatershed. The strategy will be centered on raising awareness about septic maintenance issues, identifying septic maintenance issues, and offering an at-cost septic pump out disposal in cooperation with Caveland Environmental Authority.

How selected BMPs will be targeted to specific locations
• BMP selection criteria will include:
- subwatershed location (the Honey Run subwatershed will have top priority),
- distance to the creek,
- potential load reduction,
- need (time since last pump out and number of individuals in household)
- landowner willingness to participate in project
All interested parties will be asked to complete an application including questions to address the above concerns. The applications will then be ranked based on the above criteria. The final decision will be made by the KWA Executive Director and Watershed Program Director in collaboration with the DOC technical advisor.
A secondary project goal is outreach and education in the watershed about water quality issues, particularly nonpoint source pollution. Applicants will also be asked to serve on the Bacon Creek Watershed Council and/or participate in watershed planning and outreach activities.

Financial plan of action
The grant funding will be used to promote septic BMPs in the targeted subwatershed, Honey Run, to improve water quality. To facilitate participation, there will be an 85/15% cost-share, which could be waived at KWA's discretion. Caveland Environmental Authority is accepting the pump out materials free of charge. Powell's Septic will be doing the actual pump out, not at a discounted rate of $225 per septic system. The participant's portion is to be paid in cash to Powell's Septic at the time of services. This will create buy-in on the part of the participant as well as stretch the grant funding for septic pump out farther to hopefully allow more people to participate.

Maintenance agreement with landowner

Upon selection for participation in the KWA septic best management practices program, the landowner will be required to sign the following statement (which is part of the bmp application):

I certify that the above information is true and correct. I hereby apply for payment to the extent that KWA has determined that the practice has been performed. I agree to refund all or part of the cost-share assistance paid to me as determined by KWA, if, before the expiration of the practice's life span specified above, I (a) destroy the practice installed, or (b) cease to use the practice for its intended purpose, or c.) voluntarily relinquish control or title to the land on which the installed practice has been established and the new owner and/or operator of the land does not agree, in writing, to properly use and maintain the practice for the remainder of its specified life span.

I agree to be willing for cost-share practices to be part of a field day or demonstration. I understand that before I am eligible for these funds I must complete the following: 1. Agree upon and sign contract; 2. Install practices according to the designs and specifications

_____ _____

Applicant Signature Date

Kentucky KWA Waterways Alliance

120 Webster Street, Suite 217
Louisville, KY 40206
502-589-8008
www.KWAlliance.org

Application for Septic Best Management Practices Assistance

Name:_____
Address (please include subwatershed and distance to creek): _____
_____

Phone and email: _____
Briefly describe your septic tank situation (including any known problems, number of people in the household, and approximate date of last pump out).
_____

_____
Have you completed an Agricultural Water Quality Plan (if applicable)? _____
If not, would you be willing to? _____
If funding became available at a later date, would you be interested in a septic maintenance plan? This would entail a monthly fee, but would cover all expenses in case of septic maintenance issues for the life of the contract. Questions and comments welcome here.
_____

_____
Are you interested in serving on the Bacon Creek Watershed Council? Do you have a particular area of interest?
_____

_____

Cost
The estimated cost per household septic system is $30. This represents an 85/15 cost share between KWA and the applicant. Caveland Environmental Services is donating their services in accepting pump out materials. Powell's Septic will be the service provider performing the actual pump out. Participant's portion of cost will be given directly to Powell's Septic at the time of pump out, with the remainder being paid by KWA.
Maintenance agreement with landowner

Upon selection for participation in the KWA septic best management practices program, the landowner will be required to sign the following statement (which is part of the bmp application):

I certify that the above information is true and correct. I hereby apply for payment to the extent that KWA has determined that the practice has been performed. I agree to refund all or

part of the cost-share assistance paid to me as determined by KWA, if, before the expiration of the practice's life span specified above, I (a) destroy the practice installed, or (b) cease to use the practice for its intended purpose, or c.) voluntarily relinquish control or title to the land on which the installed practice has been established and the new owner and/or operator of the land does not agree, in writing, to properly use and maintain the practice for the remainder of its specified life span.

I agree to be willing for cost-share practices to be part of a field day or demonstration. I understand that before I am eligible for these funds I must complete the following: 1. Agree upon and sign contract; 2. Install practices according to the designs and specifications

_____ _____

Applicant Signature Date

Bacon Creek Agricultural Best Management Practices
Implementation Plan
Kentucky Waterways Alliance

List of technologies to be installed

BMP:
- Fence (382) for water quality
- Filter Strip
- Grassed Waterway
- Heavy Use Area Protection (561)
--Livestock Exclusion (472)
- Livestock Shade Structure (717)
- Nutrient Management (590)
- Pond (378)
- Riparian Forest Buffer (391A)
- Sinkhole Protection (725)
- Streambank and shoreline protection (580)
- Stream Crossing (576)
- Tank (614)

More information about NRCS codes can be found here: www.ky.nrcs.usda.gov/technical/

Selection process

• How the BMPs have been selected:

Agricultural BMPs were selected based on their potential impact on water quality of Bacon Creek. The main goal of the agricultural BMPs is to reduce the bacteria load originating from agricultural sources in the Upper Bacon Creek subwatershed. The strategy will be on centered on preventing or reducing polluted runoff from agricultural fields from entering the creek and its tributaries. Thus, efforts will be focused on BMPs that have been shown to be successful at this endeavor. All of the BMPs listed above would be appropriate and useful in the target area.

How selected BMPs will be targeted to specific locations

• BMP selection criteria will include:
- subwatershed location (the Upper Bacon Creek subwatershed will have top priority),
- proximity to the creek,
- potential load reduction,
- suitability of BMP for site proposed,
- landowner willingness to participate in project and provide in-kind match, and
- cost of proposed BMP.

All interested parties will be asked to complete an application including questions to address the above concerns. The applications will then be ranked based on the above criteria. All applicants will also be asked to apply for NRCS funding. BMPs will be selected that meet the needs of the operation while providing the best resource protection. If applicants qualify for

current NRCS programs, they will be advised to use that funding instead of 319 project monies. Candidates that meet the criteria, and do not receive NRCS funding, will be in contention for project monies. The final decision will be made by the KWA Executive Director and Watershed Program Director in collaboration with the project Agricultural Coordinator and the DOC technical advisor.

A secondary project goal is outreach and education in the watershed about water quality issues, particularly nonpoint source pollution. Therefore, all applicants for 319 program monies will be asked to complete an Agricultural Water Quality Plan. Applicants will also be asked to serve on the Bacon Creek Watershed Council and/or participate in watershed planning and outreach activities. This will include BMP field days when appropriate.
The project will compliment state and federal funding programs in the watershed. Operation and maintenance agreements are required for both the EQIP and State Cost Share programs. These same agreements will be used for 319 project BMPs.

Financial plan of action
The grant funding will be used to promote appropriate agricultural BMPs in the targeted subwatershed, Upper Bacon Creek, to improve water quality. To facilitate participation, there will be no cash match requirement, only in-kind match. Specific to the BMP to be installed, land owner will be expected to assist in installation with time, equipment, and, if applicable, materials. The in-kind match will be at a 25/75% ratio of cost.
Any BMP or system considered for funding through this program must be reviewed for the potential to improve water quality. BMPs or systems designed for production improvement or efficiency will not be considered. The application process will help discern the most suitable BMPs.

Maintenance agreement with landowner
Upon selection for participation in the KWA agricultural best management practices program, the landowner will be required to sign the following statement (which is part of the bmp application):

I certify that the above information is true and correct. I hereby apply for payment to the extent that KWA has determined that the practice has been performed. I agree to maintain this practice for at least five (5) years following the year the practice is completed. I agree to refund all or part of the cost-share assistance paid to me as determined by KWA, if, before the expiration of the practice's life span specified above, I (a) destroy the practice installed, or (b) cease to use the practice for its intended purpose, or c.) voluntarily relinquish control or title to the land on which the installed practice has been established and the new owner and/or operator o the land does not agree, in writing, to properly use and maintain the practice for the remainder of its specified life span.

I agree to be willing for cost-share practices to be part of a field day or demonstration. I understand that before I am eligible for these funds I must complete the following:

1. Agree upon and sign contract;
2. Receive NRCS designs for approved practices; and
3. Install practices according to the designs and specifications

_____ _____

Applicant Signature Date

Notification process to DOW/DOC

All BMPs will be installed according to NRCS standards and specifications. All BMPs must comply with the KY Agriculture Water Quality Act and the Forest Conservation Act. BMPs must be maintained for the life of the practice.

Kentucky KWA Waterways Alliance

120 Webster Street, Suite 217
Louisville, KY 40206
502-589-8008
www.KWAlliance.org

Application for Agricultural Best Management Practices Assistance

Name:_____

Address (please include subwatershed and distance to creek): _____

_____

Phone and email: _____

Briefly describe your agricultural operation. _____

_____

_____

Have you completed an Agricultural Water Quality Plan? _____

If not, would you be willing to? _____

Did you apply for NRCS funding this year? If so, what program? _____

What type of Best Management Practice would you like to implement (please be specific)?

_____

_____

What kind of volunteer support, supplies, or equipment use can you provide for BMP implementation on your land (please be specific)?

_____

_____

_____

Are you interested in serving on the Bacon Creek Watershed Council?

_____

**Please know that if selected, this application will represent a contract with Kentucky Waterways Alliance for the completion and maintenance of the selected BMP. KWA, via the 319 grant, will provide 75-25 cost-share. The landowner portion (25%) may be provided with cash or in-kind donation (labor, supplies, and equipment use) equaling 25%. You will be required to sign the following maintenance agreement:

I certify that the above information is true and correct. I hereby apply for payment to the extent that KWA has determined that the practice has been performed. I agree to maintain this practice for at least five (5) years following the year the practice is completed. I agree to refund all or part of the cost-share assistance paid to me as determined by KWA, if, before the expiration of the practice's life span specified above, I (a) destroy the practice installed, or (b) cease to use the practice for its intended purpose, or c.) voluntarily relinquish control or title to the land on which the installed practice has been established and the new owner and/or operator o the land does not agree, in writing, to properly use and maintain the practice for the remainder of its specified life span.

I agree to be willing for cost-share practices to be part of a field day or demonstration. I understand that before I am eligible for these funds I must complete the following: 1. Agree upon and sign contract; 2. Receive NRCS designs for approved practices; and 3. Install practices according to the designs and specifications.

_____ _____

Applicant Signature Date

Appendix E: Quality Assurance Project Plan

(see disc)

Appendix F: Best Management Practices Implemented Summary

The Bacon Creek Watershed Plan Implementation project set out to install two types of Best Management Practices (BMPs), septic and agricultural, in the Upper Bacon Creek Watershed in order to reduce the amount of bacteria and sediment in the creek. The septic system program originally consisted of septic tank pump outs in the Honey Run sub-watershed. It was later expanded to include septic system repair or replacement. The agricultural program sought to install four BMPs in the Upper Bacon Creek sub-watershed. A local Agricultural Coordinator was hired to reach out to farmers to encourage them to create or update their existing Kentucky Agricultural Water Quality Plan and to apply for project BMP funding.

Background

In 2010, bacterial source tracking data collection was conducted in the Upper Bacon Creek Watershed to determine specific bacterial sources. Sampling was done at nine sites, twice during wet conditions and twice during dry conditions in the Primary Recreation Season. The data indicated that the Honey Run sub-watershed has elevated fecal levels of human origin, and the Upper Bacon Creek sub-watershed has elevated fecal levels of animal origin. Septic system and agricultural BMPs were, therefore, targeted in Honey Run and Upper Bacon, respectively (see Figure 2).

Each BMP program was supported by the Bacon Creek Watershed Council. Outreach materials including application packets, postcards, and flyers were created and disseminated throughout the watershed. The Council's newsletter, *The News from Bacon Creek*, highlighted both the septic and agricultural work. Updates on both programs were given at each Bacon Creek Watershed Council meeting, which were typically held monthly. Also, two Farm Field Days were held to demonstrate the agricultural BMPs installed as part of the program. All outreach materials invited people in the community to participate in the Bacon Creek Watershed Council.

Figure 1: Division of Conservation advisor on a farm site visit.

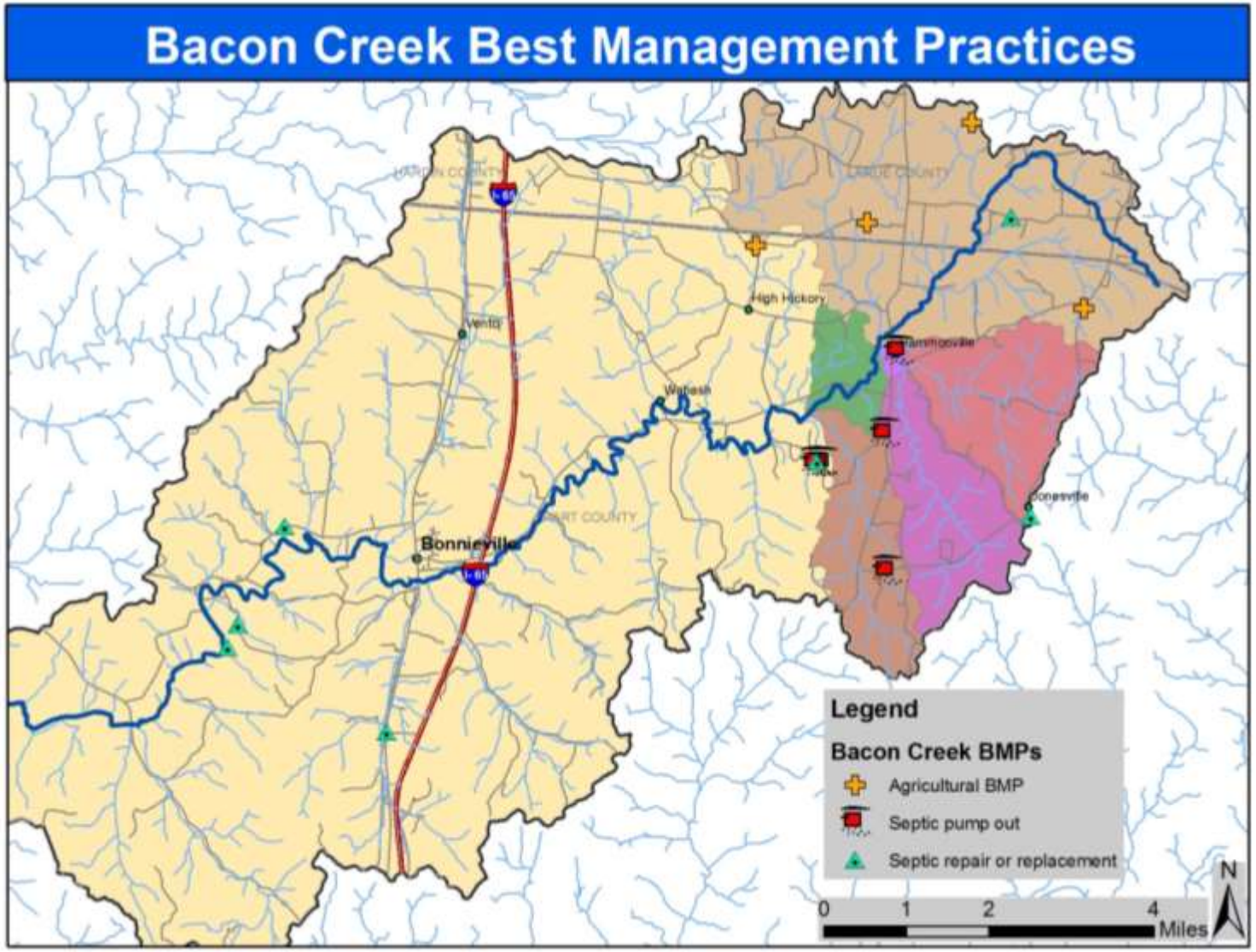


Figure 2: BMP locations in the project area. Some BMPs implemented were very close geographically and do not appear as separate icons on the map.

Septic BMPs

This project began with septic system pump outs in the Honey Run sub-watershed only. The program area was later extended to the whole watershed. Additional funding was obtained to add septic system repair or replacement to the program. Outreach materials were developed explaining how properly maintained septic systems are better for community health and safety and the water quality of Bacon Creek. A guest speaker from the Kentucky Onsite Wastewater Association addressed the Bacon Creek Watershed Council and community members at the start of the project. She spoke of the importance in maintaining a septic system, including inspecting and pumping out the tank every three to five years. A project packet was developed including an application and a fact sheet on how septic systems work, maintenance requirements, and the impacts of bacteria on human health and the environment. Tank pump outs were offered at an 85% reduction in cost to homeowners. Local certified waste haulers charged $225 per tank which put the cost to homeowners at only $30. An agreement with Caveland Environmental Authority allowed certified sewage haulers to discard the pumped out waste at cost. Postcards were created and mailed to each resident of Honey Run advertising the program (see Figure 3).

Figure 3: Post card advertising the Bacon Creek Watershed Septic Tank Pump Out Program.

The pump out program got a slow start. Local health department officials believe that some area residents may have been apprehensive to have their septic system inspected fearing it would reveal larger issues. Residents did sign up, though, and interest in the program gradually

increased. The geographic boundary was expanded to encompass the entire watershed. In total, 13 septic tanks were pumped out.

The septic system repair or replacement program was funded with additional monies request by Kentucky Waterways Alliance. A need for complete septic system replacements throughout the watershed became evident as the project progressed. An application packet was created and sent to interested parties along with a basic fact sheet about septic systems. The application included a "Maintenance agreement" whereby the applicant agreed to adhere to the recommended inspection and pump out schedule of every three to five years.
This program was met with immediate interest. There were more applicants than project funding could accommodate. Ultimately, six systems were installed; each case was an example of genuine need and will provide a boon to the water quality of Bacon Creek (see Figures 4 and 5). Another system was inspected, but no repairs were needed. The upgrades were offered at an 80% - 20% cost share. The average cost of project was $6,205, and the average cost to homeowners was $1,240.

Figure 4: Local health department official at the site of a project septic system installation.

Figure 5: Participants in the septic system repair or replacement program with their new septic tank.

Agricultural BMPs

The Upper Bacon Creek sub-watershed was the target for agricultural BMPs. Initial program goals were to install four agricultural BMPs and promote Kentucky's Agricultural Water Quality Plan. The Agricultural Coordinator spent time talking with farmers about prospective BMPs, state cost-share funding, and water quality plans.

Four types of BMPs were implemented: two watering facilities, three heavy use area protections, over 10,000 feet of fencing on three different farms to keep livestock out of Bacon Creek and farm ponds, and one stream crossing. Five Agricultural Water Quality Plans were either updated or created.

- Watering Facility (NRCS code 614)

The watering facility, sometimes referred to as a cattle waterer, is a way to provide clean, reliable water for livestock. It is often used in conjunction with fencing as an alternative water source for livestock that have been restricted from ponds or creeks. For both of the program watering facilities, there was a corresponding water line extension (see Figures 6 -8).

Figure 6: Water line for watering facility being connected.

Figure 7: Watering facility installation.

Figure 8: Finished watering facility.

- Heavy Use Area Protection (NRCS code 561)

The intent of the heavy use area protection is to stabilize areas frequently and intensively used by people or animals. It establishes a stable surface with suitable materials and installs needed structures. Geotextile fabric is laid down then topped with sand and gravel to create a stable area (see Figure 9). A roof and support beams were added over this area to create a protected surface sheltered from rain (see Figure 10). Gathering cows in this spot to feed allows manure to be collected, composted onsite, and used later for fertilizer (see Figure 11). The stable surface can withstand animal traffic without becoming muddy. This improves water quality by reducing the amount of sediment and manure running off of farm fields during and after rain.

Figure 9: Application of geotextile fabric, sand, and gravel for heavy use area protection.

Figure 10: Construction of shelter for heavy use area protection.

Figure 11: Completed heavy use area protection with adjacent watering facility.

- Fencing (NRCS code 382)

Fencing provides a means to control the movement of animals and restrict them from certain areas. Fencing can be used for pasture management or to keep livestock from accessing creeks and ponds. Cattle movement in a creek causes soil erosion often leading to sedimentation, and manure increases bacteria levels. Livestock can have the same impacts on ponds. During a rain event, the pond can overflow, allowing sediment and manure to spill over and runoff to the creek. The fencing installed created a feeding area near a heavy use area protection with adjacent watering facility on one farm (see Figures 11 and 12), restricted cattle from all access to the creek and ponds on another farm (see Figure 13), and closed off the headwaters from cattle on a third farm. In total, over 10,000 feet of fencing was installed as part of this program.

Figure 11: Fence posts being installed.

Figure 12: All three BMPs in one spot: watering facility, heavy use protection area, and fencing.

Figure 13: Over 9,000 feet of fencing total was installed to restrict cattle from Bacon Creek.

- Stream Crossing (NRCS code 578)

A stream crossing is a stabilized area constructed across a stream to provide a travel way for people, equipment, or livestock. It keeps livestock and equipment from creating erosion problems in stream. This stream crossing was installed at the headwaters of Upper Bacon Creek and keeps cattle out of the water preventing soil erosion and bacterial contamination (see Figure 14).

Figure 14: Beginning of the stream crossing development on farm.

Figure 15: Completed stream crossing.

Farm Field Days

In conjunction with the agricultural BMPs implemented, there were two Farm Field Days held on participating farms. Both of these outreach events were successful, demonstrating to the public the conservation practices installed as well as the partnerships formed between farmers, local agencies, and the Bacon Creek Watershed Council (see Figure 15).

Figure 15: Farmer leading folks on a hayride tour of the BMPs he installed through the program.

In total, there were nine agricultural BMPs installed on four farms in the Upper Bacon Creek sub-watershed and many more farmers reached by clean water messages. There were other farmers who worked with the Agricultural Coordinator who did not complete the program. In total, five farmers completed or updated their Kentucky Agricultural Water Quality Plans and signed up for the Kentucky state cost-share program.

Conclusion

Improving the water quality in Bacon Creek is the responsibility of the entire watershed community. These completed BMPs will no doubt help mitigate pollution issues, but more work needs to be done. The farmers and homeowners who did participate in this project are to be commended for their hard work and willingness to get involved.

For both the septic system and agricultural BMP programs, one intangible outcome is the relationships formed with community members. For watershed planning to work, local citizens must be engaged. Trust is hard won in most places. Partnerships and cooperation with local health departments, conservation districts, and community groups are essential to long term success. The Agricultural Coordinator was instrumental in the participation of area farmers, and the Bacon Creek Watershed Council continues to serve as the foundation of the project.

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Appendix G: Project data

(see disc)