Kentucky Division of Water
300 Sower Blvd.
Frankfort, KY 40601
502-564-3410
Website: http://water.ky.gov/water quality/Pages/TMDLHealthReports.aspx

Pond Creek Watershed Health Report

This watershed health report is an educational tool to relay scientific information to a general audience; it does not represent, and should not replace, assessments for the Integrated Report (IR). For assessment specific information, please refer to the IR at http://water.ky.gov/waterquality/Pages/IntegratedReport.aspx

Published by the Kentucky Division of Water on October 31st, 2016

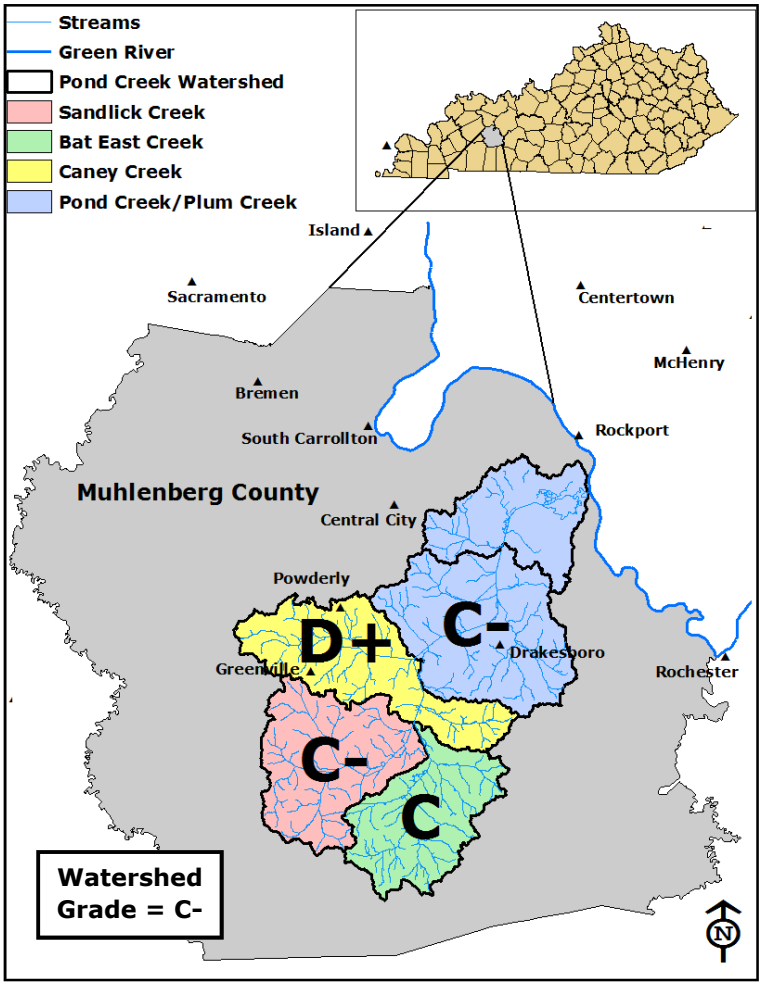
If you live in the Pond Creek Watershed and are interested in the health of your local waterway, now is the time to get involved. The Kentucky Division of Water (KDOW) has completed a study and found there are problems with pH, metals, bacteria (*E. coli*), sediment, and nutrients in the waterways of the Pond Creek watershed. The KDOW will be providing plans to help improve the watershed, but only your involvement will help! If you are interested in working with the KDOW in efforts to improve water quality in Pond Creek, please contact the Green River Basin Coordinator, Joanna Ashford, at Joanna.ashford@ky.gov or by calling 502-782-6880.

In the 1960s government officials started to realize how polluted streams, rivers, and lakes of the U.S. had become. In 1972, Congress passed laws, known as the **Clean Water Act** (CWA), to protect surface waters. The goal of the CWA is for all waters in the U.S. to be safe for swimming, fishing, and drinking (called **designated uses**). KDOW is the state agency responsible for carrying out the requirements of the Clean Water Act to reach this goal.

KDOW has developed this health report to inform the residents of Muhlenberg county of efforts to examine the health of the Pond Creek Watershed. We all affect the cleanliness of water, known as **water quality**, because we all live in a watershed. A **watershed** is an area of land where runoff flows to a common stream. Many small streams, such as Sandlick Creek, Bat East Creek, and Caney Creek, flow into Pond Creek to form the Pond Creek watershed (see map on right).

Upon initial evaluation, it was determined that many stream segments within the Pond Creek Watershed do not support the **uses** required by the Clean Water Act. The U.S. Environmental Protection Agency (EPA) requires that states conduct watershed studies on all such waters to calculate the maximum amount of pollutant a creek can receive and still support a healthy watershed. This amount is known as a **Total Maximum Daily Load**, or TMDL.

In 2011 and 2013-2014, KDOW biologists conducted a study in Pond Creek watershed to gather scientific information. Based on this information, KDOW has given a "report card grade" of C- to the entire Pond Creek Watershed. This health report 1) describes the indicators of water quality and biological health that went into assigning the grades, 2) demonstrates what the strengths and weaknesses are at each site and on a watershed scale, and 3) provides information on how water quality and biological health can be improved.



Pond Creek Watershed Overall Grade: C-

pH	B
Specific Conductivity	C+
Nutrient Enrichment	C+
Metals	C
E. coli	D+
Sediment	C
Total Habitat	D
Macroinvertebrates	C
Riparian Zone	D
Available Cover	D+

Impaired Waters

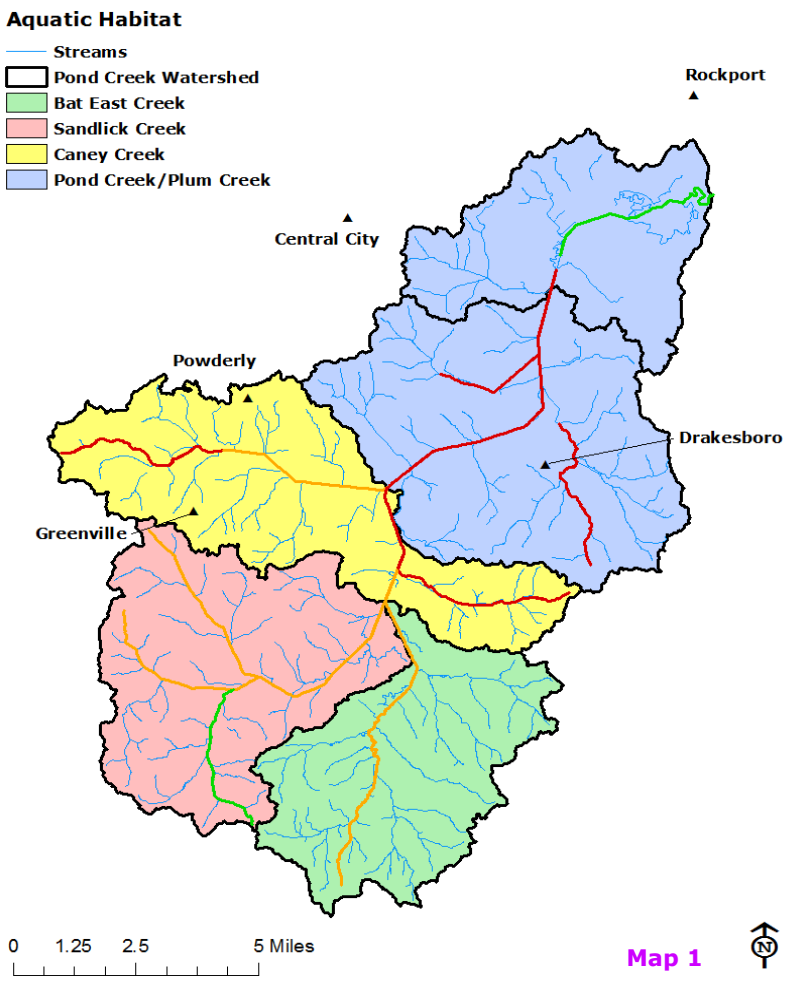
Designated Uses for the Pond Creek Watershed are **Warm Water Aquatic Habitat (WAH) (map 1), Primary Contact Recreation (PCR) (map 2),** and **Secondary Contact Recreation (SCR)** (not pictured). Between 1998 and 2006, various programs within the KDOW, and outside agencies such as Murray State University, visited parts of Pond Creek and some of its tributaries. From these initial site visits, it was determined that much of Pond Creek and some of its tributaries were impaired for a variety of pollutants, including specific conductivity, sedimentation/siltation, sulfates, and chloride, which impairs WAH, and pH, which impairs both WAH and PCR. Segments that have been assessed are highlighted in **1) green** if the water quality is good and the use is supported, **2) orange** if the water quality is fair and the use is only partially supported, and **3) red** if the water quality is poor and the use is not supported. If a segment is **blue**, its uses have not yet been assessed.

To be impaired for WAH, the fish and aquatic bug communities have reduced numbers or types. To be impaired for PCR, bacteria concentrations exceeded the level considered safe for swimming at least 20 percent of the time from May through October. To be impaired for SCR, the pH of a waterway is below 6 or above 9 more than 10% of the time, and is therefore not considered safe to recreate upon, which includes activities such as canoeing, kayaking, and wading. If a waterway is impaired for SCR due to pH, then it is impaired for PCR due to pH as well.

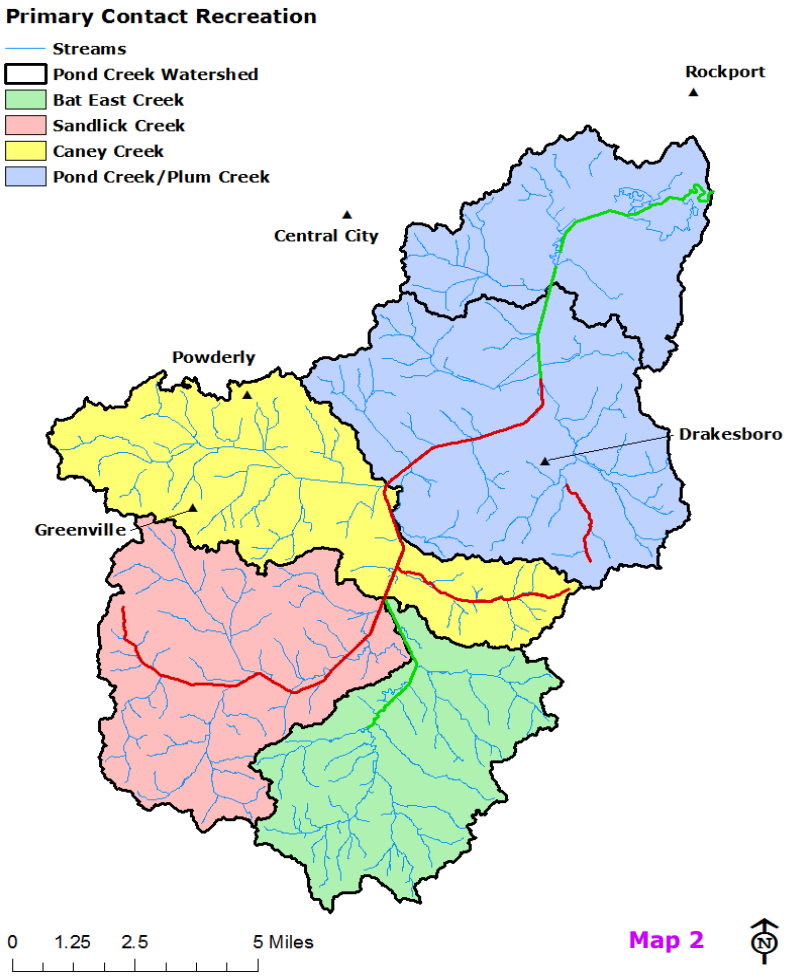
These impairments caused Pond Creek and most of its tributaries to be studied in 2011, 2013, and 2014 to determine the extent of these impairments throughout the watershed at large. Streams that had not been assessed were studied to determine if impairments were present, and streams that had been previously assessed were reassessed for confirmation.

The most recent study has been finalized and the results indicate that much of the watershed is impaired due to specific conductivity, pH, metals, bacteria (*E. coli*), sediment, and nutrients; these impairments will be included in the 2016 Integrated Report to Congress. As required by the Clean Water Act, a TMDL report for each waterbody is being written for metals, pH, and bacteria as a result of these studies, which will be made available to the public with the goal of improving water quality. TMDLs for other pollutants are required to be developed in the future.

This watershed health report, which has a report card style, explains the results of our study, and informs the public about the water quality in the Pond Creek watershed.



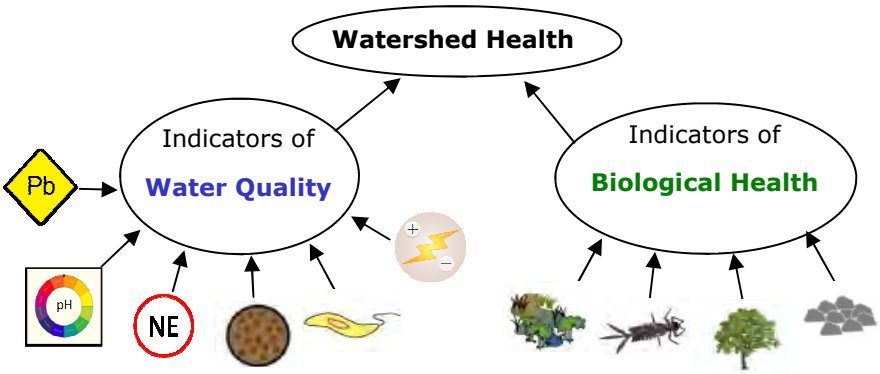
Map 1



Map 2

How was Pond Creek Graded?

1. Much like a school report card, information was collected during our study about different "subjects" related to the health of Pond Creek. These subjects were separated into two groups that are used as indicators of water health (**water quality**) and stream life (**biological health**). Each indicator and its icon are explained below.
2. The information collected for each indicator was compared to health and science requirements or DOW scientific information. Each indicator received a grade, A through F, based on how well it met the requirements.



3. The grades for each water health indicator were combined to get a **Water Quality** grade.
4. The grades for each stream life indicator were combined to get a **Biological Health** grade.
5. The Water Quality grade and Biological Health grade were then combined to get the **Overall Watershed Health** grade for Pond Creek.

For more specific information about the grading process, please visit
http://water.ky.gov/waterquality/TMDL%20Health%20Reports/Health_Report_Grade_Explanation.pdf

Water Quality

pH: An expression of the basic or acidic condition of a liquid; it may range from 0 to 14, where 0 is the most acidic, 14 is the most basic, and 7 is neutral. Natural, healthy waters have a pH between 6 and 9. Contact with high and low pH water can cause skin and eye irritation.

Specific Conductivity: A measure of the ability of water to conduct an electrical current, which is used for approximating the total dissolved solids (TDS) content of water. Low specific conductivity is desired.

Nutrient Enrichment: Although natural sources of nutrients exist, human activity is a major source of nutrient pollution, including municipal sewage treatment plants, industrial outflows, failing septic systems, commercial fertilizers, and animal waste.

***E. coli*:** A type of bacteria that lives in the intestinal tract of humans and other warm-blooded animals. The higher the amount of bacteria in the water, the higher the chance of getting sick when recreating in that water. To receive an A or a B, the water quality standard, which seeks to protect human health, must be achieved.

Metals: Metals are present in water as ions and can occur naturally or from pollution. Metals that occur naturally result from rock, soil, and minerals coming into contact with water. Metals that result from pollution enter the stream from waste water facilities, industrial activities, mining, or runoff that absorbs metals from the landscape as it travels to the stream. Excess metals are toxic to many aquatic animals, make the water unsafe for drinking, and increase treatment costs.

Sediment: Soil, sand and minerals washed from land or stream banks into water, usually after rain. Sediment can be suspended in the water column, making the water turbid, or it can deposit on the stream bottom when water flow slows.

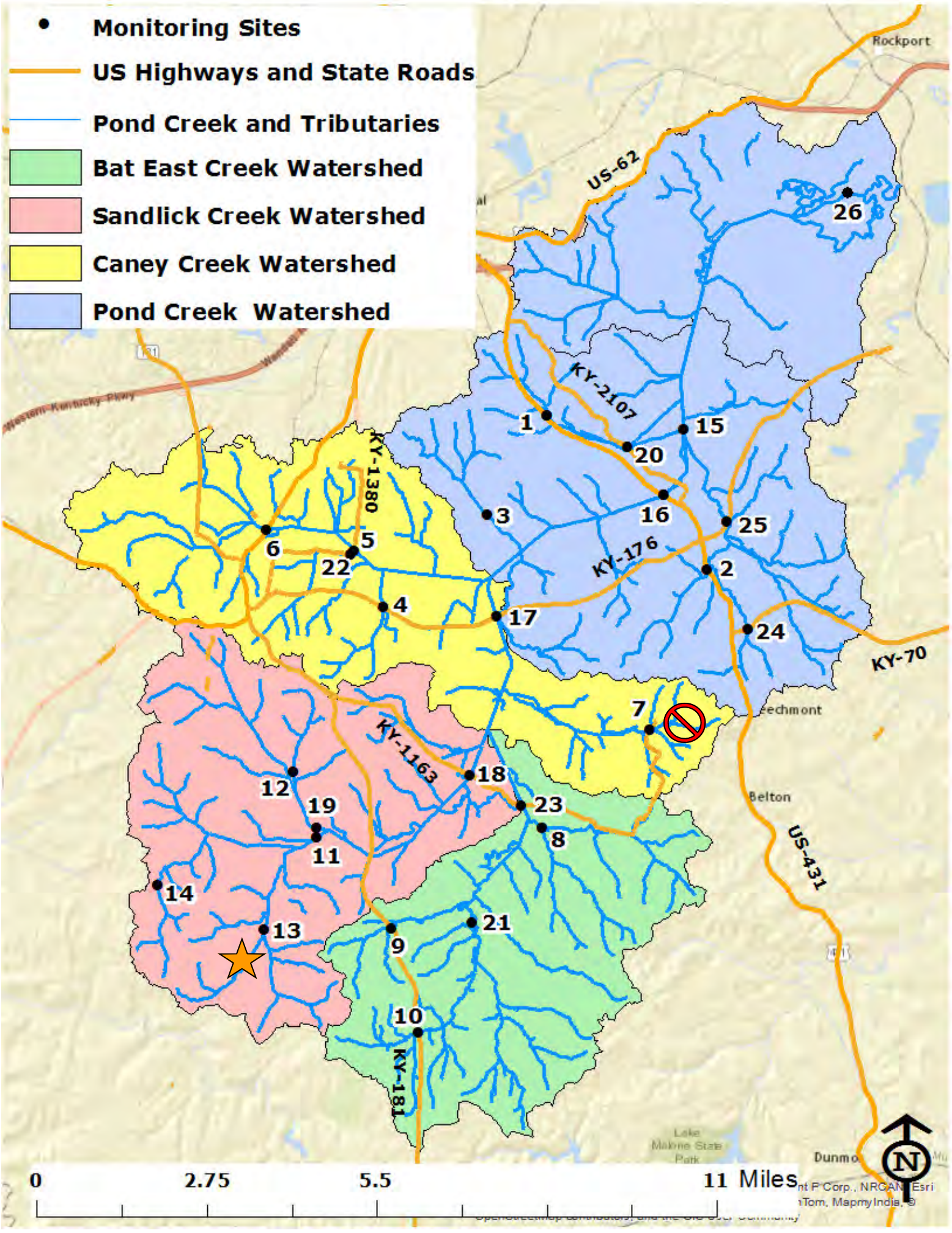
Biological Health

Total Habitat: Stream habitat is assessed by scoring 10 habitat signs, which are both living and nonliving parts of the surroundings that support an organism, population or community.

Aquatic Macroinvertebrates (bugs): An animal without a backbone, large enough to be seen with the naked eye. They are often the immature forms of insects that live on land as adults and are an important food source for fish. Different species prefer different habitats, and some are more tolerant of pollution than others.

Riparian Zone: Land adjacent to a stream that has distinct soil types and plant communities, which aid in absorbing water and shading the stream. An ideal riparian zone is at least 18 yards wide on each side of the stream.

Available Cover: The quantity and variety of structures in the creek that provide fish and bugs a place to hide, feed, reproduce and raise young. Examples include cobble and boulders, fallen trees, logs, branches, root mats, undercut banks, and aquatic vegetation.


Monitoring Sites
US Highways and State Roads
Pond Creek and Tributaries
Bat East Creek Watershed
Sandlick Creek Watershed
Caney Creek Watershed
Pond Creek Watershed
Rockport
US-62
KY-2107
KY-1380
KY-176
KY-1163
KY-70
US-431
KY-181
Belton
Lake Malone State Park
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
0
2.75
5.5
11 Miles
N

Grades by Site and Indicator

Creek Name	pH	+ −	NE	Pb							Site Grade
Caney Creek (22)	A	C	D+	D	D	C+	C	D	D	D	C-
UT to Caney Creek (4)	A	B	C	D	F	C+	D	D	D	F	D+
UT to Caney Creek (5)	A	C+	C+	D	C	D	C	D	F	C	C-
Caney Creek (6)	B	C	C	F	D	-	-	-	-	-	D+
Beech Creek (7)	F	C-	B	F	B	F	F	D	D	D	D
Pond Creek (17)	C	D+	C+	A	A	-	-	-	-	-	B
UT to Pond Creek (1)	C	C	C+	D	F	D	D	D	C	D	D+
UT to Plum Creek (2)	F	C	B+	F	B	-	-	-	-	-	C-
Pond Creek (15)	B	D+	C+	F	C	-	-	-	-	-	C
UT to Pond Creek (3)	A	D+	C-	D	B	-	-	-	-	-	C+
Pond Creek (16)	B	D+	C	F	C	C+	C	D	D	A	C
UT to Pond Creek (20)	B	D+	C	D	B	-	-	-	-	-	C
Plum Creek (24)	C	C	C-	F	F	-	-	-	-	-	D
Plum Creek (25)	B	D	C	D	D	-	-	-	-	-	C-
Pond Creek (26)	A	D+	C	D	B	-	-	-	-	-	B-
Bat East Creek (23)	B	B+	C-	F	F	-	-	-	-	-	D
Bat East Creek (21)	B	B+	C	B	C	C+	B	D	D	C	C
UT to Bat East Creek (8)	A	B+	B	B	F	D-	C	F	F	F	D+
Carters Creek (9)	B	A	B+	B	C	B+	D	C	A	F	C+
UT to Bat East Creek (10)	A	B+	B	A	D	C	B	D	A	F	C+
Sandlick Creek (19)	A	C+	C+	C	D	-	-	-	-	-	C+
Pond Creek (18)	A	B	C-	D	D	-	-	-	-	-	C
Pond Creek (11)	A	B-	C	B	D	-	-	-	-	-	B-
Opossum Run (12)	A	B	C+	A	D	C+	C	D	F	F	C
Saltlick Creek (13)	A	B+	C+	B	D	-	-	-	-	-	B-
Boggess Creek (14)	A	B	B-	A	F	C-	C	D	D	F	C-
Sign Grade	**B**	**C+**	**C+**	**C**	**D+**	**C**	**C**	**D**	**D+**	**D**	

Best in Show: Saltlick Creek, site 13, had the highest overall grade of a B-. All "subjects" received an A or B, except for *E. coli*, which received a D, and nutrient enrichment, which received a C+. It is suspected that this site would have a lower overall grade if biological indicators had been collected, and a reduction in the bacteria and nutrient inputs at this site would benefit the stream overall.

Worst in show: Beech Creek, site 7, had the lowest overall grade of a D. Except for nutrients and *E. coli*, it received a C- or lower for all other "subjects" with F being the most common grade. We suspect that the water was so acidic (low pH = acidic water) that not even bacteria could survive. Human contact with water from this stream should be avoided.

Indicator by Indicator Discussion

Top of the Class

pH levels were suitable at most sites throughout the watershed, so it received a B overall. However, low pH was common at some sites throughout the watershed. At the sites where the pH received a B or C, use caution before wading in the stream. At the sites where the pH scored a D or F, it is not safe to wade in the stream due to the acidic conditions of the water.

The Average

Nutrients ranged from a B+ to a D+ throughout the watershed. Sources of excess nutrients include municipal sewage treatment plants, industrial outflows, failing septic systems, commercial fertilizers, and animal waste. Depending on the land use activities associated with a site within the Pond Creek watershed, any of these activities could be contributing to the increased nutrient levels.

Metal levels that were above the numeric water quality standard occurred frequently throughout the watershed. Cadmium, nickel, zinc, lead, copper, or iron were frequently observed to be elevated. Watersheds that have experienced mining can have elevated metals.

Specific conductivity levels were frequently elevated throughout the Pond Creek Watershed. Metals and other dissolved solids can contribute to these increased specific conductivity levels, which has been demonstrated to reduce the type and number of aquatic organisms living in the water.

Sediment, on average, scored a C, showing that sedimentation is often impacting the Pond Creek watershed. Land use activities such as mining, agriculture, and construction can expose sediment, which is then washed into the waterway during storm events, causing the water to become turbid. Eventually, the sediment settles onto the bottom of the creek, burying aquatic organisms and habitat. Controlling storm water runoff and maintaining riparian buffers along a stream bank can help minimize the erosion potential of a streambank.

Aquatic macroinvertebrates (bugs) received a C. Poor water quality and reduced habitat are negatively affecting the aquatic community throughout the Pond Creek watershed. At the sites with very poor water quality where the pH was low and the metals were high, bugs were often not collected due to safety concerns. If they had been collected, this score would most likely be much lower. Aquatic bugs can be thought of as the canary in the coal mine; when their populations decrease, it's a warning sign of water quality and habitat problems. They are sensitive to many factors, so when multiple factors are causing them stress, such as elevated nutrients, specific conductivity, and sedimentation, their numbers and types tend to decrease substantially.

Needs Improvement

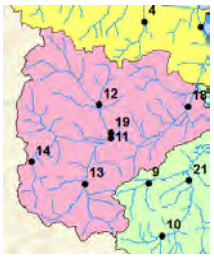
E. coli levels were above the standard considered safe for swimming 67 to 100% of the time if the grade was an F, 34 to 68% of the time if the grade was a D, 21 to 34% of the time if the grade was a C, 11 to 20% of the time if the grade was a B, and 0 to 10% of the time if the grade was an A. When *E. coli* levels are elevated there is an increased risk of gastrointestinal illness if the water is swallowed, or an infection if contact is made with an open sore or wound. Use caution when swimming or wading in Pond Creek and its tributaries, especially after rain events when the water is brown.

Available Cover scored a D+ on average. Available cover is reduced or removed from most sites throughout the watershed. Available cover comes in many varieties, including rocks, undercut banks, roots, wood, leaf packs, and vegetation. The more types of cover present in a stream, the more types of organisms that can occupy those spaces, which they need to hide, feed, reproduce, and raise young.

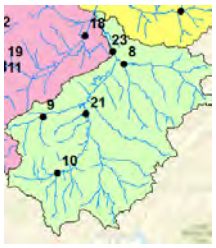
Total habitat scored a D, on average, and never scored higher than a C. This indicator of biological health is greatly reduced throughout the Pond Creek watershed. Total habitat is the building blocks for a healthy watershed, and when it is lacking, aspects of water quality and biological health begin to degrade.

Riparian Zone scored a D on average, and was almost entirely absent throughout the watershed. Most trees within the riparian zone and along the stream bank have been removed. Any remaining riparian zone should be protected and new riparian zones should be established. A shaded stream has cooler water temperatures and less sunlight to enhance algal growth, while trees and their roots help stabilize banks and provide important habitat for fish and bugs.

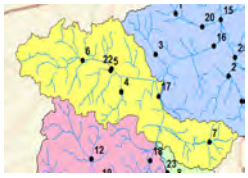
Watershed by Watershed Discussion



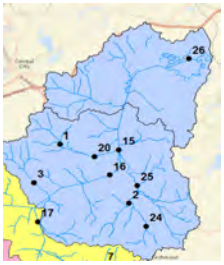
Sandlick Creek sub-watershed in the southwest portion of the Pond Creek Watershed is the most forested sub-watershed, while agricultural and mining activities are also present, which can be seen in the maps below. This sub-watershed was the only watershed that had all sites score in the A range for pH. Only 2 of the 6 sites had metals grades of a C or lower. It is not surprising that the best site, site 13, was located in this sub-watershed. However, all sites scored either a D or F for *E. coli*, so use caution swimming or wading when the water is muddy and brown, which is typical after a rain event.



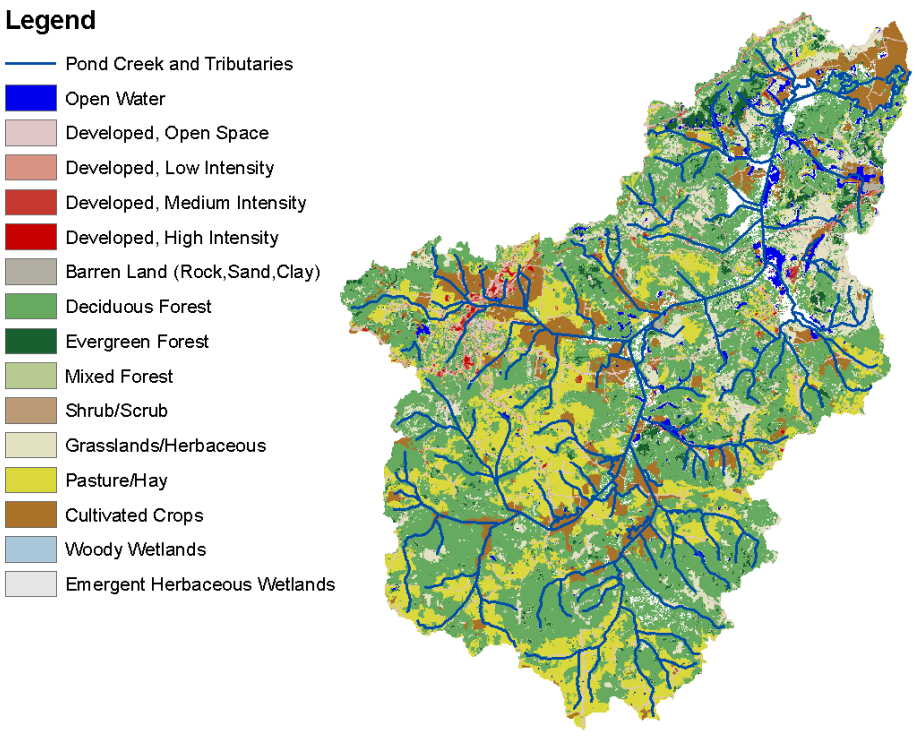
Bat East Creek sub-watershed in the southeast portion of the Pond Creek Watershed is the second most forested sub-watershed, but agricultural and mining activities are present, as can be seen in the maps below. This sub-watershed scored A's and B's for pH, and only had 1 site, site 23, that scored below a B for metals, however, it did score an F. Additionally, all sites scored a C, D, or F for *E. coli*, so use caution when swimming or wading when the water is muddy and brown, which is typical after a rain event.



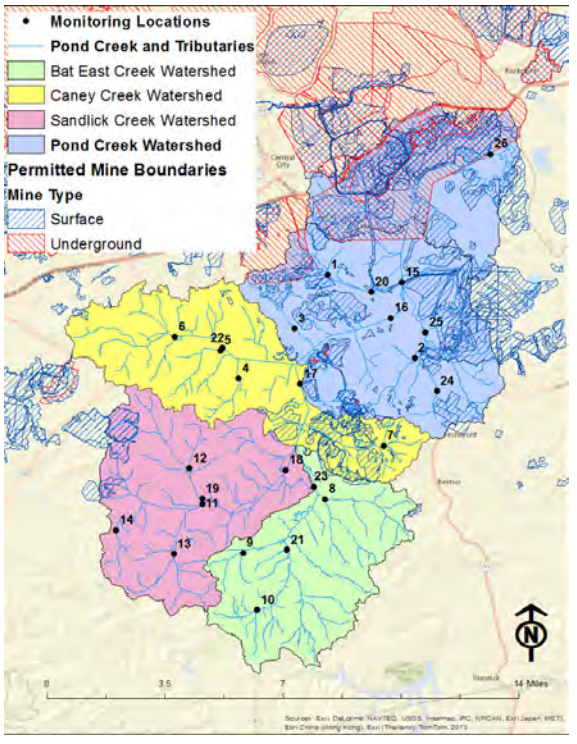
Caney Creek sub-watershed in the mid-portion of the Pond Creek Watershed is dominated by urban areas, agriculture, and some mining to the east, as can be seen in the maps below. This sub-watershed had two sites that scored below a B for pH, site 7, which scored an F, and site 17, which scored a C. Neither one of these sites should be considered safe for human contact due to the acidity of the water. Furthermore, this sub-watershed had 5 of the 6 sites score in the D or F range for metals, which can be toxic to aquatic animals. Lastly, 4 of the 6 sites scored a C or lower for *E. coli*, so use caution when swimming or wading when the water is muddy and brown, which is typical after a rain event.



Pond Creek sub-watershed, which is the lowest portion of the entire Pond Creek Watershed, is dominated by forest, agriculture, and mining, as can be seen in the maps below. This sub-watershed had three sites that scored below a B for pH, sites 1 and 24, which scored a C, and site 2, which scored an F. None of these sites should be considered safe for human contact due to the acidity of the water. Furthermore, all 9 sites in this sub-watershed had metals in the D or F range, which can be toxic to aquatic animals. Lastly, 5 of the 9 sites scored a C or lower for *E. coli*, so use caution when swimming or wading when the water is muddy and brown, which is typical after a rain event.



Land use of Pond Creek Watershed.



Location of mining activity in the Pond Creek Watershed.

Conclusions and Resources

Low pH and High Metals

- Active and historical mining is most often the cause of high metals, which often coincides with low pH and high specific conductivity waters. If you suspect acid mine drainage coming from your property, contact Jason Robinson or Ed Boone with Abandoned Mine Lands at 502-564-2141 to plug the drainage.

To keep water safe for swimming

- Remediate contaminants from mining activities.
- Maintain functional septic systems and replace failing septic systems.
- Properly dispose of pet waste.
- Reduce animal access to streamside grazing.
- Refer to the Division of Water's Swimming Advisory page for the most up to date information: http://water.ky.gov/waterquality/Pages/SwimmingAdvisories.aspx

To reduce sediment and/ or nutrient inputs

- Maintain streamside vegetation and give the stream a "buffer" from human activities.
- Plant cover crops.
- Install settling ponds.
- Reduce animal access to streamside grazing.
- Guard waterways during construction activities.
- Check the weather before applying fertilizers and pesticides to be sure they will be absorbed before it rains.

Available Resources

- KY's Department of Agriculture **free** farm chemical collections: http://www.kyagr.com/consumer/envsvs/technical/FarmChemicals.html
- KY's 319 Grant program: water.ky.gov/Funding/Pages/NonpointSource.aspx or contact James Roe at james.roe@ky.gov.
- Abandoned Mine Lands: http://aml.ky.gov/Pages/default.aspx or 502-564-2141
- Kentucky's Total Maximum Daily Load (TMDL) program: http://water.ky.gov/waterquality/Pages/TMDLProgram.aspx
- To stay informed, **LIKE** 'Kentucky Watershed Health Reports' on Facebook.
- Curious about the health of your local waterway? Check out Division of Water's ***new*** Water Health Portal at http://watermaps.ky.gov/

Kentucky Water Health Portal
Monitoring the health of the Commonwealth's water resources

What's Next?

The KDOW has written a draft bacteria, metals, and pH TMDL document for the Pond Creek Watershed and will release it for public comment before submitting it to the U.S. Environmental Protection Agency for approval. A TMDL is a great tool for any person or community interested in improving water quality in their area. The TMDL will outline which pollutants need to be reduced by how much, but community involvement is absolutely necessary to see on the ground results. Water quality can only improve if you help! Want to help? Contact the Green River Basin Coordinator, Joanna Ashford (Joanna.ashford@ky.gov). Within the decade, TMDL implementation and community efforts may help improve water quality and biological health of the Pond Creek Watershed.