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Frankfort, KY 40601
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Website: http://water.ky.gov/waterquality/Pages/TMDLHealthReports.aspx

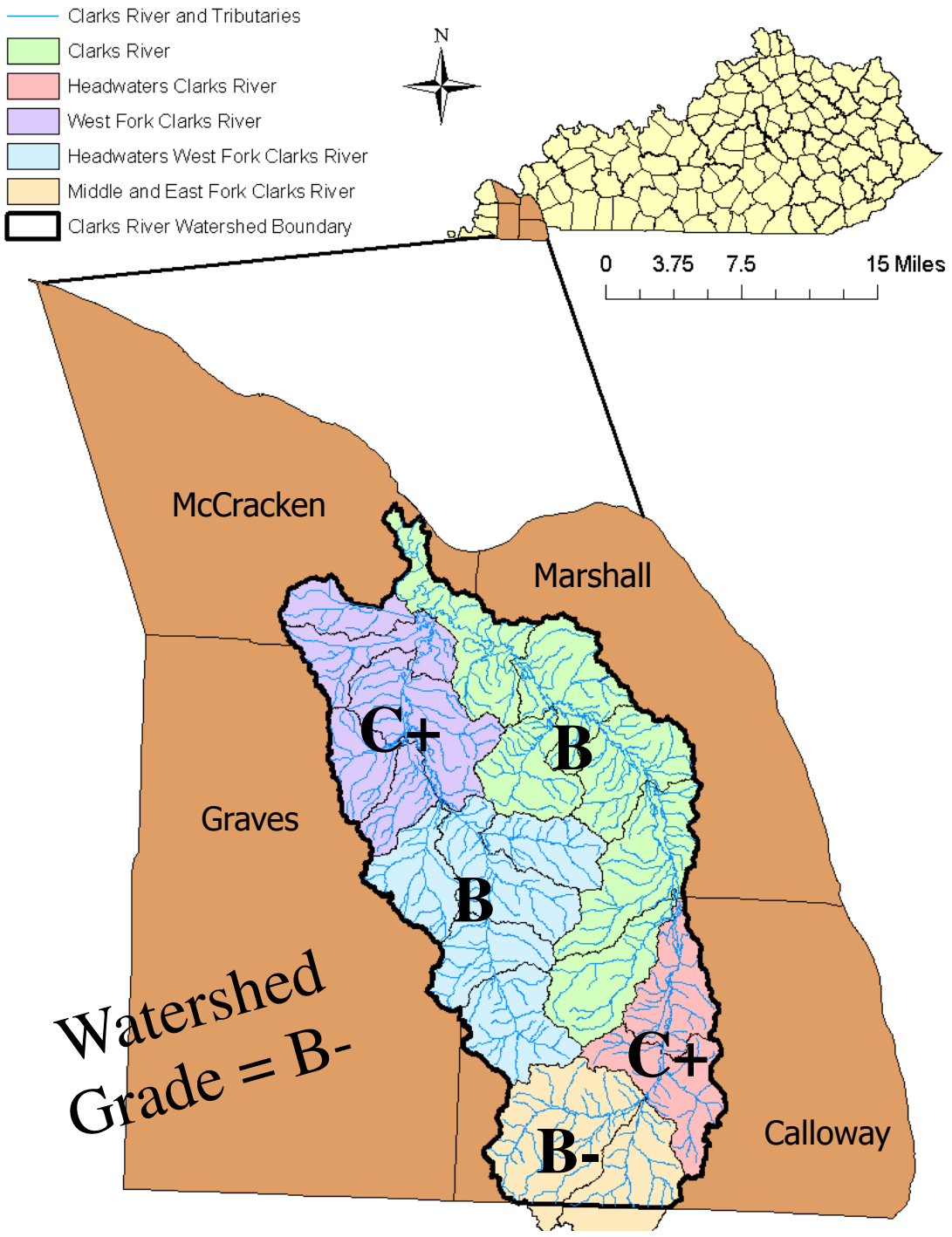
Clarks River Watershed Health Report

Department for Environmental Protection - Division of Water

The Kentucky Division of Water (DOW) is the state agency responsible for carrying out the requirements of the Clean Water Act to reach the goal of making all waters in Kentucky safe for swimming and fishing (called **designated uses**).

DOW has developed this health report to inform the residents of Graves, Calloway, McCracken and Marshall counties of efforts to examine the health of the Clarks River Watershed. A **watershed** is an area of land where runoff flows to a common stream. When streams come together, the two streams' watersheds combine to make a larger watershed. This report discusses the West Fork, Middle Fork and East Fork of Clarks River and Clarks River itself, all of which combine to form the Clarks River Watershed.

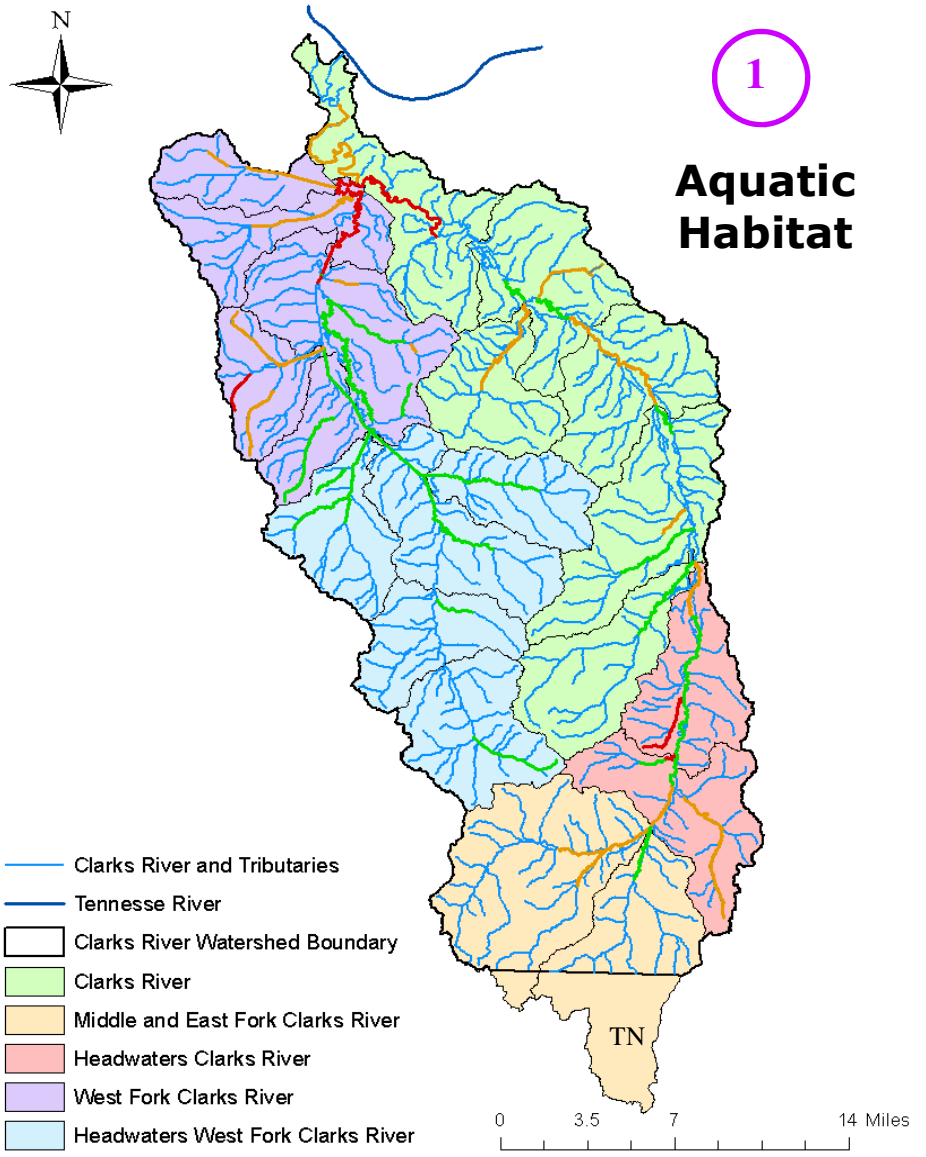
Upon initial evaluation it was determined that many stream segments within the Clarks River Watershed do not support the **uses** required by the Clean Water Act. The U.S. Environmental Protection Agency (EPA) requires that states conduct watershed studies on all such non-supporting waters to calculate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

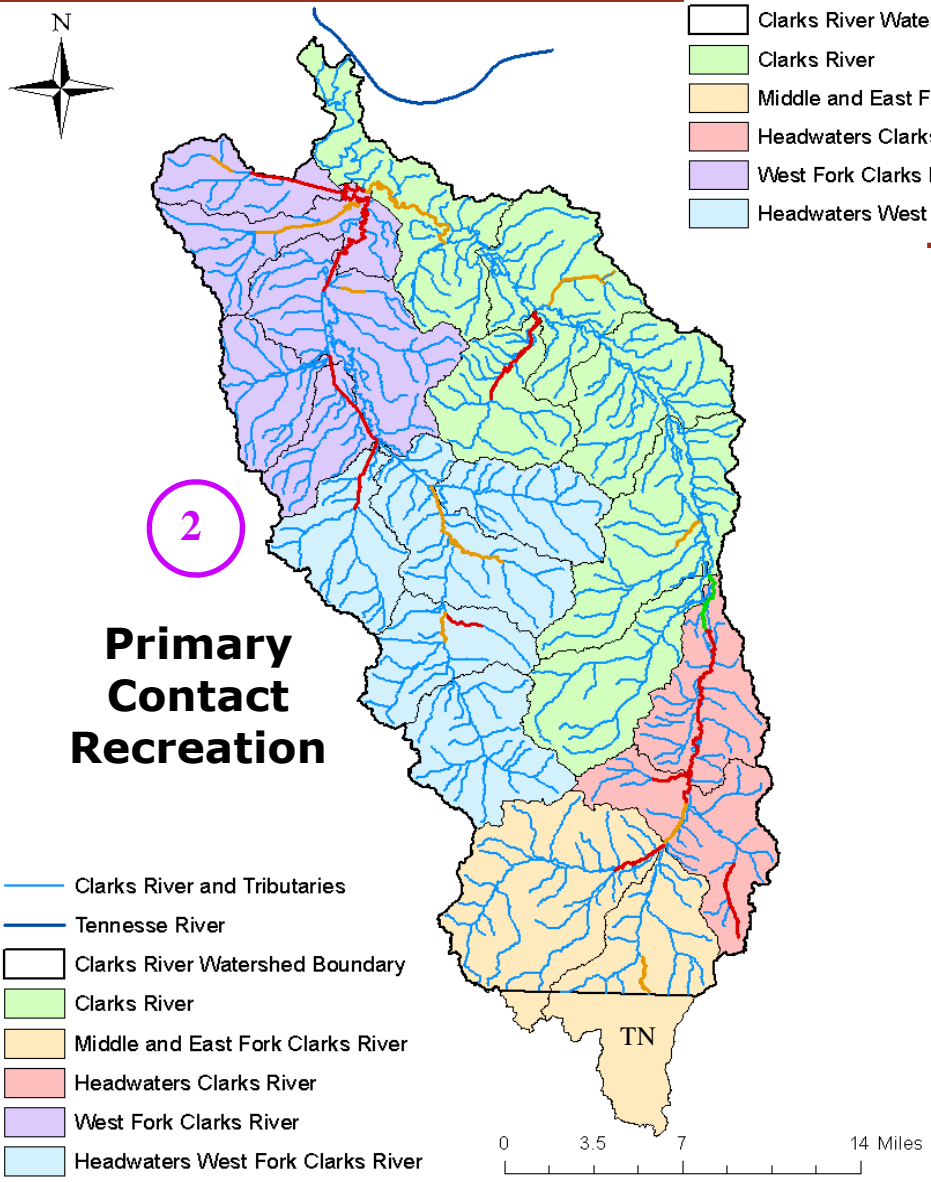


In 2005 and 2006, Murray State University and DOW biologists conducted studies on each of the watersheds shown in the map above to gather scientific information. Based on this information, DOW has given a "report card grade" of a **B-** to **Middle and East Fork Clarks River**, a **C+** to the **Headwaters of Clarks River,** a **B** to the **Headwaters** of **West Fork Clarks River** , a **C+** to **West Fork Clarks River**, a **B** to **Clarks River**, and a **B-** to the entire **Clarks River Watershed**. This health report explains where the impaired segments are located, describes the signs of health that went into assigning the grades for each watershed and provides information on how the grades can be improved.

Designated Uses for the Clarks River Watershed are **Aquatic Habitat (map 1) -** water quality promotes a healthy population of plants and animals that live in the water and **Primary Contact Recreation (map 2) -** water is safe for human swimming**.** In the maps on this page, 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.

Impaired waters are those that are highlighted in **orange** or **red** since the **designated use** is not fully supported. To be impaired for Aquatic Habitat, the fish and aquatic bug populations have reduced numbers or types. To be impaired for Primary Contact Recreation (PCR), bacteria concentrations exceeded the level considered safe for swimming at least 20 percent of the time from May through October.





When it is determined that a waterbody is impaired, the pollutant that is causing the impairment is identified. Impaired waters are required to have a **Total Maximum Daily Load** (TMDL) calculated for each pollutant identified. A TMDL calculation is the total amount of pollutant(s) a waterbody can receive and still meet its **designated use(s)**.

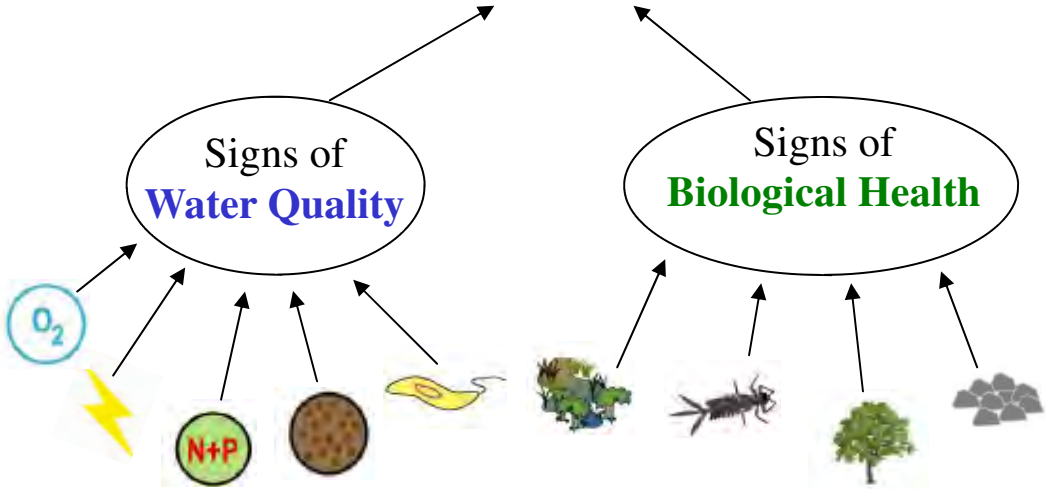
A watershed study is performed to collect the data required to calculate a TMDL. The watershed study focuses on collecting information that relates to water quality and biological health, which are described on the next page.

The Middle, East and West Forks, the Headwaters and the mainstem of Clarks River are listed as impaired for aquatic habitat and/or PCR and were therefore studied from 2005-06. An *E. coli* TMDL report was written as a result of the this study, which has been made available to the public with the goal of improving water quality. This health report shares all the results from that study to communicate the current status of the watershed to its community. The TMDL can be found at http://water.ky.gov/waterquality/Documents/ApprovedTMDL/Clarks%20River%20E.%20coli%20final-Sept2011.pdf

Grading System

1. Information collected was divided into signs of **water quality** or signs of **biological health**.
2. Each sign received a grade, A through F, according to the results of our study, which were compared to health and science requirements and DOW scientific information.
3. The grades from each biological health sign were averaged to achieve a biological health score.
4. Similarly, each sign of water quality was averaged to achieve a water quality score.
5. These two scores were averaged to achieve a **watershed health grade.**

Watershed Health



The grades can also be used to compare **sites** or **signs**. For example, one site within a watershed may receive a higher grade than the other sites in that watershed, demonstrating its quality. Or, one sign may receive a higher grade than the other signs, demonstrating that aspect of watershed health is doing well.

Signs of Water Quality

Dissolved Oxygen (DO): Concentration of oxygen dissolved in water and readily available to fish and other aquatic organisms.

Specific Conductivity: A measure of the ability of water to conduct an electrical current, which is used for approximating the total dissolved solids content of water. Low specific conductivity is desired, and increasing specific conductivity negatively impacts fish and aquatic bugs.

Nitrogen and Phosphorus (Nutrients): Although natural sources of nutrients exist, human activity is a major source of nutrient pollution, including municipal sewage treatment plants, industrial outflows, commercial fertilizers and animal waste.

***E. coli*:** A type of bacteria that lives in the intestinal tract of humans and other warm-blooded animals. To receive an A, and therefore not be impaired for Primary Contact Recreation (PCR), the *E. coli* concentrations were above the level considered safe for swimming 0—20% of the time. Grades B through F indicate an impairment for PCR. If the grade was a B, C, D or F the *E. coli* levels were above the standard 20—40%, 40—60%, 60—80% or 80—100% of the time, respectively. Elevated concentrations indicate an increased risk of gastrointestinal illness if the water is swallowed or infection if contact is made with an open sore or wound.

Turbidity: A cloudy condition in water due to suspended silt or organic matter. As turbidity increases, fish and aquatic bugs experience stress and altered behavior.

Signs of 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: A component of total habitat that is defined by the land adjacent to a stream that has distinct soil types and plant communities, which aid in absorbing water and shading the stream. To receive an A, the riparian zone must be at least 18 yards wide on each side of the stream.

Available Cover: A component of total habitat, which looks at 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.

Middle and East Forks of Clarks River

Site #	Creek Name	O_2		N+P							Site Grade
1	Middle Fork	B	A	D+	D	B					**C+**
2	Farley Branch	B	A	C-	C	B+	C	D	D	D	**C**
3	Middle Fork	B	A	D+	B	B	C	D	C	C	**C+**
4	East Fork	B	A		A	A-					**A-**
5	East Fork	B	A	C	A	A	A	D	C	B	**B**
6	Middle Fork	B	A	C	A	A	B	D	D	B	**B-**
	Sign Grade	**B**	**A**	**C-**	**B**	**B+**	**B-**	**D**	**C-**	**C+**	

Positives

DO levels were almost always suitable for aquatic fish and bugs throughout the Middle and East Forks Clarks River Watershed.

Specific conductivity received an A at every site, indicating low dissolved solids throughout the Middle and East Forks of Clarks River.

Turbidity levels were low a majority of the time throughout the Middle and East Forks Watershed. A few spikes that occurred after storm events caused the overall grade to shift from an A to a high B.

At sites 5 and 6 where turbidity received As and nutrient levels were not as elevated, the bug populations were good to fair. However, at sites 2 and 3 where turbidity received Bs and the nutrient levels were high, the bug populations were poor. Overall, the bugs scored a B-, demonstrating their sensitivity to local water quality.

Gray Area

Sites 4, 5 and 6 received A's, meaning the *E. coli* concentrations were below the level considered safe for swimming 80% of the time or more. Therefore, East Fork Clarks River and the lower part of Middle Fork Clarks River are not impaired for Primary Contact Recreation. However, sites 1, 2 and 3 exceeded the level considered safe for swimming between 20 and 80% of the time. Therefore, the upper part of Middle Fork Clarks River and Farley Branch are impaired for Primary Contact Recreation.

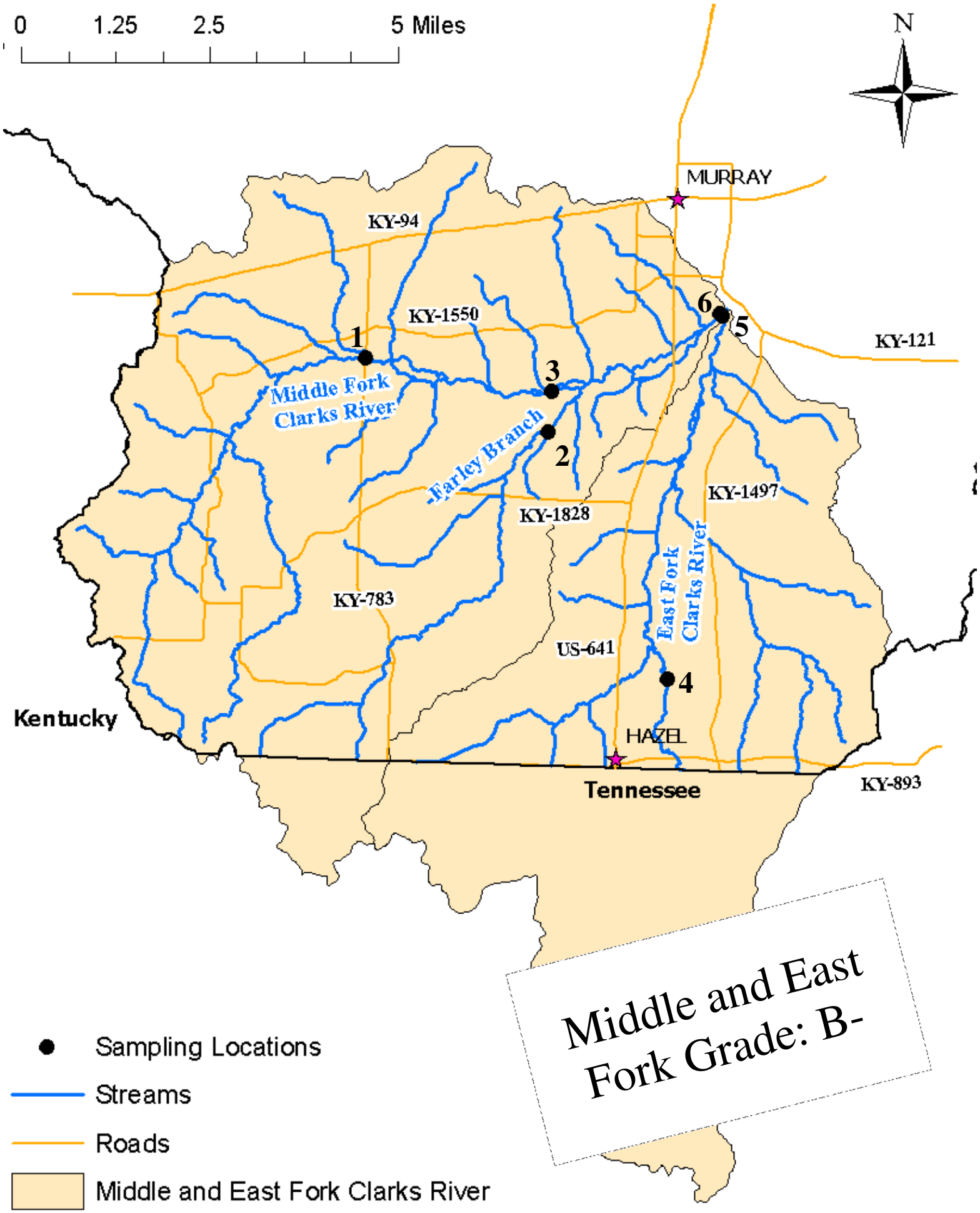
For the most part, nitrogen and phosphorous levels were reasonable but rose following rain events due to pollution entering the stream with runoff or failing septic systems.

Available cover received 2 Cs and 2 Ds in the Middle and East Fork Watershed, demonstrating that available cover is beginning to degrade for fish and aquatic bugs. Available cover is especially important because it provides habitat for beneficial bacteria, which are eaten by the bugs that are then eaten by the fish.

The width of the riparian zone varied greatly throughout the watershed. Riparian zones are important for filtering runoff, stream shading and bank stability, and when trees are cut and banks are cleared, these benefits are reduced or eliminated.

Negatives

Total habitat was reduced throughout the Middle and East Forks of Clarks River Watershed. Total habitat is the base of the building blocks for a healthy watershed, and when it is lacking, aspects of water quality and biological health begin to degrade.


0
1.25
2.5
5 Miles
N
MURRAY
KY-94
KY-1550
KY-121
KY-1497
KY-1828
KY-783
US-641
KY-893
1
2
3
4
5
6
Middle Fork Clarks River
Farley Branch
East Fork Clarks River
Kentucky
Tennessee
HAZEL
Sampling Locations
Streams
Roads
Middle and East Fork Clarks River
Clarks River Watershed Boundary
Middle and East Fork Grade: B-

Headwaters West Fork Clarks River

Site #	Creek Name	O_2		N+P							Site Grade
1	West Fork	A-	A		C	A					B+
2	West Fork	A-	A		D	A					B
3	West Fork	B+	A		B	A					B+
4	Guier Branch	B	A		A	A					A
5	Damon Creek	C-	A		D	B					C+
6	Damon Creek	B	A		F	B					B-
7	West Fork	B+	A		C	A					B
8	Duncan Creek	B	A		C	A-					B
9	West Fork	B+	A		B	A	A	D	B	D	B
10	Panther Creek	A	A		C	A	B	C	B	D	B
	Sign Grade	B	A		C	A-	A-	C-	B	D	

Positives

O_2 DO levels were almost always suitable for fish and aquatic bugs throughout the Headwaters West Fork Clarks River Watershed.

Specific conductivity received an A at every site, indicating low dissolved solids throughout the Headwaters of the West Fork of Clarks River.

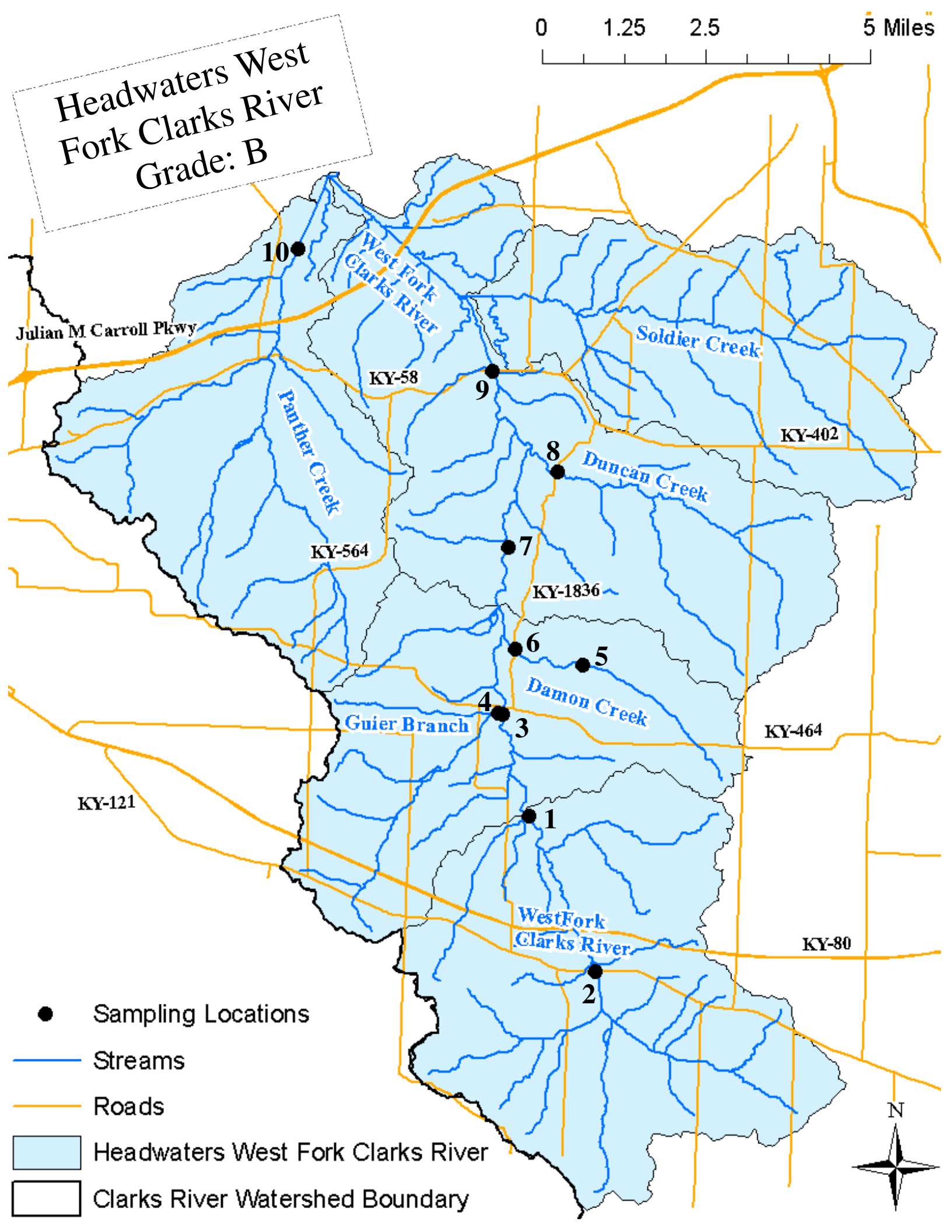
Turbidity levels were low a majority of the time throughout the Headwaters of West Fork, with every site receiving an A except for the 2 sites on Damon Creek (sites 5 and 6).

Available cover received two Bs within the Headwaters of West Fork. Currently, the available cover is not degraded enough to have it score below a B, but the available cover that is present should be protected to ensure that this sign of biological health continues to score in the positive range.

As a result of oxygenated water, low specific conductivity and turbidity, and decent available cover, the bug populations were doing well at the 2 sites where they were collected. However, total habitat and the riparian zone are degraded, so to ensure the bugs remain in the positive category, available cover should be protected and total habitat and the riparian zone should be maintained or improved.

Gray Area

All sites within the Headwaters of West Fork Clarks River had *E. coli* levels that were elevated often enough to impair the streams for Primary Contact Recreation. The one exception is Guier Branch, which received an A and is therefore not impaired. On average, *E. coli* levels exceeded the standard considered safe for swimming 53% of the time.


Headwaters West Fork Clarks River Grade: B
0
1.25
2.5
5 Miles
10
West Fork Clarks River
Julian M Carroll Pkwy
KY-58
9
Soldier Creek
Panther Creek
KY-402
8
Duncan Creek
7
KY-564
KY-1836
6
5
Damon Creek
4
Guier Branch
3
KY-464
KY-121
1
WestFork Clarks River
KY-80
2
N
Sampling Locations
Streams
Roads
Headwaters West Fork Clarks River
Clarks River Watershed Boundary

Headwaters West Fork Clarks River (continued)

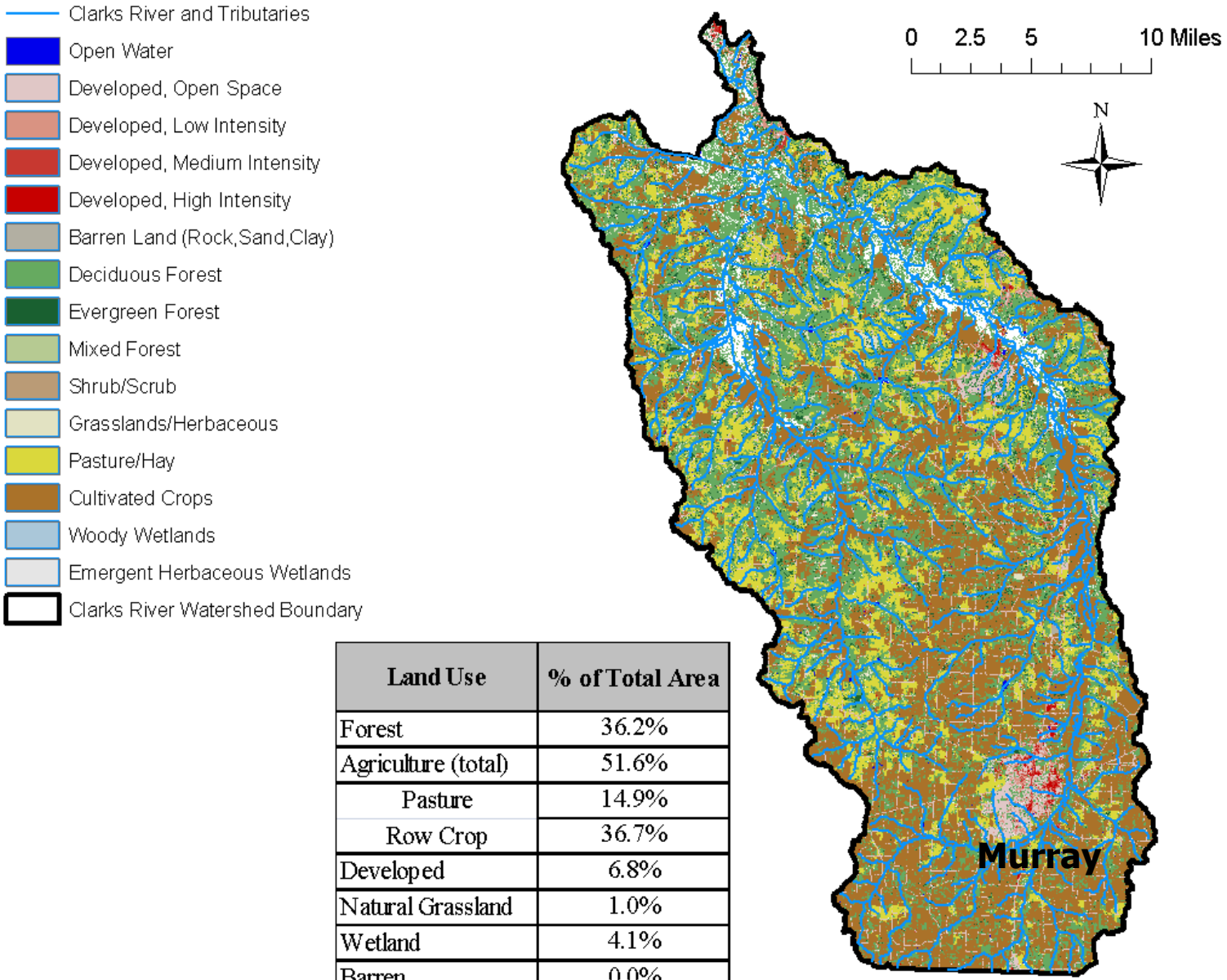
Gray Area (continued)

Total habitat received a C and a D in the Headwaters of West Fork Clarks River, demonstrating that habitat has been altered or removed from the watershed. Total habitat is the base of the building blocks for a healthy watershed, and when it is lacking, aspects of water quality and biological health begin to degrade.

Negatives

The 2 sites where the riparian zone was measured received Ds. Riparian zones are important for stream shading, bank stability, erosion control and filtering runoff before it enters the stream. As the riparian zone is narrowed or removed, these benefits are reduced or lost.

The map on this page represents the land use within the Clarks River Watershed. **Land use** is the best way to understand how humans may potentially pollute the watershed in which they live. Cities and towns tend to have more point sources due to the number of facilities required to clean the water used in households and businesses, and may also have an increase in nonpoint sources due to impervious surfaces such as roads, parking lots and sidewalks. Rural areas tend to have more nonpoint source pollution associated with agriculture. Loose soil, which is exposed when trees are cut down, animal waste, fertilizers and pesticides may enter the stream during rain events. What type of area do you live in and how does it affect water quality?



Land Use	% of Total Area
Forest	36.2%
Agriculture (total)	51.6%
Pasture	14.9%
Row Crop	36.7%
Developed	6.8%
Natural Grassland	1.0%
Wetland	4.1%
Barren	0.0%

West Fork Clarks River

Site #	Creek Name	O_2		N+P							Site Grade
1	West Fork	B+	A		B	B+	B	D	B	D	**B-**
2	Trace Creek	A	A	B-	B	B	C	A	A	A	**B+**
3	Spring Creek	B	A	C+	D	C	C	D	C	B	**C**
4	Turkey Creek	C+	A	B	D	A	C	C	C	C	**C+**
5	Spring Creek	B-	A	B-	B	A	C	D	D	B	**C+**
6	Haskell Branch	B	A	C	C	A	D	D	C	D	**C**
7	West Fork	D	A		B	C+	C				**C+**
	Sign Grade	**B-**	**A**	**B-**	**C+**	**B**	**C**	**C-**	**C+**	**C+**	

Positives

DO levels were suitable for fish and aquatic bugs throughout some of the West Fork Clarks River Watershed, but had reduced levels at sites 4 and 7. The watershed received a B– overall, keeping it in the positive range, but if DO levels are reduced further, this sign of water quality could negatively impact fish and aquatic bugs.

Specific conductivity received an A at every site, indicating low dissolved solids throughout the West Fork Clarks River Watershed.

Turbidity levels were low a majority of the time throughout the West Fork Clarks River Watershed. A few spikes that occurred after storm events at sites 1, 2, 3 and 7 caused the overall grade to shift from an A to a high B.

Most of the time, nitrogen and phosphorous levels were reasonable but rose following rain events due to pollution entering the stream with runoff or failing septic systems. This caused the average grade to shift from an A or B range to a B or C range. This sign of water quality should be monitored to ensure the nutrient levels do not continue to rise, and where Cs were scored, nutrients may need to be reduced.

Gray Area

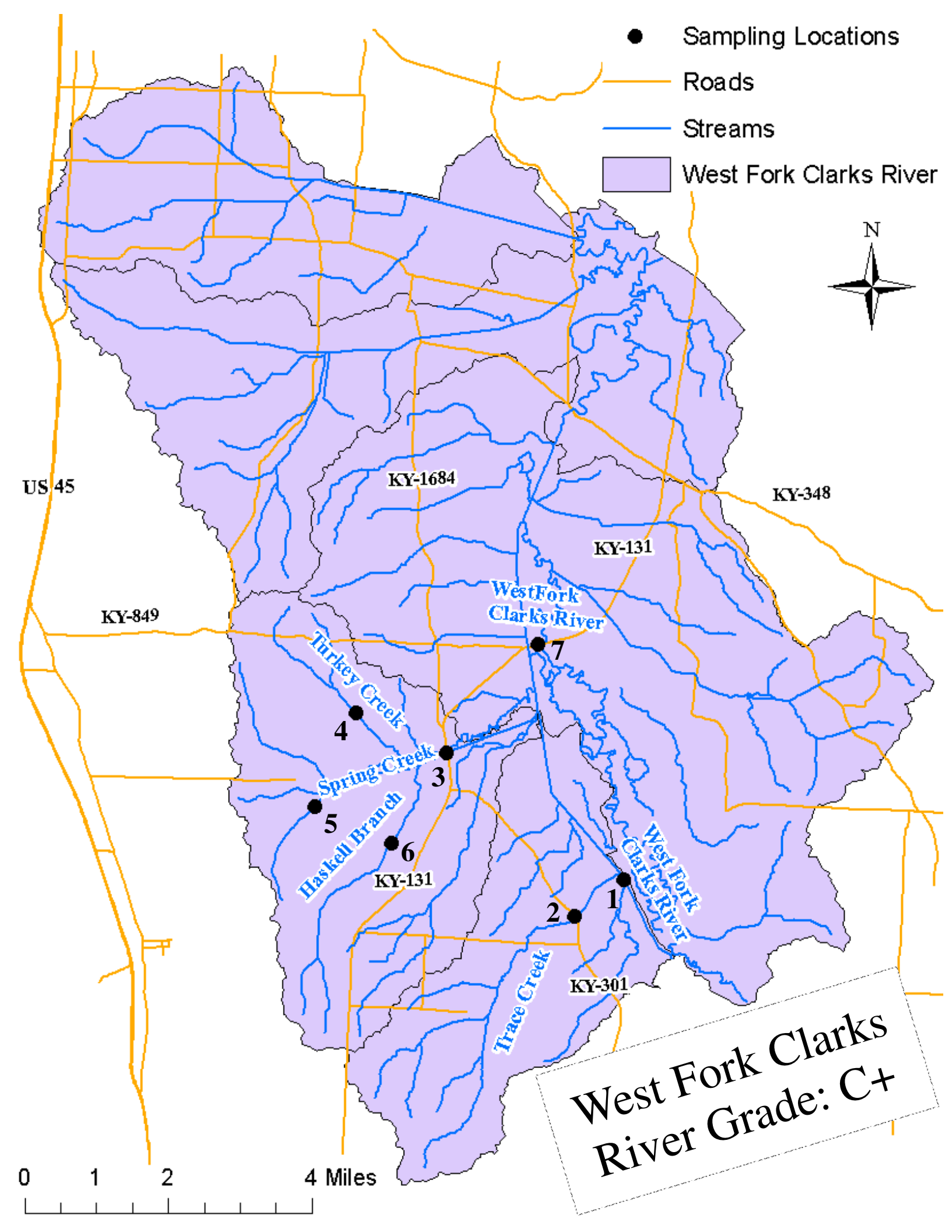
E. coli levels were above the standard considered safe for swimming often enough at every site to make the streams of West Fork Clarks River impaired for Primary Contact Recreation.

Habitat received Cs and Ds at all sites except at site 2, which received an A. Therefore, most areas in West Fork Clarks River have reduced or removed habitat. Trace Creek, which received an A, should be protected and is important to the overall health of the West Fork Clarks River Watershed.

Available cover ranged from an A to a D, with C being the most common grade in the West Fork Clarks River Watershed. These shifting grades demonstrate that available cover also shifts from good to poor throughout the watershed. Those areas that have good available cover should be protected from degradation.

Similarly, the riparian zone grades ranged from an A to a D, demonstrating that the riparian zone width shifts from wide to narrow throughout the watershed. As the width shifts, so do the benefits that are associated with riparian zones, such as stream shading, nutrient filtration and bank stability.

As a result of shifting habitat, available cover and riparian zone and elevated nutrient levels throughout the West Fork Clarks River Watershed, aquatic bug populations were reduced and considered fair throughout the watershed.


Sampling Locations
Roads
Streams
West Fork Clarks River
N
US 45
KY-1684
KY-348
KY-131
KY-849
WestFork Clarks River
Turkey Creek
Spring Creek
Haskell Branch
KY-131
West Fork Clarks River
Trace Creek
KY-301
1
2
3
4
5
6
7
0 1 2 4 Miles
West Fork Clarks River Grade: C+

Headwaters Clarks River

Site #	Creek Name	O_2		N+P							Site Grade
1	Clarks River	B	B+	D-	B	B-					**B-**
2	Clarks River	B	A	C	C	C+	D	C	B	C	**C+**
3	Tributary Clarks River	C	B	C	B	B	D	C	D	B	**C**
4	Bee Creek	B+	C+	F+	C	A-	F	D	D	D	**C-**
5	Bee Creek	B+	B	C+	D	A					**C+**
6	Clarks River	B+	A	C-	B	B+	C	D	C	C	**B**
7	Clarks River	B+	A	C	B	A-					**B**
8	Clayton Creek	B	A	C+	B	A					**B-**
9	Clayton Creek	B	A	D	D	A					**C-**
10	Clarks River							C	C	D	
	Sign Grade	**B**	**A-**	**C-**	**C+**	**B+**	**D**	**C-**	**C**	**C**	

Positives

O_2 DO levels were mostly suitable for fish and aquatic bugs throughout the Headwaters of Clarks River, with the exception of site 3, a tributary of Clarks River that received a C.

Specific conductivity levels were fairly good, with the exception of site 4, indicating reasonably low dissolved solids throughout the Headwaters of Clarks River.

Turbidity levels were low a majority of the time throughout the Headwaters of Clarks River. A few spikes that occurred after storm events caused the overall grade to shift from an A to a high B.

Gray Area

N+P Nitrogen and phosphorus levels were elevated throughout the watershed. These elevated levels were probably the accumulation of many sources such as fertilizers, animal waste or failing septics.

Available cover ranged from a B to a D in the Headwaters of Clarks River. These shifting grades demonstrate that available cover also shifts from fair to poor throughout the watershed. Those areas that have better available cover should be protected from further degradation.

The riparian zone ranged from a B to a D, demonstrating that the riparian zone width shifts from wide to narrow throughout the watershed. As the width shifts, so do the benefits that are associated with riparian zones, such as stream shading, nutrient filtration and bank stability.

Headwaters Clarks River (continued)

Gray Area (continued)

Total habitat received Cs and Ds in the Headwaters of Clarks River, demonstrating that habitat has been altered or removed from the watershed. Total habitat is the base of the building blocks for a healthy watershed, and when it is lacking, aspects of water quality and biological health begin to degrade.

E. coli levels were above the standard considered safe for swimming often enough at every site to make the headwater streams of Clarks River impaired for Primary Contact Recreation.

Negatives

As a result of shifting habitat, available cover and riparian zone and elevated levels of nutrients throughout the Headwaters of Clarks River, aquatic bug populations were reduced and considered poor throughout the watershed.

Habitat 101

- Compare the amount of instream material for aquatic bugs and fish to utilize for colonization, hiding and feeding.
- Compare the amount of food sources.

- Compare the amount of stream shading.
- Compare the number of stream bends, which slow water and reduce its energy, thereby reducing flood potential.

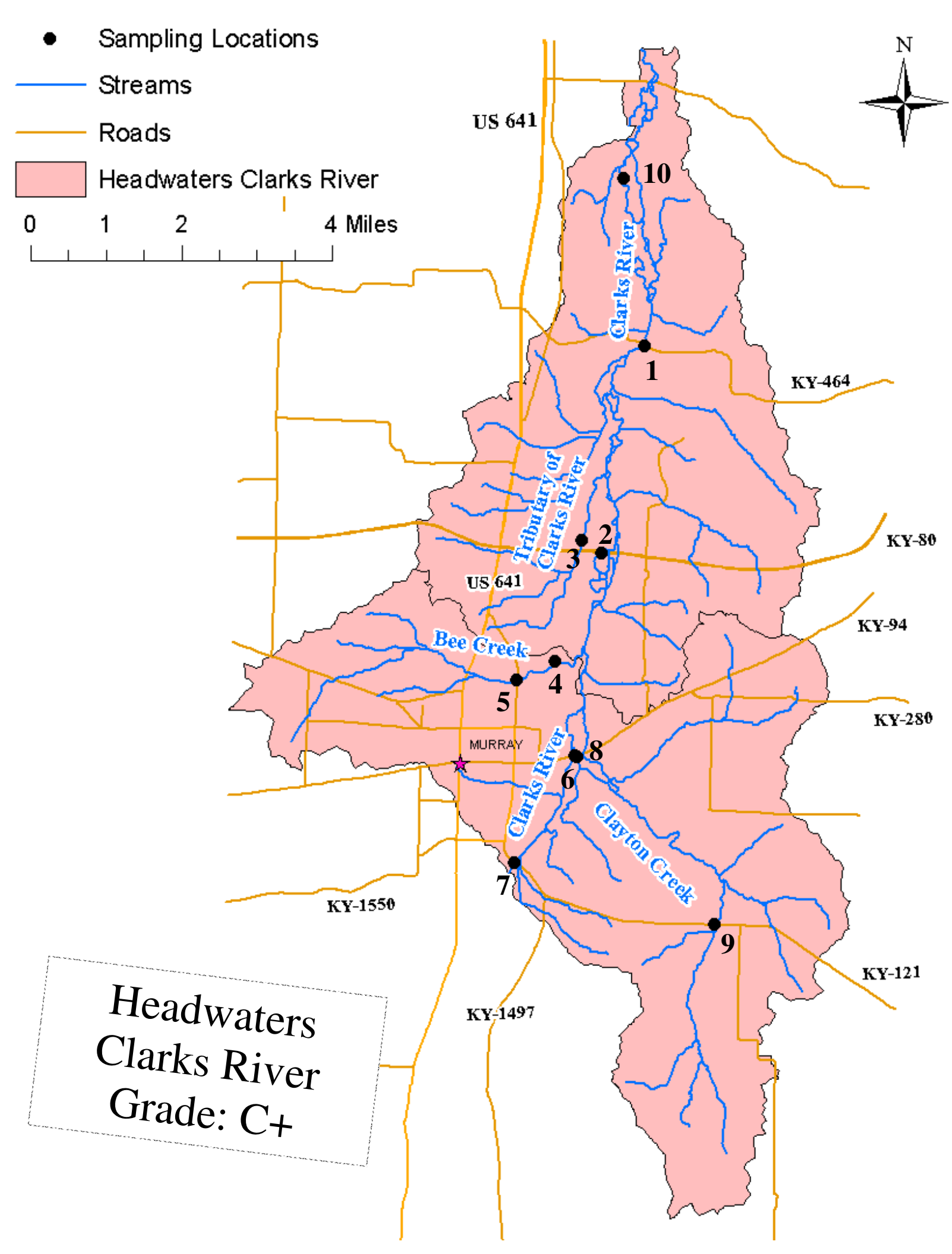
- Compare the stability of the banks.
- Compare the potential for sediment from the banks to erode when vegetative protection is lacking.

Photos from Barbour et al. 1999

Optimal Range	Poor Range
	
	
	

Farm Facts

- The **Agricultural Water Quality Act** seeks to protect ground and surface water from pollution that results from agricultural activities.
  - To learn more about the Act visit the Division of Conservation's website at http://conservation.ky.gov/Pages/AgricultureWaterQuality.aspx
- All landowners with 10 or more acres of agricultural activity should have a **Water Quality Plan**.
  - To create your plan, visit the KY Agricultural Water Quality Planning Tool at http://warehouse.ca.uky.edu/AWQP2000/index.html
- A list of **Best Management Practices** can be found at http://warehouse.ca.uky.edu/AWQP2000/allBMP.html
- KY's Department of Agriculture **free** farm chemical collections: http://www.kyagr.com/consumer/envsvs/technical/FarmChemicals.htm


Sampling Locations
Streams
Roads
Headwaters Clarks River
0 1 2 4 Miles
N
US 641
10
Clarks River
1
KY-464
Tributary of Clarks River
2
3
KY-80
US 641
KY-94
Bee Creek
4
5
KY-280
MURRAY
8
6
Clarks River
Clayton Creek
7
9
KY-121
KY-1550
KY-1497
Headwaters
Clarks River
Grade: C+

Clarks River

Site #	Creek Name	O_2		N+P							Site Grade
1	Chestnut Creek	C	B+		B	B					**B**
2	Tributary Chestnut Creek	B	B-		C	C					**C+**
3	Chestnut Creek	C+	A		D	D					**C**
4	Middle Fork Creek	C-	A		A	A					**B+**
5	Middle Fork Creek	B	A		B	B					**B**
6	Clarks River						B	B	C	B	**B**
7	Clarks River						A	A	A	B	**A**
	Sign Grade	**C+**	**A-**		**B-**	**B-**	**A-**	**A-**	**B**	**B**	

Positives

Specific conductivity was fairly good, indicating reasonably low dissolved solids throughout Clarks River.

At sites 1, 4 and 5 turbidity levels were low a majority of the time within the Clarks River Watershed. A few spikes occurred after storm events at sites 1 and 5 that caused the site grades to shift from an A to a B. At sites 2 and 3, turbidity levels were often elevated, pulling the overall grade down to a low B.

Habitat received an A and a B at the 2 sites where habitat was measured along Clarks River. These areas that have good habitat should be protected and are very important to the overall health of the Clarks River Watershed.

Available cover received an A and a C, and therefore scored a B on average. Although available cover averaged well enough to be placed in the positive category, the scores were inconsistent throughout the watershed. In some areas it was suitable, while in others it was degraded. Those areas that have good available cover should be protected.

The riparian zone scored two Bs. Although the riparian zone is not as wide as the ideal situation, it is not reduced as much along Clarks River as it is in other areas of the watershed. Therefore, the benefits associated with a wide riparian zone are most likely occurring to a greater extent.

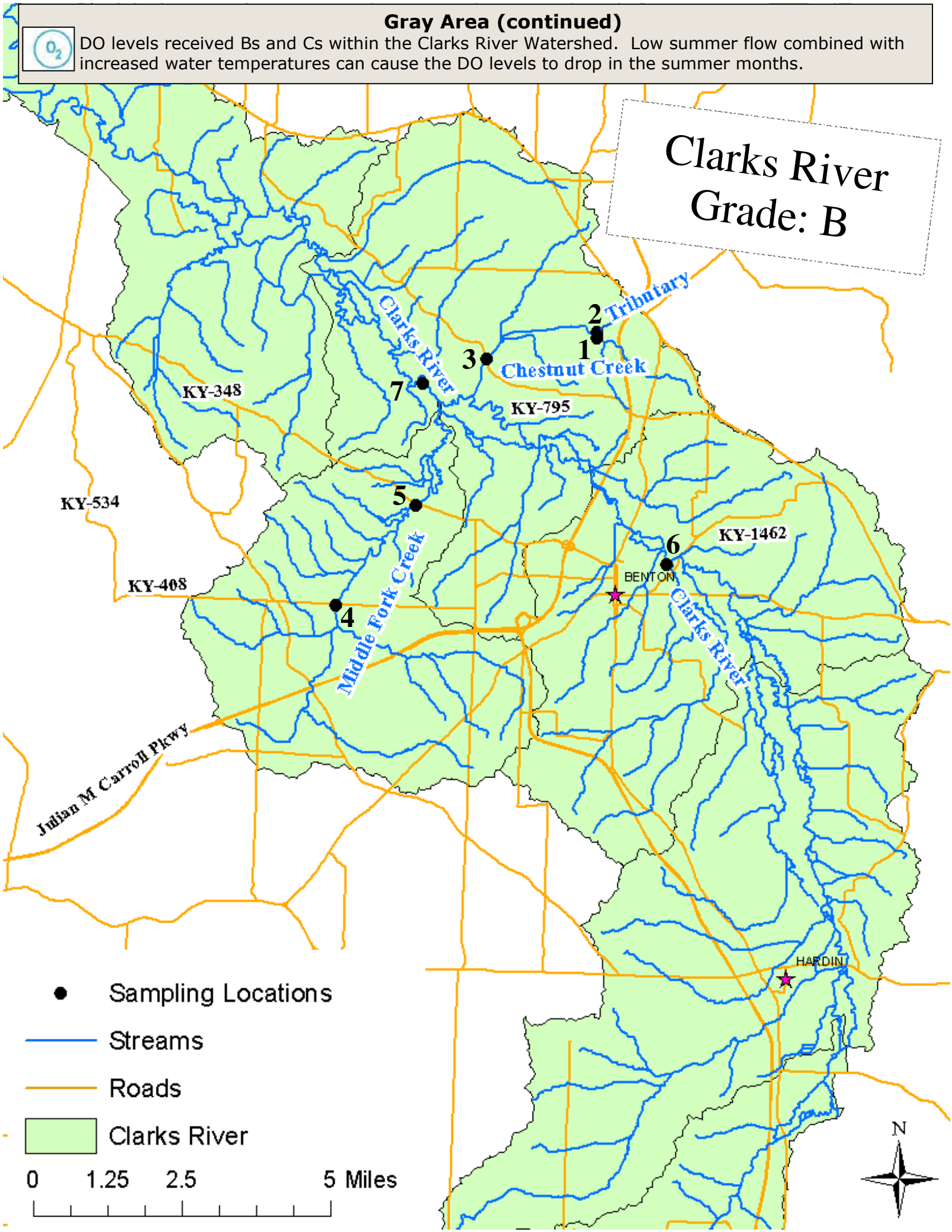
As a result of good habitat, available cover and shaded streams due to a wide riparian zone, the bug populations were found to be either good or fair along Clarks River.

Gray Area

Site 4 received an A, meaning the *E. coli* concentrations were below the level considered safe for swimming 80% of the time or more. Therefore, the upper section of Middle Fork Creek is not impaired for Primary Contact Recreation. However, sites 1, 2, 3 and 5 exceeded the level considered safe for swimming between 20 and 80% of the time. Therefore, the associated stream segments are impaired for Primary Contact Recreation.

Gray Area (continued)

DO levels received Bs and Cs within the Clarks River Watershed. Low summer flow combined with increased water temperatures can cause the DO levels to drop in the summer months.



Summary: Room for improvement, but some have more work to do than others

Best Site: Guier Branch, site 4 in the Headwaters of West Fork Clarks River, received an A for its signs of water quality, while Clarks River site 7 received an A for its signs of biological health. These sites are especially important for the overall health of Clarks River, as they are refuge for fish and aquatic bug populations.

Best Watershed: Headwaters West Fork Clarks River was the watershed that received the highest overall grade, with Clarks River coming in as a close second, both of which received Bs. Each of these watersheds had 5 signs of watershed health listed as positives. However, Headwaters West Fork Clarks River and Clarks River had the least amount of data collected, so it's important to note that these conclusions are based on less data than the other watersheds. If more data were collected, the scores have the potential to go either up or down.

Best Sign: Specific conductivity consistently scored As throughout the watershed and was the sign of health that scored the best within every subwatershed.

Worst Site: Bee Creek, site 4 in the Headwaters of Clarks River, received the lowest overall grade and scored a C-. All signs of health, with the exception of DO and turbidity, scored a C or lower. Part of this stream is located within Murray and may be impacted by the development that dominates its watershed's land use.

Worst Watershed: Headwaters Clarks River Watershed, which scored a C+ and had the fewest signs of watershed health listed as positives.

Worst Sign: Total habitat and nutrients were the 2 signs of watershed health that consistently scored the worst throughout the Clarks River Watershed. Inputs of nutrients to our waterways are increasing and steps should be taken to reduce these inputs from their many sources. Additionally, habitat has been removed from streams historically, and therefore the habitat that remains is especially important to protect.

What can you do?

- Make every effort to **protect the good** that remains. Work with local government and land owners to protect areas that are less degraded and improve land management to minimize further degradation.
- **Trees are the best way to protect and restore water quality and biological health.**
  - ◊ Leave in place or establish vegetation alongside streams to provide natural filters that stabilize stream banks, minimize erosion, regulate water flow, provide shade, retain sediment and absorb excess nutrients.
  - ◊ Plant trees and do not mow within 18 yards of the stream bank.
- **To keep water safe for swimming,** keep animals out of the streams, which will limit the amount of animal waste entering the waterways, reduce excess nutrients and protect habitat.
- **To improve habitat,** allow fallen trees, logs, leaves, gravel, cobble and boulders to remain in the stream to create habitat for fish and bugs to feed, find refuge and reproduce.
- **To reduce turbidity,** maintain streamside vegetation, plant cover crops, install settling ponds, reduce animal access to streamside grazing and guard waterways during construction activities.
- **To reduce nutrients**
  - ◊ Use chemicals and pesticides according to labels and fertilizers based on soil test results. Limit uses and store and dispose of properly.
  - ◊ Maintain functional septic systems and replace failing septic systems.
  - ◊ Reduce runoff by increasing pervious surfaces and by installing filter strips, rain barrels or rain gardens.
  - ◊ Properly dispose of pet waste.
  - ◊ Keep animals out of the stream.
- Keep grass clippings, petroleum products, trash, and litter out of storm drains; this material enters the stream directly without treatment.
- Service your vehicle regularly to prevent oil and antifreeze leaks and reduce noxious emissions.
- Become a certified citizen **volunteer** water quality monitor or establish a program in your local community or watershed.

Where to go for more information

Making changes at home and work
- Bluegrass PRIDE at www.bgpride.org/gallery1.htm

Volunteering
- Watershed Watch in Kentucky at water.ky.gov/wsw/Pages/default.aspx or contact Jo Ann Palmer at 800-928-0045 or JoAnn.Palmer@ky.gov

What are other watersheds doing?
- Hinkston Creek Watershed Protection Project at http://www.hinkstoncreek.org/index.html
- Strodes Creek Conservancy at http://www.strodescreek.org
- Friends of Stoner Creek at http://www.stonercreek.us/

Grants and Programs
- KY's Nonpoint Source (Runoff) Pollution program: water.ky.gov/nsp/Pages/default.aspx
- KY's Natural Resource Conservation Service: www.ky.nrcs.usda.gov/
- KY's 319 Grant program: water.ky.gov/Funding/Pages/NonpointSource.aspx or contact James Roe at 502-564-3410 or James.Roe@ky.gov

Purchasing or planting native trees and plants
- Division of Forestry: forestry.ky.gov/Pages/default.aspx
- Kentucky Native Plant Society: www.knps.org/plant_resources.html