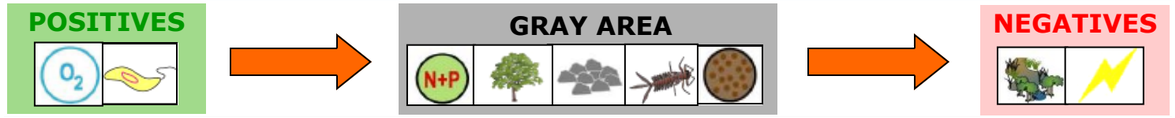
Summary: The middle ground dominates during a year of drought



By comparing the results of samples collected from a stream in a wet year (2011) to the results of the same set of samples collected in a dry year (2012), one can learn a lot about the watershed and the potential sources of pollution. Some indicators, such as habitat and riparian zone, are not affected by rainfall and change more slowly over time. So, it is not surprising that these scores were similar between the two years.

Water quality indicators, on the other hand, can change dramatically from year to year, especially when the amounts of rainfall are different. In 2011, when the weather was wet, the *E. coli* levels were high, but then in 2012, which was dry, most of the *E. coli* levels were low. This demonstrates that the source of *E. coli* in the Gunpowder Creek watershed is most often linked to runoff events when rain washes the bacteria present on the land into the streams.

Conversely, specific conductivity and nutrient levels were low in 2011 when the weather was wet, but were higher when the weather was dry in 2012. This demonstrates that the source of dissolved solids (measured by specific conductance) and nutrients is most often linked to sources that release water regardless of weather, but become diluted by rainfall. Additionally, dissolved oxygen (DO) was lower in 2012 when compared to 2011, which is not surprising since warm, stagnant water holds less oxygen than cold, moving water, and this can again be explained by the differences in rainfall between the two years.

Macroinvertebrate communities are sensitive to both habitat and water quality issues, which makes them such an important group of animals in the watershed. Their types and numbers can change from year to year in response to changes created by higher and lower amounts of rainfall. The macroinvertebrates scored a C in 2012, which was better than in 2011 when they scored a D. However, the 2011 macroinvertebrate samples were collected soon after a large rain event, and this may have affected their community makeup. Some types of macroinvertebrates recover more quickly than others, so some types may have been incorrectly represented. In 2012, the macroinvertebrate samples were collected in lower flow conditions and without a recent large rain event. This resulted in an improved score, but the continuing habitat and water quality issues prevented the macroinvertebrate community from achieving a better than average score. So, the score of C may or may not be representative of a true improvement in macroinvertebrates.

What can you do?

- **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 and other plants protect and restore water quality and biological health.**
  - ◊ Leave in place or establish trees and other vegetation along streams to provide natural filters that stabilize stream banks, minimize erosion, regulate water flow, provide shade, retain sediment, absorb excess nutrients, and provide habitat.
  - ◊ Don't mow to the edge of a stream. Leave a buffer of trees and other vegetation at least 18 yards wide along the stream bank.
  - ◊ Allow fallen trees, logs, leaves, gravel, cobble and boulders to remain in the stream to create habitat for fish and macroinvertebrates to feed, find refuge and reproduce.
  - ◊ Minimize streamside grazing by animals.
- **Reduce Total Suspended Solids (TSS)**
  - ◊ Maintain streamside vegetation.
  - ◊ Plant cover crops.
  - ◊ Install settling ponds.
  - ◊ Reduce animal access to streamside grazing.
  - ◊ Guard waterways during construction activities.
- **Education**
  - ◊ Check out some of the resources provided on the front page. Knowing how our daily actions affect water quality is half the battle to improve it.
- **To keep water safe for swimming**
  - ◊ Maintain functional septic systems and replace failing septic systems.
  - ◊ Pick up after your pets. Dispose of animal waste properly.
  - ◊ Keep animals out of the stream.
- **Other Tips**
  - ◊ Keep grass clippings and petroleum products out of storm drains. This material enters the stream directly without treatment.
  - ◊ Dispose of trash and recyclables properly.
  - ◊ Disconnect downspouts from storm sewers.
  - ◊ Install a rain garden to absorb storm water and reduce the amount of runoff from your property.
  - ◊ Consider using porous pavement for driveways and parking lots.
  - ◊ Have your soil tested and apply fertilizers according to the results of the soil test. Apply pesticides according to label directions. Check the weather before applying fertilizers and pesticides to be sure they will be absorbed before it rains!
- **Volunteer**
  - ◊ Become a certified citizen water quality monitor by joining Kentucky Watershed Watch. Contact 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
  - ◊ Organize a creek clean-up to remove litter along and within Gunpowder Creek.

Gunpowder Creek Watershed Health Report - Phase II

Gunpowder Watershed Initiative Steering Committee
Thursday, March 21, 2013

Gunpowder Creek Watershed Initiative

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For more information

Like "Kentucky Watershed Health Reports" on Facebook and check DOW webpage for watershed Health Reports at http://water.ky.gov/waterquality/Pages/ TMDLHealthReports.aspx

Water Quality Reports
http://water.ky.gov/waterquality/Pages/default.aspx

Or contact:
Kentucky Division of Water
Lajuanda Haight-Maybriar
Licking River Basin Coordinator
200 Fair Oaks Lane 4th Floor
Frankfort, KY 40601
502-564-3410 Ext. 4937

What other watersheds are doing:

- Hinkston Creek at http://www.hinkstoncreek.org/index.html
- Strodes Creek Conservancy at http://www.strodescreek.org
- Friends of Stoner Creek at http://www.stonercreek.us/

This work was funded in part by a grant from the U.S. Environmental Protection Agency under §319(h) of the Clean Water Act through the Kentucky Division of Water to the Boone County Conservation District (Grant # 09-10).

The Gunpowder Creek Watershed Initiative (GCWI) is developing a watershed plan for Gunpowder Creek and its tributary creeks. As a part of this process, samples are being collected to determine the health of these creeks and watersheds. In order to share the findings from these samples with residents and stakeholders of Boone County, GCWI has borrowed a "report card" approach from the Kentucky Division of Water's (KDOW) Total Maximum Daily Load Section. With assistance from KDOW, this approach processes the findings from the samples collected. A letter grade is calculated for different factors that influence the watersheds and affect the quality of the water in the creeks flowing in these watersheds. After grades have been calculated for the individual factors, these grades are combined and averaged to develop an overall grade for Gunpowder Creek Watershed.

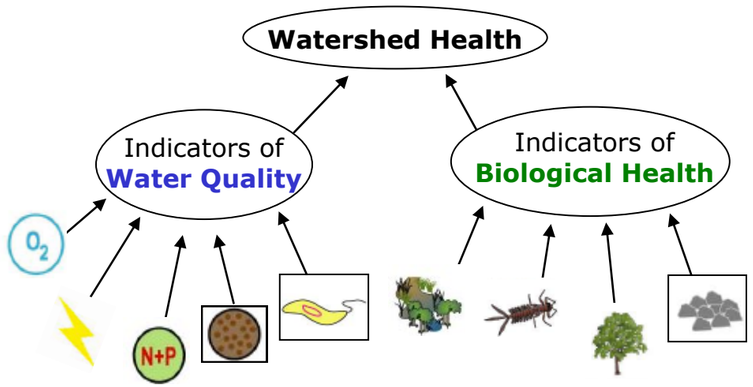
A **watershed** is an area of land where runoff flows to a common stream. When creeks come together, the two creeks' watersheds combine to make a larger watershed. Many small creeks, such as Fowlers Fork and Riddles Run, flow into Gunpowder Creek. Eventually, Gunpowder Creek flows into the Ohio River, and is therefore part of the Ohio River Watershed. A map of the watershed is included in this report card. As rainfall or water from melting snow and ice flows across the land and structures in the watershed, it picks up any pollution on the ground and carries it into creeks. This includes bacteria from humans and animals, fertilizers from homes, farms, and businesses, oils and chemicals from roads, parking lots, homes and farms, dirt from construction areas and farms, and heat from rooftops, roads, parking lots and other paved areas.

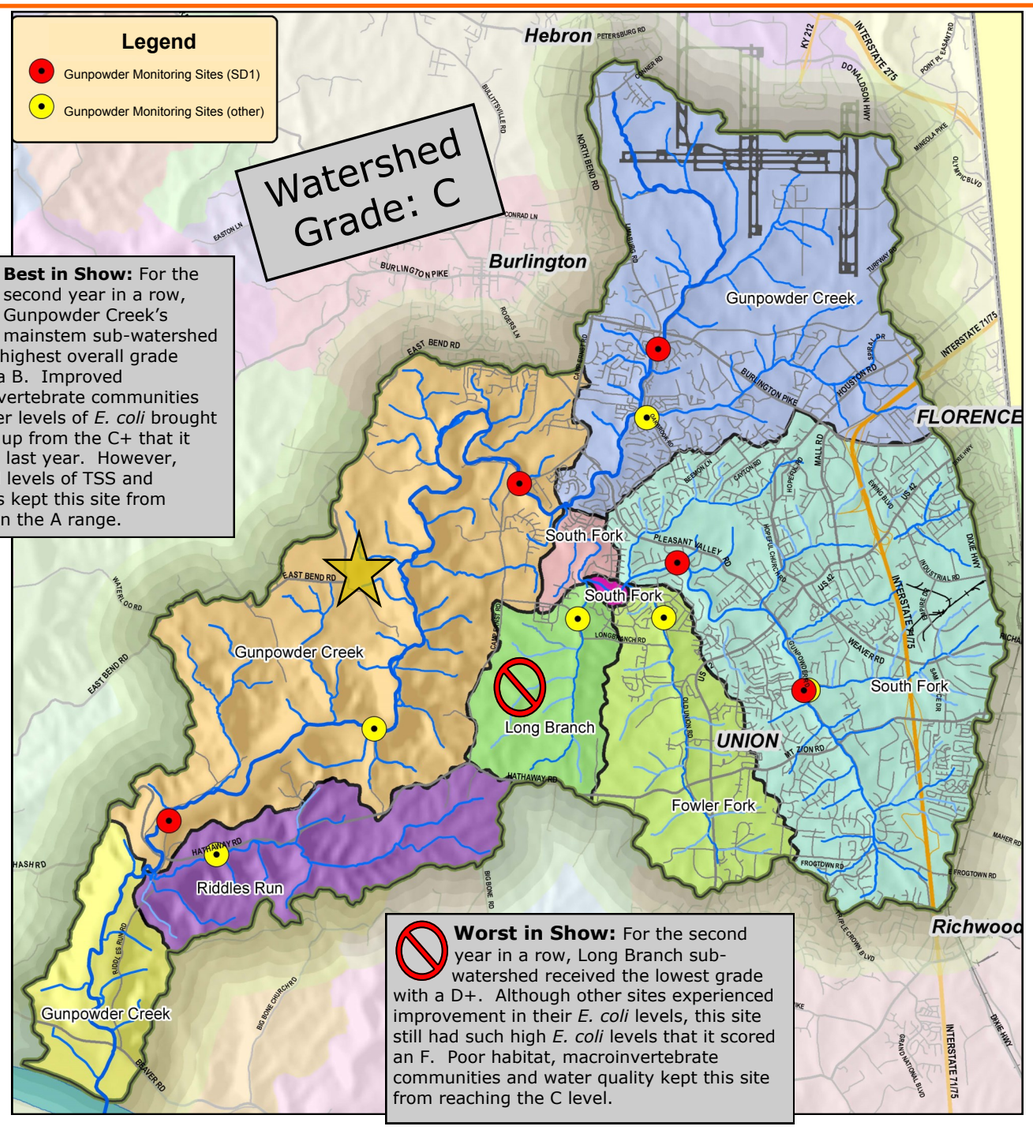
When areas of land are covered over with buildings, pavement, and other structures, we prevent the rain and snow melt from soaking into the ground, disrupting this natural cycle. This sends more water to creeks more quickly and causes more frequent and severe flooding. The increased frequency and strength of flooding in creeks cause erosion that adds smothering dirt to the system and cause stream banks to become unstable.

In 2011 and 2012 project staff and students from the Thomas More College Environmental Academy were trained and then conducted tests to gather scientific information. Based on this information, GCWI has calculated a 2012 "report card grade" of C for the Gunpowder Creek Watershed. This is higher than the C– that it received in 2011. Although the overall grade went up, some grades went down (dissolved oxygen and specific conductivity), some stayed the same (riparian zone and total habitat) and improvement was seen in certain indicators (macroinvertebrates and *E. coli*). This health report discusses some of the changes that were seen between 2011 and 2012. These two years were extreme in regard to rainfall, with 2011 being very wet and 2012 being very dry. These comparisons can help understand the potential sources of pollutants, ways to reduce them, and help those who live in the watershed understand how their actions affect the water in their streams.

How was Gunpowder Creek Graded?

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





Best in Show: For the second year in a row, Gunpowder Creek's mainstem sub-watershed had the highest overall grade scoring a B. Improved macroinvertebrate communities and lower levels of *E. coli* brought this site up from the C+ that it received last year. However, elevated levels of TSS and nutrients kept this site from scoring in the A range.

Worst in Show: For the second year in a row, Long Branch sub-watershed received the lowest grade with a D+. Although other sites experienced improvement in their *E. coli* levels, this site still had such high *E. coli* levels that it scored an F. Poor habitat, macroinvertebrate communities and water quality kept this site from reaching the C level.

Indicators 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 and reflect *E. coli* levels that were above the standard 20—100% of the time.

Total Suspended Solids (TSS): A cloudy condition in water due to suspended silt or organic matter. As TSS increase, fish and aquatic bugs experience stress and altered behavior.

Indicators of Biological Health

Total Habitat: Stream habitat is assessed by scoring 10 habitat indicators, 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 aquatic 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.

Creek Name (Hydrologic Unit Code)	Year	O2		N+P							Site Grade
Gunpowder Creek (Middle: 05090203-190-070)	2011	A-	C	B-	D	D+	D**	A	B	B	C+
	2012	A	B	C	A	D+	B	A	B	A	B
Tributary to Gunpowder Creek (Upper: 05090203-190-010)	2011	B	D+	C+	D	C	F**	D	B	B	C
	2012	C+	D	C+	A	C	C	D	B	B	C+
Tributary to South Fork Gunpowder Creek (South Fork: 05090203-190-020)	2011	B	D-	B	D	C-	F**	D	B	D	C-
	2012	B+	F+	B-	B	C	D	F	C	F	C-
Fowlers Fork (05090203-190-030)	2011	B+	C	C+	F	C-	D**	D	C	F	D+
	2012	C	D-	C+	C	C+	C	D	D	D	C-
Riddles Run (05090203-090-080)	2011	C+	C-	B-	F	B-	C**	D	B	A	C
	2012	D+	D	B-	A	C	B	D	B	C	C
Long Branch* (05090203-090-050) * these grades are based on less data when compared to the other sites since this site was pooled or had low flow often. Use with caution.	2011	B	C	C+	D	C-	D**	D	D	D	D+
	2012	B	C+	C	F	F+	D	D	C	D	D+
Indicator Grade	2011	B	C-	B-	D-	C	D**	D+	B-	C	
	2012	B-	D+	C+	B	C-	C	D+	C+	C	

** Macroinvertebrate samples collected in 2011 may be skewed low due to the occurrence of large rain events throughout the spring and summer, which diminishes the community structure and some groups of macroinvertebrates are quicker to recover than others. The macroinvertebrates collected in 2012 are considered a more realistic observation of the macroinvertebrate community present in the Gunpowder Creek Watershed.

Lowest Scoring Indicators: Habitat and specific conductivity had the lowest grades, both scoring a D+.

Highest Scoring Indicator: *E. coli,* which scored a B, and is also the most improved, as last year it scored a D– during a year dominated by rain.