Summary of 2012 Kentucky River Watershed Watch Sampling Results
What and when?

Herbicides (Atrazine and 2,4-D)
25 sites in May

Pathogens
113 sites in mid-July
88 sites in mid-August

Chemicals and Nutrients
53 sites in September

Metals
15 sites in September
Total # of KRWW Sites Sampled by Year

- 1999: 87
- 2000: 115
- 2001: 155
- 2002: 166
- 2003: 207
- 2004: 157
- 2005: 202
- 2006: 248
- 2007: 231
- 2008: 197
- 2009: 176
- 2010: 189
- 2011: 145
- 2012: 134
Where?

2012 KRWW Sampling Sites

Legend
- Sampling Sites
- 8-Digit Hydrologic Units
Dissolved Oxygen
• Aquatic Life Standard = 5 mg/L
• 55 of 291 readings < 5 mg/L

pH
• Aquatic Life Standard = 6 to 9
• 2 readings > 9

Temperature
• None greater than Aquatic Life Std. of 31.7°C, but a few sites were close in July!

Conductivity
• Unofficial Aquatic Life Std. of 500 microsiemens/cm
• 53 of 291 readings > 500
% of Dissolved Oxygen Readings < 5 mg/L

North Fork: 0%
Red River: 20%
Palisades: 37%
Dix River: 13%
Elkhorn: 31%
Lower Kentucky: 0%
% of Sites with Conductivity > 500 umhos/cm

North Fork: 42%
Red River: 0%
Palisades: 21%
Dix River: 0%
Elkhorn: 51%
Lower Kentucky: 25%

Lab Conductivity
Field Conductivity
**Herbicides**

**Triazines**
Common herbicide used on corn crops
Highly persistent in soil, EPA Standards only
Drinking Water Std. = 3.0 micrograms/L
Acute Aquatic Life Std. = 350 micrograms/L
Chronic Aquatic Life Std. = 12 micrograms/L

**2,4-D**
Common herbicide to control broadleaf weeds
EPA Drinking Water Std. (MCL) = 70 micrograms/L
Pesticides detected at 10 of 25 KRWW sampling sites
**E coli testing**

- Can indicate presence of pathogens that may cause illness or infections in people.

- **Sources** - failing septic systems, straightpipes, leaking sewage lines, livestock

- To reduce pathogens – maintain septic systems / repair sewer line leaks / increase municipal sewerage / fence livestock from waterways / maintain riparian buffers
Swimming Standard = 240 cfu/100 ml (instantaneous)

Swimming Standard = 130 cfu/100ml (geometric mean of at least 5 samples in 30 days)

Standards apply during Recreation Season from May 1 to October 31
Pathogen Sampling Results

SYNOPTIC EVENT (mid-July)
79% (89/113) of sites EXCEEDED instantaneous swimming standard
Increasing flows, or peaking flows
Potential runoff capture?

FOLLOW-UP EVENT (August)
68% (60/88) of sites EXCEEDED instantaneous swimming standard
Just after peak flows in upper basin,
mid-peak flows in lower basin
Pathogen Re-Sampling Findings

- **DECREASE in E coli counts at 73% of Re-Sampled Sites**
- **INCREASE in E coli counts at 27% of Re-Sampled Sites**

**Synoptic Event** – flows mainly rising, but levels lower → runoff contributions, pathogens more concentrated?

**Follow-Up Event** – flows peaking, but levels higher → dilution of pathogens, flushing of pathogens downstream?
Percentage of KRWW Sites Exceeding Safe Swimming Standard for Pathogens

- 79% of Synoptic Sites
- 68% of Follow-Up Sites
% of Sites with Pathogen Levels above PCR Standard

- **North Fork:** 89%, 19 total sites
- **Red River:** 80%, 5 total sites
- **Palisades:** 72%, 43 total sites
- **Dix River:** 63%, 8 total sites
- **Elkhorn:** 73%, 55 total sites
- **Lower Kentucky:** 50%, 4 total sites
NUTRIENT SAMPLING CRITERIA:
($95/sample – includes Conductivity, Total Nitrogen, Total Phosphorus, Chloride, Sulfate, Nitrate, Alkalinity and Total Suspended Solids)

- High conductivity readings (>500 μS/cm)
- New sampling sites

METALS SAMPLING CRITERIA:
($70/sample – includes 30 metals)

- High conductivity readings (>500 μS/cm)
- Eastern Kentucky sites
- New sampling sites
NUTRIENTS

- Nitrogen (nitrate-nitrogen, NO$_3$- N)
- Phosphorus (total phosphorus, P)
- Sulfur (sulfate, SO$_4$)

- Lead to ALGAL BLOOMS, algae die off and OXYGEN CONSUMED as they decompose ⇒ BAD FOR AQUATIC LIFE
- Taste and odor problems in drinking water
- High nitrates in drinking water can cause “Blue baby” disease (or methemoglobinemia)
Nutrient Effects on Water Quality

1. Nutrient-rich water flows in
2. Algae grow, feed, and die
3. Zooplankton eat algae
4. Bacteria feed on fecal pellets and dead algae
5. Bacteria deplete the water of oxygen
6. Marine life flees (2.0 mg/l) or dies (1.0 mg/l)
Nitrate-Nitrogen (NO₃-N)

Drinking Water Supply Std. = 10 mg/L
Aquatic Life Benchmark = 3.0 mg/L

10 (of 53) Nitrate results > 3.0 or 10 mg/L

Highest reading = 16.7 mg/L at Site #3140 on Town Branch in Fayette County
Phosphorus is part of **Photosynthesis Cycle**, allowing plants to convert $\text{CO}_2$ to oxygen.

Higher than average natural levels of phosphorus in bedrock & soils of Central Kentucky.

**Aquatic Life Benchmark = 0.3 mg/L**

15 (of 53) Phosphorus Results > 0.3 mg/L

Highest reading = 2.4 mg/L

**ALSO at #3140 on Town Branch in Fayette County!**
Can be picked up as groundwater moves through sulfate-containing minerals in bedrock. Drinking water with high sulfate levels can cause diarrhea & dehydration in people and animals. |

**Drinking Water Supply Std. = 250 mg/L**

10 of 53 Sulfate results > 250 mg/L

Highest reading of **1,260 mg/L** at #945 Lost Creek, Breathitt County
2012 KRWW Sulfate Sampling Results

Legend:
- ★ Sulfate (SO4) > 250 mg/L
- ○ Sulfate (SO4) < 250 mg/L
- 11-Digit Hydrologic Units

South Elkhorn Creek Watershed

Quicksand Creek
Lost Creek
North Fk Kentucky River
Maces Creek
Carr Creek
North Fork - all sulfate hits in Perry, Breathitt Counties
Palisades - all in Glenns Creek watershed
Elkhorn - throughout S. Elkhorn and in Cane Run
Conductivity

Measure of total dissolved solids or ability of water to carry an electrical current.

- Levels directly affect aquatic life support, negative impacts observed at 300-500 microSiemens/centimeter.
- Can serve as indicator of sewage input.

Ohio River Std. = 800 μS/cm
EPA’s Proposed Central Appalachia Std. = 500 μS/cm
KRWW Benchmark = 500 μS/cm
66% of field readings > 500 micromhos/cm
87% of lab readings > 500 micromhos/cm

Highest Lab Conductivity = 2,003 µS/cm
Site #945, Lost Creek, Breathitt County

Highest Field Conductivity = 1,987 µS/cm
Site #783, McConnell Spring, Fayette County
Chlorine + Metals = Chloride Salts

Drinking Water Supply Std = 250 mg/L
Chronic Aquatic Life Std = 600 mg/L
Acute Aquatic Life Std = 1,200 mg/L

Chloride levels ranged from 9 to 255 mg/L

Highest Chloride Reading – Site #1139 on Vaughn’s Branch, Fayette County AGAIN!
28 different metals analyzed at lab for 15 sites.

Of the 28 metals, only 14 have associated Water Quality Standards

12 Metals w/ Drinking Water Supply Standard

10 Metals w/ Warm Water Aquatic Habitat Standard
Metals WITH Water Quality Criteria

Detections:
Barium
Copper
Iron *
Nickel

* > DWS Std. at #820, N. Fork KY River, Perry Co.

No Detections:
Antimony
Arsenic
Beryllium
Chromium
Lead
Silver
Thallium

ONLY 1 METAL DETECTION WAS ABOVE WATER QUALITY STANDARD.
2012 Sites of Concern

Overall Water Quality Problems
(pathogens, nutrients, conductivity)

North Fork Kentucky River Region
#820 – North Fork Kentucky River, Perry Co.
#869 – Maces Creek, Perry Co.
#875 – Right Fork Carr Creek, Perry Co.
#945 – Lost Creek, Breathitt Co.
#946 – Troublesome Creek, Breathitt Co.
#827, #943 – Quicksand Creek, Breathitt Co.
2012 Sites of Concern

Overall Water Quality Problems
(pathogens, nutrients, conductivity)

Kentucky River Palisades Region
#823, #861, #1198 – Glens Creek, Woodford
#954, #833 – Springs, Woodford

Elkhorn Creek Region
#914 – Holly Spring, Fayette
#1129, #1246 – Cardinal Run, Fayette
#1138, #1139, #3019, #3060 – Vaughn’s Branch
#1221 – Cane Run, Fayette
#1048, #3013 – Shannon Run, Woodford
Pathogen Problems
(pathogens, dissolved oxygen, conductivity)

#977 – Muddy Creek, Madison Co.

#1175 – Calloway Creek, Madison Co.

#2970 – Preston’s Cave, Fayette Co.

#3006 – Lower Howard Creek, Clark Co.
Conductivity readings are helpful!  
Should continue using field monitors as a screening tool to identify other water quality issues.

Sites are STILL becoming increasingly concentrated in Central region of basin!  
Should use 2012-13 training workshops to recruit new volunteers in other areas of the basin.

Pathogens are STILL a continuing water quality threat across the basin!  
Volunteers should spread message about septic system maintenance and livestock fencing.
Anyone present have a 2012 Site of Concern? Is there any local watershed activity addressing the concerns? Need help?

Other questions about sampling results and their meanings?
Kentucky River Watershed Watch is part of a statewide organization, Watershed Watch in Kentucky, which is a citizen monitoring effort to improve and protect water quality by raising community awareness and supporting implementation of the goals of the Clean Water Act. The organization hopes to encourage people to venture out into the Kentucky River Basin to see, first-hand, the condition of their local streams and rivers.
Kentucky Watershed Watch Database Project

Legend:
- Red: Tradewater, Lower Green
- Blue: Upper Cumberland
- Light Blue: Upper Green
- Gray: Four Rivers
- Purple: Big Sandy
- Black: Kentucky
- Yellow: Licking
- Blue: Salt