

# A SURVEY OF WATERSHED QUALITY AT BLACKACRE STATE NATURE PRESERVE, JEFFERSON COUNTY, KENTUCKY



Photo by Susan Reigler

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# Introduction



Urban riparia have an important role in filtering and cleaning water as it passes through an urban landscape. Urban landscapes have the added feature of impervious ground cover, such as the concrete and asphalt of roads and parking lots. Riparian zones of parks and urban nature preserves play a role in controlling overflow from these impervious features of urban landscape (Paul and Meyer, 2001 and Schueler, 1994). At the same time, increased flow of water from chemically-treated lawns, septic overflow and expanding areas of impervious, paved surfaces can put considerable stress on the filtering capacity of riparia (Pickett, et al., 2001).

# Hypothesis



*Given the documented filtering effects of riparia in general (Stewart, et al., 2001 and Teels, et al., 2006) and urban riparia in particular (Pitt, 2002), water quality in the main Blackacre stream should improve as the water moves through the preserve.*

# Research Questions



- Is the main stream's riparian zone improving water quality?
- What is the overall water quality?
- Recommendations for improvement?

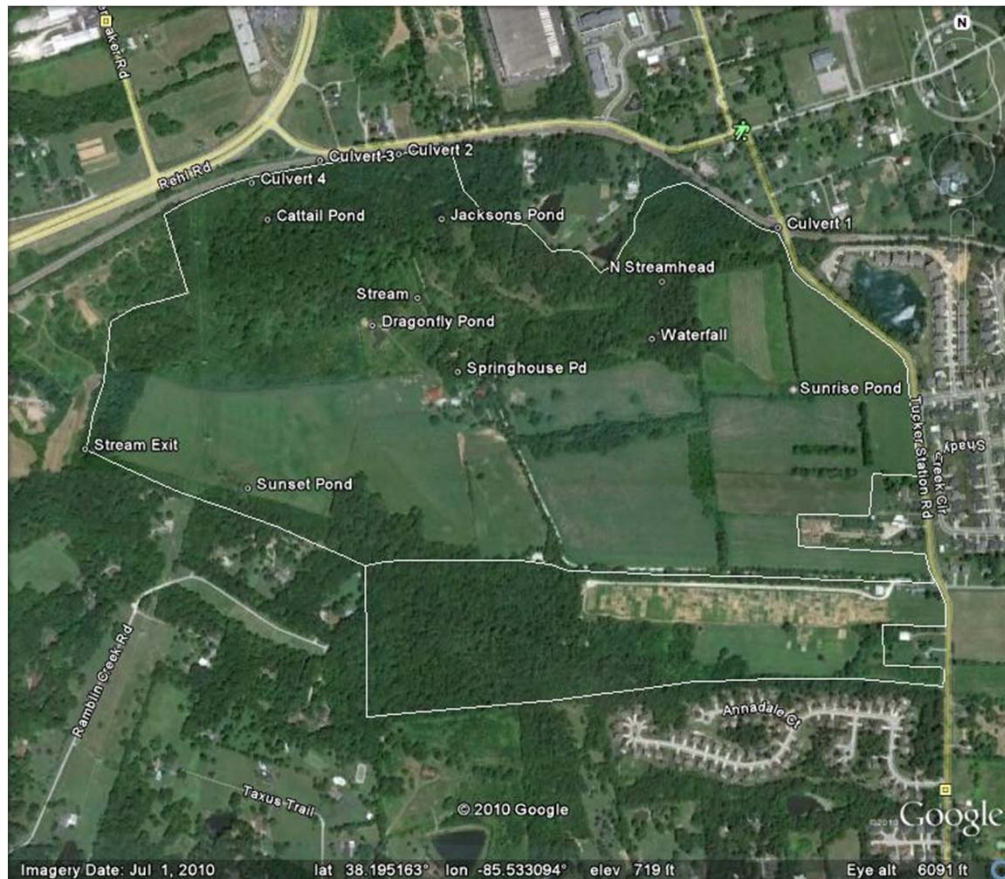
# Concerns



- Run-off from livestock pastures
- Run-off from chemically treated lawns
- Septic overflow
- Expanding areas of impervious, paved surfaces

# Blackacre Watershed

## Points Surveyed



Google Earth image, July 1, 2010

- Sunrise Pond
- Jackson Pond
- Springhouse Pond
- Cattail Pond
- Dragonfly Pond
  
- Culverts 1-4
  
- Stream (testing points included)
  - Beginning
  - Waterfall
  - Bridge
  - Exit

# Methods and Materials

- Mapping

1. Garmin eTrex GPS handheld unit
2. Google Earth maps (interlinked w/ Garmin software)



<https://buy.garmin.com/shop/shop.do?CID=144>

- Chemical Testing - using Hach Water Analysis Kits

1. Dissolved Oxygen
2. Orthophosphates
3. Nitrates
4. Ammonia Nitrogen



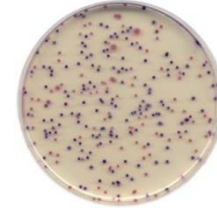
[www.fores...lbers.com/product\\_pagesbigpic.asp?id=5073](http://www.fores...lbers.com/product_pagesbigpic.asp?id=5073)

- Temperature - thermometer to measure air and water temps.
- pH and Hardness - using test strips or pH handheld reader
- Turbidity Tube - used to measure water clarity



# Methods and Materials (cont.)

- *E. coli* testing (with Coliscan Easygel medium)



- Biological Testing

Benthic Macroinvertebrate Search - using a dip net, and identification keys from Hoosier

Riverwatch manual

<https://d-e-science11.wikispaces.com/Coiform+Bacteria>



- Data analysis

A. Hoosier Riverwatch protocols followed in calculating values for each chemical test (IDNR 2010)

B. Water Quality Index (WQI) rating

C. Pollution Tolerance Index (PTI) rating based on macroinvertebrate searches

D. Data tables created for stream points and ponds using Microsoft Excel

[www.umass.edu/tei/mwwp/wkshdes.html](http://www.umass.edu/tei/mwwp/wkshdes.html)

# Stream Results

**TABLE 1. STREAM**

Metric	Culvert 1	N. Fork	Waterfall	Bridge Area	Exit
<i>E. coli</i> (colonies/100mL)	360.0	6240.0	8000.0	5467.0	20.0
Air Temperature (°C)	24.4	24.4	24.4	25.7	24.4
Water Temperature (°C)	28.0	26.0	29.0	18.0	25.0
Dissolved O <sub>2</sub> (mg/L)	—	—	—	3.5	5.6
pH	—	7.9	8.2	7.7	7.5
Hardness (mg/L)	—	300.0	300.0	185.0	250.0
Orthophosphate (mg/L)	—	0.06	0.04	0.25	0.1
Nitrates (mg/L)	—	0.0	0.0	0.0	0.0
Ammonia Nitrogen (mg/L)	—	1.4	0.2	1.35	0.2
Turbidity (NTU's)	—	—	—	18.0	17.0
Water Quality Index (WQI)	—	55.0	50.0	58.7	72.0

Pollution Tolerance Index Rating (PTI) = 42 for the length of the stream

WQI	Excellent: 100-90	Good: 89-70	Medium: 69-50	Bad: 49-25	Very Bad: 24-0
PTI	23+	22-17	16-11	10-2	<1

# Pond Results

**TABLE 2. PONDS**

Metric	Jackson's	Springhouse	Dragonfly	Cattail	Sunrise
<i>E. coli</i> (colonies/100mL)	2700.0	694.0	667.0	260.0	1180.0
Air Temperature (°C)	24.4	24.4	24.4	24.4	24.4
Water Temperature (°C)	22.7	16.0	24.0	27.0	22.0
Dissolved O <sub>2</sub> (mg/L)	5.5	7.0	4.6	3.4	12.0
pH	7.5	7.3	8.1	7.5	7.2
Hardness (mg/L)	263.0	250.0	180.0	250.0	180.0
Orthophosphate (mg/L)	0.25	0.25	0.25	0.25	0.25
Nitrates (mg/L)	0.25	0.25	0.25	0.0	0.25
Ammonia Nitrogen (mg/L)	0.07	0.3	0.15	0.0	0.0
Turbidity (NTU's)	19.0	17.0	15.0	15.0	18.0
Water Quality Index (WQI)	64.0	74.5	66.5	64.0	70.4
Pollution Tolerance Index Rating (PTI)	23.0	17.0	29.0	2.0	28.0
WQI	Excellent: 100-90	Good: 89-70	Medium: 69-50	Bad: 49-25	Very Bad: 24-0
PTI	23+	22-17	16-11	10-2	<1

# Cattail Pond



Cattail Pond in October, 2009 showing no siltation.



Cattail Pond in June, 2010 showing siltation.

	<u>Cattail Pond</u>	<u>Culvert 4</u>
<i>E. coli</i> (colonies/100mL)	260.0	1620.0
Air Temperature (°C)	24.4	24.4
Water Temperature (°C)	27.0	31.0
Dissolved O <sub>2</sub> (mg/L)	3.4	-----
pH	7.5	8.3
Hardness (mg/L)	250.0	425.0
Orthophosphate (mg/L)	0.25	0.14
Nitrates (mg/L)	0.0	0.25
Ammonia Nitrogen (mg/L)	0.0	0.3
Turbidity (NTU's)	15.0	-----
WQI	64.0	59.5
PTI	2.0	-----

# Discussion

- Chemical testing within normal limits - no danger
- High *E.coli* levels
  - A. Compared to March 2010 testing (<50 colonies/100mL)
  - B. All points well over limit
  - C. Unsafe for prolonged human exposure
  - D. Possible causes - high temperature and low flow
- Overall water quality - medium to good
- Biological water quality - good to excellent (except Cattail Pond)
- Overall water quality improved as it flowed through riparian zone, with notable decrease in *E.coli* levels from entrance to exit.

# Recommendations



- Wear latex gloves when handling water
- Service septic tanks on property
- Reduce number of livestock at Blackacre
- Mitigation of flow from culverts
- Possible future restoration of Cattail Pond
- Annual surveys to monitor water quality

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