State of the Streams

2011 WATER QUALITY SYNTHESIS REPORT

MSD
Metropolitan Sewer District

Important Terms

Goose Creek

Pond Creek

South Fork of Beargrass Creek

Aquatic insects: Aquatic insects are small animals that can be seen with the naked eye, live on the bottom of streams and lakes, and don't have a backbone. They are often the aquatic immature forms of insects that live on land as adults, and they are an important food source for fish and other aquatic animals. Aquatic insects are also known as benthic macroinvertebrates.

Benthic macroinvertebrates: See Aquatic insects.

Confluence: Confluence is the point where two streams are joined into a larger stream as one flows into the other.

Dissolved oxygen: Dissolved oxygen is the oxygen that is freely available in water, and that is vital to fish and other aquatic life and for the prevention of odors. Dissolved oxygen levels are considered an important indicator of a water body's ability to support desirable aquatic life. Dissolved oxygen levels fluctuate seasonally and over a 24-hour period. They also vary with water temperature and altitude. Water at the same temperature holds less oxygen at higher altitudes and cold water holds more oxygen than warm water.

Erosion: Erosion is when soil, silt, sand, rock and other particles are removed from unprotected land surfaces or stream banks usually by flowing water (runoff and stream flow) and are deposited downstream as sediment (mud, silt, sand, and gravel). Sediment becomes problematic when it covers good stream habitat.

Floodplain: A floodplain, or flood plain, is the flat or nearly flat land adjacent to a stream or river that experiences occasional or periodic flooding. It includes the floodway, which consists of the stream channel and adjacent areas that carry flood flows, and the flood fringe, which are areas covered by the flood, but which do not experience a strong current.

Impervious Surface: An impervious surface is any surface that is covered by materials that block water infiltration of water into the ground or soil. Impervious surfaces include roads, sidewalks, driveways, parking lots, and rooftops. Compacted soils (including some lawns) can also behave like impervious surfaces.

Runoff: Runoff is the portion of rain, snow melt, or irrigation water that arrives in streams, rivers, lakes, ponds, drains or sewers.

Stream Flow: Stream flow is the volume of water flowing past a fixed point in a fixed unit of time. Stream flow is often expressed in cubic feet per second (ft^3/ sec).

Stream habitat: Stream habitat is the underwater environment that is used as a living space by fish, aquatic insects, other plants and animals. Streams that have a variety of habitats, with shallow and deep areas, fast and slow water, and places with gravel and shade are characteristics of good habitats.

Watershed: The area of land where all the water drains to a particular stream or location along a stream. The boundary of a watershed is formed by the highest elevations surrounding the stream. A drop of water falling outside the watershed boundary will drain to another watershed. Small watersheds join together to form larger watersheds; a major river, such as the Ohio River, will encompass many smaller watersheds.

1. Executive Summary

The Louisville Metropolitan Sewer District (MSD) in cooperation with United States Geological Survey (USGS) operates a Long-Term Monitoring Network (LTMN) to collect physical, chemical and biological data about streams in the Metro Area. MSD collects the water quality and biological data and USGS collects stream flow. This Synthesis Report is focused on trends in the conditions of fish, aquatic insects, stream habitat, stream flow and dissolved oxygen from 1999 to 2008 collected at twenty-seven MSD Long-Term Monitoring Network sites.

Typical of urban streams, the habitat along many streams in the Metro Area are variably compromised by channel modifications such as straightening and shoring up with concrete, often limiting amounts of rock riffle habitat and pool/riffle development, insufficient protective vegetation along the banks, stream bank erosion due to the increases in runoff, deposition of sediment that covers habitat needed by fish and aquatic insects, and, periods of low dissolved oxygen.

Below normal stream flow prior to and during sampling events for aquatic insect and fish communities likely affected observed health in 2005 and 2008. This condition appeared to have affected the aquatic insects more than fish.

Some watersheds, like Pond Creek and Mill Creek, have considerable amounts of man-made channels, so many of the habitat features of natural channels, such as a mix of rocky riffles and deep pools, submerged logs and well vegetated banks, especially tree cover, are not present.

Streams that run on bedrock, like Cedar Creek and Pennsylvania Run, are lacking in the deep pools and, to some extent, rocky riffles that provide good habitat for fish and aquatic insect communities.

The predominance of agricultural and forested areas in less developed watersheds, like Harrods Creek and Floyds Fork, slow down and absorb runoff after rain events. As such, habitat conditions were found to be supporting healthy aquatic insect and fish communities.

Status of fish community health in 2008 indicates that seven sites were “poor” status, thirteen sites were “fair”, five were “good”, and two were excellent. Trends in fish community health indicate that only one site was declining (Muddy Fork of Beargrass Creek), twelve had no trend, and fourteen sites were improving.

Status of aquatic insect community health in 2008 indicates that thirteen sites had “poor” status, eleven were “fair”, one was “good”, and two were “excellent”. Trends in aquatic insect community health indicates that eleven sites were declining, two had no trend, and fourteen sites were showing improving health.

Status of stream habitat conditions in 2008 indicates that seven sites had “poor” status, seven were “fair”, and thirteen were “good”. Trends in stream habitat conditions from 2005 to 2008 indicate that only one (1) site was declining (Cedar Creek at Thixton Road), ten sites had no trend, and fifteen sites were improving and one site did not have sufficient data to determine trend.

Top: Mayfly Nymph Photo by Rich Merritt
Bottom: Mayfly Adult Emerging Photo by John Wallace
Photos courtesy of Society for Freshwater Science (NABS (www.benthos.org)).

Status of dissolved oxygen conditions in 2008 indicates that six were "fair", sixteen were "good" and five did not have data in 2008. A preliminary analysis of trends in dissolved oxygen conditions indicates that two sites were declining (Middle Fork of Beargrass Creek at Trevilian Way, and Pond Creek at Pendleton Road), thirteen had no trend, eight (8) sites were improving and four had insufficient data to determine trend. The dissolved oxygen data also suggest that the quality control measures implemented by MSD jointly with USGS have led to a noticeable improvement in the amounts of usable data from the water quality gages in recent years.

Stream flow during fish and aquatic insect sampling events was below normal, based on ten years of flow data, at twenty-four sites in 2008. A comparison in stream flow between the 2005 and 2008 sampling events indicates that nine sites had lower flow conditions in 2008, fourteen were similar in 2005 and 2008, no sites had higher flow in 2008 and four sites had insufficient data to compare flows in 2005 and 2008.

This data analysis suggests that the natural effects of drought and fair to poor habitat quality significantly affected the observed health of fish and aquatic insect communities in many watersheds. Lower dissolved oxygen conditions likely contributed to lower aquatic health status in some streams as well.

NUMBER OF SITES IN EACH CATEGORY

STATUS CATEGORY (2008)	Fish Communities	Aquatic Insect Communities	Stream Habitat	Dissolved Oxygen	Stream Flow
Poor/Very Poor	7	13	7	0	All sites were below normal
Fair	13	11	7	6	
Good	5	1	13	16	
Excellent	2	2	N/A*	N/A*	
No Data				5	

TREND CATEGORY (OLDEST TO 2008)	Oldest to 2008		2005 to 2008	Oldest to 2008	2005 to 2008
Declining	1	11	1	2	9
No Trend	12	2	10	13	14
Improving	14	14	15	8	0
Insufficient Data			1	4	

*N/A: Not Applicable

REFERENCES AND ADDITIONAL INFORMATION

Louisville and Jefferson County Metropolitan Sewer District: http://www.msdlouky.org/
2009 Water Quality Synthesis Report: http://www.msdlouky.org/projectwin/docs.htm
MSD Watersheds: http://www.msdlouky.org/insidemsd/wqwatershed.htm

Environmental Protection Agency Biological Monitoring Information:
http://www.epa.gov/bioiweb1/html/indicator.html
http://www.epa.gov/bioiweb1/html/benthosclean.html
http://www.epa.gov/bioiweb1/html/fish_id.html

Kentucky Division of Water Standard Operating Procedures: http://water.ky.gov/Pages/SurfaceWaterSOP.aspx

2. Introduction

Cedar Creek

ABOUT MSD

MSD was formed in 1946 to take over the operation and maintenance of Louisville's combined sanitary and storm sewer system and sanitary-only sewer system. While wastewater treatment was added with the construction of the Morris Forman plant in the late 1950s, the basic mission remained the same through the 1970s.

Today, MSD is responsible for a much larger wastewater collection and treatment network, which continues to expand; a comprehensive public stormwater drainage system for most of Jefferson County; the operation and maintenance of the community's Ohio River flood protection system; the LOJIC computerized mapping and geographic information system; and several other programs — including stream monitoring and hazardous materials control — designed to protect and enhance the environment.

MSD employee conducts fish sampling.

MSD is a non-profit regional utility service. Its revenue comes from wastewater and stormwater service fees, plus charges for extending wastewater lines and connecting new customers. MSD does not receive supplementary income from taxes nor from other local government agencies. All of the agency's revenue is used for operation, maintenance and extension and improvement of services.

MSD is governed by an eight-member board. All members are appointed by the Louisville Metro Mayor, with the approval of the Metro Council. Members serve three-year terms and can be reappointed. The full Board meets twice a month; committees meet as needed.

MSD periodically reports on the condition and quality of streams within its jurisdiction. This report fulfills requirements for MSD to produce a biennial Synthesis Report. As described below, MSD monitors the condition of streams in the Long Term Monitoring Network using a variety of methods.

THE LONG TERM MONITORING NETWORK

In 1988, the Louisville and Jefferson County Metropolitan Sewer District and the United States Geological Survey began monitoring water quality and stream flow throughout the Jefferson County area. The monitoring program has changed over the years and currently includes twenty-seven (27) monitoring sites. The monitoring sites were selected to represent streams in each of eleven watersheds. A map of the monitoring sites is shown on page 58.

The Metropolitan Sewer District collects a wide variety of data at

each of these sites to evaluate stream quality. This report provides information on the following important aspects of water quality:

- **Fish:** Fish have been used for many years to indicate whether waters are clean or polluted, doing better or getting worse. Knowing just whether fish live in the waters is not enough - we need to know what kinds of fish are there, how many, and their health. Fish are excellent indicators of watershed health because they live in the water all of their life, differ in their tolerance to the amount and types of pollution, are easy to collect with the right equipment, live for several years, and are easy to identify in the field.

  Fish communities are evaluated using a scoring system that considers the types and numbers of fish species present and the ability of each species to tolerate stressful conditions such as low dissolved oxygen and poor habitat quality. The score is translated into a narrative rating of "excellent", "good", "fair" and "poor" that considers the region of the state and size of the stream.

It is important to recognize that individual species, as well as whole communities, of fish and aquatic insects are affected by natural factors such as drought and floods, and changes in the habitat and water quality in which they live. If degraded fish and aquatic insect communities are present, it can be difficult to determine how much of the problem is caused by drought, pollution or degraded habitat.

Professional biologists collect fish using a backpack shocker. Most fish are caught, identified in the field and released unharmed back to the stream.

MSD has collected fish community data since 1999 using protocols developed by the Kentucky Division of Water. MSD developed and is implementing a Quality Assurance Project Plan to ensure high quality data. Data collected between 1999 and 2008 was included in this report. Data analysis for this report included examining the results from 2008 and a qualitative evaluation of trends in the fish community rating. A preliminary trend was noted if the rating category changed over time. A more detailed evaluation of trends was not possible since the Kentucky Division of Water methods that were used to collect and analyze the data have changed over time as more experience was gained.

- **Aquatic Insects:** Insects that live on the bottoms of streams are called aquatic insects or benthic macroinvertebrates. Aquatic insects also have been used for many years to indicate whether waters are clean or polluted, getting better or worse. Similar to fish communities, we need to know what kinds of aquatic insects are there and how many of each type are present. Aquatic insects are useful to evaluate stream quality because they live in the water for weeks to months (until they turn into adults and emerge), have limited mobility staying in areas suitable for their survival, are easy to collect, are easy to identify in a laboratory, differ in their tolerance to the amount and types of pollution, and integrate over time environmental conditions such as water quality, stream flow and habitat quality.

  Similar to fish communities, aquatic insect communities are evaluated using a scoring system that considers the types and numbers of species present and the ability of each species to tolerate stressful conditions such as low dissolved oxygen and poor habitat quality. The score is translated into a narrative rating of "excellent", "good", "fair" and "poor" that considers the region of the state and size of the stream.

  MSD has collected aquatic insect community data since 2000 using protocols developed by the

Kentucky Division of Water. MSD developed and is implementing a Quality Assurance Project Plan to ensure high quality data. Data collected between 1999 and 2008 was included in this report. Data analysis for this report included examining the results from 2008 and a preliminary evaluation of trends based on a comparison of the oldest result and 2008 results for each monitoring site. A preliminary trend was noted if the results changed by more than five (5) percent.

- **Stream Habitat:** Stream habitat is the underwater environment that is used as a living space by fish, aquatic insects, other plants and animals. Fish and aquatic insects must rely on their local environment for food and shelter. Streams that have a variety of habitats, with shallow and deep areas, fast and slow water, and places with gravel and shade are characteristics of good habitats. As the photo on right shows, streams with eroding banks, large amounts of silt and sediment, and straightened stream channels are characteristics of poor habitats.

  Stream habitat data collected by MSD in 2005 and 2008 were used in this report. MSD used protocols developed by the Kentucky Division of Water. MSD developed and is implementing a Quality Assurance Project Plan to ensure high quality data. Data analysis for this report included examining the results from 2008 and a preliminary evaluation of trends based on a comparison of the 2005 and 2008 results for each monitoring site. A preliminary trend was noted if the results changed by more than five (5) percent.

- **Dissolved Oxygen:** Both fish and aquatic insects rely on oxygen that is dissolved in water to "breathe". When oxygen levels are too low, this causes stress on both fish and aquatic insects. A dissolved oxygen reading less than four (4) milligrams per liter at any time, or average readings less than five (5) milligrams per liter over a 24-hour period are considered stressful for fish and aquatic insects. Dissolved oxygen can be lowered by natural factors such as drought and lack of shade, and also by excessive algae and pollution. MSD and the US Geological Survey continuously monitor dissolved oxygen at the 27 monitoring sites in the Long Term Monitoring Network. This level of effort highlights MSD's commitment to effectively monitor the quality and condition of streams in Jefferson County.

  Dissolved oxygen data collected by MSD and the US Geological Survey between 2002 and 2008 were assessed for this report. The data are collected using protocols developed by the US Geological Survey. It is important to note that collection of continuous dissolved oxygen data requires diligent attention to cleaning and calibrating the dissolved oxygen probes that are used to collect the dissolved oxygen readings. In some streams, the probes can frequently become dirty or covered by silt and sediment, resulting in missing data. MSD has developed a Quality Assurance Project Plan to improve the maintenance of dissolved oxygen probes.

  For this report, the average daily dissolved oxygen concentration was calculated from dissolved oxygen readings collected at 15 minute intervals. Days with one or more missing 15 minute readings were

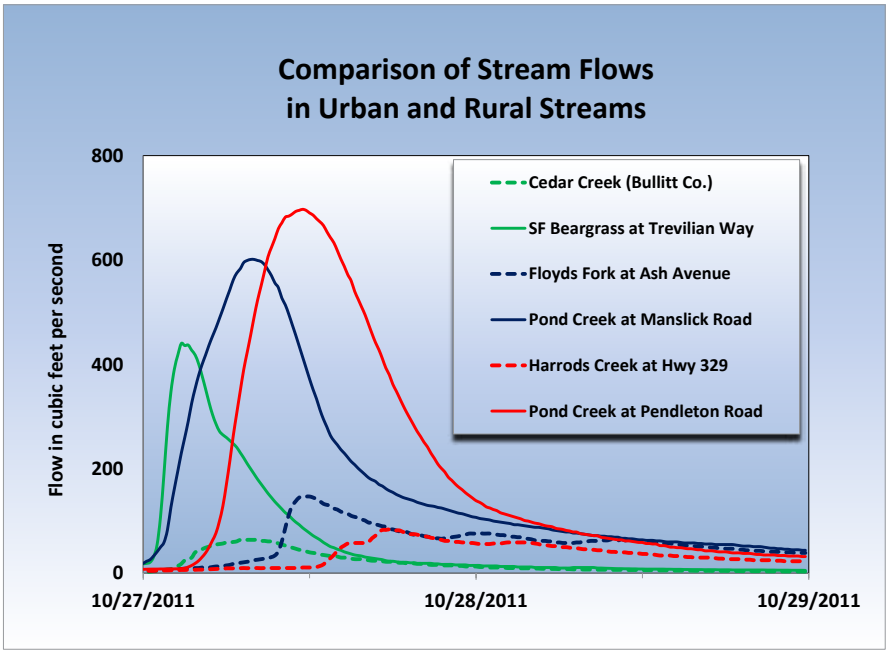
This USGS flow gage (gray box) is located on Brier Creek at Bear Camp Road. The gage is used to continuously monitor dissolved oxygen and stream flow. The antenna on top transmits data for real time monitoring results.

not included in the analysis. Years with more than half of the daily data missing were not included in the analysis.

Results were grouped into rating categories based on the percent of days when average dissolved oxygen concentration was above five (5) parts per million: "good" if more than 90 percent of days with valid data per year were above five (5) parts per million; "fair" if 75 percent to 90 percent of days with valid data per year were above five (5) parts per million; and "poor" if less than 75 percent of days with valid data per year were above five (5) parts per million. A preliminary evaluation of trends was based on a comparison of the oldest result with valid data and 2008 results for each monitoring site. A preliminary trend was noted if the results changed by more than five (5) percent.

- **Stream Flow:** The amount of flow in a stream has a major influence on fish and aquatic insects. Stream flow varies naturally in response to rain, and seasonally tends to be higher in the winter and spring, lower in summer and fall. Streams may flow very little or not at all during times of drought, or flows may be very high during floods. Stream flow is also affected by runoff from developed areas, where hard surfaces (impervious) such as roofs and roads prevent water from filtering into the soil. In areas where a significant portion of the land has been developed, greater amounts of runoff reach streams more quickly. MSD and the US Geological Survey continuously monitor stream flow at 25 of the 27 monitoring sites in the Long Term Monitoring Network.

  The analysis of stream flow for this report focused on stream flow during and prior to the 2005 and 2008 biological sampling events, since stream flow is an important factor influencing the condition of fish and aquatic insect communities. Monthly stream flow data for 2005 and 2008 were retrieved from the US Geological Survey website. The average monthly flow between 1999 and 2010 was computed as a basis for the comparison. Stream flows for each month were classified as "average" if they were within 50 percent of the average flow for 1999 to 2009, "high" or "low" if they were outside of this range. This approach provided a way to account for seasonal variability in flows while identifying potentially stressful conditions associated with abnormally high or low flows.



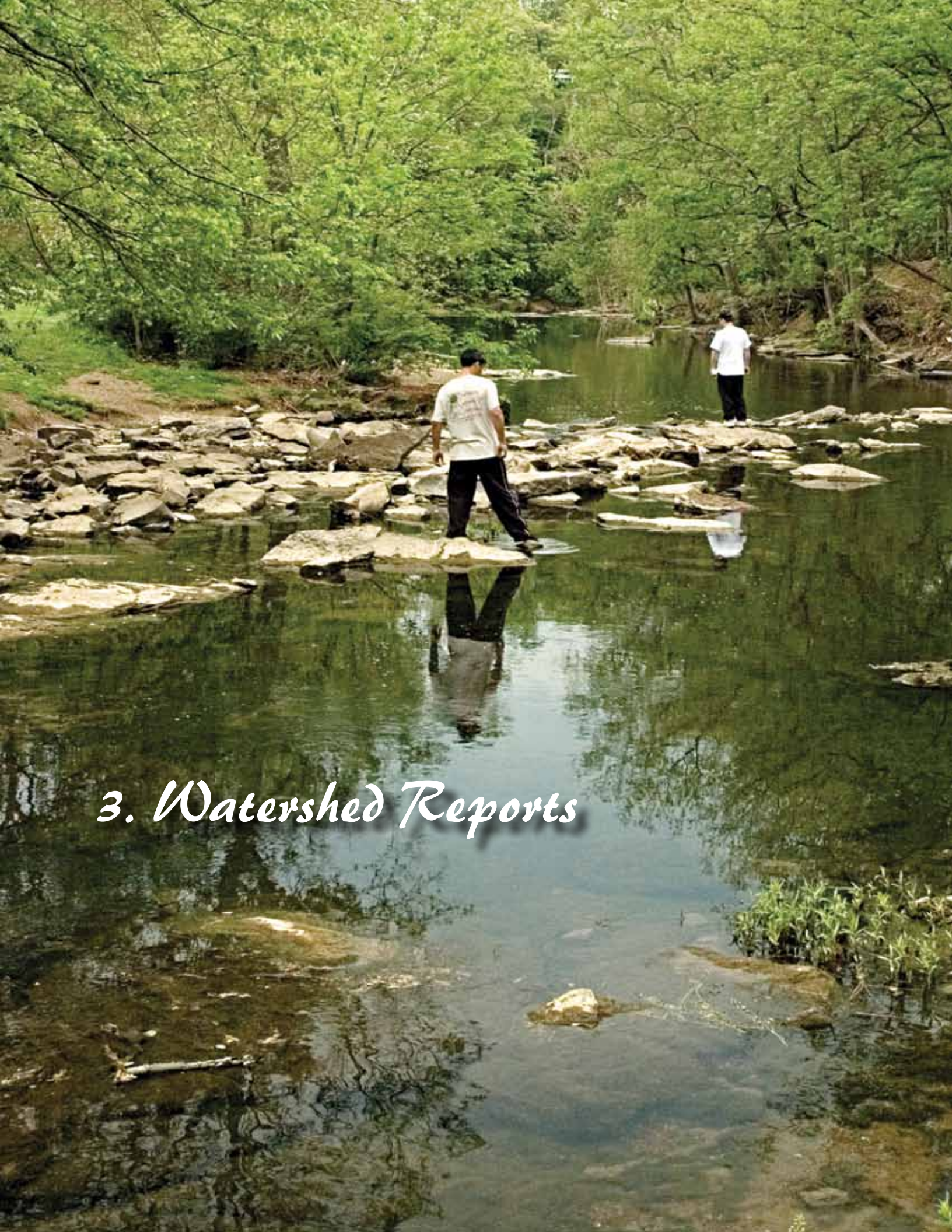
Solid lines show stream flow for urban watersheds; dashed lines show stream flow for rural watersheds, colors show watersheds of similar sizes. Note how urban watersheds have much higher stream flow than rural watersheds for the same storm.

Stream flow records integrate the effects of climate, land use, and landscape, and record when and how much runoff occurs over time. Stream flow data is used for a variety of purposes, including planning for floods and droughts, as well as understanding stream conditions.

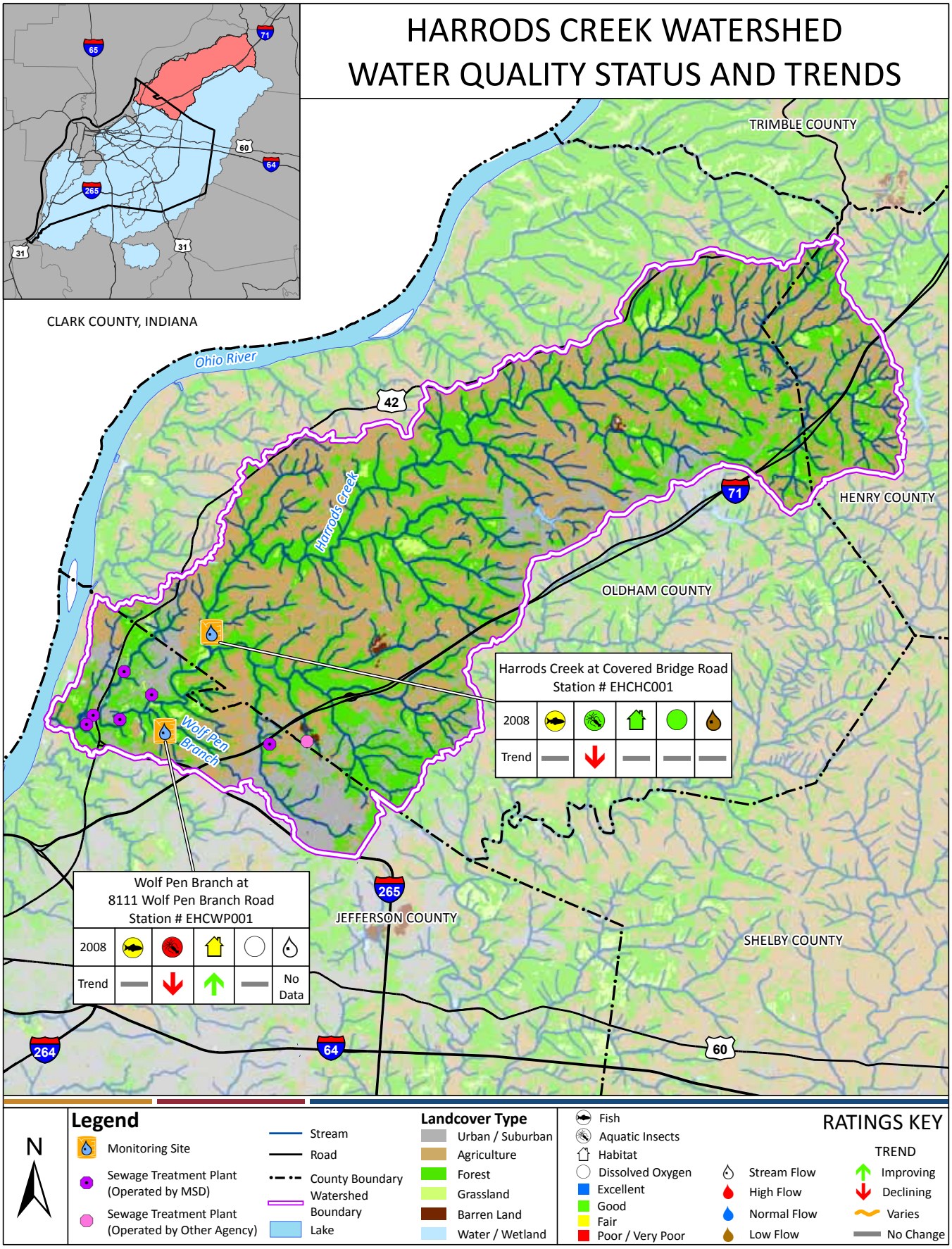
This graph illustrates the role of development on the runoff from six watersheds. The more urban watersheds, Pond Creek and the South Fork of Beargrass Creek, tend to have higher stream flows during the same storm than the similar sized rural or undeveloped watersheds, Cedar Creek (Bullitt County), Floyds Fork, and Harrods Creek. These undeveloped watersheds in the outer perimeter of the Metro area tend to have a more gradual rise in stream flow over time.

Urban streams have more impervious surfaces, including roadways, rooftops and driveways. Impervious surfaces prevent rain water from filtering into the soil. Decreased infiltration results in more water running off and therefore, higher stream flows. Higher stream flows can cause erosion and accumulation of silt and sediment in streams that cover habitats used by fish and aquatic insects.

In rural streams, with less impervious surfaces, more rain filters into the soil and runoff is slower. In these more natural systems, small storms are less likely to cause erosion and accumulation of silt and sediment in streams.



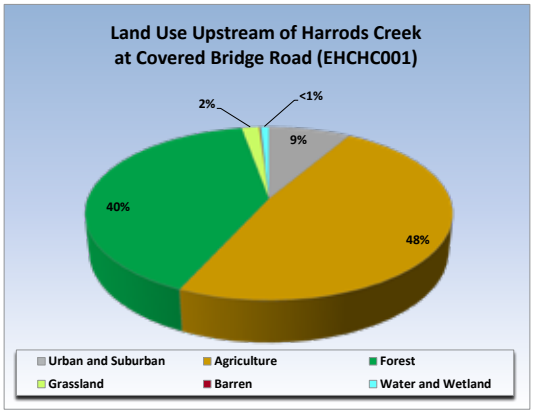
3. Watershed Reports


HARRODS CREEK WATERSHED
WATER QUALITY STATUS AND TRENDS
CLARK COUNTY, INDIANA
TRIMBLE COUNTY
HENRY COUNTY
OLDHAM COUNTY
JEFFERSON COUNTY
SHELBY COUNTY
Ohio River
Harrods Creek
Wolf Pen Branch
Harrods Creek at Covered Bridge Road
Station # EHCHC001
2008
Trend
Wolf Pen Branch at
8111 Wolf Pen Branch Road
Station # EHCWP001
2008
Trend
No Data
Legend
Monitoring Site
Sewage Treatment Plant (Operated by MSD)
Sewage Treatment Plant (Operated by Other Agency)
Stream
Road
County Boundary
Watershed Boundary
Lake
Landcover Type
Urban / Suburban
Agriculture
Forest
Grassland
Barren Land
Water / Wetland
Fish
Aquatic Insects
Habitat
Dissolved Oxygen
Excellent
Good
Fair
Poor / Very Poor
Stream Flow
High Flow
Normal Flow
Low Flow
RATINGS KEY
TREND
Improving
Declining
Varies
No Change
N

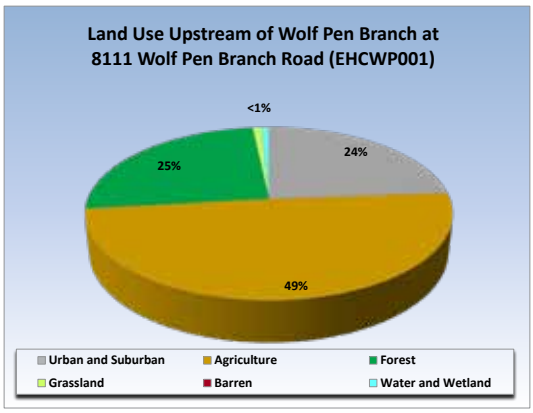
3.1 Harrods Creek Watershed

The small streams that eventually form Harrods Creek originate in Trimble County. Harrods Creek flows southwest through Oldham County and drains into the Ohio River in northern Jefferson County near Prospect. The Harrods Creek watershed drains approximately 92 square miles. The commercial and residential development has been expanding in the area.

MSD has been monitoring water quality and flow in Harrods Creek at Covered Bridge Road since 1999. There are 70.3 square miles of land draining to the monitoring site on Harrods Creek. This land is mostly agricultural and forest. Nine percent of the land has been developed for urban and suburban uses. Approximately 1.3 percent of the land is covered by impervious surfaces such as roads, rooftops and driveways.

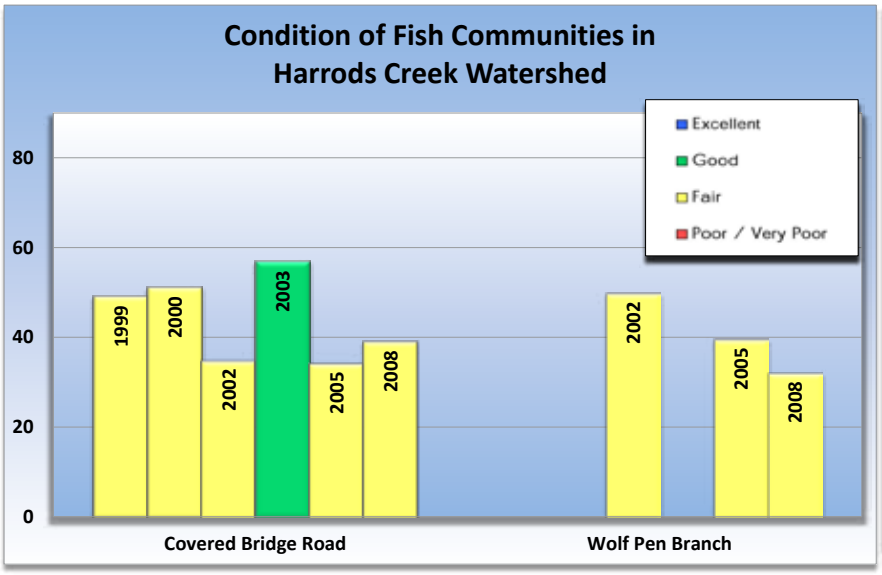


MSD has been monitoring water quality of the Wolf Pen Branch tributary since 2002; flow is not monitored at this location. There are 3 square miles of land draining to the monitoring site on Wolf Pen Branch. This land is a mix of agricultural, forest, and a 24 percent is developed for urban and suburban uses. Approximately 7 percent of the land is covered by impervious surfaces.

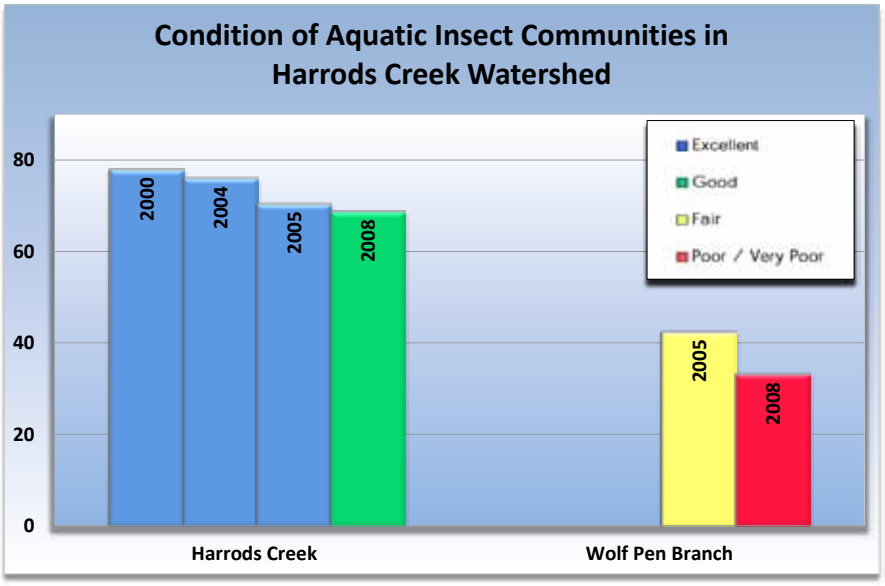


MONITORING SUMMARY

MSD monitored the fish communities in Harrods Creek at Covered Bridge Road between 2000 and 2008. During this time, the fish communities were in "fair" condition, except in 2003, when they were in "good" condition. Fish communities in Wolf Pen Branch were monitored between 2002 and 2008. During this time, fish communities were in "fair" condition.



MSD monitored the aquatic insect communities in Harrods Creek at Covered Bridge Road between 2000 and 2008. During this time, aquatic communities were consistently in "excellent" condition, except in 2008, when they declined to "good". MSD also monitored aquatic insect communities in Wolf Pen Branch between 2005 and 2008. During this time, the aquatic insect communities declined from "fair" to "poor" condition.

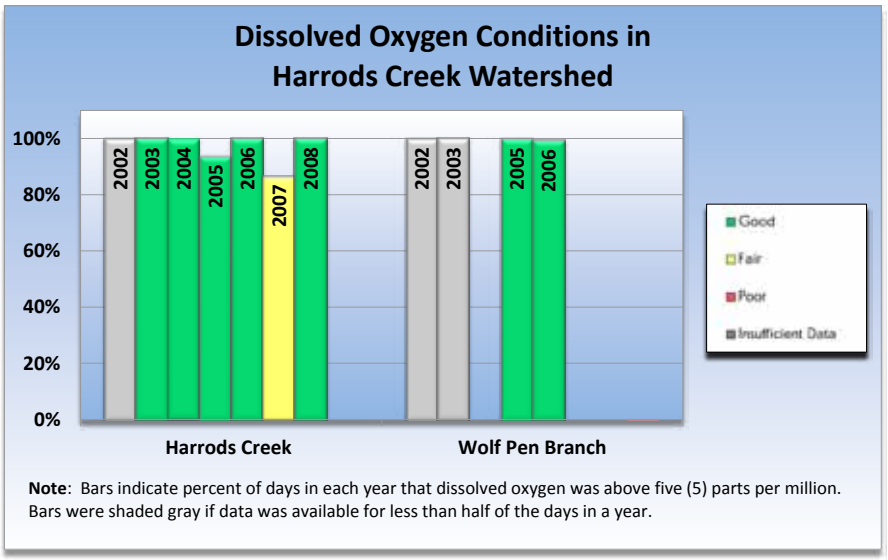


Mayfly Nymph Photo Courtesy of the Society of Freshwater Science

MSD assessed habitat for fish and aquatic insect communities in 2005 and 2008. In Harrods Creek, habitat was classified as "good" in both years. Habitat quality improved from "poor" to "fair" in Wolf Pen Branch between 2005 and 2008. Sediment deposition, unstable banks and a lack of trees and other protective vegetation on the banks were identified in both of these streams.

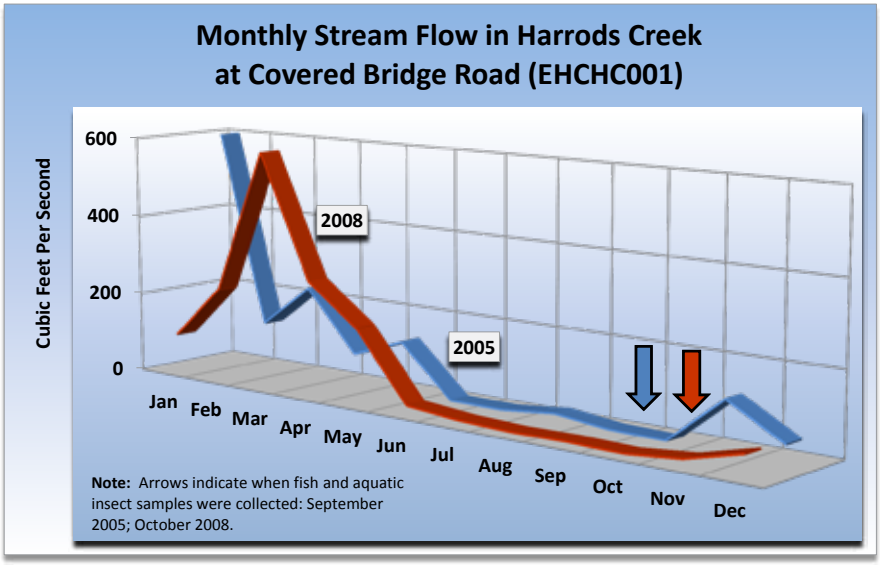
Trees help to stabilize stream on Harrods Creek upstream of Covered Bridge Road

MSD and US Geological Survey continuously monitor dissolved oxygen in Harrods Creek at Covered Bridge Road (Highway 329), at USGS gage 03292470. MSD continuously monitors dissolved oxygen in Wolf Pen Branch at 8111 Wolf Pen Branch Road. Fish and aquatic insects need dissolved oxygen to breathe, and amounts greater than five parts per million are what is deemed necessary. At Harrods Creek, more than half of the daily data were available for all years except 2002, indicating good data quality for this location. Between 2003 and 2008, dissolved oxygen levels were "good" in all years except 2007, when dissolved oxygen levels decreased to "fair". At Wolf Pen Branch, more than half of the daily data were available for 2005 and 2006. During this time period, dissolved oxygen levels were "good" in Wolf Pen Branch.

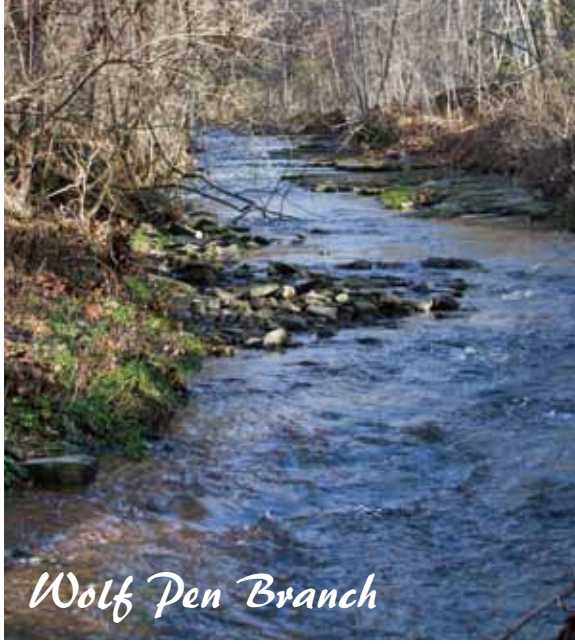


Note: Bars indicate percent of days in each year that dissolved oxygen was above five (5) parts per million. Bars were shaded gray if data was available for less than half of the days in a year.

MSD and US Geological Survey continuously monitor stream flow in Harrods Creek at the gage that is also monitored for dissolved oxygen. In 2005, stream flows were below normal in September, when fish and aquatic insect samples were collected in Harrods Creek. However, for the month prior to sampling, stream flows were average. In 2008, conditions throughout the watershed were drier, with below normal stream flows for five months prior to sampling event in October. Although stream flow was not monitored in Wolf Pen Branch, a similar pattern of drier conditions in 2008 occurred. In general, low stream flows can cause stress on fish and aquatic insects.



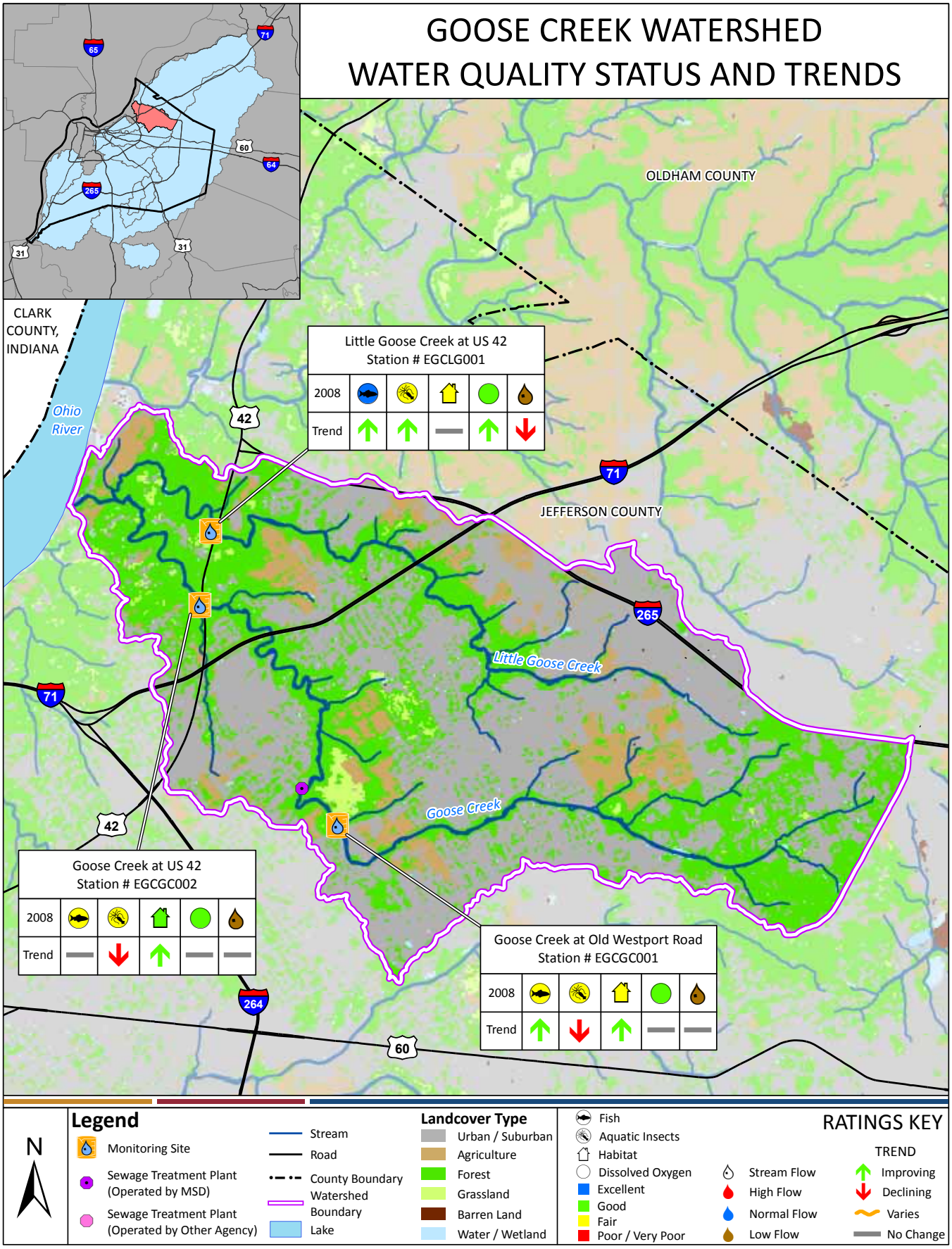
Note: Arrows indicate when fish and aquatic insect samples were collected: September 2005; October 2008.



WATERSHED ASSESSMENT

Fish communities in the Harrods Creek site were consistently "fair" and aquatic insect communities were "good to excellent". The Harrods Creek watershed has good habitat to support reasonably healthy fish and aquatic insect communities. The agricultural and forested areas slow down and absorb runoff after rain events. Thus, the stream habitat is well suited to aquatic life. The amount of dissolved oxygen in the water was "good" in all years except 2007, when it was "fair", indicating that fish and aquatic insects had sufficient dissolved oxygen during most of the monitoring period.

In Wolf Pen Branch fish communities were consistently "fair" but the aquatic insect communities declined from "fair" to "poor" by 2008. Habitat quality improved from "poor" in 2005 to "fair" in 2008 but not enough to support better fish and insect communities. The amount of dissolved oxygen in the water was "good" in 2005 and 2006, indicating that fish and aquatic insects had sufficient dissolved oxygen during this time period. Dry conditions in 2008 may have contributed to declines in aquatic insect communities in Wolf Pen Branch.


GOOSE CREEK WATERSHED
WATER QUALITY STATUS AND TRENDS
OLDHAM COUNTY
CLARK COUNTY, INDIANA
Ohio River
JEFFERSON COUNTY
Little Goose Creek
Goose Creek
Little Goose Creek at US 42
Station # EGCLG001
2008
Trend
Goose Creek at US 42
Station # EGCGC002
2008
Trend
Goose Creek at Old Westport Road
Station # EGCGC001
2008
Trend
Legend
Monitoring Site
Sewage Treatment Plant (Operated by MSD)
Sewage Treatment Plant (Operated by Other Agency)
Stream
Road
County Boundary
Watershed Boundary
Lake
Landcover Type
Urban / Suburban
Agriculture
Forest
Grassland
Barren Land
Water / Wetland
Fish
Aquatic Insects
Habitat
Dissolved Oxygen
Excellent
Good
Fair
Poor / Very Poor
Stream Flow
High Flow
Normal Flow
Low Flow
RATINGS KEY
TREND
Improving
Declining
Varies
No Change
N

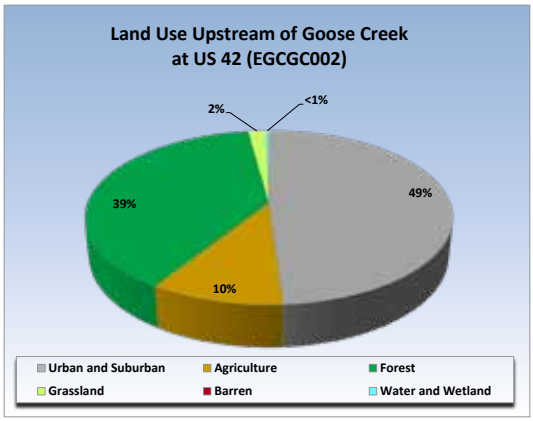
3.2 Goose Creek Watershed

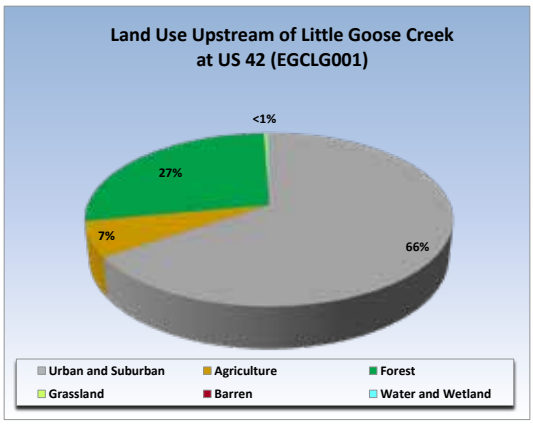
The streams that form the Goose Creek Watershed, Little Goose Creek and Goose Creek, flow northwest from Anchorage to Glenview Acres. Goose Creek enters into the Ohio River near Lime Kiln Lane and River Road.

There are 19 square miles of land in the Goose Creek Watershed. The land use associated with each monitoring site, like the entire watershed, is a mix of urban, forest and some agriculture. MSD monitors three stream sites in the watershed: Goose Creek at Old Westport Road, Goose Creek at US 42 and Little Goose Creek at US 42.

Land draining to monitoring sites in Goose Creek at Old Westport Road and Goose Creek at US 42 have very similar land uses. There are 6.7 square miles draining to the Goose Creek at Old Westport Road, with almost 10 percent impervious surfaces, such as roads, rooftops and driveways. There are 9.7 square miles of land draining to the Goose Creek at US 42, with almost 11 percent impervious surfaces. Approximately half of the land is used for urban and suburban purposes, approximately 40 percent is forested and 10 percent is agriculture.

There are 5.8 square miles of land draining to the Little Goose Creek at US 42, with 18 percent impervious surfaces. With 66 percent of the land area used for urban and suburban development, this watershed is the most developed of the three Goose Creek sites. As a result of the additional development, there is less agriculture and forest in this tributary to Goose Creek.

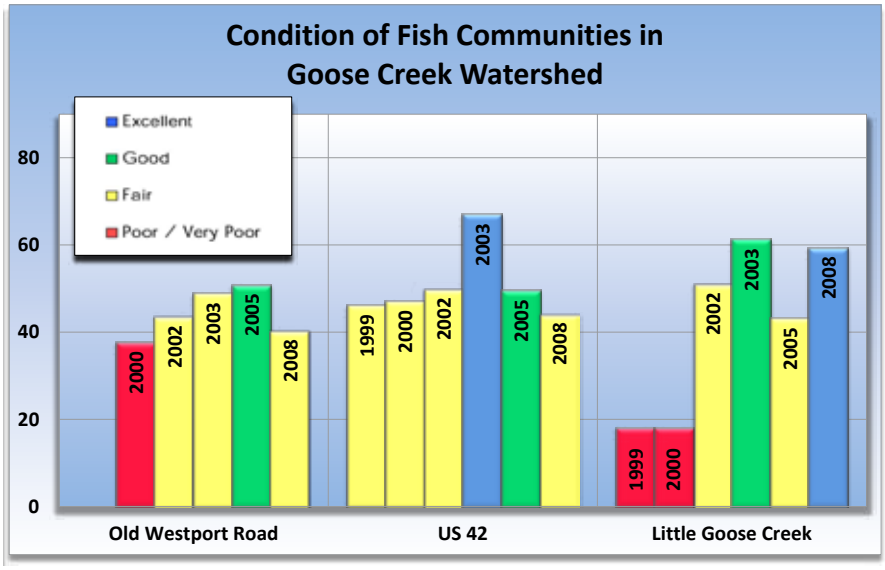


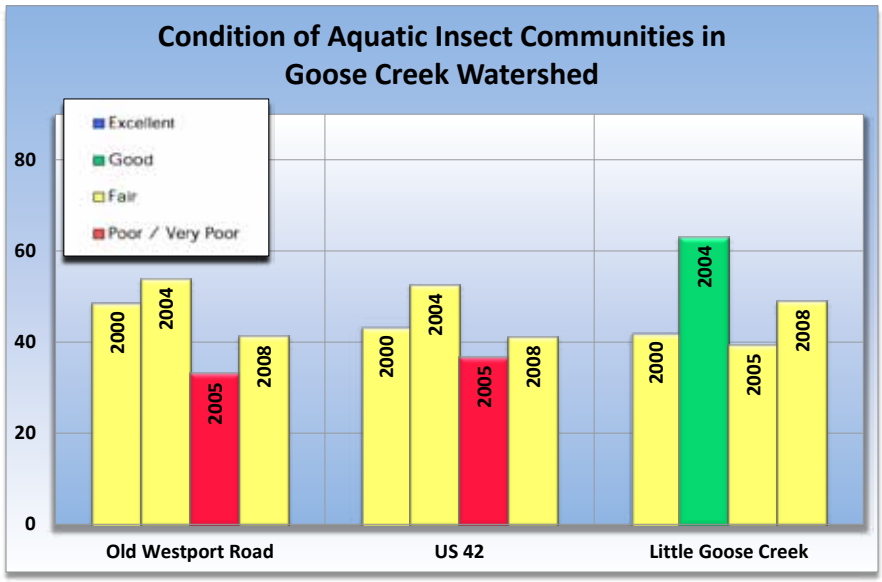


MONITORING SUMMARY

MSD monitored fish communities in Goose Creek at Old Westport Road between 2000 and 2008. Fish communities improved steadily from "poor" in 2000 to "good" in 2005, but declined to "fair" in 2008. MSD monitored fish communities in Goose Creek at US 42 between 1999 and 2008. Fish communities were "fair" in most years except 2003, when they were "excellent" and 2005, when they were "good". Although some improvements were observed in the mid-2000's, fish communities in Goose Creek have remained consistent over the monitoring period. Fish communities were monitored in Little Goose Creek at US 42 between 1999 and 2008. Fish communities improved from "very poor" to "excellent" during this time period.

Note that the procedure for converting the fish community data to a narrative rating changed as more experience with biological monitoring was gained. In Little Goose Creek, the fish community data resulted in a higher score in 2003 than in 2008. However, the narrative rating for 2003 is "good", whereas the narrative rating in 2008 is "excellent". Despite these differences, the overall condition of fish communities in Little Goose Creek improved dramatically between 1999 and 2008.

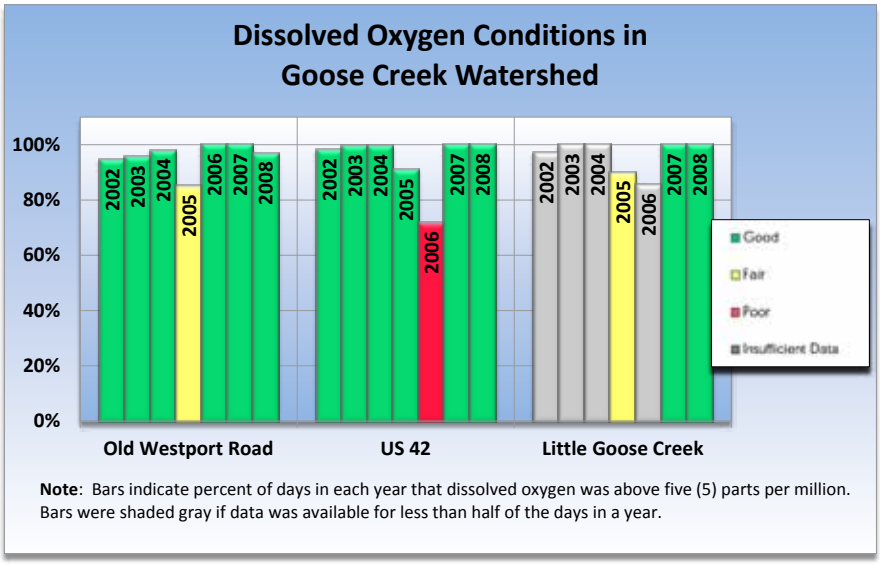




MSD monitored aquatic insect communities at the three sites between 2000 and 2008. During this time, the aquatic insect communities were classified as "poor" and "fair", except in 2004, when the Little Goose Creek site was classified as "good". Overall, the aquatic insect communities in Goose Creek declined slightly between 2000 and 2008. During this time period, aquatic insect communities improved slightly in Little Goose Creek.

MSD assessed habitat for fish and aquatic insect communities in 2005 and 2008. At the three Goose Creek sites, habitat was classified as "poor" and "fair" in 2005 and improved to "fair" and "good" in 2008. The largest improvement was seen at Goose Creek at Old Westport Road. Sediment deposition, unstable banks and a lack of trees and other protective vegetation were identified in these streams as limitations of the habitat quality. Goose Creek at Old Westport Road lacked rocky riffles that are used as habitat by aquatic insects.

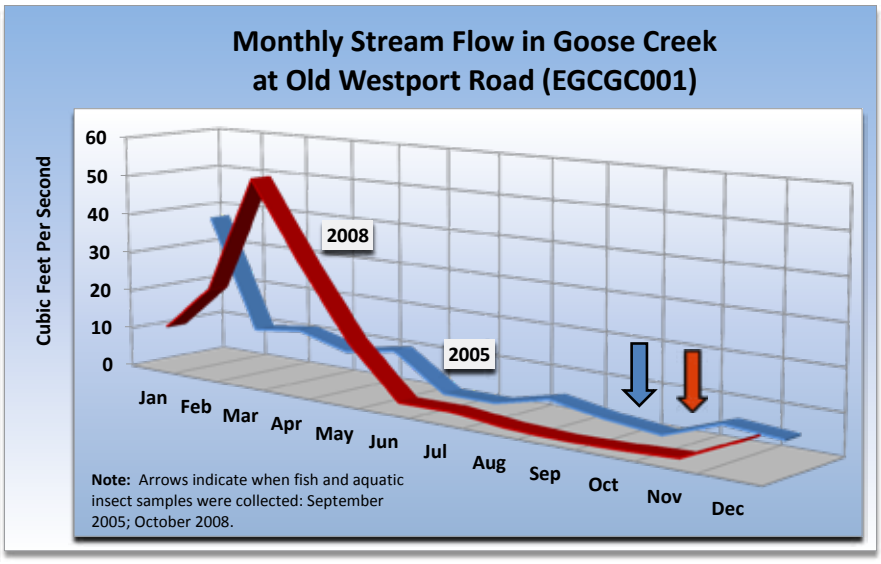
MSD and the US Geological Survey continuously monitor dissolved oxygen at three locations in the watershed: Goose Creek at Old Westport Road (USGS gage 03292474), Goose Creek at US 42 (USGS gage 03292475) and Little Goose Creek at US 42 (USGS gage 03292480). Fish and aquatic insects need dissolved oxygen to breathe, and amounts greater than five parts per million are what is deemed necessary.



Note: Bars indicate percent of days in each year that dissolved oxygen was above five (5) parts per million. Bars were shaded gray if data was available for less than half of the days in a year.

More than half of the daily data was available between 2002 and 2008 in Goose Creek at Old Westport Road and Goose Creek at US 42, indicating good data quality. In Goose Creek at Old Westport Road, the percent of days when dissolved oxygen in the water was above five parts per million was consistently "good" with two exceptions. At Old Westport Road in 2005, dissolved oxygen levels decreased to "fair". In 2006, dissolved oxygen levels decreased to "poor" in Goose Creek at US 42.

In Little Goose Creek at US 42, more than half of the daily data was available for 2005, 2007 and 2008, indicating improving data quality. The percent days when dissolved oxygen in the water was above five parts per million increased from "fair" in 2005 to "good" in 2007 and 2008.

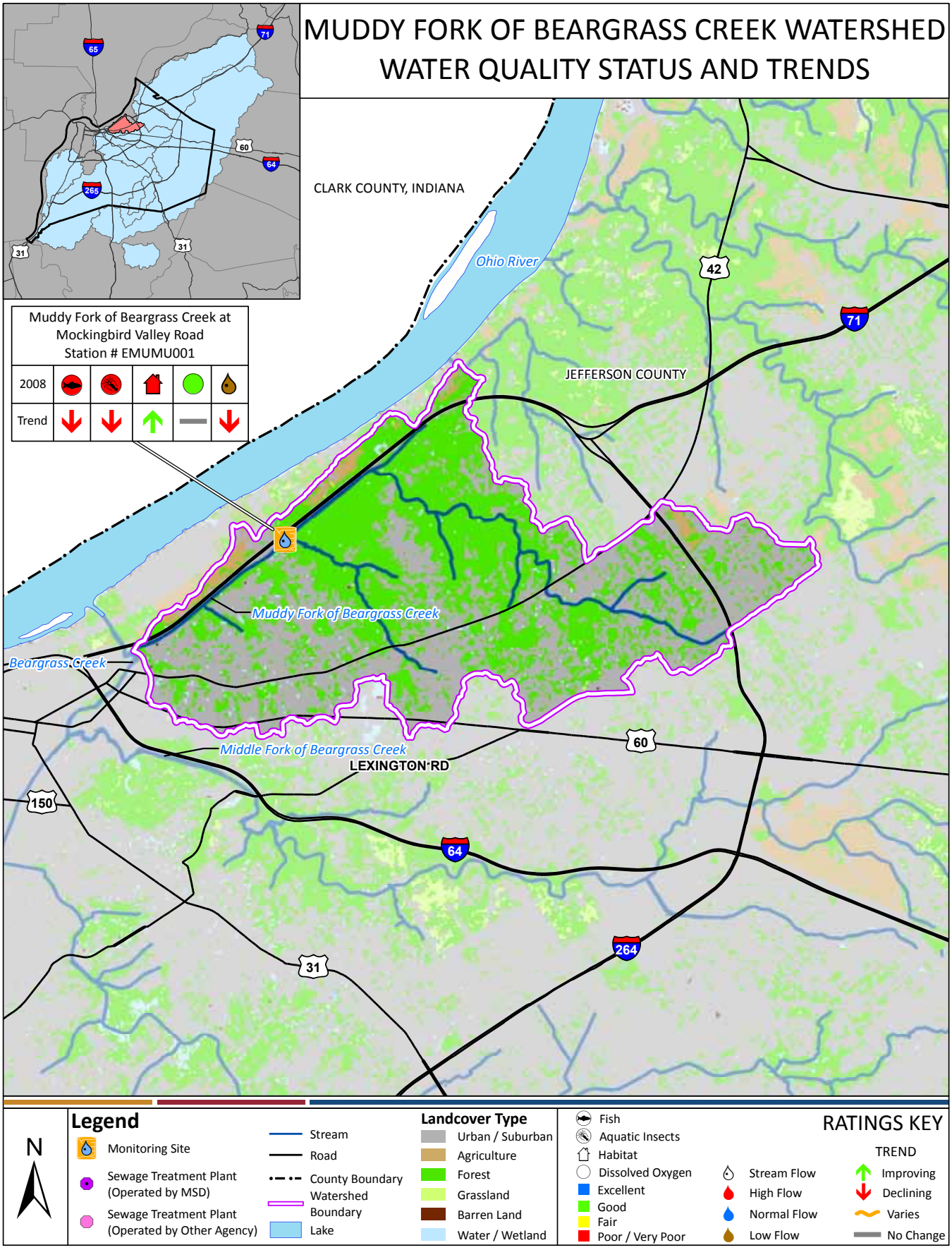


Note: Arrows indicate when fish and aquatic insect samples were collected: September 2005; October 2008.

MSD and the US Geological Survey continuously monitor stream flow at the three gages that are also monitored for dissolved oxygen. The graph shown here is representative of the flow pattern that occurred in this watershed in 2005 and 2008. Stream flow in Goose Creek was below normal in September 2005 and October 2008 when fish and aquatic insect samples were collected. Stream flow was normal in September 2005 in Little Goose Creek. In 2008, conditions were drier throughout the watershed, with below normal stream flows for three to five months prior to sampling in October. In general, low stream flows can cause stress on fish and aquatic insects.

WATERSHED ASSESSMENT

Since 1999, the fish communities in the Goose Creek watershed showed significant improvement from "very poor" and "fair" to "fair" and "excellent" in 2005 and 2008. However, the aquatic insect communities at the Goose Creek sites declined somewhat and the Little Goose Creek site showed only slight improvement over that time period. Habitat for fish and aquatic insects was "fair" in 2005 and "good" in 2008. Dissolved oxygen levels were generally good, indicating sufficient dissolved oxygen was available for fish and aquatic insects. The lower than normal flow conditions during and preceding the 2005 and 2008 sampling periods might partly account for the decline in insect communities at the sites in this watershed.

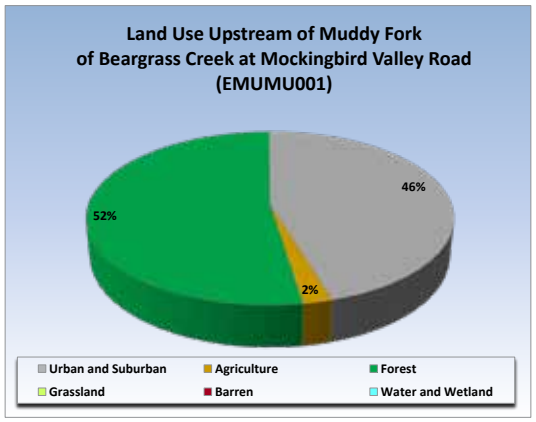

MUDDY FORK OF BEARGRASS CREEK WATERSHED
WATER QUALITY STATUS AND TRENDS
CLARK COUNTY, INDIANA
Ohio River
JEFFERSON COUNTY
Muddy Fork of Beargrass Creek at
Mockingbird Valley Road
Station # EMUMU001
2008
Trend
Muddy Fork of Beargrass Creek
Beargrass Creek
Middle Fork of Beargrass Creek
LEXINGTON RD
65
71
60
64
265
31
42
150
264
N
Legend
Monitoring Site
Sewage Treatment Plant (Operated by MSD)
Sewage Treatment Plant (Operated by Other Agency)
Stream
Road
County Boundary
Watershed Boundary
Lake
Landcover Type
Urban / Suburban
Agriculture
Forest
Grassland
Barren Land
Water / Wetland
Fish
Aquatic Insects
Habitat
Dissolved Oxygen
Excellent
Good
Fair
Poor / Very Poor
Stream Flow
High Flow
Normal Flow
Low Flow
RATINGS KEY
TREND
Improving
Declining
Varies
No Change

3.3 Muddy Fork of Beargrass Creek Watershed

The Muddy Fork is one of the three streams that join to form the larger Beargrass Creek watershed. The Muddy Fork flows west across from Windy Hills toward the Ohio River, then southwest along Interstate 71 before joining with the South Fork to become Beargrass Creek near Mellwood Avenue and Story Avenue.

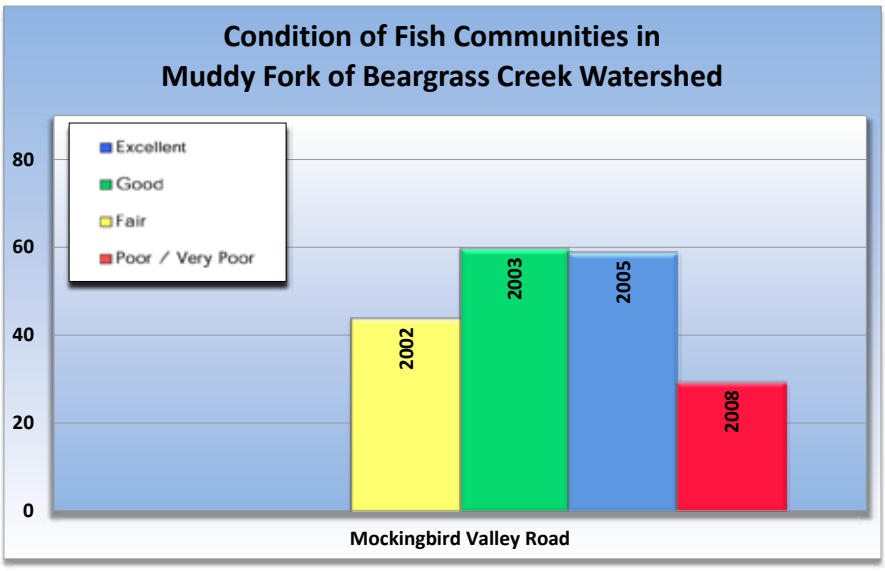
When water levels are higher on the Ohio River than on Muddy Fork, river water flows into Beargrass Creek and up Muddy Fork. Historically, major segments of Muddy Fork have been straightened along Interstate 71 and along Mockingbird Valley Road.

MSD has been monitoring water quality and stream flow since 2002 in the Muddy Fork at Mockingbird Valley Road. There are about 9 square miles of land draining the entire Muddy Fork Watershed and 6.2 square miles of land draining to the Muddy Fork at Mockingbird Valley Road. The land use draining to the monitoring site, like the entire watershed, is a mix of forest and urban and suburban uses. Fifty-two percent of the watershed is classified as forest. However, this area of Louisville is densely developed and many the areas classified as forested are actually tree-covered developed areas. There is a small area of agricultural land in the very upper part of the watershed. Impervious surfaces such as roads, rooftops and driveways cover about 9 percent of this watershed.

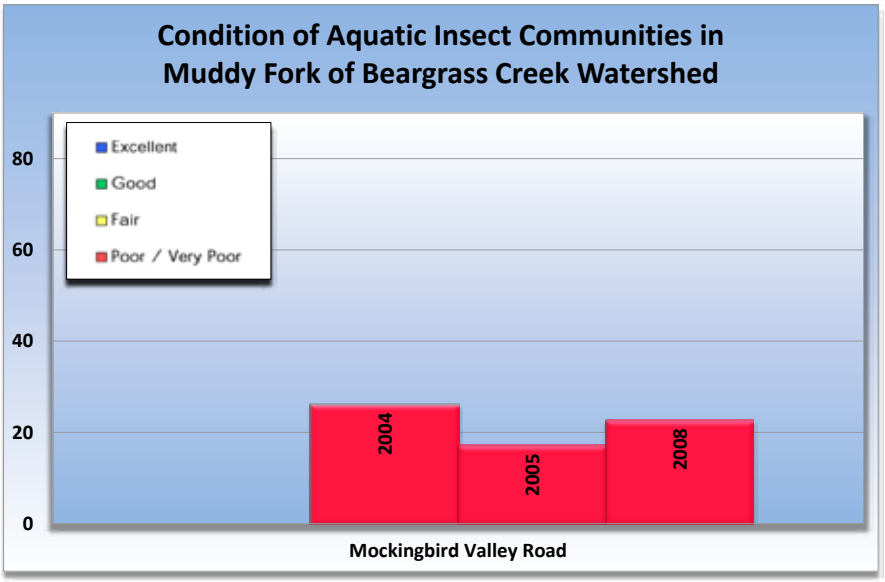


MONITORING SUMMARY

MSD monitored fish communities in the Muddy Fork of Beargrass Creek between 2002 and 2008. Fish communities improved from "fair" in 2002 to "excellent" in 2005, but showed a decline to "poor" conditions in 2008.



MSD assessed the condition of aquatic insect communities between 2004 and 2008 in the Muddy Fork of Beargrass Creek at Mockingbird Valley Road. Aquatic insect communities were consistently classified as "poor" and "very poor".



Top: Stonefly Nymph (Plecoptera) Photo by Dave Penrose
Bottom: Stonefly Adult (Plecoptera) Photo by Howell Daly
Photos courtesy of Society for Freshwater Science (NABS (www.benthos.org)).

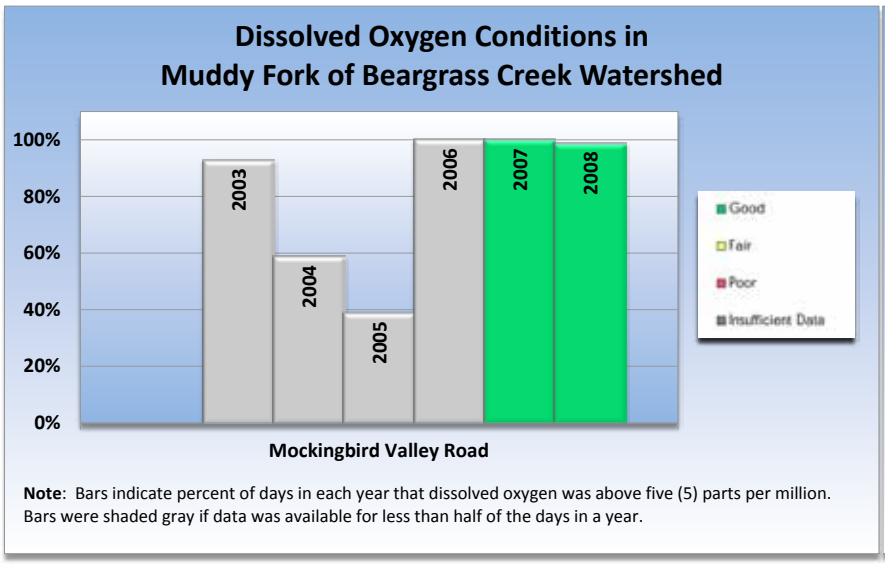
Straightened channel and eroding banks contribute to "poor" habitat along Muddy Fork.

MSD assessed stream habitat conditions for fish and aquatic insect communities in 2005 and 2008 at the Mockingbird Valley Road site. Stream habitat was classified as "poor" both in 2005 and 2008, with some improvement in 2008 but not enough to change the classification. The poor quality habitat is associated with straightening of the channel, lack of trees and other protective vegetation along the stream banks and eroding banks. These issues have contributed to silt and sediment accumulating in the stream, which covers habitats used by aquatic insects and fish.

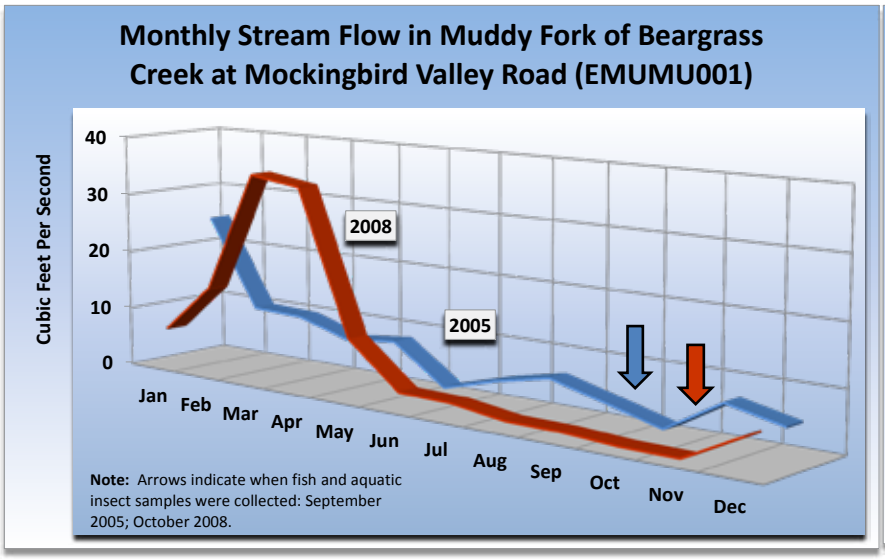
Did you know?

All species of stoneflies are intolerant of stream pollution and usually indicate good water quality.

MSD and the US Geological Survey monitor dissolved oxygen in the Muddy Fork of Beargrass Creek at Mockingbird Valley Road at USGS gage 03293530. Fish and aquatic insects need dissolved oxygen to breathe, and amounts greater than five parts per million are what is deemed necessary. More than half of the daily data was available for 2007 and 2008, indicating improving data quality. For these years, the percent of days when the average amount of dissolved oxygen in the water was above five parts per million increased was consistently "good".

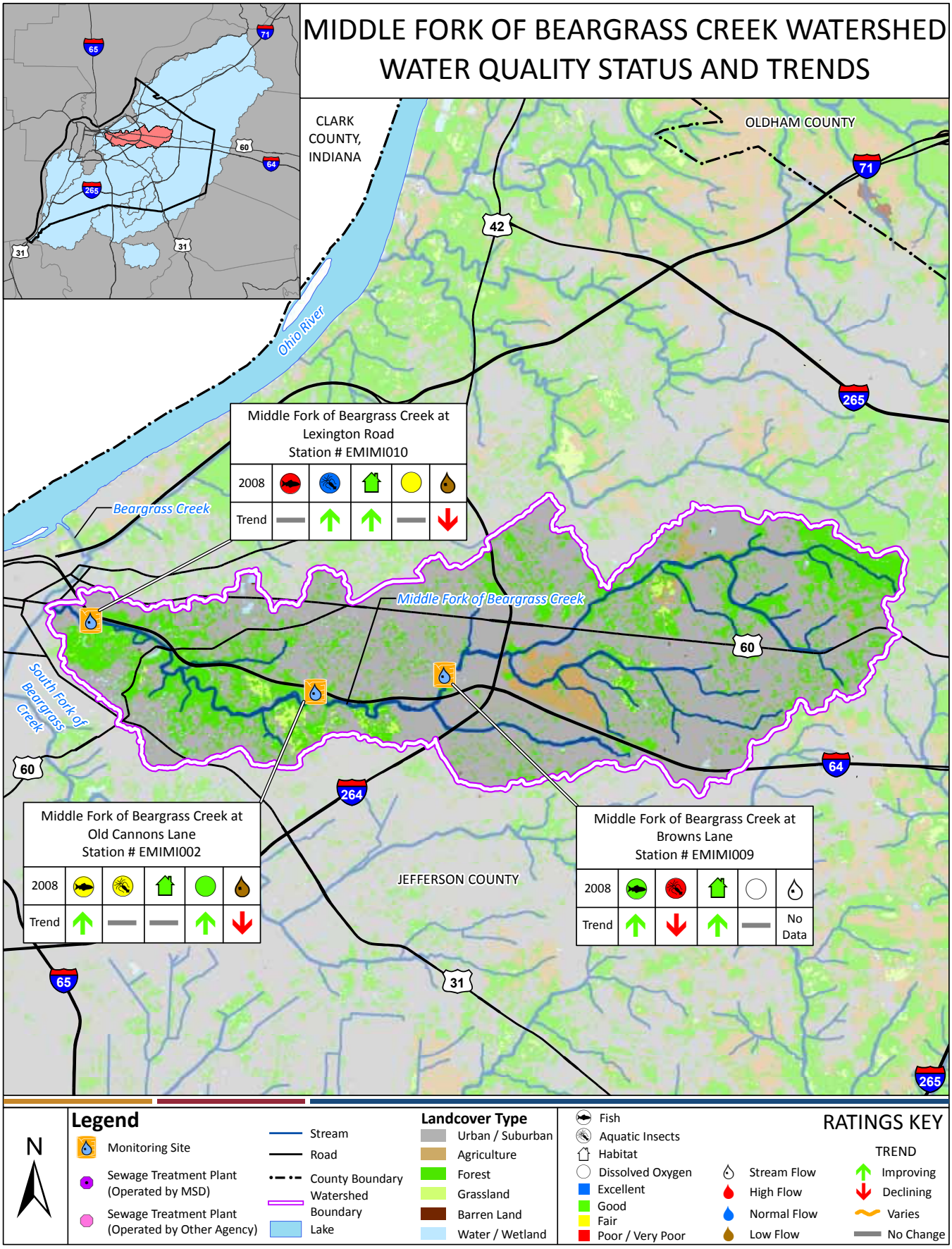


MSD and the US Geological Survey continuously monitor stream flow in the Muddy Fork of Beargrass Creek at the gage that is also monitored for dissolved oxygen. In 2005, stream flows were below normal in September, when fish and aquatic insect samples were collected in the Muddy Fork of Beargrass Creek. However for the month prior to sampling, stream flows were average. In 2008, conditions throughout the watershed were drier, with below normal stream flows for five months prior to sampling event in October. In general, low stream flows can cause stress on fish and aquatic insects.



WATERSHED ASSESSMENT

Since 2002, the fish communities in the Muddy Fork at the Mockingbird Valley Road site showed significant improvement from 2002 to 2005 but then declined to "poor" in 2008. The aquatic insect communities were classified as "very poor" and "poor" between 2004 and 2008. Stream habitat conditions for fish and aquatic insects were "poor" due to straightening of the channel, lack of trees and other protective vegetation along the stream banks, eroding banks and silt and sediment accumulating in the stream. Stream flows were below normal in 2005 and were considerably drier in 2008. In 2007 and 2008, dissolved oxygen was over five parts per million almost every day for which data was available. The unexpected decline in fish communities in 2008 may be, in part, the result of the very low flow conditions at the sites during and prior to sampling.

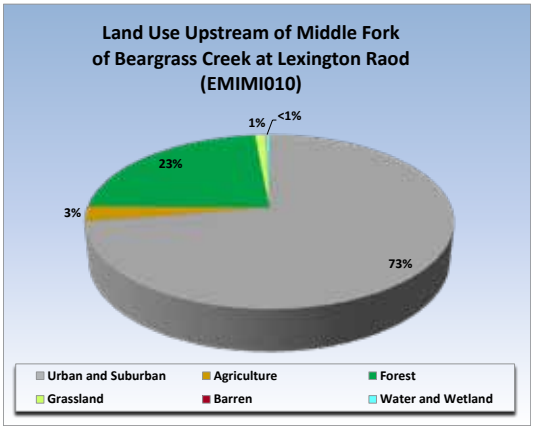

MIDDLE FORK OF BEARGRASS CREEK WATERSHED
WATER QUALITY STATUS AND TRENDS
CLARK COUNTY, INDIANA
OLDHAM COUNTY
JEFFERSON COUNTY
Ohio River
Beargrass Creek
Middle Fork of Beargrass Creek
South Fork of Beargrass Creek
Middle Fork of Beargrass Creek at Lexington Road
Station # EMIMI010
2008
Trend
Middle Fork of Beargrass Creek at Old Cannons Lane
Station # EMIMI002
2008
Trend
Middle Fork of Beargrass Creek at Browns Lane
Station # EMIMI009
2008
Trend
No Data
N
Legend
Monitoring Site
Sewage Treatment Plant (Operated by MSD)
Sewage Treatment Plant (Operated by Other Agency)
Stream
Road
County Boundary
Watershed Boundary
Lake
Landcover Type
Urban / Suburban
Agriculture
Forest
Grassland
Barren Land
Water / Wetland
Fish
Aquatic Insects
Habitat
Dissolved Oxygen
Excellent
Good
Fair
Poor / Very Poor
Stream Flow
High Flow
Normal Flow
Low Flow
RATINGS KEY
TREND
Improving
Declining
Varies
No Change

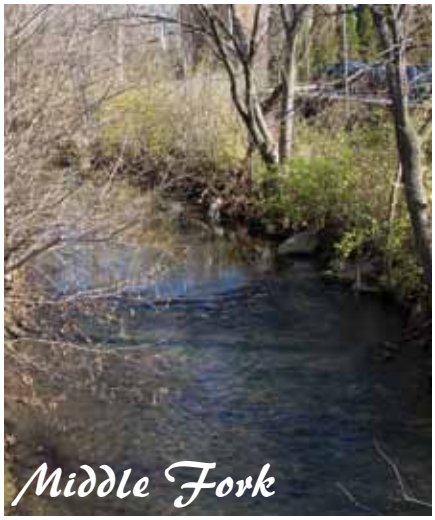
3.4 Middle Fork of Beargrass Creek Watershed

The Middle Fork of Beargrass Creek is one of the three streams that join to form the larger Beargrass Creek watershed. The small streams that eventually form the Middle Fork of Beargrass Creek originate in Middletown and Douglass Hills.

The Middle Fork of Beargrass Creek flows west across Saint Matthews before joining the South Fork of Beargrass Creek near Irish Hill. The South Fork then joins with the Muddy Fork to become Beargrass Creek near the intersection of Interstates 71 and 64. Prominent features of this watershed include Cherokee Park, Seneca Park and Cave Hill Cemetery. This part of Louisville is currently served by combined sewers.

There are just over 25 square miles of land in the Middle Fork of Beargrass Creek Watershed. MSD monitors three stream sites in the watershed: Browns Lane, Old Cannons Lane and Lexington Road. There are 5 square miles of land draining to the Browns Lane site; 18.5 square miles of land are draining to the Old Cannons Lane site and 25.2 square miles of land are draining to the Lexington Road site.

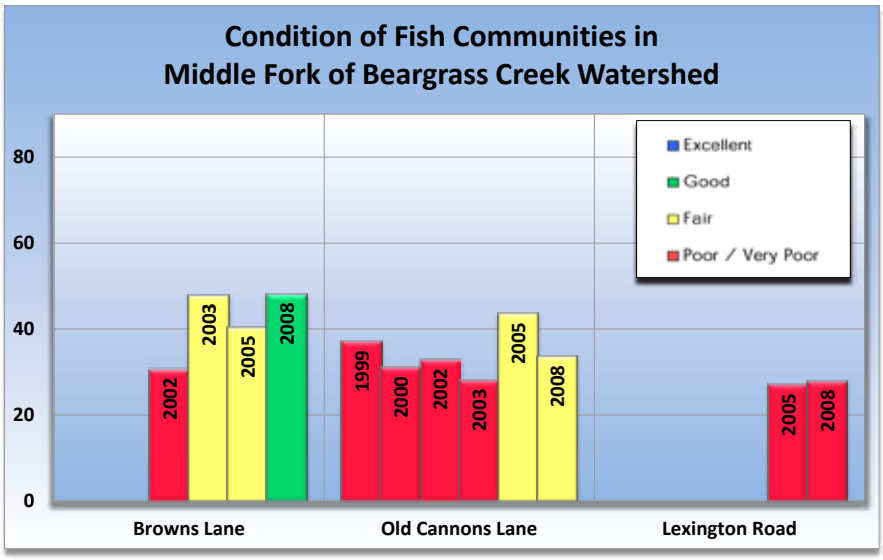




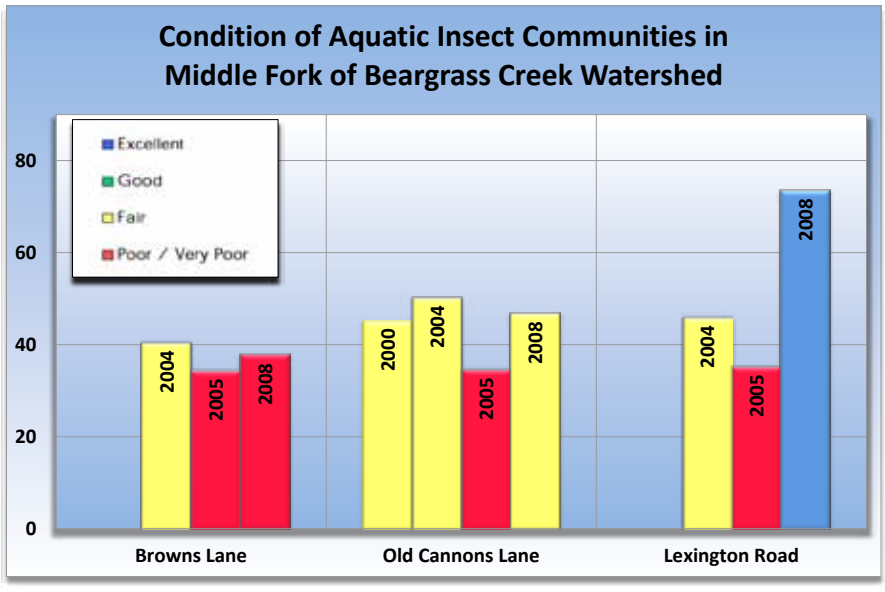
The land use associated with each monitoring site, like the entire watershed, is mostly developed for urban and suburban uses. Portions of the watershed classified as forest include Cherokee Park and Seneca Park. However this area of Louisville is densely developed, and some of the areas classified as forested in the western part of the watershed are actually tree-covered developed areas. There is a small area of agricultural land in the middle part of the watershed. Impervious surfaces such as roads, rooftops and driveways cover about 23 percent of this watershed.

MONITORING SUMMARY

MSD monitored the fish communities at Browns Lane, Old Cannons Lane and Lexington Road between 1999 and 2008. Between 2002 and 2008, fish communities improved from "poor" to "good" at Browns Lane. Between 1999 and 2008, fish communities improved from "poor" to "fair" at Old Cannons Lane. In 2005 and 2008, fish communities were "poor" at Lexington Road.



MSD monitored aquatic insect communities at the three sites between 2000 and 2008. The aquatic insect communities at Browns Lane declined from "fair" in 2004 to "poor" in 2005 and 2008. The aquatic insect communities were "poor" or "fair" at Old Cannons Lane. Aquatic insect communities improved from "fair" in 2004 to "excellent" in 2008 at Lexington Road.



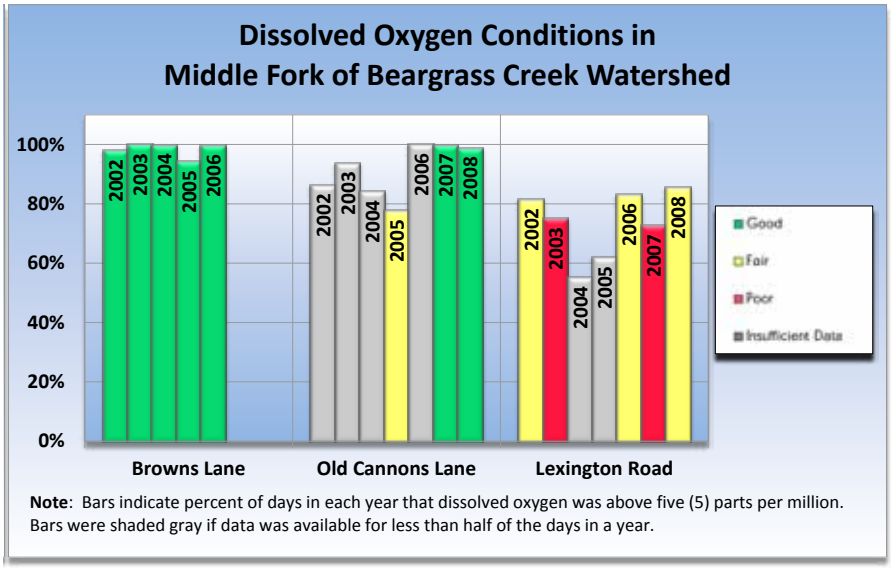
Pervious pavement reduces direct stormwater runoff to streams.

Forest along Middle Fork of Beargrass Creek contributes to "good" habitat at Old Cannons Lane.

MSD assessed stream habitat for fish and aquatic insect communities in 2005 and 2008. The aquatic habitat at Browns Lane was "good" and improving, consistently "good" at Old Cannons Lane and "good" and improving at Lexington Road. Similar to many urban streams, the habitat assessment noted a lack of trees and other protective vegetation along stream banks.

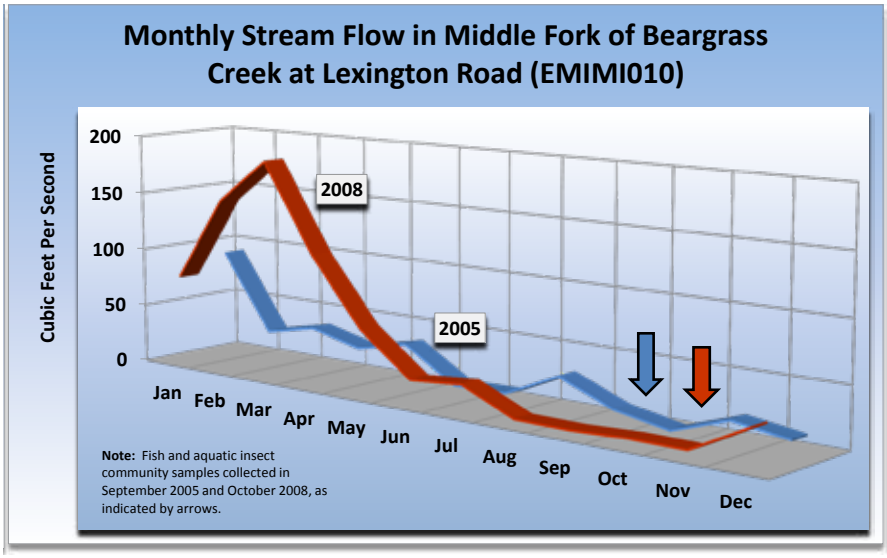
MSD and the US Geological Survey continuously monitor dissolved oxygen in the Middle Fork of Beargrass Creek at Old Cannons Lane (USGS gage 03293000) and at Lexington Road

(USGS gage 03293500). MSD continuously monitors dissolved oxygen in the Middle Fork of Beargrass Creek at Browns Lane. Fish and aquatic insects need dissolved oxygen to breathe, and amounts greater than five parts per million are what is deemed necessary. More than half of the daily data was available for 2002 to 2006 at Browns Lane; for 2005, 2007 and 2008 at Old Cannons Lane; and in all years except 2004 and 2005 at Lexington Road, indicating improving data quality. The percent of days when the average amount of dissolved oxygen in the water was above five parts per million was "good" in all years at Browns Lane, increased from "fair" in 2005 to "good" in 2007 and 2008 at Old Cannons Lane and, varied between "fair" and "poor" at Lexington Road.



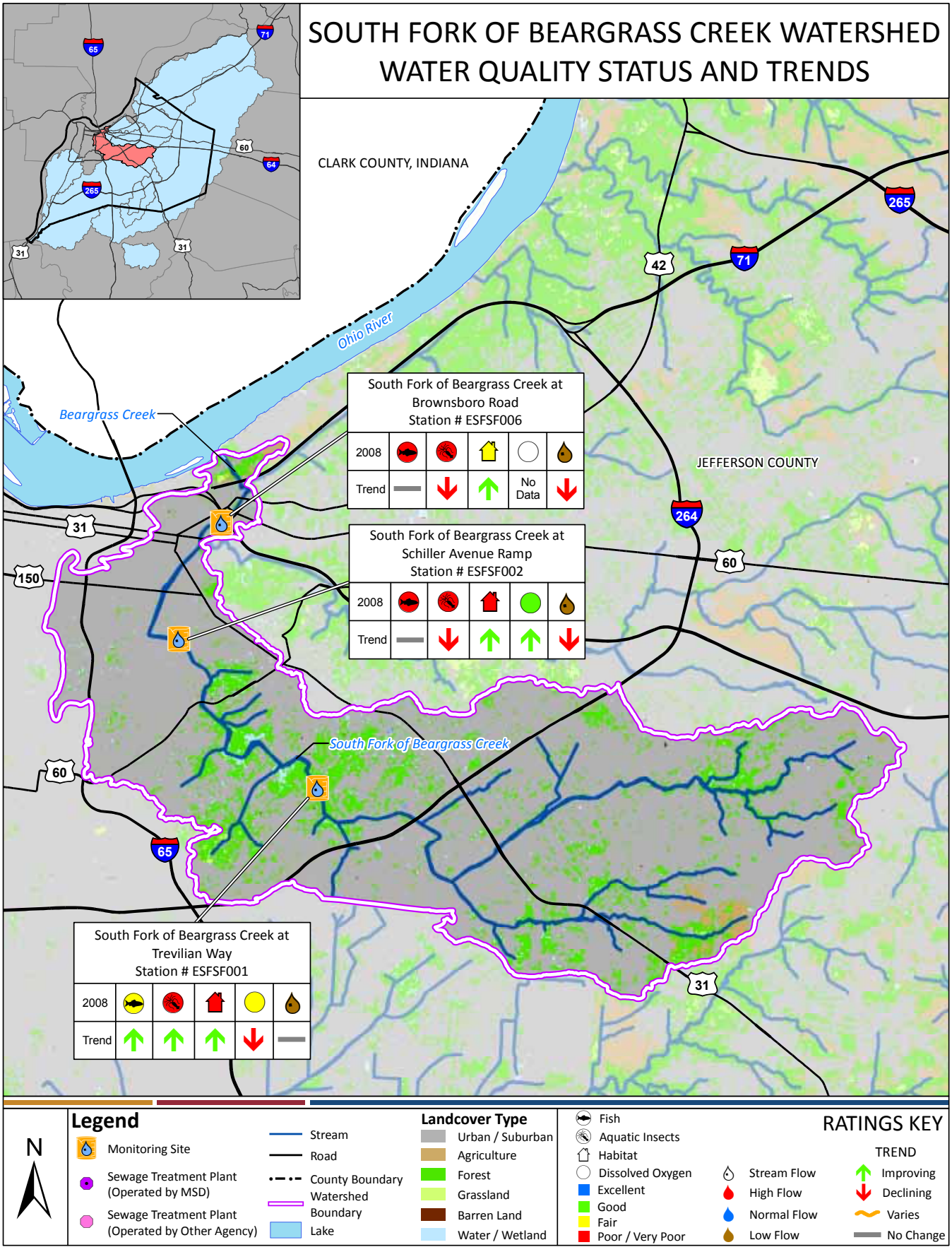
Note: Bars indicate percent of days in each year that dissolved oxygen was above five (5) parts per million. Bars were shaded gray if data was available for less than half of the days in a year.

MSD and the US Geological Survey continuously monitor stream flow in the Beargrass Creek watershed at the two gages that are also monitored for dissolved oxygen. Stream flow in September 2005 was below normal at Old Cannons Lane and average at Lexington Road, when fish and aquatic insect samples were collected in the watershed. However, for the month prior to sampling, stream flow was average. In 2008, conditions throughout the watershed were drier, with below normal stream flow for three months prior to sampling event in October. In general, low stream flow can cause stress on fish and aquatic insects.



WATERSHED ASSESSMENT

Since 1999, the fish communities showed significant improvement from "poor" to "good" at the furthest upstream Browns Lane site and from "poor" to "fair" at the mid-watershed Old Cannons Lane. Fish communities were consistently "poor" in Middle Fork of Beargrass Creek at Lexington Road. The aquatic insect communities at all three sites generally were classified as "poor" or "fair" with some improvement shown by 2008, especially at the Lexington Road site. The stream habitat conditions for fish and aquatic insects were generally "good" at all three sites except for an unexplained "poor" for the Browns Lane site in 2005. The percent of days for which dissolved oxygen was above five parts per million was consistently "good" at Browns Lane, improved from "fair" to "good" at Old Cannons Lane, but ranged from "fair" to "poor" at Lexington Road. Frequent days of low dissolved oxygen may have contributed to the poor fish communities in the downstream portion of the watershed at Lexington Road. Stream flows were below normal in 2005 and were considerably drier in 2008. In general, low stream flow can cause stress on fish and aquatic insects. The presence of the parks, which provide natural areas to absorb runoff from developed areas as well as tree cover, probably buffer this watershed to some degree from the otherwise significant urban influences.


SOUTH FORK OF BEARGRASS CREEK WATERSHED
WATER QUALITY STATUS AND TRENDS
CLARK COUNTY, INDIANA
JEFFERSON COUNTY
Ohio River
Beargrass Creek
South Fork of Beargrass Creek
South Fork of Beargrass Creek at
Brownsboro Road
Station # ESFSF006
2008
Trend
No Data
South Fork of Beargrass Creek at
Schiller Avenue Ramp
Station # ESFSF002
2008
Trend
South Fork of Beargrass Creek at
Trevilian Way
Station # ESFSF001
2008
Trend
N
Legend
Monitoring Site
Sewage Treatment Plant (Operated by MSD)
Sewage Treatment Plant (Operated by Other Agency)
Stream
Road
County Boundary
Watershed Boundary
Lake
Landcover Type
Urban / Suburban
Agriculture
Forest
Grassland
Barren Land
Water / Wetland
Fish
Aquatic Insects
Habitat
Dissolved Oxygen
Excellent
Good
Fair
Poor / Very Poor
Stream Flow
High Flow
Normal Flow
Low Flow
RATINGS KEY
TREND
Improving
Declining
Varies
No Change

3.5 South Fork of Beargrass Creek Watershed

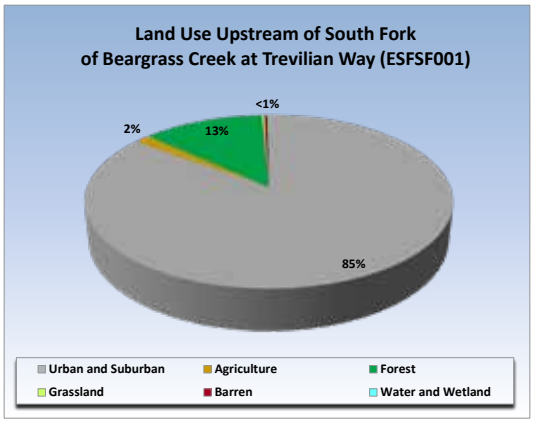
The South Fork of Beargrass Creek is one of the three streams that join to form the larger Beargrass Creek Watershed. The small streams that eventually form the South Fork of Beargrass Creek originate in Jeffersontown and Hurstbourne Acres.

The South Fork of Beargrass Creek flows west across Buechel before joining the Middle Fork of Beargrass Creek near Irish Hill. The South Fork then joins with the Muddy Fork to become Beargrass Creek near the intersection of Interstates 71 and 64. Streams in this watershed were straightened and several miles have been enclosed in concrete channels in the past to reduce flooding.

There are about 25 square miles of land in the entire South Fork of Beargrass Creek Watershed. MSD has been monitoring water quality in South Fork of Beargrass Creek at the Trevilian Way since 1999, at Schiller Avenue since 2000, and at Brownsboro Road since 2004.

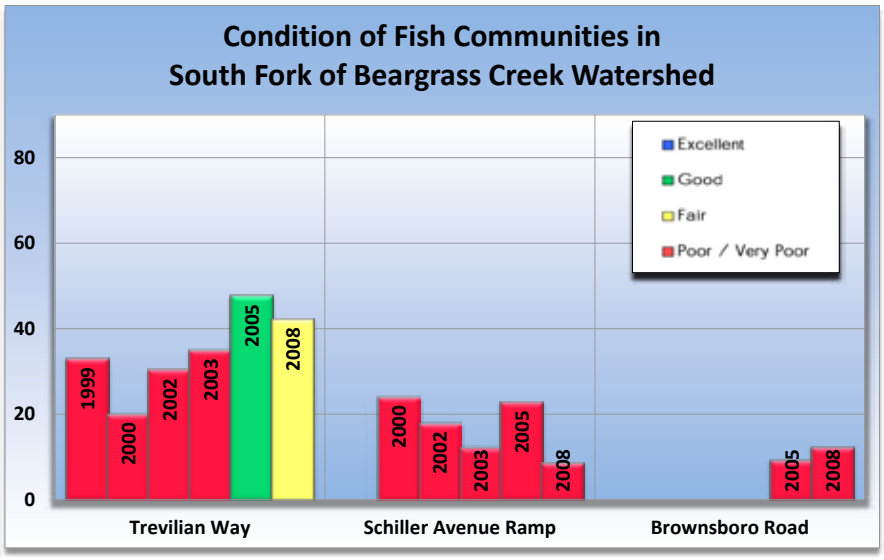
In the upper part of the watershed, there are 16.8 square miles of land draining to the Trevilian Way site. At the lower end, 22.6 square miles of land are draining to the Schiller Avenue Ramp site and 24.9 square miles of land are draining to the Brownsboro Road site.

The land use associated with each monitoring site, like the entire watershed, is mostly developed for urban and suburban uses. Impervious areas, including roadways, rooftops and driveways covers 32 percent of the land draining to the Trevilian Way monitoring site. At the Brownsboro Road monitoring site, impervious surfaces cover 28 percent of the land area. A modest percentage of the land is forested and very little land is agricultural in the very upper part of the watershed.

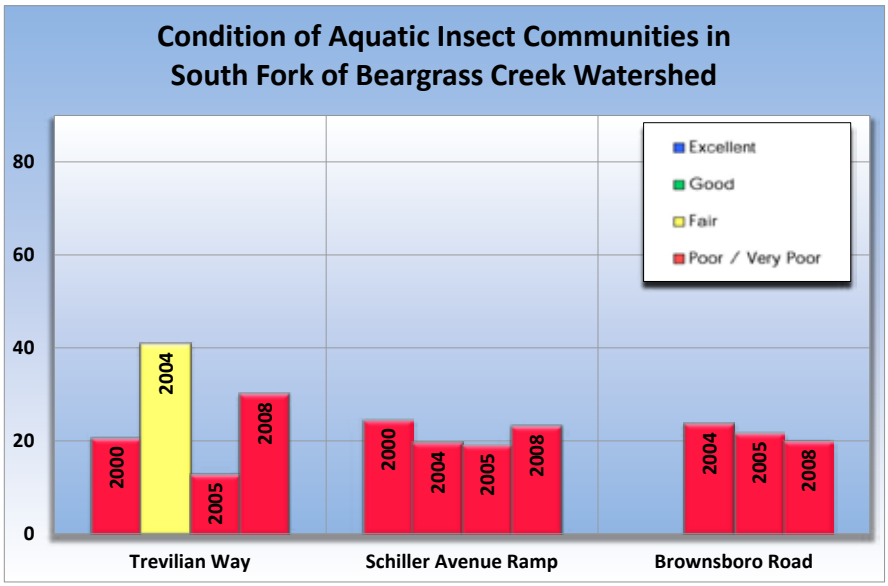


MONITORING SUMMARY

MSD monitored fish communities in South Fork of Beargrass Creek at Trevilian Way between 1999 and 2008. The Schiller Avenue site was not sampled in 1999 and the Brownsboro Road site was only sampled in 2005 and 2008. The fish communities at the two downstream sites, Schiller Avenue and Brownsboro Road, were "very poor" or "poor" throughout the sampling period. Prior to 2005, the fish communities at the upstream site at Trevilian Way also were "very poor" or "poor" but they improved to "good" and "fair" in 2005 and 2008, respectively.



MSD monitored aquatic insect communities at the three sites in 2000, 2004, 2005 and 2008. The Brownsboro Road site was not sampled in 2000. During this time period, the aquatic insect communities were found as "very poor" or "poor", except in 2004, when the Trevilian Way site was classified as "fair".

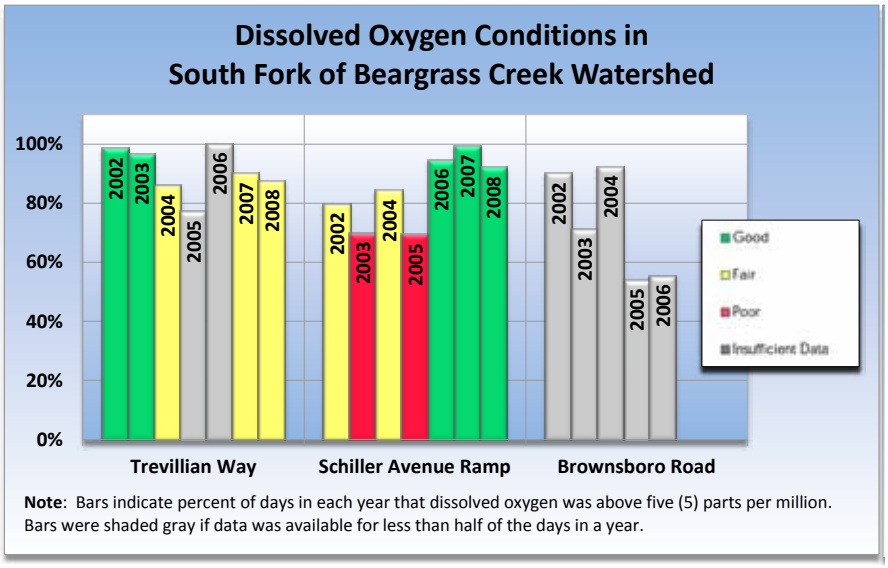


Eroding banks, silt and sediment deposits contribute to "poor" habitat at Trevilian Way

MSD assessed stream habitat for fish and aquatic insect communities in 2005 and 2008. In both years, stream habitat at Trevilian Way and Schiller Avenue Ramp was classified as "poor". In both years, stream habitat at Brownsboro Road was classified as "fair". All three sites showed some improvement by 2008 but not enough to change their classification. Stream habitat at Trevilian Way and Schiller Avenue Ramp was affected by many of the issues that affect urban streams: the stream channel at both locations has been significantly altered, resulting in unstable banks, accumulation of silt and sediment in the stream which covers habitat used by fish and aquatic insects. In these areas, the stream lacked the variety of habitats typically found in good quality streams: shallow rocky riffles and slow deep pools. These issues also affected the South Fork of Beargrass Creek at Brownsboro Road, but less severely.

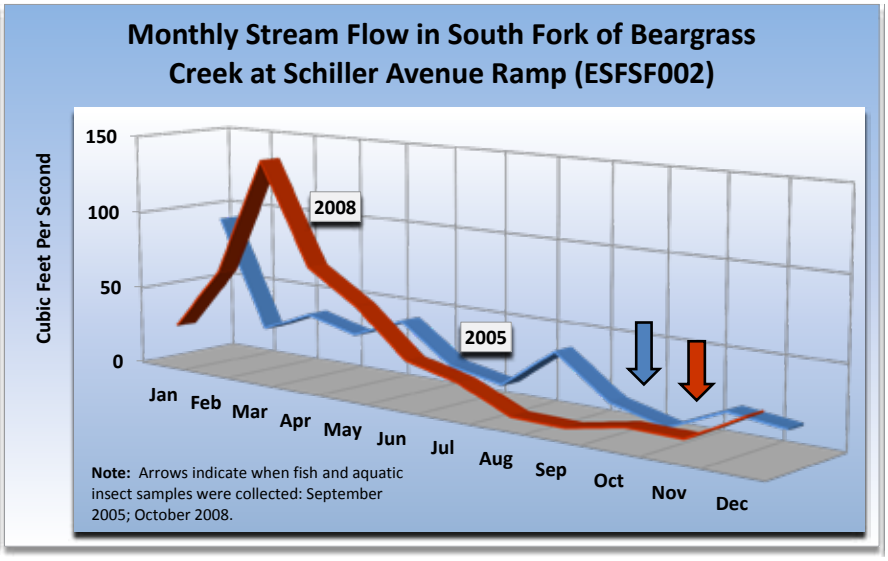
MSD and the US Geological Survey continuously monitor dissolved oxygen in the South Fork of Beargrass Creek at Trevilian Way (USGS gage 03292500) and at Schiller Avenue Ramp (USGS gage 03292550). MSD also continuously monitors dissolved oxygen at Brownsboro Road. Fish and aquatic insects need dissolved oxygen to breathe, and amounts greater than five parts per million are what is deemed necessary. More than half of the daily data was available in all years except 2005 and 2006 at Trevilian

Way and more than half of the daily data was available in all years at Schiller Avenue Ramp, indicating good data quality. Insufficient data were available at Brownsboro Road. The percent of days when the average amount of dissolved oxygen in the water was above five parts per million increased declined from "good" in 2002, 2003 and 2005 to "fair" in 2008, a sign of some declining conditions at Trevilian Way, but increased from "fair" and "poor" between 2002 and 2005 to "good" in 2006 through 2008 at Schiller Avenue Ramp.



Note: Bars indicate percent of days in each year that dissolved oxygen was above five (5) parts per million. Bars were shaded gray if data was available for less than half of the days in a year.

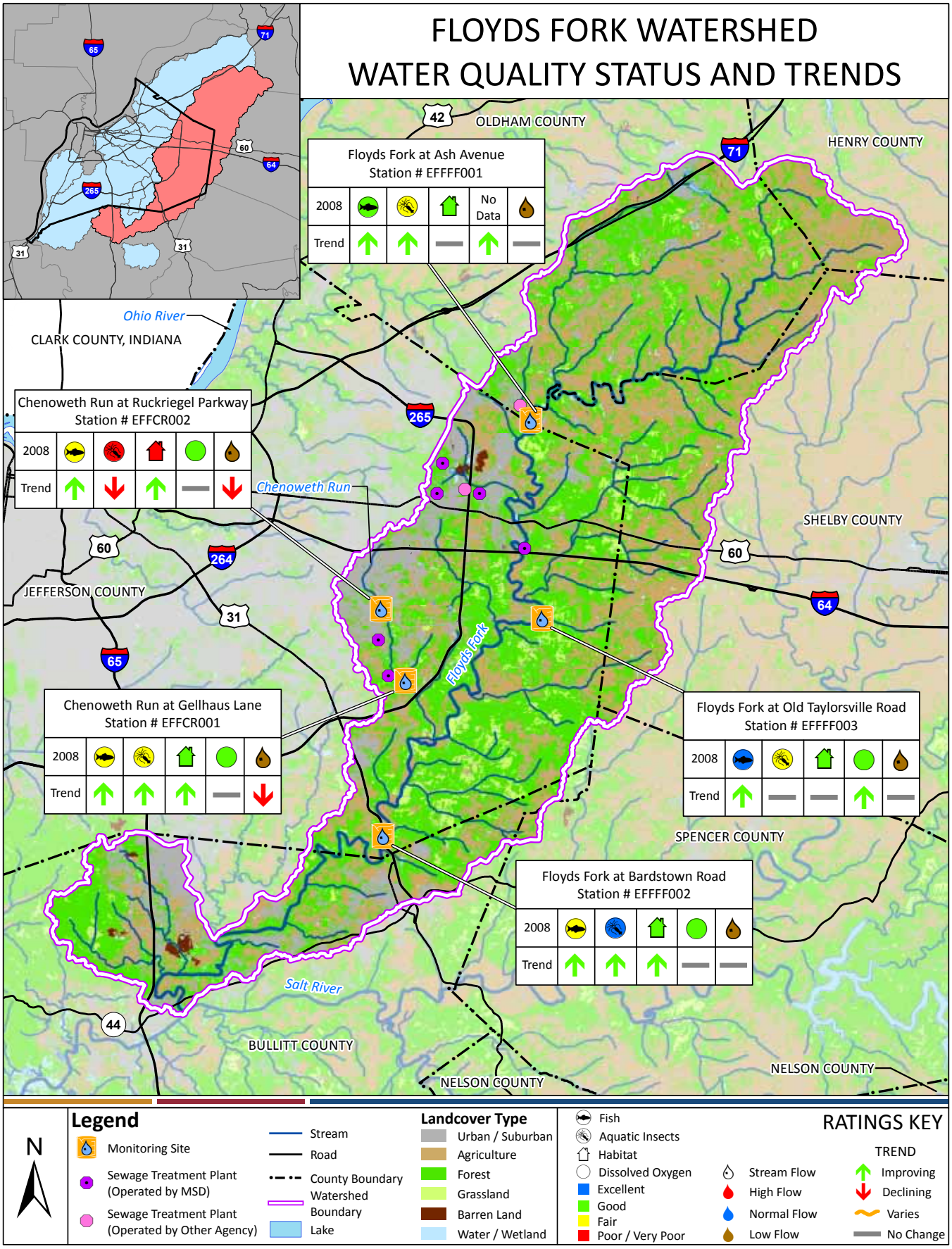
MSD and the US Geological Survey continuously monitor stream flow at the two gages in the South Fork of Beargrass Creek watershed that are also monitored for dissolved oxygen. Stream flow has been monitored at the US Geological Survey gage at Trevilian Way since 1944, providing an excellent long term record of stream flow.

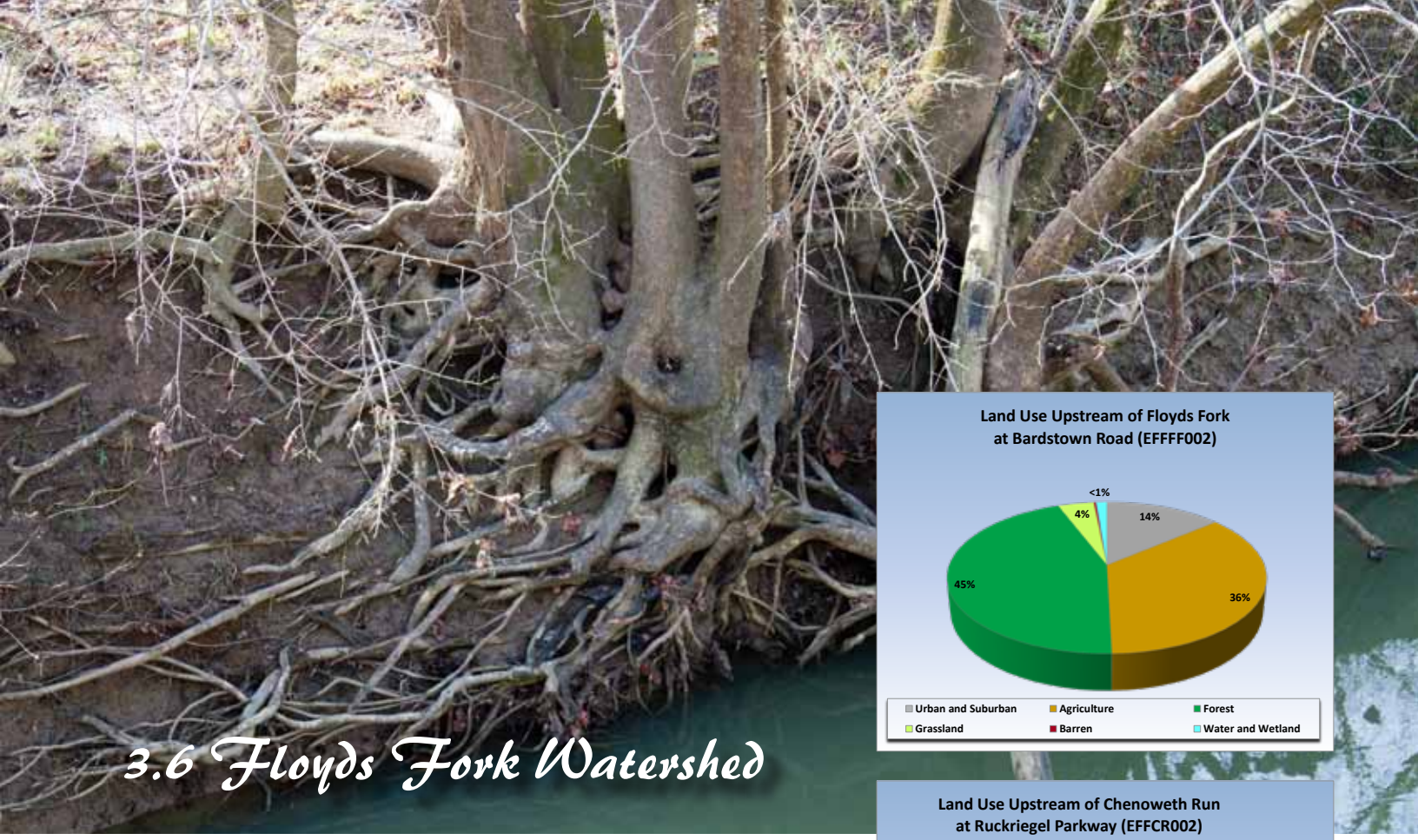


In September 2005, stream flows were below normal at both the Trevilian Way and Schiller Avenue Ramp sites, when fish and aquatic insects were sampled in the watershed. Stream flows were above average, however, for the month prior to sampling. In 2008, conditions throughout the watershed were drier, with below normal stream flows for three months prior to sampling event in October. In general, low stream flows can cause stress on fish and aquatic insects.

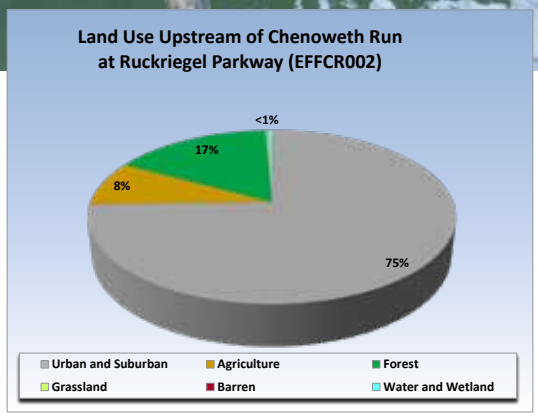
WATERSHED ASSESSMENT

The fish communities in South Fork of Beargrass Creek at Trevilian Way showed significant improvement from "very poor" to "good" between 1999 and 2005, but then declined to "fair" in 2008. During this period, aquatic insect communities were "poor", except in 2004, when they were "fair". The fish and aquatic insect communities were "poor" and "very poor" in South Fork of Beargrass Creek at Schiller Avenue Ramp and Brownsboro Road. Stream habitat conditions for fish and aquatic insects were "poor" to "fair" for the three sites in the South Fork of Beargrass Creek. Stream habitat at Trevilian Way and Schiller Avenue Ramp was affected by many of the issues that affect urban streams: altered stream channels, unstable banks, silt and sediment accumulation and lack of shallow rocky riffles and slow deep pools. These issues also affected the South Fork of Beargrass Creek at Brownsboro Road, but less severely. The percent of days when the average amount of dissolved oxygen in the water was above five parts per million declined from "good" in 2002 to "fair" in 2008, a sign of some declining conditions at Trevilian Way. The percent of days when the average amount of dissolved oxygen in the water was above five parts per million improved from "fair" and "poor" between 2002 and 2005 to "good" in 2006 through 2008 at Schiller Avenue Ramp. There was insufficient data from the Brownsboro Road site to evaluate dissolved oxygen conditions. Stream flows were below normal in 2005 and were considerably drier in 2008. In this watershed, the natural effects of low stream flow combined with degraded habitat, and lowered dissolved oxygen at Trevilian Way contribute to poor and In general, low stream flow can cause stress on fish and aquatic insects.


FLOYDS FORK WATERSHED
WATER QUALITY STATUS AND TRENDS
Floyds Fork at Ash Avenue
Station # EFFFF001
2008
No Data
Trend
Chenoweth Run at Ruckriegel Parkway
Station # EFFCR002
2008
Trend
Chenoweth Run at Gellhaus Lane
Station # EFFCR001
2008
Trend
Floyds Fork at Old Taylorsville Road
Station # EFFFF003
2008
Trend
Floyds Fork at Bardstown Road
Station # EFFFF002
2008
Trend
OLDHAM COUNTY
HENRY COUNTY
SHELBY COUNTY
SPENCER COUNTY
BULLITT COUNTY
NELSON COUNTY
JEFFERSON COUNTY
CLARK COUNTY, INDIANA
Ohio River
Floyds Fork
Salt River
Chenoweth Run
Legend
Monitoring Site
Sewage Treatment Plant (Operated by MSD)
Sewage Treatment Plant (Operated by Other Agency)
Stream
Road
County Boundary
Watershed Boundary
Lake
Landcover Type
Urban / Suburban
Agriculture
Forest
Grassland
Barren Land
Water / Wetland
Fish
Aquatic Insects
Habitat
Dissolved Oxygen
Excellent
Good
Fair
Poor / Very Poor
Stream Flow
High Flow
Normal Flow
Low Flow
RATINGS KEY
TREND
Improving
Declining
Varies
No Change
N



3.6 Floyds Fork Watershed



The small streams that form the Floyds Fork originate in Oldham, Shelby, and Henry Counties. Floyds Fork flows south through Oldham, eastern Jefferson, and northern Bullitt Counties where it drains into the Salt River near Shepherdsville.

The Floyds Fork watershed, which drains 257 square miles, is the largest metro area watershed. Approximately 104 square miles of the Floyds Fork watershed lie within southeastern Jefferson County.

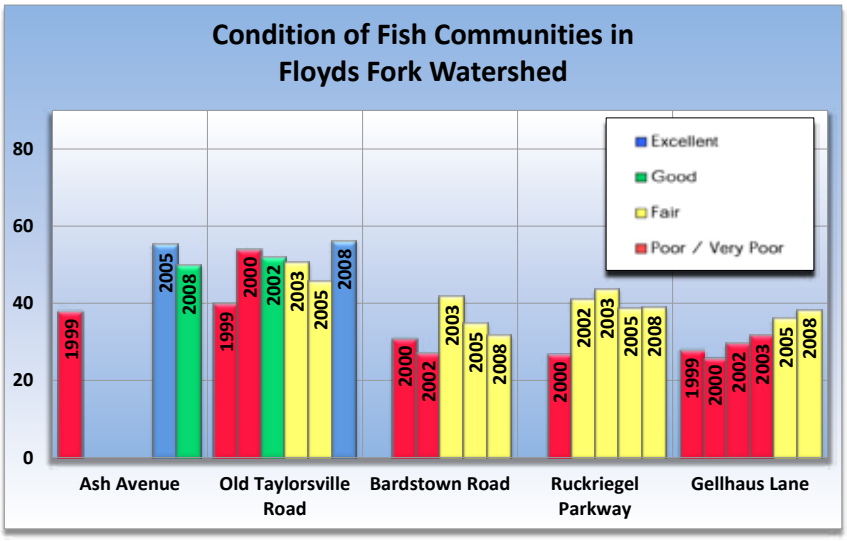
The Floyds Fork Water Quality Treatment Center was constructed to eliminate less efficient, small package plants and septic systems from the most populated areas of the watershed. The Jeffersontown Water Quality Treatment Center currently discharges treated effluent into Chenoweth Run. A premier park system is being developed along Floyds Fork. Extensive tracts of land have been preserved and the parks will provide a variety of opportunities for recreation and enjoyment of natural areas.

MSD monitors five stream sites in the Floyds Fork watershed. There are three sites on Floyds Fork and two on Chenoweth Run, a tributary to Floyds Fork. MSD monitors water quality in Floyds Fork at Ash Avenue, Old Taylorsville Road and Bardstown Road. There are 80 square miles of land draining to the Ash Avenue site, 138 square miles draining to the Old Taylorsville Road site, and 213 square miles draining to the Bardstown Road site. The land use for the three sites on Floyds Fork is mostly forest and agricultural. There also is a modest amount of land developed and developing for urban and suburban uses, mostly in the portions of the watersheds nearer to Louisville. Impervious area, including roadways, rooftops and driveways, is less than 4 percent in Floyds Fork.

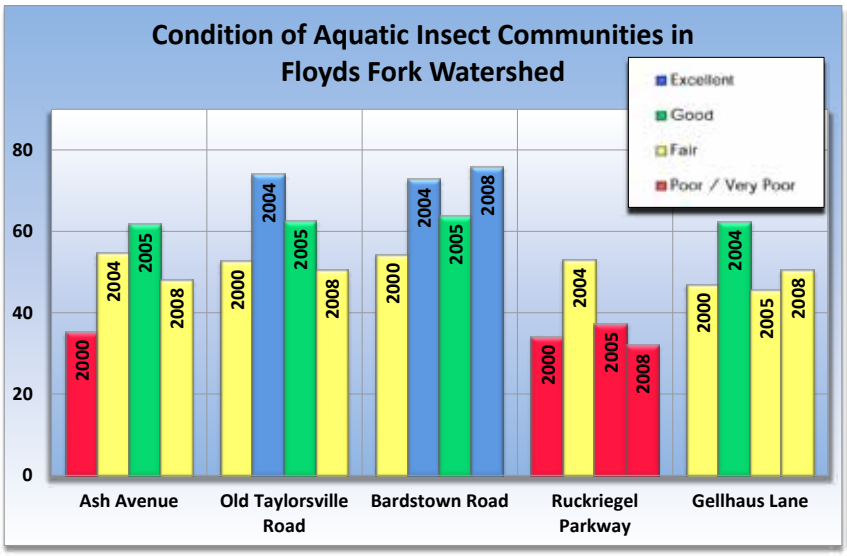
MSD monitors two sites on Chenoweth Run: at Ruckriegel Parkway and at Gellhaus Lane. There are 5.5 square miles of land draining to the Ruckriegel Parkway site and 11.6 square miles draining to the Gellhaus Lane site. Chenoweth Run drains land in Jeffersontown that in mostly urban and suburban. In contrast to Floyds Fork, the area draining to Chenoweth Run at Ruckriegel Parkway is over 33 percent impervious, and the area draining to Gellhaus Lane is 21 percent impervious.

MONITORING SUMMARY

MSD monitored the fish communities in Floyds Fork between 1999 and 2008. The Ash Avenue site improved from "poor" in 1999 to "excellent" and "good" in 2005 and 2008, respectively. The Old Taylorsville Road site improved from "poor" in 1999 to "excellent" in 2008. The Bardstown Road site improved from "poor" in 2000 to "fair" in 2008. The most significant improvements were seen at Ash Avenue and Old Taylorsville Road. MSD monitored fish communities in Chenoweth Run watershed between 1999 and 2008. The Ruckriegel Parkway site improved from "poor" to "fair" by 2002, then remained consistently "fair" through 2008. The Gellhaus Lane site steadily improved from "poor" in 1999 to "fair" in 2008.



MSD monitored the aquatic insect communities in Floyds Fork between 2000 and 2008. In 2000, all sites were classified as "poor" or "fair". At Ash Avenue, the aquatic insect communities improved from "poor" in 2000 to "fair" in 2008. At Old Taylorsville Road, aquatic insect communities improved in 2004 and 2005, but were "fair" in 2000 and 2008. At Bardstown Road, the aquatic insect communities improved from "fair" to "excellent" between 2000 and 2008. MSD monitored aquatic insect communities in Chenoweth Run between 2000 and 2008. At Ruckriegel Parkway, the aquatic insect communities had a "poor" rating. At Gellhaus Lane, the aquatic insect communities were consistently "fair" between 2000 and 2008, except in 2004 when they were "good".

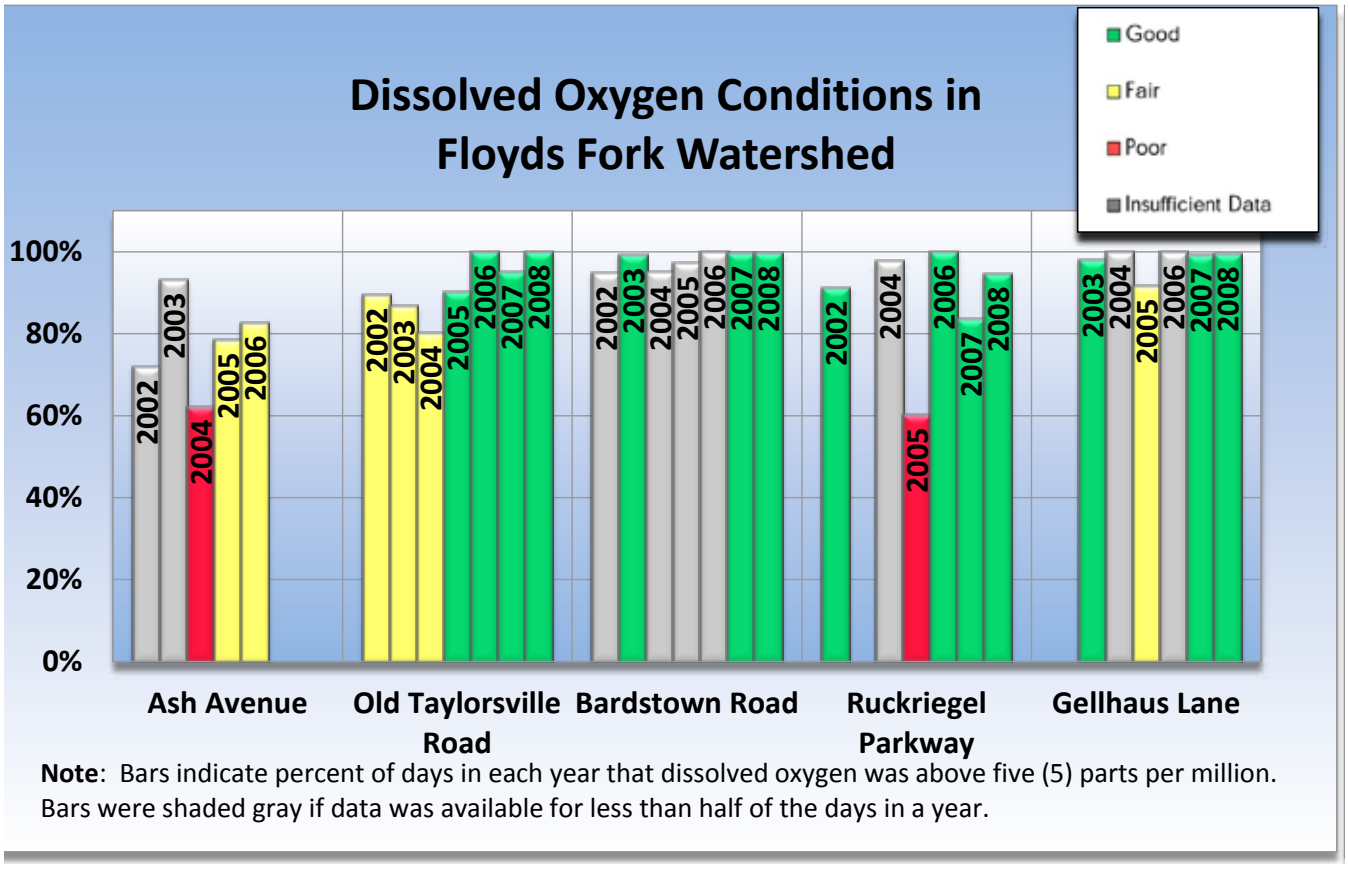


Tree along the banks contribute to "good" habitat in Floyds Fork at Ash Avenue.

MSD assessed stream habitat for fish and aquatic insect communities in 2005 and 2008. At the three Floyds Fork sites, stream habitat was classified in "good" condition in 2008. In Chenoweth Run at Ruckriegel Parkway, habitat was classified as "poor" in both 2005 and 2008, but improving. In Chenoweth Run at Gellhaus Lane, habitat was "good" and improving. Sediment deposition, unstable banks and a lack of trees and other protective vegetation were identified at Ruckriegel Parkway as limitations of the habitat quality. Gellhaus Lane lacked rocky riffles that are used as habitat by aquatic insects.

Did you know?

Rainbow darters live about 4 years, grow to 3 inches in length, and adults spawn in clean rocky riffles March through June. They are very sensitive to pollution and sediment.



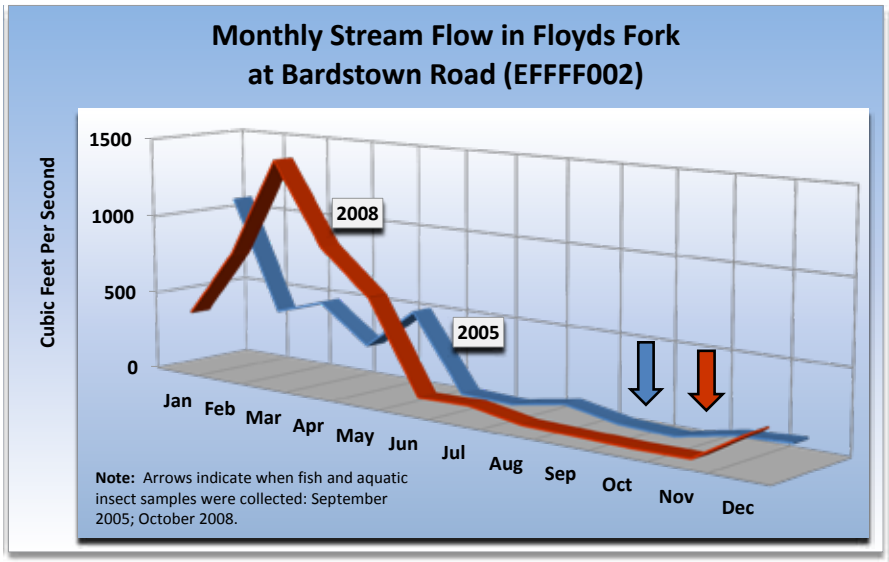
Note: Bars indicate percent of days in each year that dissolved oxygen was above five (5) parts per million. Bars were shaded gray if data was available for less than half of the days in a year.

MSD and the US Geological Survey continuously monitor dissolved oxygen in Floyds Fork at Ash Avenue (US Geological Survey gage 03297900), Old Taylorsville Road (US Geological Survey gage 03298000), and Bardstown Road (US Geological Survey gage 03298200). Fish and aquatic insects need dissolved oxygen to breathe, and amounts greater than five parts per million are what is deemed necessary. More than half of the daily data was available for 2004 through 2006 at Ash Avenue, for all years between 2002 and 2008 at Old Taylorsville Road, and for 2003, 2007 and 2008 at Bardstown Road, indicating good and improving data quality. The percent of days when the average amount of dissolved oxygen in the water was above five parts per million increased from "poor" in 2004 to "fair" in 2005 and 2006 at Ash Avenue. Downstream at Old Taylorsville Road, the percent of days when dissolved oxygen conditions were above five parts per million improved steadily from "fair" to "good" between 2002 and 2008. The percent of days when the average amount of dissolved oxygen in water was above five parts per million was consistently "good" for 2003, 2007 and 2008 in Floyds Fork at Bardstown Road.

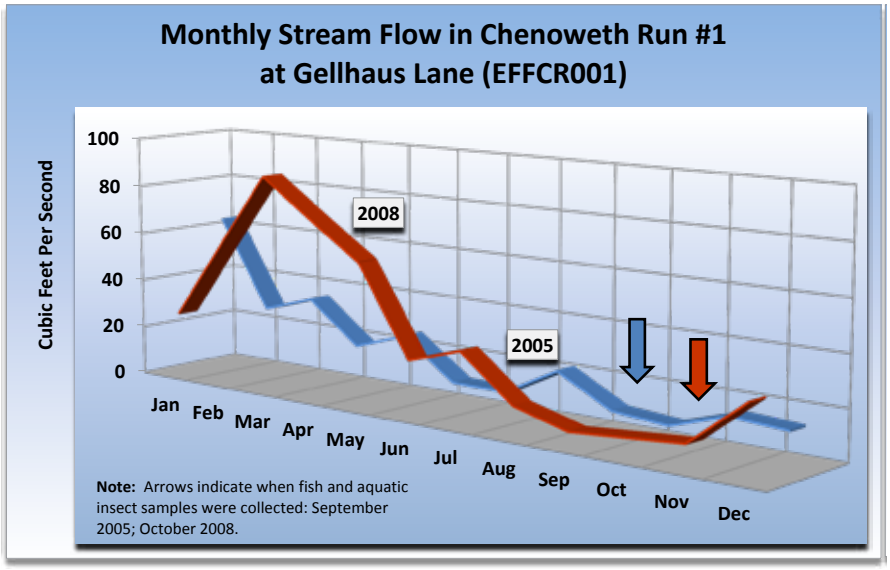
Dissolved oxygen is continuously monitored in Chenoweth Run #1 at Ruckriegel Parkway (US Geological Survey gage 03298135) and at Gellhaus Lane (US Geological Survey gage 03298150). In Chenoweth Run at Ruckriegel Parkway, more than half of the daily data was available for all years between 2002 and 2008, except 2003 and 2004. At Gellhaus Lane, more than half of the daily data was available between 2003 and 2008, except 2004 and 2006, indicating good data quality. At Ruckriegel Parkway, the percent of days when the average amount of dissolved oxygen in the water was above five parts per million declined from "good" in 2002 to "poor" in 2005, but improved to "good" by 2008. At Gellhaus Lane, the percent of days when dissolved

oxygen conditions were above five parts per million was consistently "good" between 2003 and 2008.

MSD and the US Geological Survey have been monitoring flow at three sites on Floyds Fork: Ash Avenue and Old Taylorsville Road since 1991, and Bardstown Road since 1991. The US Geological Survey monitored flow at Old Taylorsville Road between 1944 and 1991. Stream flow has been monitored for Chenoweth Run at Ruckriegel Parkway since 1999 and at Gellhaus Lane since 1996.



In September 2005, stream flows were below normal at the three sites on Floyds Fork when fish and aquatic insect samples were collected. In August 2005, stream flows in Floyds Fork were average. In Chenoweth Run, stream flows were average in September 2005, when fish and aquatic insect samples were collected. In August, stream flows in Chenoweth Run also were above average. In 2008, conditions throughout the watershed were drier, with below normal stream flows for two to three months prior to the sampling event in October throughout the watershed. In general, low stream flows can cause stress on fish and aquatic insects.

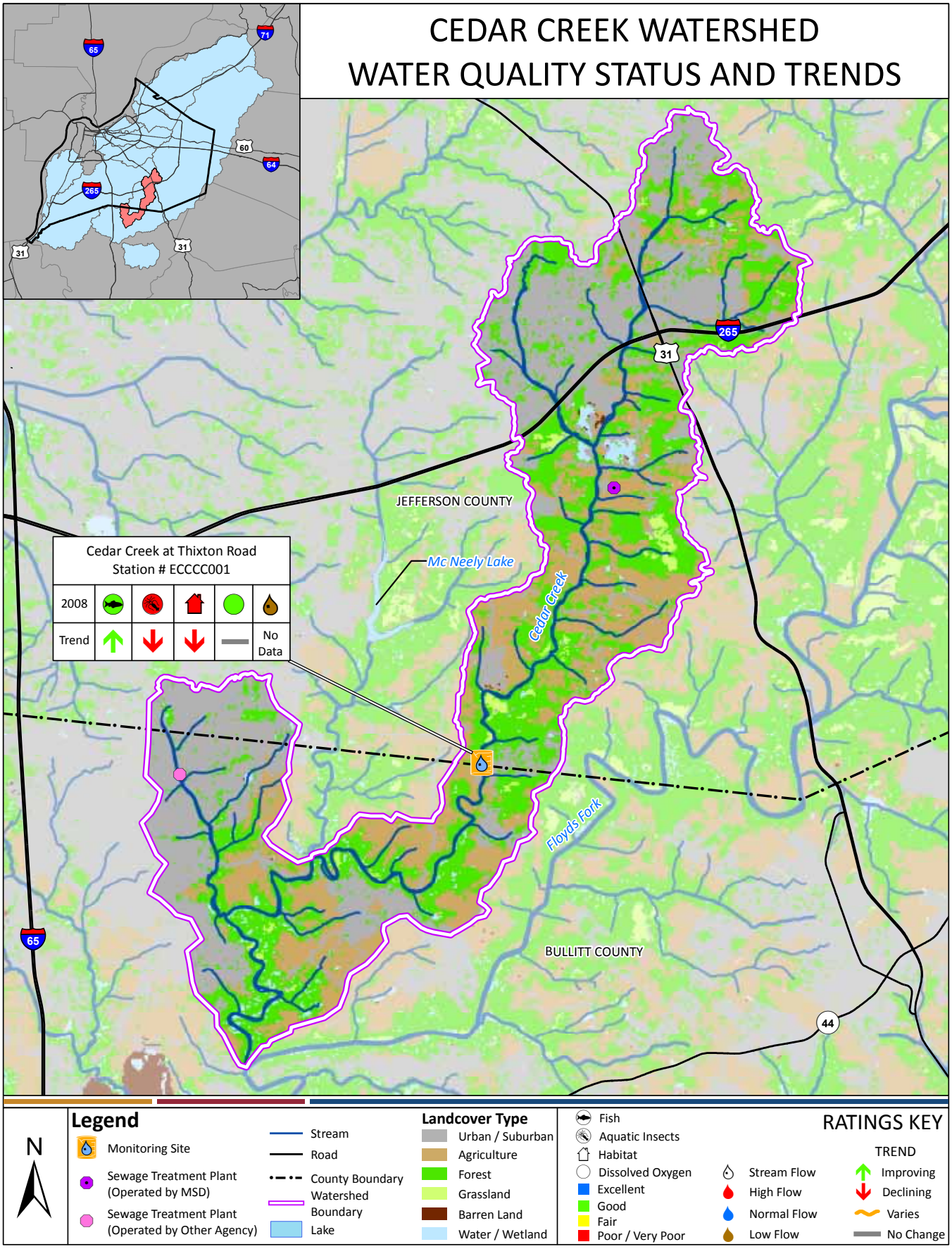


WATERSHED ASSESSMENT

The fish communities at all five sites showed significant improvement from a "poor" condition prior to 2004, to "fair", "good" or "excellent" in 2005 and 2008. The most significant improvement was seen in Floyds Fork at the Ash Avenue and Taylorsville Road sites. All three Floyds Fork sites showed improvement in the aquatic insect communities from 1999 to 2008. Aquatic insect communities in Chenoweth Run at Ruckriegel Parkway were generally "poor" and at Gellhaus Lane were generally "fair" throughout the sampling period. The stream habitat conditions for fish and aquatic insects were generally "good" at all three Floyds Fork sites. Chenoweth Run at Ruckriegel Parkway had "poor" ratings, but habitat was improving. Chenoweth Run at Gellhaus Lane showed improvement to "good" habitat conditions in 2008.

The percent of days for which dissolved oxygen was above five parts per million improved from "poor" to "fair" in Floyds Fork at Ash Avenue, and improved from "fair" to "good" at Old Taylorsville Road. Dissolved oxygen concentrations were consistently "good" in Floyds Fork at Bardstown Road and in Chenoweth Run at Gellhaus Lane. In Chenoweth Run at Ruckriegel Parkway, dissolved oxygen concentrations declined from "good" in 2002 to "poor" in 2005, but improved to "good" in 2008. Stream flows were below normal in 2005 and were considerably drier in 2008. The lower flows do not seem to have had a significant negative impact on fish and aquatic insect communities in this watershed.

Following these recommendations when drainingyour pool is one way you can help to protect local streams.

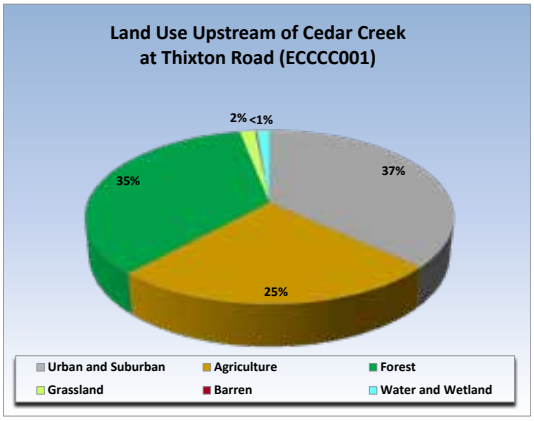

CEDAR CREEK WATERSHED
WATER QUALITY STATUS AND TRENDS
JEFFERSON COUNTY
BULLITT COUNTY
Mc Neely Lake
Cedar Creek
Floyds Fork
Cedar Creek at Thixton Road
Station # ECCCC001
2008
Trend
No Data
Legend
Monitoring Site
Sewage Treatment Plant (Operated by MSD)
Sewage Treatment Plant (Operated by Other Agency)
Stream
Road
County Boundary
Watershed Boundary
Lake
Landcover Type
Urban / Suburban
Agriculture
Forest
Grassland
Barren Land
Water / Wetland
Fish
Aquatic Insects
Habitat
Dissolved Oxygen
Excellent
Good
Fair
Poor / Very Poor
Stream Flow
High Flow
Normal Flow
Low Flow
RATINGS KEY
TREND
Improving
Declining
Varies
No Change
N

3.7 Cedar Creek Watershed (Jefferson County)

The small streams that eventually form Cedar Creek in Jefferson County originate in the Fern Creek area and flow south. Cedar Creek empties into Floyds Fork in Bullitt County east of Shepherdsville.

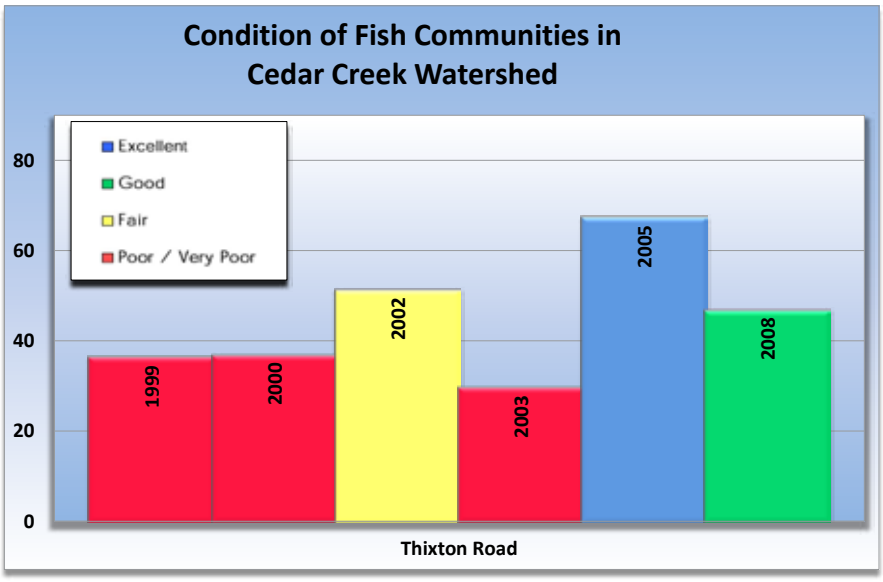
The Cedar Creek Water Quality Treatment Center discharges treated wastewater into Cedar Creek. This facility was constructed in 1995 to improve water quality by eliminating small package wastewater treatment plants that are not as effective at treating wastewater. The facility was expanded to have the capacity to treat 7.5 million gallons per day of wastewater in 2003 and currently serves over 7,500 customers.

MSD has been monitoring water quality and stream flow in Cedar Creek at Thixton Road since 1999. There are 11.1 square miles of land draining to the Cedar Creek monitoring site. This land includes urban, agriculture and forested areas. Small areas are classified as grassland. Almost 10 percent of this watershed is covered by impervious surfaces such as roads, rooftops and driveways.

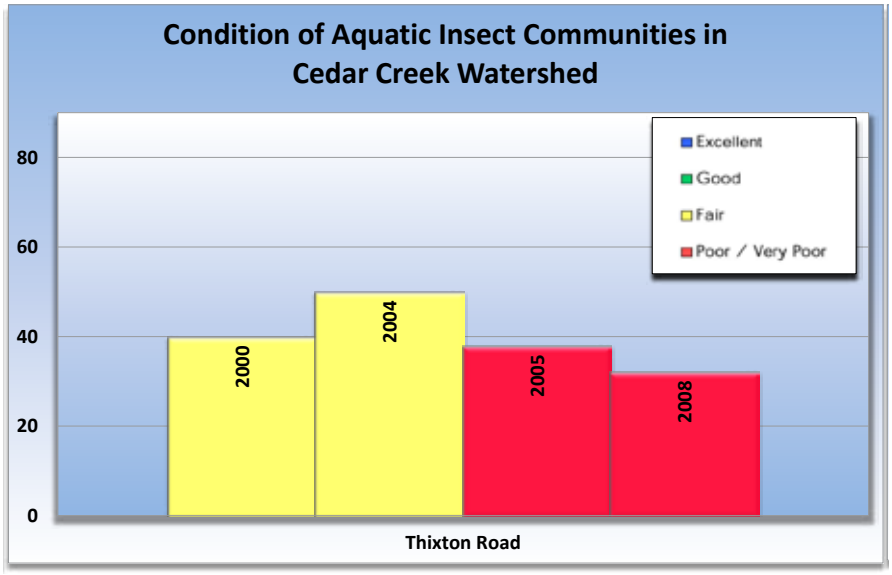


MONITORING SUMMARY

MSD monitored fish communities between 1999 and 2008. During this time, results improved from "poor" to "excellent" in 2005 and "good" in 2008. Overall, the fish communities improved during this period.



MSD monitored aquatic insect communities in 2000, 2004, 2005, 2008. Aquatic insect communities were classified as "fair" in 2000 and 2004 and declined to "poor" in 2005 and 2008.

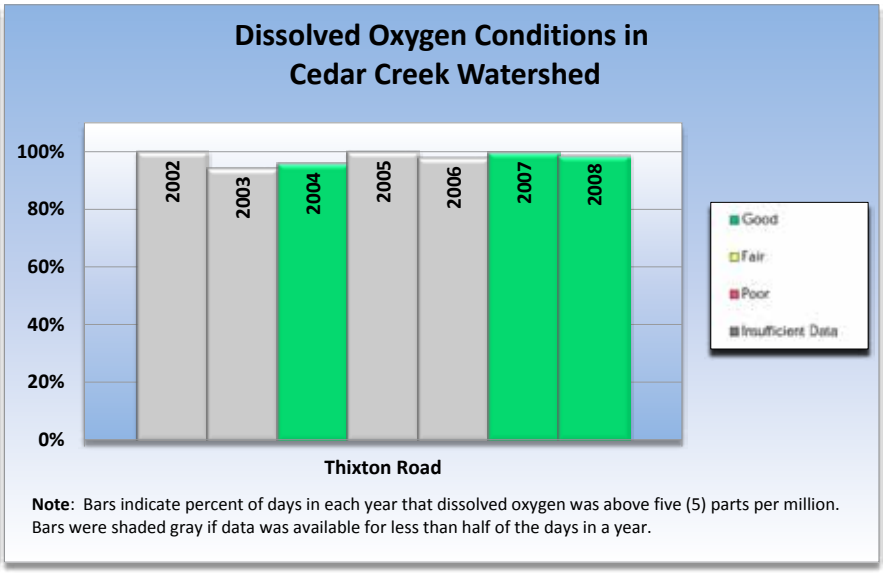


MSD assessed the quality of habitat for fish and aquatic insect communities in 2005 and 2008. Habitat quality declined from "fair" in 2005 to "poor" in 2008. At the monitoring site, this stream has stable banks, which are not eroding, and the stream habitat was only slightly degraded by silt and sediment deposition. The stream channel had not been straightened or otherwise altered.

Habitat is "fair" along Cedar Creek at Thixton Road.

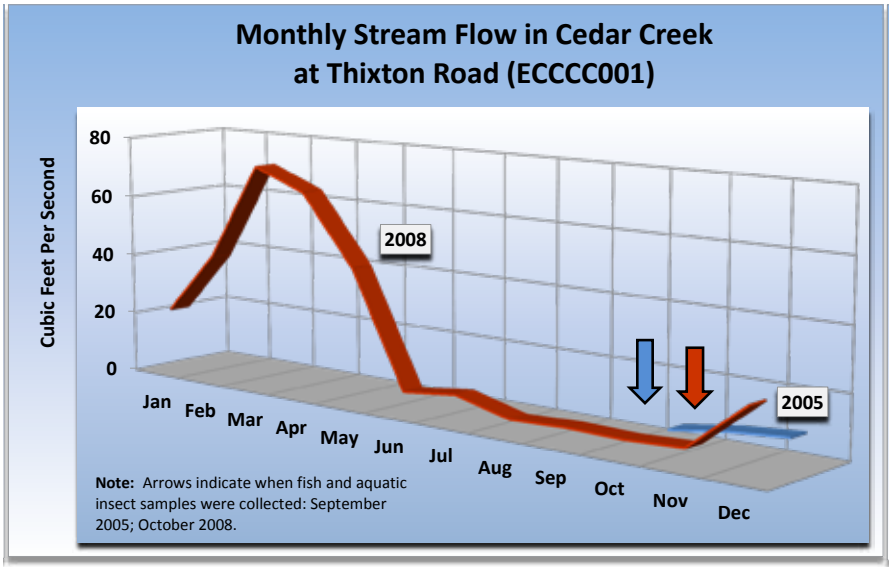
Exposed bedrock in Cedar Creek prevents formation of deep pool habitat.

MSD and the US Geological Survey continuously monitor dissolved oxygen in Cedar Creek at Thixton Road (US Geological Survey gage 03298250). Fish and aquatic insects need dissolved oxygen to breathe, and amounts greater than five parts per million are what is deemed necessary. More than half of the daily data was available for 2004, 2007 and 2008, indicating improving data quality. The percent of days when the average amount of dissolved oxygen in the water was above five parts per million was consistently "good" during this time period.



Note: Bars indicate percent of days in each year that dissolved oxygen was above five (5) parts per million. Bars were shaded gray if data was available for less than half of the days in a year.

MSD and the US Geological Survey monitor stream flow in Cedar Creek at Thixton Road (USGS gage 03298250) since 1999. Stream flow data were not available for 2005. In 2008, stream flows were above normal in the spring and normal during the summer. During the fall, stream flows were below normal were especially low for two months prior to the sample event in October. During dry weather, the stream flow in Cedar Creek is increased by the discharge of effluent from the Cedar Creek Water Quality Treatment Center. In general, low stream flows can cause stress on fish and aquatic insects.



Note: Arrows indicate when fish and aquatic insect samples were collected: September 2005; October 2008.

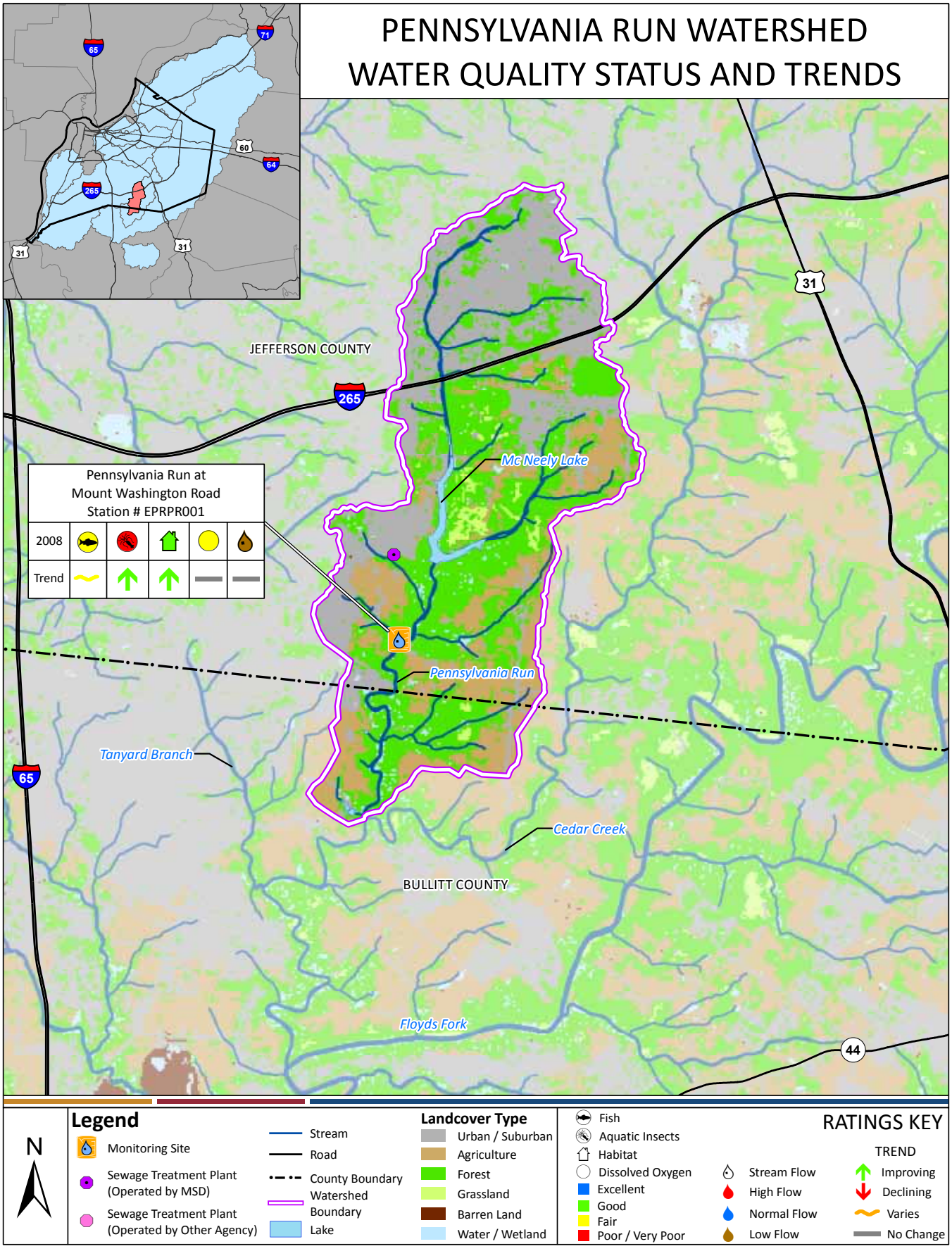
WATERSHED ASSESSMENT

Fish communities at the Cedar Creek monitoring site improved from "poor" in 1999 to "good" in 2008, but aquatic insect communities declined from "fair" in 2000 to "poor" in 2008. Stream habitat declined from "fair" to "poor" between 2005 and 2008. The percent of days for which dissolved oxygen was above five parts per million was consistently "good" in Cedar Creek at Thixton Lane. Stream flow data was not available for 2005, but was very low in 2008. The poor quality habitat and the natural effects of low stream flow may contribute to declining aquatic insect communities.

Midges or chironomids (Diptera) photo by Dave Penrose, courtesy of Society for Freshwater Science (NABS (www.benthos.org)).

Did you know?

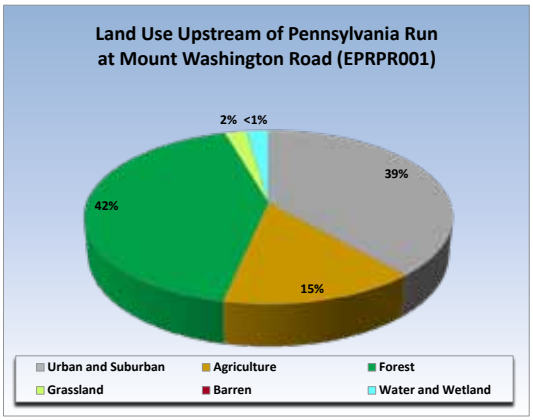
Midges or Chironomids generally signify poor water quality


PENNSYLVANIA RUN WATERSHED
WATER QUALITY STATUS AND TRENDS
JEFFERSON COUNTY
BULLITT COUNTY
Mc Neely Lake
Pennsylvania Run
Tanyard Branch
Cedar Creek
Floyds Fork
Pennsylvania Run at
Mount Washington Road
Station # EPRPR001
2008
Trend
N
Legend
Monitoring Site
Sewage Treatment Plant (Operated by MSD)
Sewage Treatment Plant (Operated by Other Agency)
Stream
Road
County Boundary
Watershed Boundary
Lake
Landcover Type
Urban / Suburban
Agriculture
Forest
Grassland
Barren Land
Water / Wetland
Fish
Aquatic Insects
Habitat
Dissolved Oxygen
Excellent
Good
Fair
Poor / Very Poor
Stream Flow
High Flow
Normal Flow
Low Flow
RATINGS KEY
TREND
Improving
Declining
Varies
No Change

3.8 Pennsylvania Run Watershed

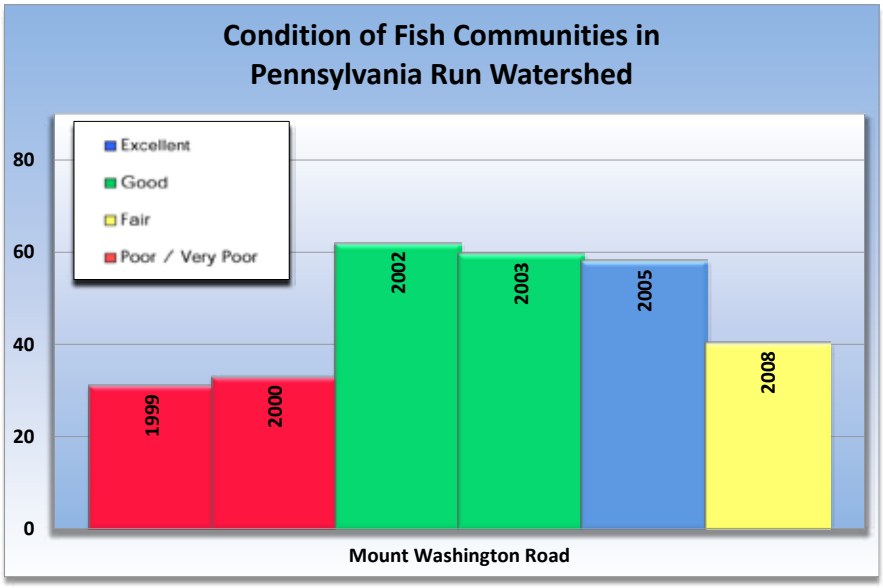
The small streams that eventually form Pennsylvania Run originate in the Highview area and flow south into McNeely Lake. Pennsylvania Run empties into Cedar Creek in Bullitt County east of Zoneton. McNeely Lake was built in the mid-1950's.

MSD has been monitoring water quality in Pennsylvania Run at the Mount Washington Road site since 1999. There are 6.4 square miles of land draining to the monitoring site. This land includes urban and suburban uses, mostly in the upper watershed reaches, agriculture and forested areas in the middle and lower reaches, and the 46 acre McNeely Lake. Small areas are classified as grassland. Almost 9 percent of this watershed is covered by impervious surfaces such as roads, rooftops and driveways.

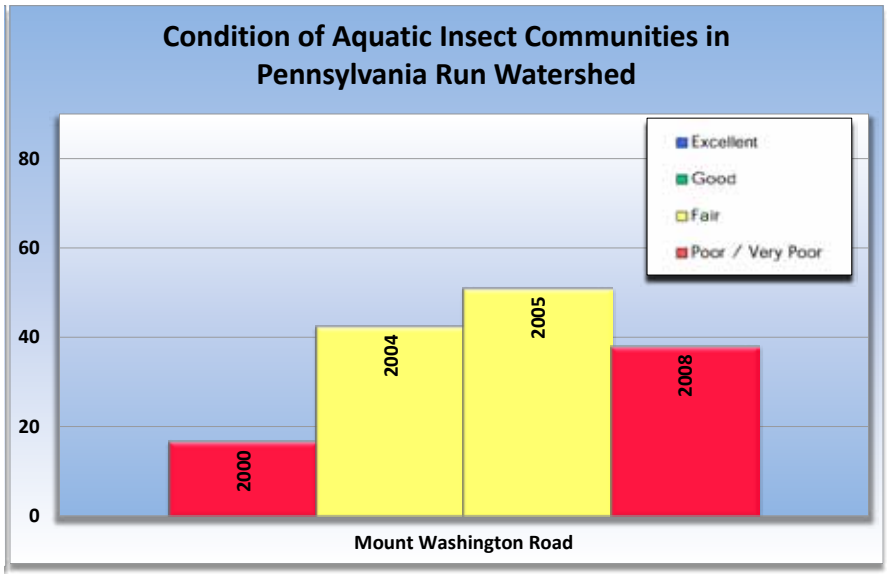


MONITORING SUMMARY

MSD monitored fish communities at the site between 1999 and 2008. During this time, results varied from "poor" in 1999 and 2000 to "excellent" in 2005 and then "fair" in 2008. Note that the procedure for converting the fish community data to a narrative rating changed in 2005 as more experience with biological monitoring was gained. In Pennsylvania Run, the fish community data resulted in a higher score in 2002 and 2003 than in 2005, yet the narrative rating for 2002 and 2003 are "good", whereas the narrative rating in 2005 is "excellent".



MSD monitored aquatic insect communities between 2000 and 2008. Aquatic insect communities were classified as "very poor" in 2000, improved to "fair" in 2004 and 2005, but declined to "poor" in 2008. There was improvement between 2000 and 2008, but not enough to change the classification.



Habitat improved from "poor" to "good" in Pennsylvania Run.

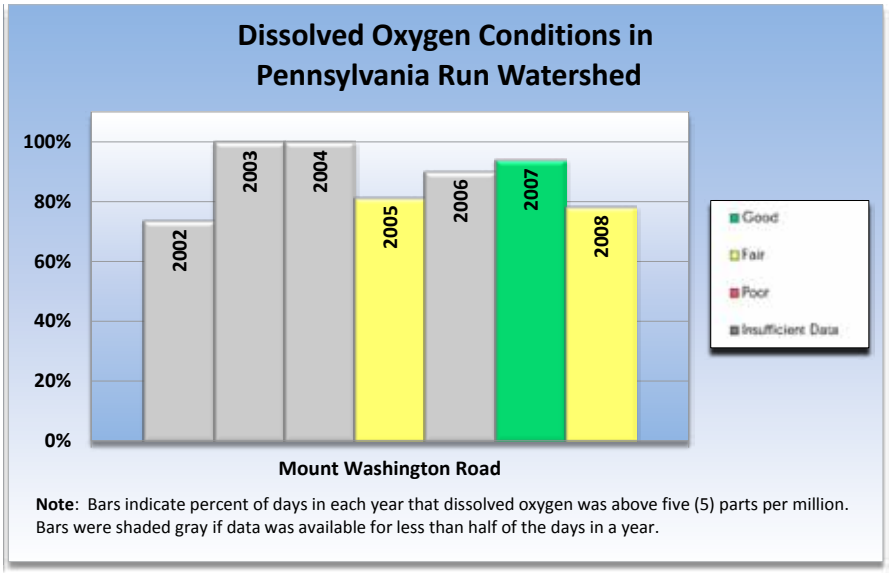
MSD assessed the quality of habitat for fish and aquatic insect communities in 2005 and 2008. Habitat quality improved from "poor" in 2005 to "good" in 2008. At the monitoring site, the stream banks have some stability problems and the stream lacks shallow, rocky riffles that provide good habitat for aquatic insects and fish. The stream channel had not been straightened or otherwise altered.

Caddisfly Larvae in and out of its case (Trichoptera) Photo by J.C. Hodges, Jr., courtesy of Society for Freshwater Science (NABS (www.benthos.org)).

Did you know?

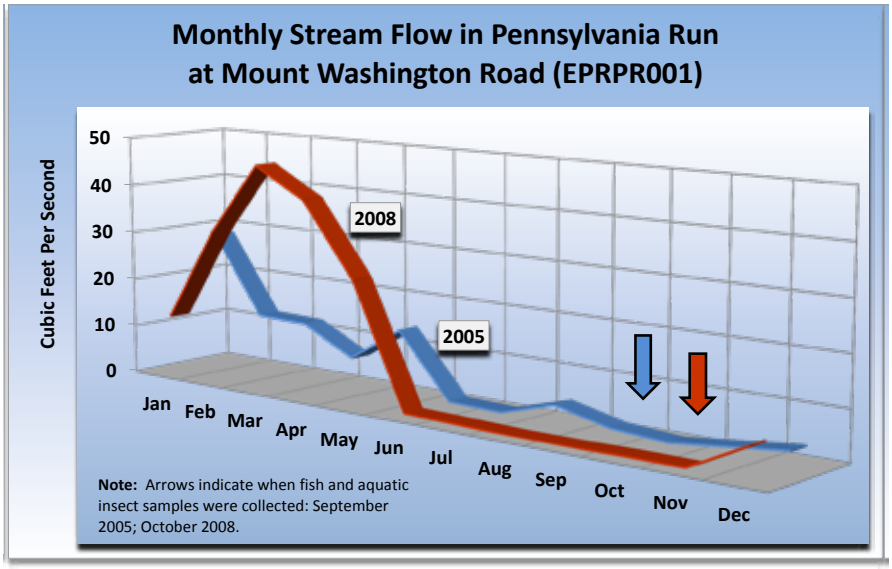
Some caddisfly larvae build houses for protection.

MSD and the US Geological Survey continuously monitor dissolved oxygen in Pennsylvania Run at Mount Washington Road (USGS gage 03298300). Fish and aquatic insects need dissolved oxygen to breathe, and amounts greater than five parts per million are what is deemed necessary. More than half of the daily data was available for 2005, 2007 and 2008. The percent of days when the average amount of dissolved oxygen in the water was above five parts per million increased from "fair" in 2004 to "good" in 2007, but declined again to "fair" in 2008.



Note: Bars indicate percent of days in each year that dissolved oxygen was above five (5) parts per million. Bars were shaded gray if data was available for less than half of the days in a year.

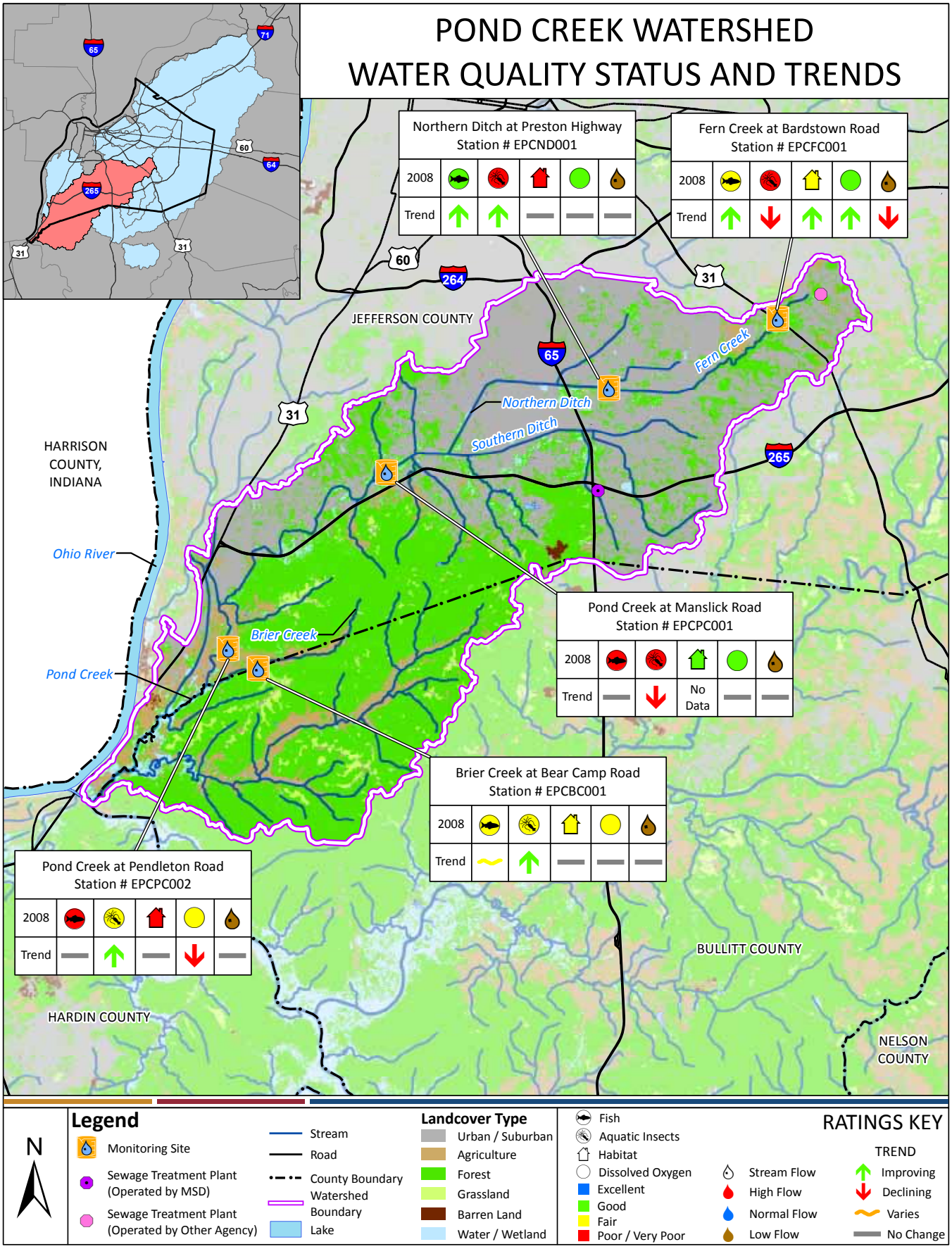
MSD and the US Geological Survey monitor stream flow in Pennsylvania Run at Mount Washington Road (USGS gage 03298300) since 1999. In 2005 stream flow was below normal in September, when samples were collected. Stream flow was below normal for the entire summer and fall in 2008. In general, low stream flow can cause stress on fish and aquatic insects.



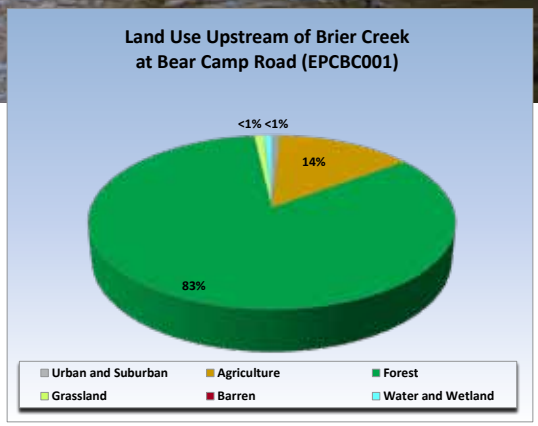
WATERSHED ASSESSMENT

The fish communities in Pennsylvania Run at Mount Washington Road improved from "poor" in 1999 to "good" or "excellent" in 2003 to 2005, but declined to "fair" in 2008. However, fish communities improved between 1999 and 2008. The aquatic insect communities were generally "fair" to "poor" between 2000 and 2008. Aquatic insect communities improved during the monitoring period, but not enough to change the classification. Habitat quality improved from "poor" in 2005 to "good" in 2008. The stream banks have some stability problems and the stream lacks shallow, rocky riffles that provide good habitat for aquatic insects and fish. The percent of days for which dissolved oxygen was above five parts per million was generally "fair" at Mount Washington Road. Stream flows were low in 2005 and were even drier in 2008 when fish and aquatic insect samples were collected. Multiple factors may be affecting the fish and aquatic insect communities in this stream, including stream habitat limitations, frequent low dissolved oxygen levels and the natural effects of low stream flow.

Crayfish (Decapoda) Photo by Bob DiStefano, courtesy of Society for Freshwater Science (NABS (www.benthos.org)).


POND CREEK WATERSHED
WATER QUALITY STATUS AND TRENDS
Northern Ditch at Preston Highway
Station # EPCND001
2008
Trend
Fern Creek at Bardstown Road
Station # EPCFC001
2008
Trend
Pond Creek at Manslick Road
Station # EPCPC001
2008
Trend
No Data
Brier Creek at Bear Camp Road
Station # EPCBC001
2008
Trend
Pond Creek at Pendleton Road
Station # EPCPC002
2008
Trend
JEFFERSON COUNTY
HARRISON COUNTY, INDIANA
HARDIN COUNTY
BULLITT COUNTY
NELSON COUNTY
Ohio River
Pond Creek
Brier Creek
Fern Creek
Northern Ditch
Southern Ditch
Legend
Monitoring Site
Sewage Treatment Plant (Operated by MSD)
Sewage Treatment Plant (Operated by Other Agency)
Stream
Road
County Boundary
Watershed Boundary
Lake
Landcover Type
Urban / Suburban
Agriculture
Forest
Grassland
Barren Land
Water / Wetland
Fish
Aquatic Insects
Habitat
Dissolved Oxygen
Excellent
Good
Fair
Poor / Very Poor
Stream Flow
High Flow
Normal Flow
Low Flow
RATINGS KEY
TREND
Improving
Declining
Varies
No Change
N

3.9 Pond Creek Watershed



The Pond Creek watershed drains about 126 square miles in southwestern Louisville, where it flows into the Salt River near West Point. Approximately 89 square miles are located in Jefferson County and 37 square miles are located in Bullitt County.

Small streams in Jeffersontown and Fern Creek join to form Northern Ditch, and small streams in High View and Okolona join to form Southern Ditch. Northern Ditch and Southern Ditch join to form Pond Creek near Outer Loop. The Louisville International Airport and associated large industrial complex, and Jefferson Memorial Forest are prominent features in this watershed.

The relatively flat portion of the Pond Creek watershed was once a pond which gradually filled with silt and debris to form a flat plain with standing water and dense swamp vegetation. Parts of this area were known as “wet woods” in the past.

Starting in the 1850’s, a system of man-made ditches was developed to reduce flooding and to increase the amount of land suitable for development, which continued to expand rapidly before and after World War II. Many of the streams in Pond Creek watershed have been extensively channelized, and large flat areas are now drained by Northern Ditch and Southern Ditch.

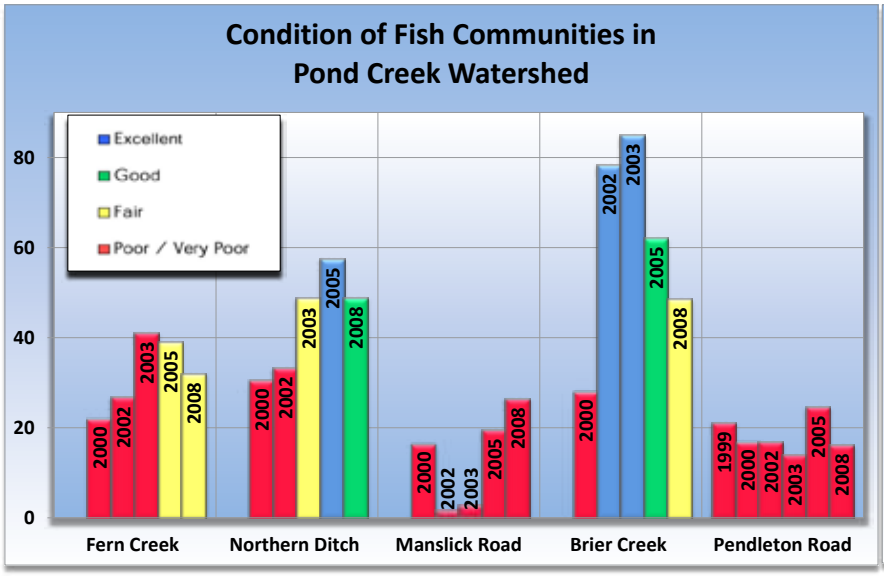
MSD has been monitoring water quality and stream flow in this large watershed since 1999 at five locations which are listed here from upstream to downstream: Fern Creek at Bardstown Road, Northern Ditch at Preston Highway, Pond Creek at Manslick Road, Pond Creek at Pendleton Road, and Brier Creek at Bear Camp Road. The amount of land draining to each site in square miles, respectively, is 3.5, 11.1, 64.0, 80.3, and 4.0.

The first four monitoring sites are similar to Pond Creek at Pendleton Road with 60 percent or more of the land in urban and suburban uses. The amount of impervious surfaces such as roads, rooftops and driveways, ranged from 16 percent to 24 percent. Forest ranged from 28 to 34 percent and agriculture ranged from 2 to 7 percent.

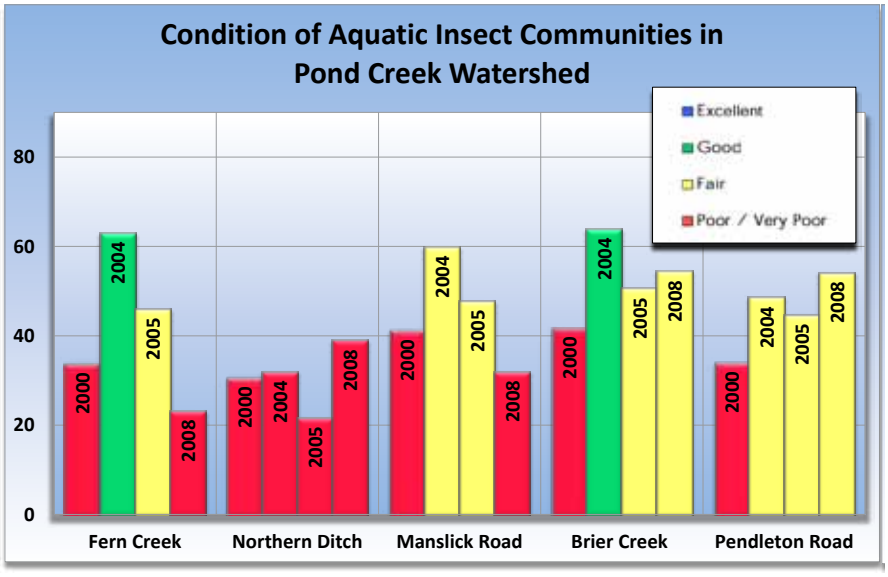
The land draining to Brier Creek at Bear Camp Road is quite different from the other four sites. This small stream drains steep wooded areas southwest of Jefferson Memorial Forest. The watershed is largely undeveloped with 83 percent forest and 14 percent agriculture.

MONITORING SUMMARY

MSD monitored fish communities between 1999 and 2008. During this time, results improved at the Fern Creek monitoring site from "very poor" to "fair" and at the Northern Ditch site from "fair" to "good". At Manslick Road and Pendleton Road, fish communities are consistently "poor". Fish communities varied in Brier Creek at Bear Camp Road, improving from "poor" in 2000 to "excellent" in 2002 and 2003, then declining to "good" in 2005, and declining again to "fair" in 2008.



MSD monitored aquatic insect communities in 2000, 2004, 2005, 2008. During this time, aquatic insect communities at the Fern Creek monitoring site improved from "poor" in 2000 to "good" in 2004, and declined again to "poor" in 2008. Aquatic insect communities in Northern Ditch were "poor" throughout. Aquatic insect communities improved in Pond Creek at Pendleton Road, but declined at the Manslick Road site between 2000 and 2008. In Brier Creek, aquatic insect communities improved from "poor" in 2000 to "fair" in 2005 and 2008.



MSD assessed the quality of stream habitat for fish and aquatic insect communities in 2005 and 2008. Habitat quality improved from "poor" to "fair" at the Fern Creek monitoring site. Habitat quality was consistently "poor" at the Northern Ditch and Pendleton Road sites. Habitat quality was "good" at the Manslick Road site in 2008.

Typical of many urban streams, the habitat in the Pond Creek watershed is compromised by insufficient trees and other vegetation along the banks that help to prevent erosion. Because of erosion, silt and sediment are deposited in the stream bottom. These deposits cover habitat used by aquatic insects and for fish spawning. The Northern Ditch site and Pond Creek at Manslick Road site are located in man-made channels, so many of the features of a natural channel such as a mix of rocky riffles and deep, slow pools, submerged logs and undercut banks are not present. These features provide important habitat for fish and aquatic insects.

In Brier Creek at Bear Camp Road, habitat quality was "poor" in 2005 and "fair" in 2008. Habitat in this location lacked trees and other vegetation along the banks, resulting in unstable banks, silt and sediment deposits in the stream. These deposits can cover habitat used by aquatic insects and fish. This monitoring site also has a very small drainage area, and is quickly affected by periods of low stream flow.

MSD and the US Geological Survey continuously monitor dissolved oxygen at the five sites in the Pond Creek watershed. Gages include Fern Creek at Bardstown Road (USGS gage 03301900), Northern Ditch at Okolona (USGS gage 03301940), Pond Creek near Louisville (USGS

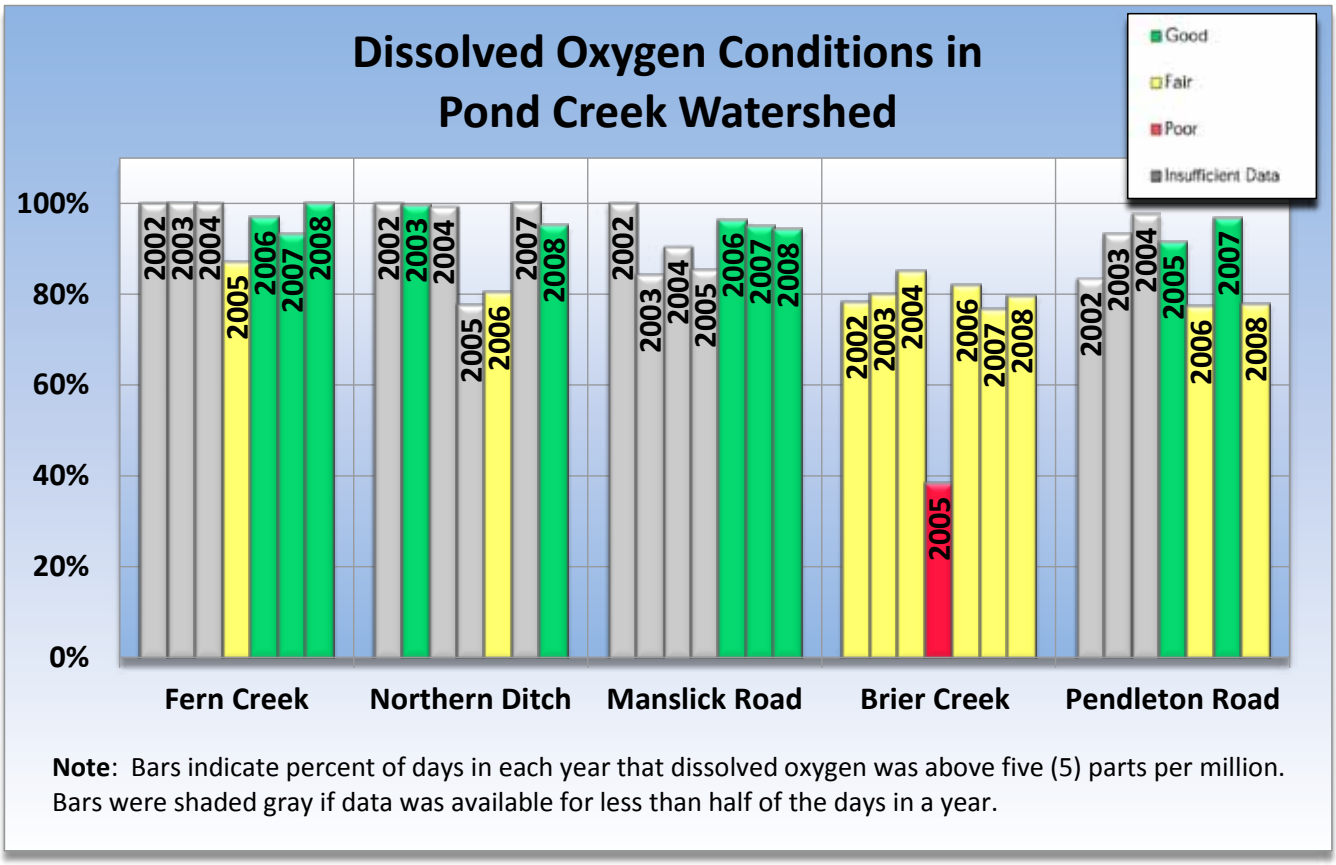
Habitat along Northern Ditch lacks tree cover and deep pools.

Although picturesque, Brier Creek lacks a stable rocky bottom more suitable for fish and insect habitat.

gage 03302000, located at Manslick Road), Pond Creek at Bear Camp Road (USGS gage 03302030) and Brier Creek at Pendleton Road (USGS gage 03302050). Fish and aquatic insects need dissolved oxygen to breathe, and amounts greater than five parts per million are what is deemed necessary.

More than half of the daily data was available for 2005 through and 2008 in Fern Creek at Bardstown Road, indicating improving water quality. During this period, the percent of days when the average amount of dissolved oxygen in the water was above five parts per million increased from "fair" in 2005 to "good" in 2006 through 2008.

In Northern Ditch at Preston Highway, more than half of the daily data was available for 2003, 2006 and 2008. During this period, the percent of days when the average amount of dissolved



Note: Bars indicate percent of days in each year that dissolved oxygen was above five (5) parts per million. Bars were shaded gray if data was available for less than half of the days in a year.

oxygen in the water was above five parts per million increased was "good" in 2003 and 2008, but "fair" in 2006.

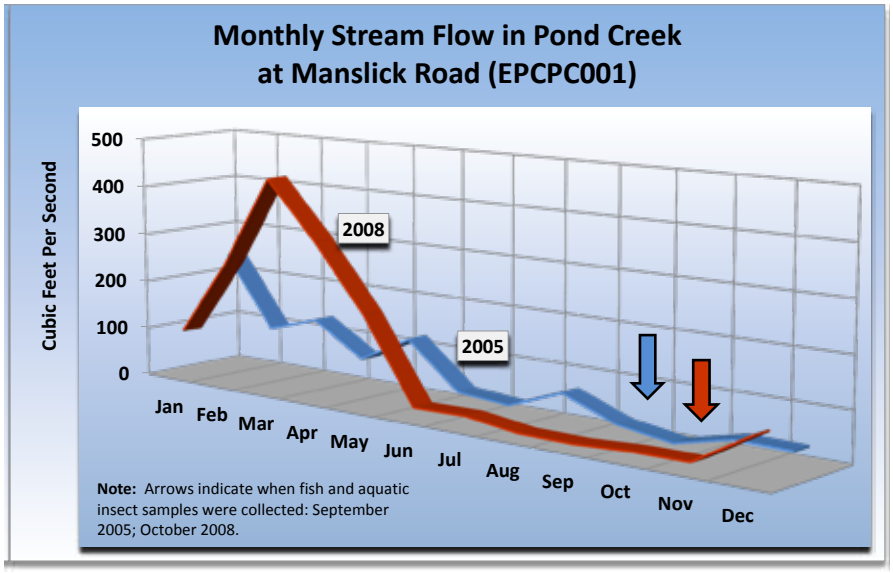
In Pond Creek at Manslick Road, more than half of the daily data was available between 2006 and 2008, indicating improving data quality. During this period, the percent of days when the average amount of dissolved oxygen in the water was above five parts per million was consistently "good".

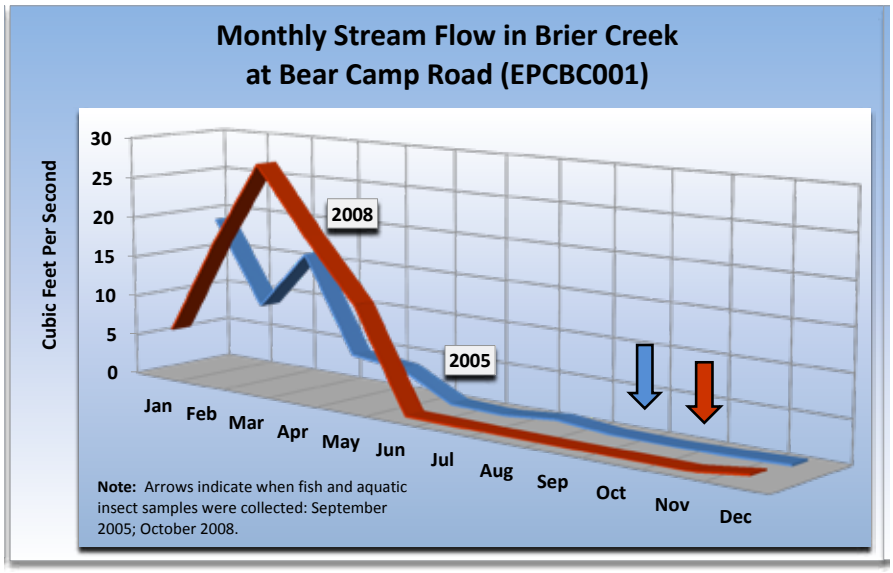
In Brier Creek at Bear Camp Road, more than half of the daily data was available for between 2002 and 2008, indicating good data quality. During this period, the percent of days when the average amount of dissolved oxygen in the water was above five parts per million was "fair" in all years except 2005, when it was "poor". It is not clear if the low dissolved oxygen readings were a result of very low stream flows or some other factor.

In Pond Creek at Pendleton Road, more than half of the daily data was available between 2005 and 2008, indicating improving data quality. During this period, the percent of days when the average amount of dissolved oxygen in the water was above five parts per million varied between "good" in 2005 and 2007 and "fair" in 2006 and 2008.

MSD and the US Geological Survey monitor stream flow at the five sites in the Pond Creek watershed that are monitored for dissolved oxygen.

In September 2005, when the fish and aquatic insect samples were collected, stream flows were below normal at all sites except Fern Creek, where they were average. For a month prior to that sampling, however, stream flows were average or above. In 2008, conditions throughout the watershed were drier, with below normal stream flows for three to five months prior to the sampling event in October. In Brier Creek, this small stream had almost no flow in September and October. In general, low stream flows can cause stress on fish and aquatic insects.





Did you know?

Dobsonfly nymphs are predators on other insects, here one is feeding on a stonefly.

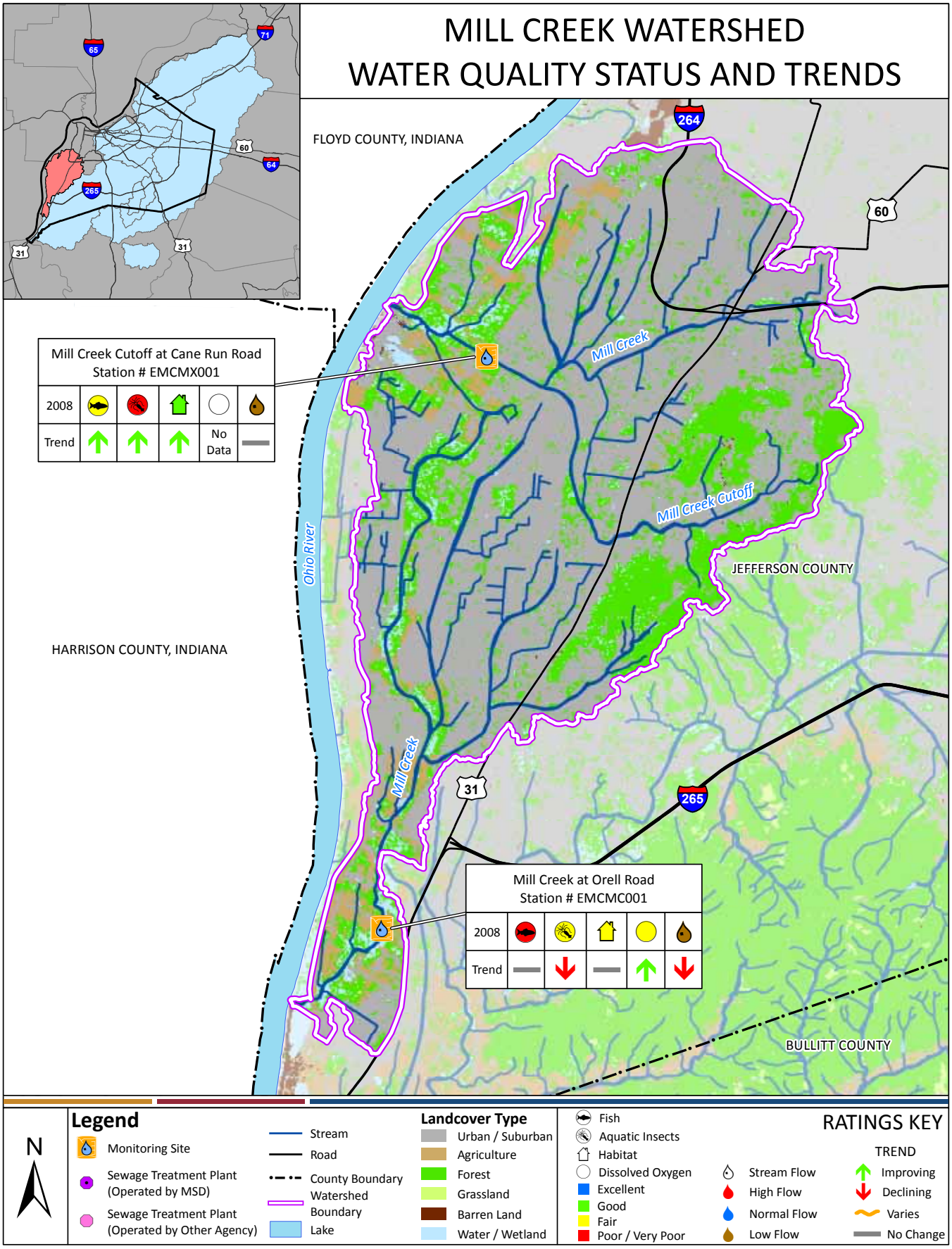
dobsonfly nymph or hellgrammite (Megaloptera) feeding on a stonefly (Plecoptera) photo by Larry Serpa courtesy of Society for Freshwater Science (NABS (www.benthos.org)).

WATERSHED ASSESSMENT

In the Pond Creek watershed, fish communities improved in the upper part of the watershed, in the Fern Creek and Northern Ditch, and were poor and stable in the middle and lower part of the watershed, at the Manslick Road and Pendleton Road. Fish communities were variable in Brier Creek. Aquatic insect communities improved from 'poor" to "fair" between 2000 and 2004 in Fern Creek, but then declined to "poor" in 2008. In Northern Ditch, aquatic insect communities were "poor" and improved, although not enough to change classification. In Pond Creek at Manslick Road, aquatic insect communities were "fair" between 2000 and 2005, but declined to "poor" in 2008. In Brier Creek and Pond Creek at Pendleton Road, aquatic insect communities improved from "poor" in 2000 to "fair" in 2008.

Habitat quality improved in Fern Creek from "poor" to "fair" but was stable at the remaining sampling locations; "poor" at Northern Ditch and Pendleton Road, and "good" at the Manslick Road. Typical of many urban streams, the habitat in the Pond Creek watershed is compromised by insufficient trees and other protective vegetation along the banks, erosion and sediment deposition. Both Northern Ditch and Pond Creek at Manslick Road sites are located in a man-made channel, so many of the features of a natural channel such as a mix of rocky riffles and deep, slow pools, submerged logs and undercut banks are not present. In Brier Creek, habitat quality was "poor" to "fair". Habitat in this location lacked trees and other vegetation along the banks, resulting in unstable banks, silt and sediment deposits in the stream. This monitoring site also has a very small drainage area, and is affected by periods of low stream flow. The percent of days for which dissolved oxygen was above five parts per million was consistently "good" in Fern Creek and Manslick Road since 2005. Dissolved oxygen varied between "fair" and "good" in Northern Ditch and Pendleton Road. In Brier Creek, the percent of days for which dissolved oxygen was above five parts per million was "fair" between 2002 and 2008, except in 2005, when it was "poor". Stream flows were low prior to and at the time aquatic insect and fish community samples were collected in 2005 and 2008. The natural effects of low stream flows and poor habitat quality affect fish and aquatic insect communities throughout the Pond Creek watershed.

Planting a rain garden is one way that citizens can help to improve local streams.


MILL CREEK WATERSHED
WATER QUALITY STATUS AND TRENDS
FLOYD COUNTY, INDIANA
HARRISON COUNTY, INDIANA
JEFFERSON COUNTY
BULLITT COUNTY
Ohio River
Mill Creek
Mill Creek
Mill Creek Cutoff
Mill Creek Cutoff at Cane Run Road
Station # EMCMX001
2008
Trend
No Data
Mill Creek at Orell Road
Station # EMCMC001
2008
Trend
Legend
Monitoring Site
Sewage Treatment Plant (Operated by MSD)
Sewage Treatment Plant (Operated by Other Agency)
Stream
Road
County Boundary
Watershed Boundary
Lake
Landcover Type
Urban / Suburban
Agriculture
Forest
Grassland
Barren Land
Water / Wetland
Fish
Aquatic Insects
Habitat
Dissolved Oxygen
Excellent
Good
Fair
Poor / Very Poor
Stream Flow
High Flow
Normal Flow
Low Flow
RATINGS KEY
TREND
Improving
Declining
Varies
No Change
N

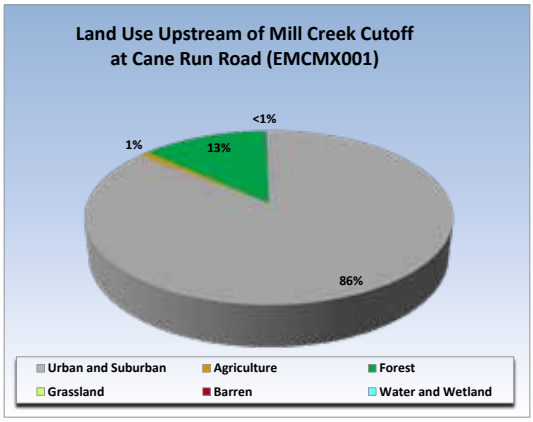
3.10 Mill Creek Watershed

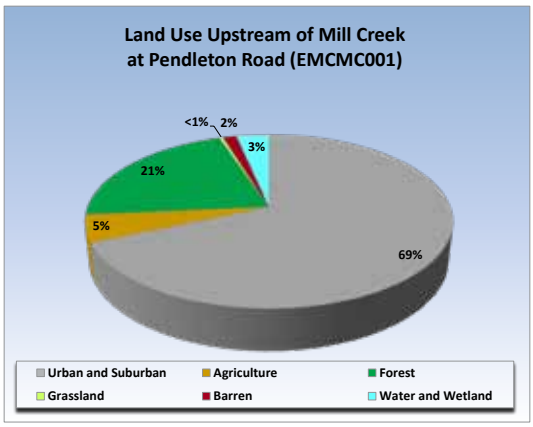
The Mill Creek watershed drains about 34 square miles in western Louisville, near the Ohio River. The northern part of the watershed includes streams that drain to the Mill Creek Cutoff, which flows directly into the Ohio River near Shively. The southern part of the watershed flows south through Pleasure Ridge Park and then into the Ohio River near Watson Lane.

Many of the streams in this watershed have been straightened or channelized in the past to reduce flooding and to increase the amount of land suitable for development.

MSD has been monitoring water quality in this watershed since 1999 at two locations: Mill Creek Cutoff at Cane Run Road and Mill Creek at Orell Road.

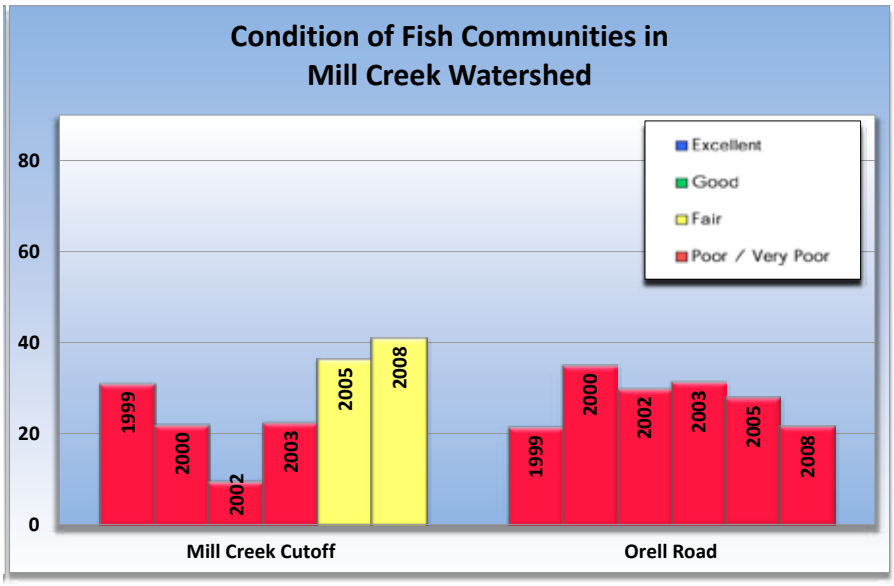
There are 24.4 square miles of land draining to the monitoring site on the Mill Creek Cutoff. There are 13.5 square miles of land draining to the monitoring site on Mill Creek at Orell Road. Both of these watersheds are highly urbanized, with some forest and very little agriculture. Approximately 38 percent of the land draining to the Mill Creek Cutoff monitoring site is covered by impervious surfaces such as roads, rooftops and driveways. About 21 percent of the land draining to the monitoring site on Mill Creek is covered by impervious surfaces.



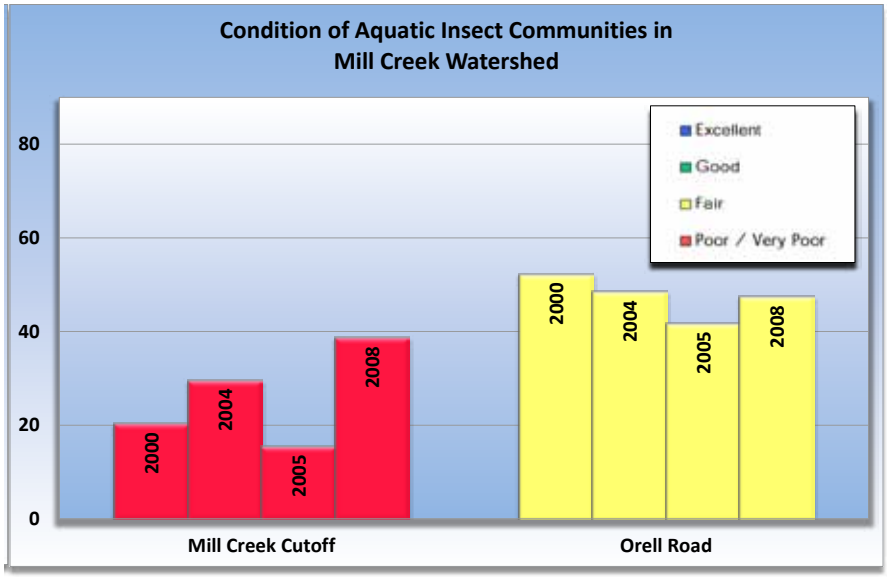


MONITORING SUMMARY

MSD monitored fish communities at the two sites between 1999 and 2008. During this time, results improved from "poor" to "fair" at the Mill Creek Cutoff monitoring site. At Orell Road, fish communities were consistently "poor" or "very poor".



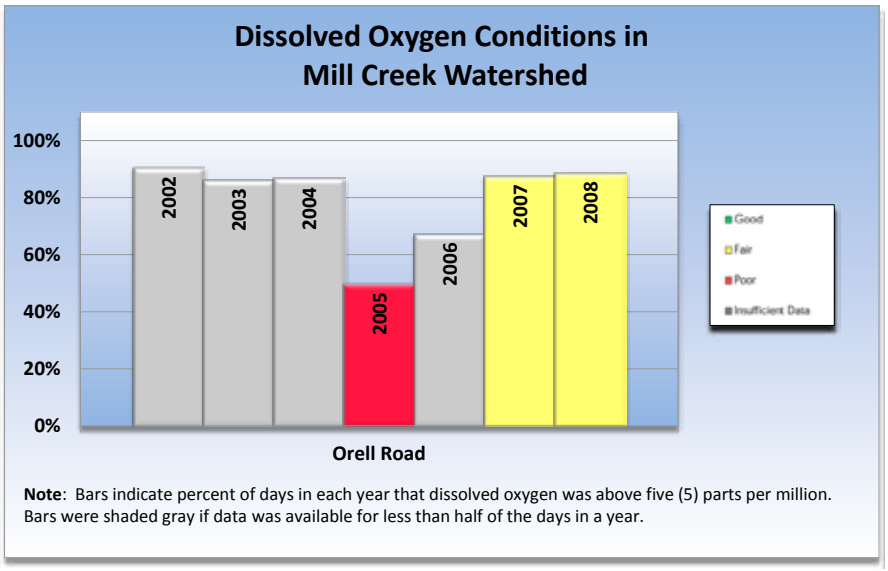
MSD monitored aquatic insect communities at the two sites in 2000, 2004, 2005, 2008. During this time, aquatic insect communities improved from "very poor" to "poor" at the Mill Creek Cutoff monitoring site. At Orell Road, aquatic insect communities were classified as "fair" throughout the sampling period.

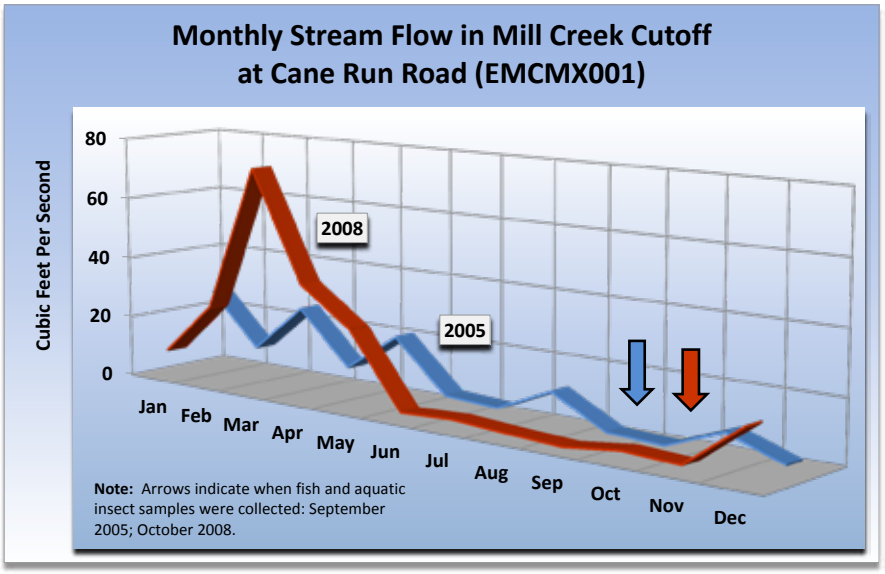


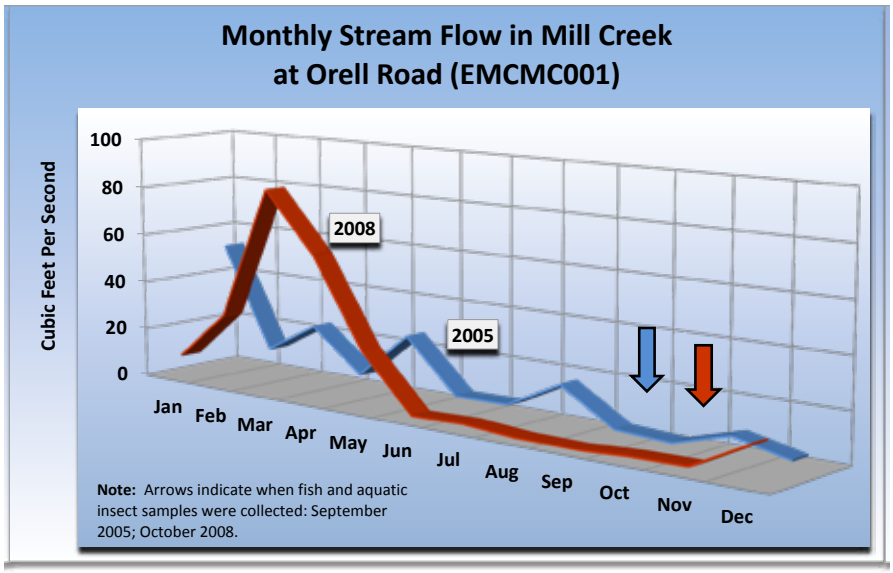
MSD assessed the quality of habitat for fish and aquatic insect communities in 2005 and 2008. Habitat quality improved from "fair" to "good" at the Mill Creek Cutoff monitoring site. This monitoring site is located in a straightened channel that lacks rocky riffles that provide habitat for fish and aquatic insects.

At the Mill Creek Cutoff monitoring site, the stream consists of a man-made channel, so many of the features of a natural channel, such as a mix of rocky riffles and deep, slow pools, submerged logs and vegetated banks are not present. These features provide important habitat for fish and aquatic insects. The stream banks do not have sufficient vegetation to protect them from erosion. At the Orell Road monitoring site, the channel has also been altered, and the stream banks also lack sufficient trees for shade and other vegetation to protect them from erosion.

MSD and the US Geological Survey continuously monitor dissolved oxygen in Mill Creek at Orell Road (USGS gage 03294570). Fish and aquatic insects need dissolved oxygen to breathe, and amounts greater than five parts per million are what is deemed necessary. More than half of the daily data was available for 2005, 2007 and 2008 in Mill Creek at Orell Road, indicating improving data quality. During this period, the percent of days when the average amount of dissolved oxygen in the water was above five parts per million increased from "poor" in 2005 to "fair" in 2006 through 2008.







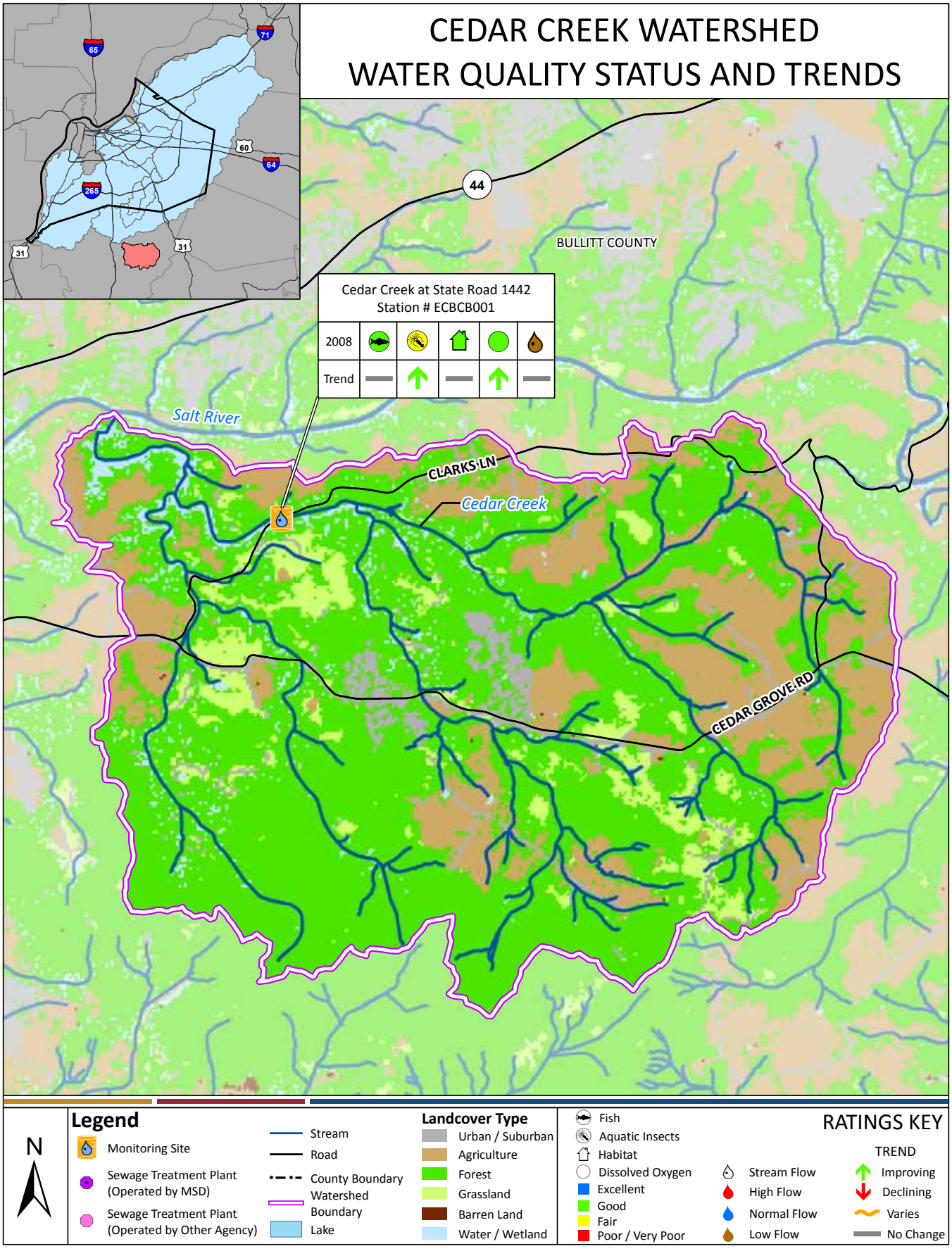
MSD and the US Geological Survey continuously monitor stream flows at the Mill Creek Cutoff site (USGS gage 03294550) and at Mill Creek at Orell Road (USGS gage 03294570). In 2005, stream flows were below normal in September, when fish and aquatic insect samples were collected. However, for the two months prior to sampling, stream flows were average or above. In 2008, conditions throughout the watershed were drier, with below normal stream flows for 5 months prior to sampling event in October. In general, low stream flows can cause stress on fish and aquatic insects.

WATERSHED ASSESSMENT

In the Mill Creek Cutoff, fish communities were "fair" in 2008 and have improved from "poor" between 1999 and 2003. Between 2000 and 2008, and aquatic insect communities were poor but showing some improvement. Habitat conditions improved to "good" quality in 2008. Stream flows were below normal in 2005 and 2008, when fish and aquatic insect community samples were collected. The less than optimal habitat and natural effects of low stream flow may have stressed aquatic communities, particularly during 2008.

At Orell Road, fish communities in Mill Creek were consistently "poor" and aquatic insect communities were "fair" and declining slightly. Aquatic habitat was consistently "fair" and stream flow was below normal. Between 2005 and 2008, the percent of days for which dissolved oxygen was above five parts per million improved from "poor" to "fair" in Mill Creek at Orell Road. As frequency of low dissolved oxygen, the less than ideal habitat, and the low stream flows may have stressed aquatic communities, particularly during 2008.

CEDAR CREEK WATERSHED
WATER QUALITY STATUS AND TRENDS



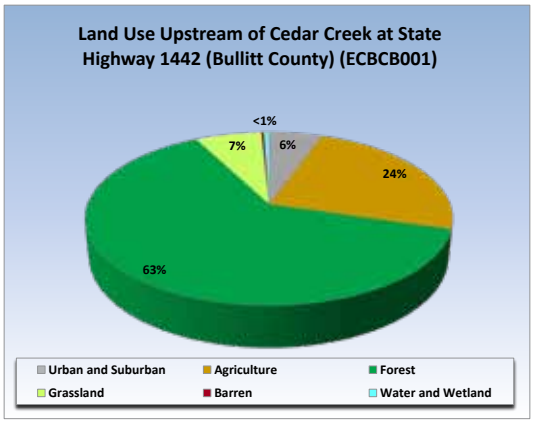
3.11 Cedar Creek Watershed (Bullitt County)

The small streams that eventually form Cedar Creek originate in the Cedar Grove area in Bullitt County. Cedar Creek flows north and empties into the Salt River east of Shepherdsville.

This site is located outside of the urban influences of Louisville and provides a basis for comparison of water quality conditions to sites in the Louisville Metro area.

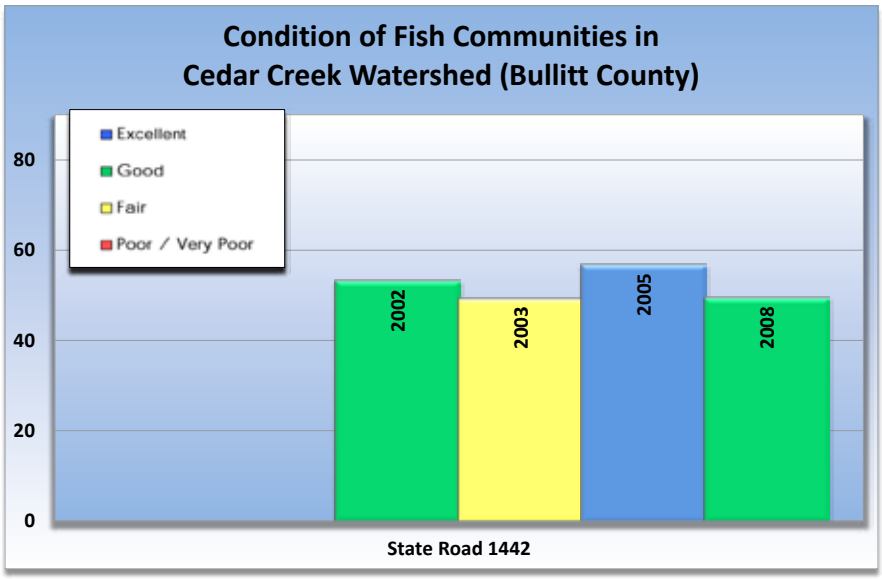
Since 2002, MSD has been monitoring water quality and stream flow in Cedar Creek at State Highway 1442 (Cedar Road) since 2002. There are 15.2 square miles of land draining to the Cedar Creek monitoring site. This land is mostly forested, with significant amounts of agriculture and grasslands. A relatively small percentage of the land has been developed for urban and suburban uses. Impervious area covers only 0.2 percent of this watershed.

Water Penny Photo by Ken Krieger, courtesy of Society for Freshwater Science (NABS (www.benthos.org)).

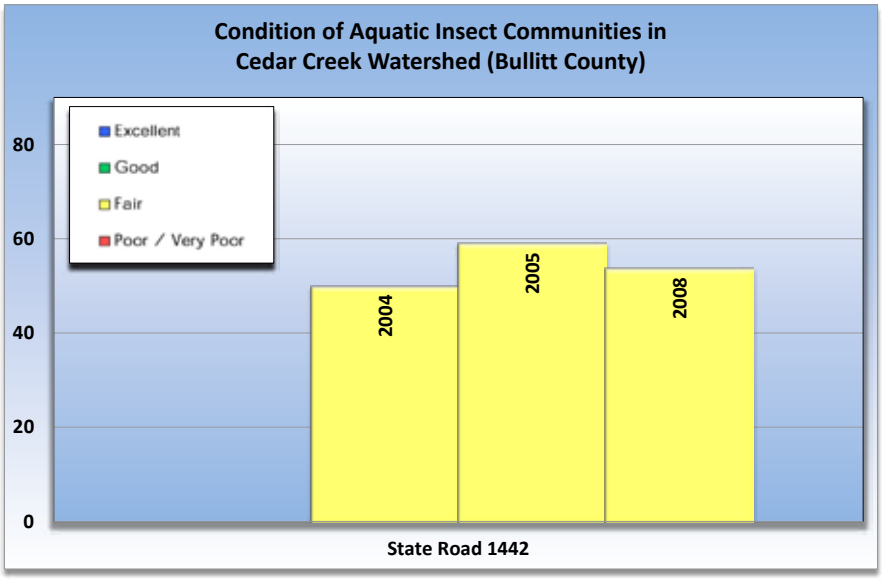


MONITORING SUMMARY

MSD monitored the condition of fish communities in Cedar Creek at State Road 1442 between 2002 and 2008. During that time, the fish communities in Cedar Creek varied very little and were generally classified as “good”.

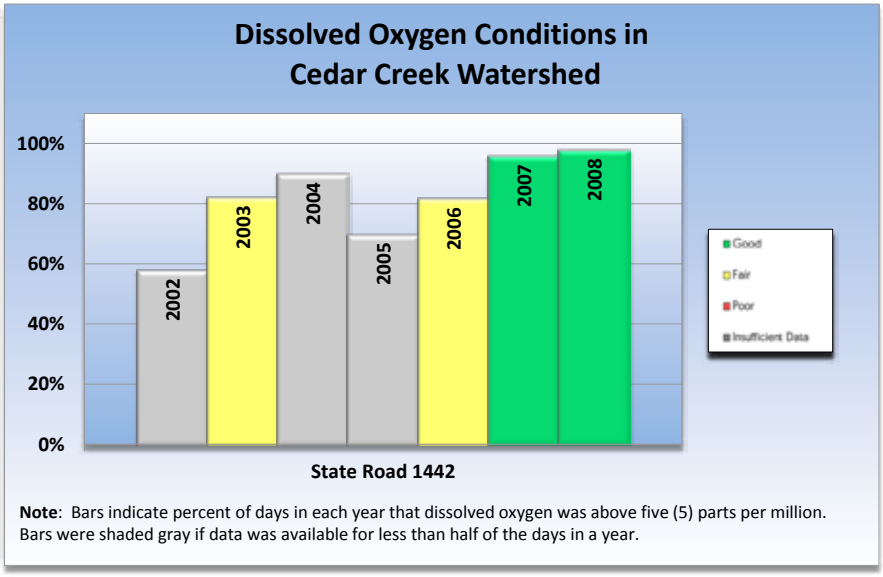


MSD monitored the condition of aquatic insect communities in Cedar Creek at State Road 1442 between 2004 and 2008. During this time, aquatic insect communities were classified as “fair” and improved very slightly over time.



MSD assessed the quality of stream habitat in 2005 and 2008. Both results were classified as “good”, meaning that this stream provides good habitat for fish and aquatic insect communities. At the monitoring site, this stream has stable banks and was only slightly degraded by silt and sediment deposition. The stream channel had not been straightened or otherwise altered.

MSD and the US Geological Survey continuously monitor dissolved oxygen in Cedar Creek at State Highway 1442 (USGS gage 03297800). Fish and aquatic insects need dissolved oxygen to breathe, and amounts greater than five parts per million are what is deemed necessary. More than half of daily data was available for 2003 and 2006 through 2008, indicating improving data quality. For these years, the percent of days when the average amount of dissolved oxygen in the water was above five parts per million increased from "fair" in 2003 and 2006 to "good" in 2007 and 2008.

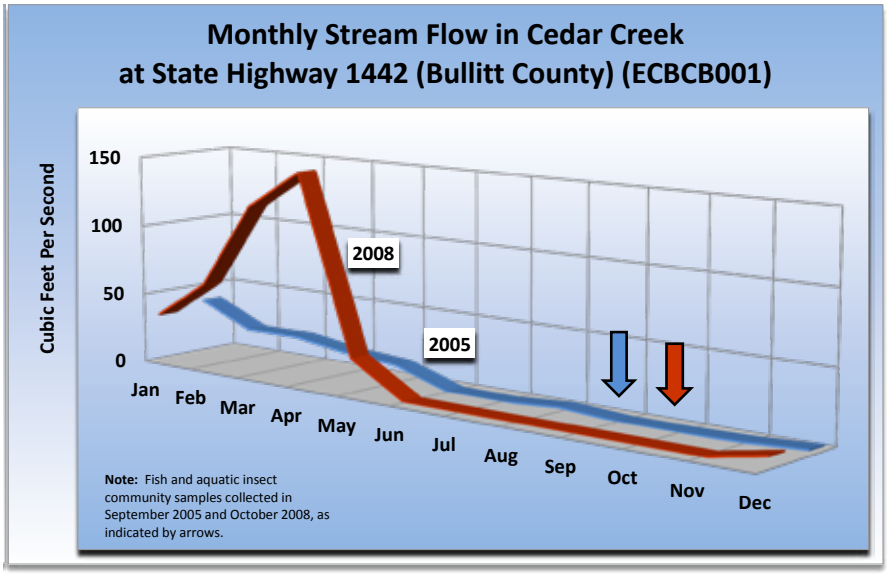


Note: Bars indicate percent of days in each year that dissolved oxygen was above five (5) parts per million. Bars were shaded gray if data was available for less than half of the days in a year.

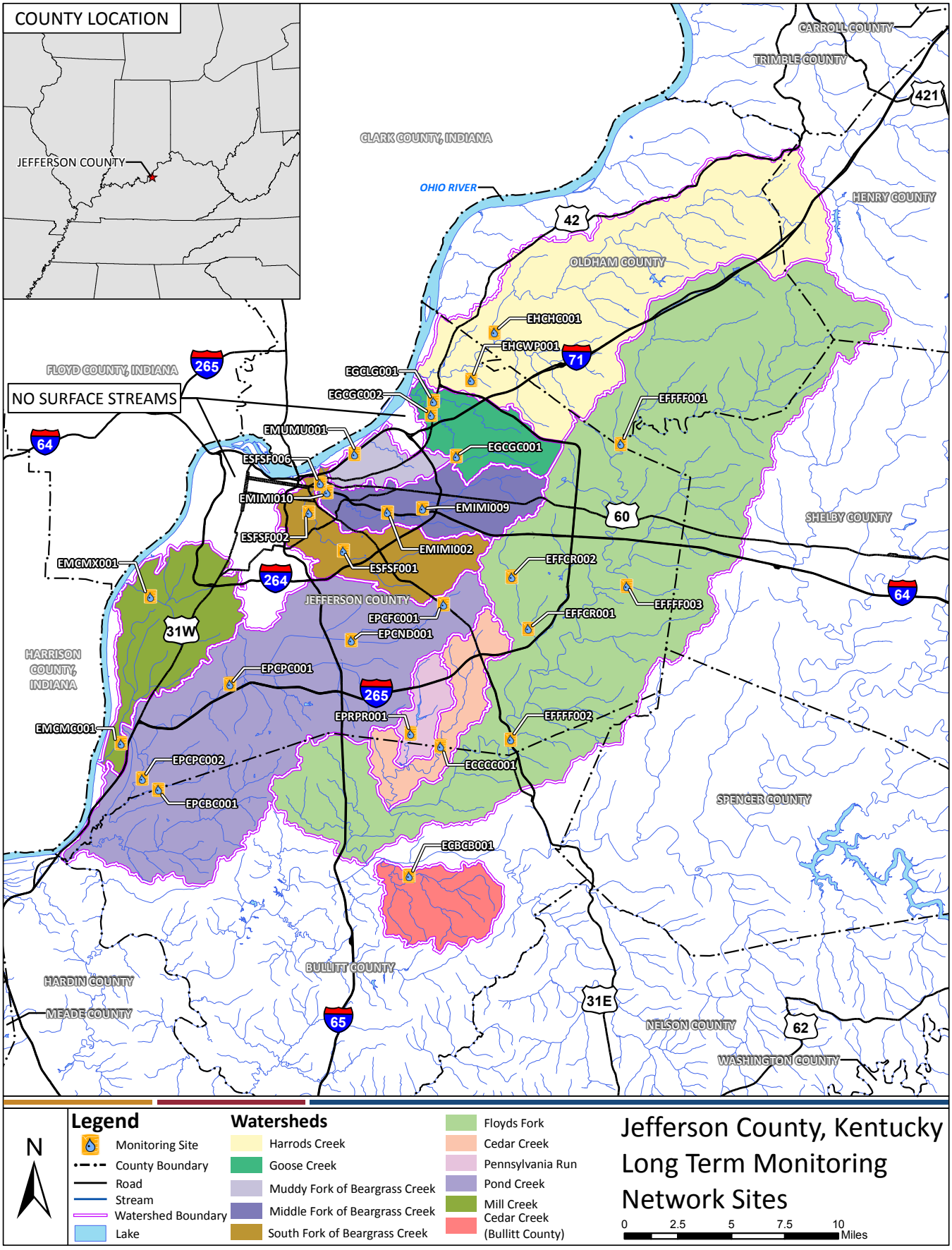
WATERSHED ASSESSMENT

Fish communities were variable but generally "good" and aquatic insect communities were generally "fair" in Cedar Creek. Both fish and aquatic communities declined slightly in 2008. The Cedar Creek watershed has good habitat for fish and aquatic insects. The forests, agricultural and grassland areas slow down and absorb runoff after rain events. Thus, the stream banks are stable and stream habitat is well suited to aquatic life. The amount of dissolved oxygen in the water increased steadily to "good" In 2007 and 2008. Since aquatic habitat and dissolved oxygen were "good" and no other major factors were affecting this watershed, the slight decline in fish and aquatic communities between 2005 and 2008 is likely the result of the natural effects of low stream flows during and prior to sampling.

MSD and the US Geological Survey continuously monitored stream flow at USGS gage 03297800. Stream flows in both 2005 and 2008 were below normal, and were especially low in 2008 for three months prior to the sampling event in October. Low stream flow can cause stress on fish and aquatic insects.



Stonecat fish


COUNTY LOCATION
JEFFERSON COUNTY
CARROLL COUNTY
TRIMBLE COUNTY
421
CLARK COUNTY, INDIANA
OHIO RIVER
HENRY COUNTY
42
OLDHAM COUNTY
EHCHC001
EHCWP001
71
FLOYD COUNTY, INDIANA
265
EGCLG001
EGCGC002
NO SURFACE STREAMS
EFFFF001
64
EMUMU001
EGCGC001
ESFSF006
EMIMI010
EMIMI009
60
SHELBY COUNTY
ESFSF002
EMIMI002
ESFSF001
EFFCR002
EMCMX001
264
JEFFERSON COUNTY
EFFFF003
64
EPCFC001
EFFCR001
EPCND001
31W
HARRISON COUNTY, INDIANA
EPCPC001
265
EPRPR001
EFFFF002
EMCMC001
EGCGC001
EPCPC002
EPCBC001
SPENCER COUNTY
EGBGB001
BULLITT COUNTY
HARDIN COUNTY
MEADE COUNTY
65
31E
NELSON COUNTY
62
WASHINGTON COUNTY
N
Legend
Monitoring Site
County Boundary
Road
Stream
Watershed Boundary
Lake
Watersheds
Harrods Creek
Goose Creek
Muddy Fork of Beargrass Creek
Middle Fork of Beargrass Creek
South Fork of Beargrass Creek
Floyds Fork
Cedar Creek
Pennsylvania Run
Pond Creek
Mill Creek
Cedar Creek (Bullitt County)
Jefferson County, Kentucky
Long Term Monitoring Network Sites
0 2.5 5 7.5 10
Miles

4. Summary


Harrods Creek


Eroding Road Ditch


Northern Ditch at Preston Highway

In 1988, the Louisville Metropolitan Sewer District (MSD) and the United States Geological Survey (USGS) began a sampling and monitoring program to collect physical, chemical and biological samples from streams in the Jefferson County and surrounding areas. The USGS conducts stream flow monitoring and MSD conducts water quality and biological monitoring. The MSD Long Term Monitoring Network consists of 27 sites, 24 of which are located at USGS continuous stream flow gaging stations. MSD collects continuous water quality parameters (water temperature, dissolved oxygen, pH, and conductivity) at each Long Term Monitoring Network site with recording gages.

This report is focused on the status and trends in the quality of fish and aquatic insect communities, and the stream habitat, stream flow and dissolved oxygen conditions at the Long Term Monitoring Network sites between 1999 and 2008. This report augments a previous report "Water Quality in Jefferson County, Kentucky, A Watershed Synthesis Report, 2000 – 2007" that provided very detailed analysis of water quality status and trends.

OVERALL FINDINGS

Typical of urban streams, the habitat of streams in Jefferson County watersheds was variably compromised by:

- insufficient tree cover and other protective vegetation along the banks,
- often limited amounts of rocky, riffle habitat and pool-riffle development,
- stream bank erosion due to increases in runoff,
- deposition of sediment that covers habitat needed by fish and aquatic insects, and
- periods of low dissolved oxygen.

Some watersheds, like Pond Creek and Mill Creek, have considerable lengths of man-made channels, so many of the habitat features of natural channels such as a mix of rocky riffles and deep pools, submerged logs and well vegetated banks, especially tree cover, are not present.

Lower than normal stream flows prior to and during fall sampling events for aquatic insect and fish communities likely affected aquatic community health both in 2005 and 2008. It appeared to have affected aquatic insects more than fish, likely owing to differences in mobility perhaps. As a result, MSD has been advised to change sampling for aquatic insects to an earlier summer time.

The data suggest that the natural effects of lower stream flows and fair to poor habitat quality, affect the health of fish and aquatic insect communities in many watersheds. Lower dissolved oxygen conditions likely contributed to lower aquatic health status in some streams, but conditions overall seem to be improving in many streams. The dissolved oxygen data also suggest that the quality control measures implemented by MSD jointly with USGS have led to a noticeable improvement in the amounts of usable data from the water quality gages in recent years.

The land use patterns and changes in flow conditions for each Long Term Monitoring Network watershed are major influencing factors of the health of the downstream aquatic communities. The status and trends of the aquatic insect and fish community conditions are summarized for each Long Term Monitoring Network site with consideration for the stream habitat, stream flow and dissolved oxygen conditions for each site and then, for the Metro area as a whole.

ASSESSMENT OF INDIVIDUAL WATERSHEDS

Harrods Creek Watershed

The predominance of agricultural and forested areas in the Harrods Creek watershed slows down and absorbs runoff after rain events. Harrods Creek stream habitat and dissolved oxygen conditions were found to be well suited to support healthy aquatic insect and fish communities. In Wolf Pen Branch, fish and aquatic insect communities were "fair" to "poor". Habitat quality improved to "fair" in 2008 but not enough to support better fish and insect communities. In Harrods Creek, dissolved oxygen conditions were "good" in all years except in 2007, when dissolved oxygen levels decreased to "fair". In 2005 and 2006, dissolved oxygen levels were "good" in Wolf Pen Branch. Dry conditions in 2008 may have contributed to observed declines in aquatic insect communities in Wolf Pen Branch.

Goose Creek Watershed

Since 1999, fish communities in the watershed showed significant improvement to "fair" and "excellent" in 2005 and 2008, however, aquatic insect communities declined or showed only slight improvement. Habitat was "fair" to "good". And dissolved oxygen levels were generally good. The lower than normal flow conditions prior to and during the 2005 and 2008 sampling likely account for some of the decline in insect communities.

Muddy Fork Watershed

Since 2002, fish communities at the Mockingbird Valley Road site showed significant improvement from 2002 to 2005 but declined to "poor" in 2008. The aquatic insect communities were in "poor" condition. Stream habitat conditions were "poor" likely due to channel straightening, lack of protective vegetation and eroding banks, and sediment accumulation. In 2007 and 2008, dissolved oxygen conditions were good. The unexpected decline in fish communities in 2008 may be, in part, the result of the very low flow conditions at the sites during and prior to sampling.

Middle Fork Watershed

Since 1999, fish communities showed significant improvement in the upper and middle parts of the watershed, at Browns Lane site and Old Cannons Lane, whereas, they were consistently "poor" in the lower part of the watershed, at Lexington Road. Aquatic insect communities at all three sites were "poor" or "fair" with some improvement in 2008, especially at Lexington Road. Stream habitat conditions generally were "good". Dissolved oxygen was consistently "good" between 2002 and 2006 at Browns Lane, improved from "fair" to "good" at Old Cannons Lane, but were "fair" to "poor" at Lexington Road; this likely contributed to poor fish communities at Lexington Road. Low stream flows in 2005 and 2008 also likely affected aquatic communities. The presence of parks and significant tree cover along the streams, probably buffer to some degree the intensity of urban development.

South Fork of Beargrass Creek Watershed

Fish communities at Trevilian Way improved to "good" between 1999 and 2005, but declined to "fair" in 2008. Aquatic insect communities were "poor" to "fair" throughout. Fish and aquatic insect communities were "poor" and "very poor" at both Schiller Avenue Ramp and Brownsboro Road. Stream habitat conditions were "poor" to "fair" for the three sites. Habitat at Trevilian Way and Schiller Avenue Ramp are affected by many urban issues: altered stream channels, unstable banks, sediment accumulation and a lack of shallow rocky riffles and deep pools. These issues also affected the site at Brownsboro Road, but less severely. Dissolved oxygen at Trevilian Way declined from "good" in 2002 to "fair" in 2008, but at Schiller Avenue Ramp improved to "good" in 2006 to 2008. There was insufficient data to evaluate dissolved oxygen conditions at Brownsboro Road. The natural effects of lower stream flow combined with degraded habitat and lowered dissolved oxygen likely affected aquatic communities.

Floyds Fork Watershed

The fish communities at all five sites improved significantly from "poor" prior to 2004, to "fair", "good" or "excellent" in 2005 and 2008, especially at Ash Avenue and Taylorsville Road. Aquatic insect communities at all three Floyds Fork sites improved from 1999 to 2008, but were generally "poor" in Chenoweth Run at Ruckriegel Parkway and "fair" in Chenoweth Run at Gellhaus Lane. Stream habitat conditions generally were "good" at all three Floyds Fork sites. In Chenoweth Run, habitat was "poor" but improving at Ruckriegel Parkway, and improved to "good" at Gellhaus Lane in 2008.

Dissolved oxygen improved from "poor" to "fair" at Ash Avenue and from "fair" to "good" at Old Taylorsville Road. Dissolved oxygen was "good" at Bardstown Road and Chenoweth Run at Gellhaus Lane, but declined from "good" in 2002 to "poor" in 2005 and back to "good" in 2008 at Ruckriegel Parkway. Stream flows were low in 2005 and drier yet in 2008, but did not seem to have a significant impact on fish and aquatic insect communities.

Cedar Creek Watershed (Jefferson County)

From 1999 to 2008, fish communities at Thixton Road improved from "poor" to "good", but aquatic insect communities declined from "fair" to "poor". Stream habitat declined from "fair" to "poor" from 2005 to 2008, but dissolved oxygen was consistently "good". Stream flow data was not available in 2005, but stream flow was very low in 2008. Cedar Creek runs on bedrock and lacks rocky riffles that provide good habitat. The poor quality habitat and low stream flows likely contributed to declining aquatic insect communities.

Pennsylvania Run Watershed

From 1999 to 2008, fish communities at Mount Washington Road improved from "poor" to "excellent", whereas, aquatic insect communities were "poor" but improving. Habitat quality improved significantly to "good" in 2008. Like Cedar Creek, this stream runs on bedrock and lacks rocky riffles that provide better habitat. Dissolved oxygen was generally "fair". Stream flows were low in 2005 and were even drier in 2008. Multiple factors affect fish and aquatic insect communities, including some stream habitat limitations, frequent low dissolved oxygen levels, and the natural effects of low stream flow.

Pond Creek Watershed

From 1999 to 2008, fish communities improved in Fern Creek and Northern Ditch, were "poor" in Pond Creek at Manslick Road and Pendleton Road, and were variable in Brier Creek. Aquatic insect communities in Fern Creek improved from 'poor" to "fair" and back to "poor"; in Northern Ditch they were "poor"; in Pond Creek at Manslick Road they were "fair", but declined to "poor" in 2008; and in Brier Creek and Pond Creek at Pendleton Road they improved from "poor" to "fair".

Habitat quality improved in Fern Creek from "poor" to "fair" but was stable at the other sites; "poor" at Northern Ditch and Pendleton Road, and "good" at Manslick Road. In Brier Creek, habitat quality was "poor" to "fair" with unstable banks and sediment deposits. Typical of many urban streams, the habitat in the Pond Creek watershed is compromised by channelized streams, insufficient tree cover and other protective vegetation along the banks, bank erosion and sediment deposition. Northern Ditch and Pond Creek at Manslick Road sites are man-made channels, where a mix of rocky riffles, deep pools, submerged logs and vegetated banks are not present. Dissolved oxygen was consistently "good" in Fern Creek and Manslick Road since 2005. Dissolved oxygen varied between "fair" and "good" in Northern Ditch and Pendleton Road, and generally was "fair" In Brier Creek. Stream flows were low in 2005 and 2008. The natural effects of low stream flows, poor habitat quality, and in some sites, low dissolved oxygen affect fish and aquatic insect communities throughout the watershed.

Mill Creek Watershed

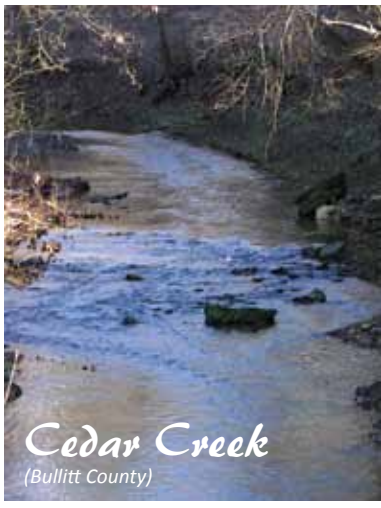
In Mill Creek Cutoff, fish communities have improved from "poor" to "fair" between 1999 and 2008. Aquatic insect communities were "poor" but showing some improvement. Habitat conditions improved to "good" in 2008. Stream flows were below normal in 2005 and 2008. Dissolved oxygen was not collected. Mill Creek Cutoff is a man-made channel to divert flood waters directly to the Ohio River. In spite of good habitat, it is not clear what contributed to the poorer aquatic communities in this stream beyond the natural effects of low stream flow.


Mill Creek Cutoff

flow. In Mill Creek at Orell Road, fish communities were consistently "poor" and aquatic insect communities were "fair" and declining slightly. Aquatic habitat was consistently "fair" and stream flow was below normal. Dissolved oxygen was improved from "poor" to "fair". The low dissolved oxygen, less than ideal habitat, and low stream flows likely have stressed aquatic communities, particularly during 2008.

Cedar Creek Watershed (Bullitt County)

Fish communities were variable but generally "good" and aquatic insect communities were generally "fair". Both fish and aquatic insect communities declined slightly in 2008. Cedar Creek has good stream habitat and the predominance of forest, agricultural and grassland areas slow down and absorb runoff after rain events. Stream banks are stable. Dissolved oxygen increased steadily to "good" in 2007 and 2008. Since aquatic habitat and dissolved oxygen were "good" and no other major factors were affecting this watershed, the slight decline in fish and aquatic communities between 2005 and 2008 is likely the result of the natural effects of low stream flows during and prior to sampling.


Cedar Creek
(Bullitt County)

STATE OF THE STREAMS

Summary of the Status and Trends in Stream Water Quality from 1999 to 2008 for the MSD Long Term Monitoring Network (LTMN).

MSD Site Name	% Urban	% Impervious	MSD LTMN Site ID	USGS Stream Gage ID	Site Drainage Area (square miles)	Stream Size	Fish Status (2008)
Harrods Creek at Covered Bridge Road	9	1	EHCHC001	03292470	70.3	W	Fair
Wolf Pen Branch at 8111 Wolf Pen Branch Road	24	7	EHCWP001	No Gage	3.0	H	Fair
Goose Creek at Old Westport Road	53	11	EGCGC001	03292474	6.7	W	Fair
Goose Creek at US 42	49	10	EGCGC002	03292475	9.7	W	Fair
Little Goose Creek at US 42	66	18	EGCLG001	03292480	5.8	W	Excellent
Muddy Fork of Beargrass Creek at Mockingbird Valley Road	46	9	EMUMU001	03293530	6.2	W	Poor
Middle Fork of Beargrass Creek at Browns Lane	73	24	EMIMI009	No Gage	5.0	H	Good
Middle Fork of Beargrass Creek at Old Cannons Lane	76	24	EMIMI002	03293000	18.5	W	Fair
Middle Fork of Beargrass Creek at Lexington Road	73	22	EMIMI010	03293500	25.2	W	Poor
South Fork Beargrass Creek at Trevilian Way	85	32	ESFSF001	03292500	16.8	W	Fair
South Fork Beargrass Creek at Schiller Avenue Ramp	81	30	ESFSF002	03292550	22.6	W	Very Poor
South Fork Beargrass Creek at Brownsboro Road	78	28	ESFSF006	03293510	24.9	W	Very Poor
Floyds Fork at Ash Avenue	9	1	EFFFF001	03297900	80.0	W	Good
Floyds Fork at Old Taylorsville Road	13	3	EFFFF003	03298000	138.0	W	Excellent
Floyds Fork at Bardstown Road	14	4	EFFFF002	03298200	213.0	W	Fair
Chenoweth Run #1 at Ruckriegel Parkway	75	33	EFFCR002	03298135	5.5	W	Fair
Chenoweth Run #1 at Gellhaus Lane	52	21	EFFCR001	03298150	11.6	W	Fair
Cedar Creek at Thixton Road	37	10	ECCCC001	03298250	11.1	W	Good
Pennsylvania Run at Mount Washington Road	39	9	EPRPR001	03298300	6.4	W	Fair
Fern Creek at Bardstown Road	60	17	EPCFC001	03301900	3.5	H	Fair
Northern Ditch at Preston Highway	62	17	EPCND001	03301940	11.1	W	Good
Pond Creek at Manslick Road	58	25	EPCPC001	03302000	64.0	W	Poor
Pond Creek at Pendleton Road	60	21	EPCPC002	03302030	80.3	W	Poor
Brier Creek at Bear Camp Road	1	0.05	EPCBC001	03302050	4.0	H	Fair
Mill Creek Cutoff at Cane Run Road	86	38	EMCMX001	03294550	24.4	W	Fair
Mill Creek at Orell Road	69	21	EMCMC001	03294570	13.5	W	Poor
Cedar Creek at State Highway 1442	6	0.2	ECBCB001	03297800	15.2	W	Good

Stream Size -- H = headwaters; W = Wadeable

Color key -->

No Data	Excellent	Good	Improving
Fair	Poor	Very Poor	Lower
	No Trend	Varies	Low

Fish Trend (oldest to 2008)	Aquatic Insects Status (2008)	Aquatic Insects Trend (oldest to 2008)	Habitat Status (2008)	Habitat Trend (2005-2008)	Dissolved Oxygen Status (2008)	Dissolved Oxygen Trend (oldest to 2008)	USGS Flow Status (2008)	USGS Flow Trend (2005-2008)	Watershed Name - Number	
No Trend	Good	-12.5%	Good	-1.9%	100.0%	0.0%	Low	No Trend	Harrods Creek -1	
No Trend	Poor	-24.3%	Fair	16.0%	No Data	No Data	No Data	No Data		
Improving	Fair	21.8%	Fair	34.5%	96.9%	2.3%	Low	No Trend	Goose Creek -2	
No Trend	Fair	-5.1%	Good	7.3%	100.0%	1.8%	Low	No Trend		
Improving	Fair	14.5%	Fair	-0.7%	100.0%	10.0%	Low	Lower		
Declining	Poor	-15.3%	Poor	11.8%	98.7%	-1.3%	Low	Lower	Muddy Fork -3	Beargrass Creek
Improving	Poor	-7.4%	Good	54.9%	No Data	No Data	No Data	No Data	Middle Fork -4	
Improving	Fair	3.4%	Good	2.9%	98.7%	21.1%	Low	Lower		
No Trend	Excellent	53.3%	Good	9.1%	85.4%	4.0%	Low	Lower		
Improving	Poor	36.5%	Poor	74.1%	87.5%	-11.0%	Low	No Trend	South Fork -5	
No Trend	Poor	-5.8%	Poor	23.9%	92.1%	12.4%	Low	Lower		
No Trend	Very Poor	92.0%	Fair	7.4%	No Data	No Data	No Data	No Data		
Improving	Fair	25.6%	Good	1.3%	No Data	20.5%	Low	No Trend	Floyds Fork -6	
Improving	Fair	-3.8%	Good	1.2%	100.0%	10.5%	Low	No Trend		
Improving	Excellent	32.6%	Good	5.5%	99.6%	0.5%	Low	No Trend		
Improving	Poor	-5.5%	Poor	12.9%	94.4%	3.3%	Low	Lower		
Improving	Fair	7.1%	Good	21.6%	99.5%	1.4%	Low	Lower		
Improving	Poor	-19.5%	Poor	-24.3%	98.7%	3.0%	Low	No Data	Cedar Creek -7	
Varies	Poor	57.8%	Good	34.1%	78.3%	-3.2%	Low	No Trend	Pennsylvania Run -8	
Improving	Poor	-25.8%	Fair	35.5%	100.0%	12.8%	Low	Lower	Pond Creek -9	
Improving	Poor	26.8%	Poor	1.9%	95.2%	-4.4%	Low	No Trend		
No Trend	Poor	-20.5%	Good	No Data	94.3%	-2.1%	Low	No Trend		
No Trend	Fair	44.4%	Poor	-3.6%	77.9%	-13.6%	Low	No Trend		
Varies	Fair	24.2%	Fair	4.7%	79.6%	1.3%	Low	No Trend		
Improving	Poor	70.7%	Good	33.0%	No Data	No Data	Low	No Trend	Mill Creek -10	
No Trend	Fair	-10.2%	Fair	4.3%	88.6%	38.8%	Low	Lower		
No Trend	Fair	7.0%	Good	0.6%	97.8%	16.3%	Low	No Trend	Cedar Creek-Bullitt-11	

MSD
Metropolitan Sewer District

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Louisville, KY 40203-1911

Customer Relations
www.msdlouky.org
502-587-0603

LOJIC
www.lojic.org
502-540-6000

Louisville Green
www.louisvillegreen.com
502-587-0603

MSD Facility Tours
www.msdlouky.org
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2011 WATER QUALITY SYNTHESIS REPORT