

# Clean Water

Essential to Life



# Karst - Our Unique Landscape

Karst refers to a terrain characterized by sinkholes, caves, springs, underground rivers, and a lack of surface streams. Karst terrains can be found in places that have limestone bedrock, like here in Bowling Green. Limestone is easily dissolved by water as it percolates through the soil due to its mildly acidic nature. Over time, this dissolution process forms the caves that we find under Bowling Green. Through time, as more and more of the surface drainage found its way to the cave streams below, sinkholes formed. Sinkholes in our area are nature's way of carrying storm water to the cave streams, like the Lost River.

Bowling Green is located on the vast sinkhole plain of central Kentucky. This plain is adjacent to Mammoth Cave, the world's longest known cave system. Very few surface streams can be found on this plain, in fact, once one crosses Barren River in Bowling Green and travels north, there is not surface drainage until the Green River, some 35 miles to the north. All of the big rivers between the Barren and the Green can be found hundreds of feet below the surface.



Drainage well



Collapse off Cemetery Road

Bowling Green is one of the largest cities in the country built entirely on a karst sinkhole plain. The City has utilized our karst aquifer for storm water drainage since it was founded. The sinkholes and caves found all over town made for a perfect storm sewer system.

For years, in an effort to alleviate localized flooding problems, the City has drilled drainage wells into the limestone bedrock. The well is drilled into a void or cave that can accept storm water. Today, over 1,000 drain wells have been installed in Bowling Green.

Karst aquifers are very susceptible to contamination from the surface because storm water drains virtually untreated into the large cave streams flowing under Bowling Green. Any pollutant on the ground is picked up and carried with storm water into the karst aquifer during every rain event.

Since a major spill of a hazardous material would be disastrous in Bowling Green, determining ground water flow routes is especially important. Over the last 30 years, through the use of fluorescent dyes, all of the prominent ground water basins have been delineated. All karst ground water basins return to the surface at springs, so a spill particular basin could be contained at its discharge spring. Lost River Rise is the discharge spring of the 58.6 square mile Lost River basin.



State Trooper Cave



Use of fluorescent dye to trace ground water flow



Jennings Creek

# The Effects of Pollution

According to the Environmental Protection Agency, the primary cause of water quality problems in the U.S. today is not from factories or waste water treatment plants, but rather something called "nonpoint source pollution." Nonpoint source pollution is runoff from rainfall, snowmelt, or irrigation that picks up soil and other contaminants as it runs over land eventually depositing them into surface streams and ground water. Ground water in Bowling Green flows very quickly through cave streams, which reappear as springs.

Polluted stormwater runoff can have many adverse effects on plants, fish, animals, and people.

- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.
- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.
- Bacteria and other pathogens can wash into swimming areas and create health hazards, often making swimming area closures necessary.
- Debris--plastic bags, six-pack rings, bottles, and cigarette butts--washed into waterbodies can choke, suffocate, or disable aquatic life like ducks, fish, turtles, and birds.
- Household hazardous wastes like insecticides, pesticides, paint, solvents, used motor oil, and other auto fluids can poison aquatic life. Land animals and people can become sick or die from eating diseased fish and shellfish or ingesting polluted water.
- Polluted storm water often affects drinking water sources. This, in turn, can affect human health and increase drinking water treatment costs. Barren River is the source of Bowling Green's drinking water.



Lost River Cave after a storm event



Lost River Rise



By-Pass Cave



Lost River Rise after a storm event



BGMU outfall on Barren River

# What Bowling Green is Doing

The US EPA mandated that communities across the country develop programs to minimize the effects of nonpoint source pollution. Nonpoint sources of pollution include impervious surfaces such as parking lots, roads and rooftops, residential areas, as well as construction sites, farms and septic systems.

Each program had to reduce these nonpoint sources of pollution to the "maximum extent practicable" via activities within six different control measures. Outlined below are some of the activities that the City of Bowling Green has taken within each of the six minimum control measures:

## ■ Public Education and Outreach

City staff present water quality briefings to schools and civic organizations and setup informational displays at various functions around the City throughout the year.

## ■ Public Participation/Involvement

Opportunities are available to citizens, schools and civic organizations to participate in curb marking, watershed cleanups and other activities designed to reduce the impact of pollutants on our water resources.

## ■ Illicit Discharge Detection and Elimination

Recent update to City ordinance made illicit discharges illegal, subject to citations and fines. The City has developed a SOP (Standard Operating Procedure) to help detect, find and eliminate illicit discharges.

## ■ Construction Site Runoff Control

An updated ordinance outlines strict procedures required on construction sites to prevent erosion and control sediment from leaving work sites. Sediment is the number one pollutant in our waters today, causing sedimentation in pipes, storm sewer inlets, and impacting species that live in our rivers.

## ■ Post-Construction Runoff Control

A new ordinance addresses discharge from new development and certain "hot spot" land uses such as restaurants, gas stations and large retail development. The City had developed a BMP (Best Management Practices) manual that contains guidance for implementing Post-Construction measures that will aid in reducing the amount of pollutants reaching our natural water.

## ■ Pollution Prevention/Good Housekeeping

The City takes water quality issues into account for all new projects and operations it conducts. Systematic water quality review of all City operations is incorporated into the storm water program.



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