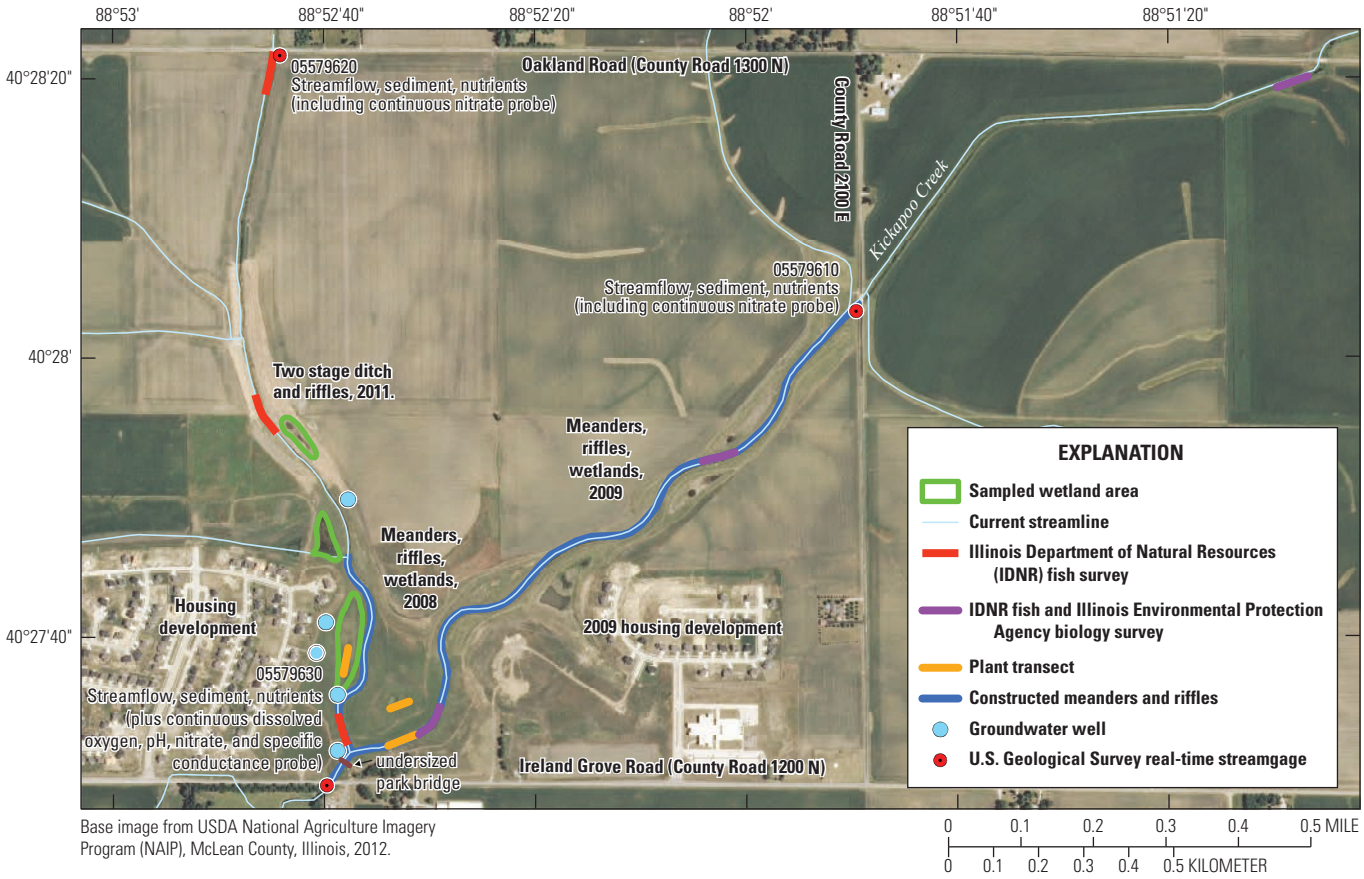
Monitoring of Green Infrastructure at The Grove in Bloomington, Illinois

The monitoring effort includes a U.S. Environmental Protection Agency (EPA) National Nonpoint Source Pollution (NPS) monitoring project using funds under Section 319 of the Clean Water Act, which were distributed through the Illinois Environmental Protection Agency (IEPA). Additional monitoring and (or) implementation funds were provided by the EPA, IEPA, City of Bloomington, Illinois Department of Natural Resources (IDNR), U.S. Geological Survey (USGS), and the U.S. Department of Agriculture, Natural Resources Conservation Service.

Introduction

The City of Bloomington, Illinois, restored Kickapoo Creek to a more natural state by incorporating green infrastructure—specifically flood-plain reconnection, riparian wetlands, meanders, and rock riffles—at a 90-acre park within The Grove residential development. A team of State and Federal agencies and contractors are collecting data to monitor the effectiveness of this stream restoration in improving water quality and stream habitat. The U.S. Geological Survey (USGS) is collecting and analyzing water resources data; Illinois Department of Natural Resources (IDNR) is collecting fish population data; Illinois Environmental Protection Agency (IEPA) is collecting macroinvertebrates and riparian habitat data; and Prairie Engineers of Illinois, P.C., is collecting vegetation data. The data collection includes conditions upstream, within, and downstream of the development and restoration.

The 480-acre development was designed by the Farnsworth Group to reduce peak stormwater flows by capturing runoff in the reconnected flood plains with shallow wetland basins. Also, an undersized park bridge was built at the downstream end of the park to pass the 20-percent annual exceedance probability flows (historically referred to as the 5-year flood), but detain larger floods. This design also helps limit sediment deposition from sediments transported in the drainage ditches in the upper 9,000 acres of agricultural row crops. Maintaining sediment-transport capacity minimizes sediment deposition in the restored stream segments, which reduces the loss of riparian and wetland-plant communities and instream



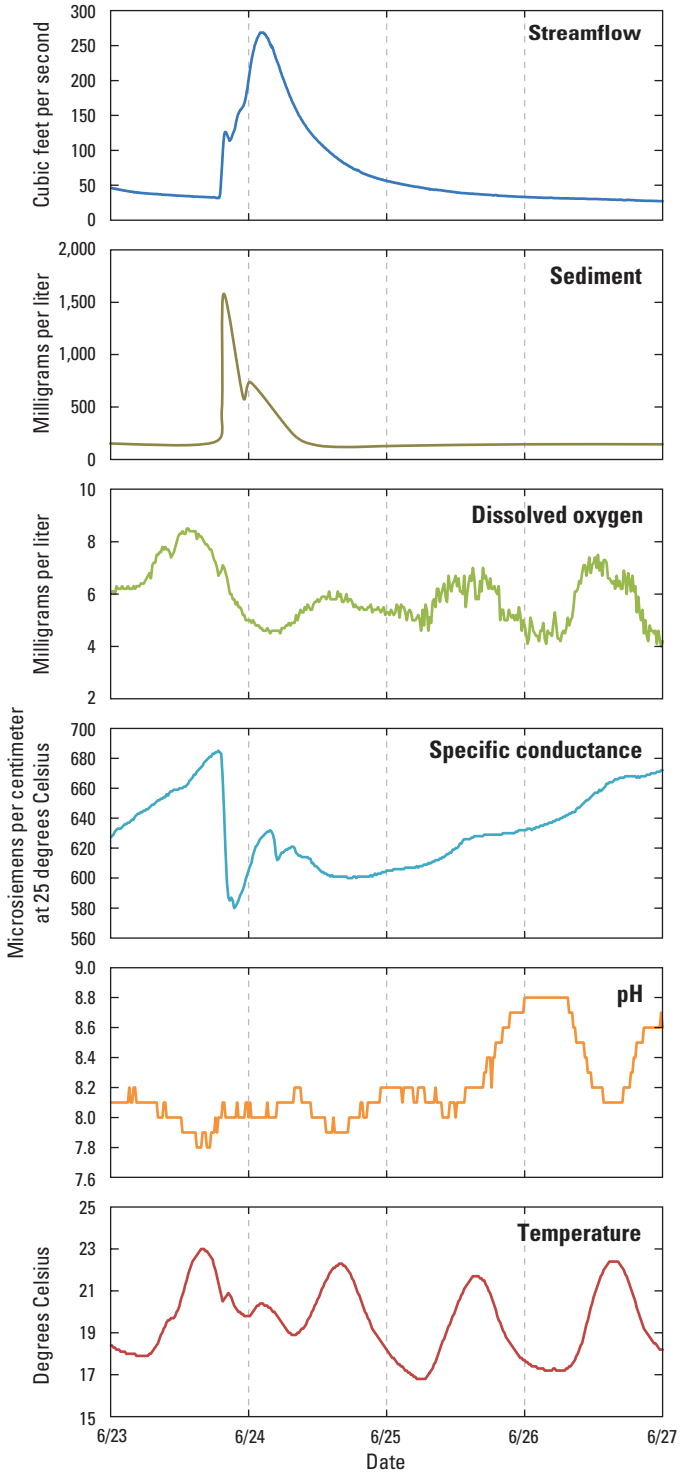
The Grove Restoration Site within the Kickapoo Creek Watershed, McLean County, Illinois.

habitat. Two additional goals of the restoration were to reduce nutrient loads and maintain water quality to support a diverse community of biotic species. Overall, 2 miles of previously managed agricultural-drainage ditches of Kickapoo Creek were restored, and the park landscape maximizes the enhancement of native riparian, wetland, and aquatic species for the park's trail system. The purpose of this fact sheet is to give an overview and examples of the data being collected.

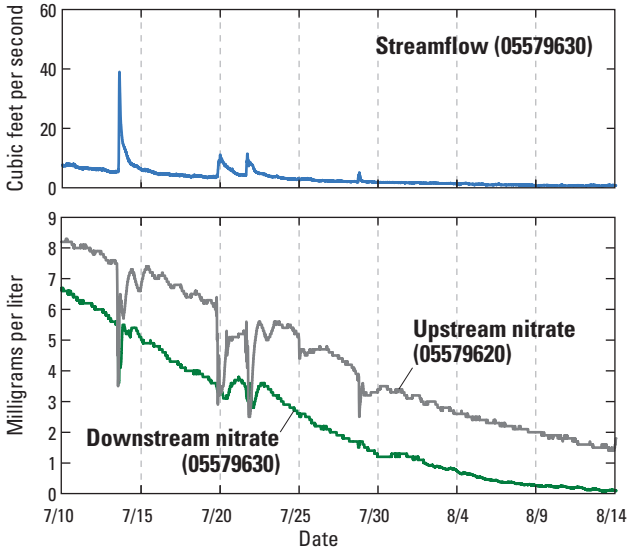
Streamflow

In 2006, the USGS established two streamgages upstream of the development area: Kickapoo Creek at 2100E Road near Bloomington (05579610), with a drainage area of 7.3 square miles (mi^2); and Kickapoo Creek Tributary near Bloomington (05579620), with a drainage area of 3.8 mi^2. A third streamgage is located downstream of the development area: Kickapoo Creek near Bloomington (05579630), with a drainage area of 14.8 mi^2. All three streamgages have real-time telemetry, and the data are available on the Web at http://waterdata.usgs. gov/il/nwis/nwis. The site design for the 480-acre development called for a reduction in peak stormflows. Analysis of streamflow data over a period of years and storm events at the three gages will show how stream restoration has changed the flow in the system.

Data collection by the USGS



Example streamflow, sediment, and water-quality data at the downstream station (05579630) in 2010.



Example streamflow, and upstream and downstream nitrate data in 2010.

Sediment

In 2006, automated samplers also were installed at the three streamgages. The samples are analyzed for suspended-sediment concentrations. Also, testing of sediment surrogates including acoustic and turbidity equipment were added at the downstream streamgage in 2009 and 2012, respectively.

Relatively straight and incised agricultural-drainage ditches maximize sediment transport for a large range of flows. The site was designed to detain the stormflows while minimizing sediment deposition. The sediment sampling monitors the effectiveness of the stream restoration at preserving the sediment-transport capacity of the stream from the incoming agricultural-drainage ditches. The sampling and photo documentation also help to assess the effectiveness of construction-erosion controls such as silt fences, reseeding, rock check dams, buffer strips, and sediment-detention ponds.

Water Quality

Since 2006, dissolved oxygen, pH, temperature, and specific conductance has been continuously monitored in place at the downstream streamgage during the spring, summer, and fall. Continuously recording nitrate probes were installed at two of the streamgage locations during 2010–11, and all three streamgages during 2012. In addition to the continuous sampling, ambient water chemistry is characterized with periodic discrete sampling. The continuous and discrete data can help to determine if the restored stream's water quality is suitable for diverse biotic species and if the overall water quality of the stream is improving.

The constructed wetlands are sampled for water-quality constituents at the surface and in the nearby groundwater. Since 2010, nutrient samples have been collected at the inlets and outlets of the wetlands during selected storms. Groundwater-monitoring wells were installed near one constructed wetland during 2010–11. The wells are sampled seasonally for water-quality characteristics (pH, temperature, dissolved oxygen, specific conductance, nutrients, and major ions). Data from the groundwater wells can help to determine the transport and fate of nutrients and other compounds. Selected wells have continuous groundwater and temperature data.

Fish Population

The IDNR-Division of Fisheries has collected data on the fish population in Kickapoo Creek in the summer and fall of every year since 2007. This data collection is done by electrofishing, weighing and measuring and identifying species of the larger fish caught before releasing them back to the stream and preserving smaller fish for later identification in the laboratory. The data on fish population is then used to rate the stream with the revised Index of Biotic Integrity (IBI) for Illinois. The IBI is used to compare the size and diversity of the fish population as the restoration progresses.

Data collection by Prairie Engineers of Illinois, P.C.

Macroinvertebrates and Habitat

The IEPA has collected data about the macroinvertebrate communities, water quality, and habitat in Kickapoo Creek on an annual basis since 2007 and has rated the stream with the qualitative habitat evaluation index (QHEI). The QHEI gives an indication of the physical characteristics of a stream related to how well the stream supports flora and fauna communities. It is analogous to the IBI used to measure the biological characteristics of the stream. The IEPA can show changes in the biological diversity and health by documenting changes in the macroinvertebrate communities, water quality, habitat, and increases in the QHEI.

Data collection by the IDNR

Vegetation

Prairie Engineers of Illinois, P.C., staff has collected data on the vegetation along Kickapoo Creek on an annual basis since 2007. Along with adding constructed wetlands and remeandering the stream, native plants were reintroduced to the study site. These native plants improve bank stability and provide riparian habitat. The vegetation data are used to document the rate of plant establishment and the changes in the plant communities during the study period. The improvement in the vegetation at the site is rated with the floristic quality index (FQI), which quantifies the variety and health of the vegetation at the site. The FQI also can be used to show changes in the vegetation at the site.

Data collection by the IEPA

For more information:

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