

**Kickapoo Creek
Section 319
National Monitoring Program Project**

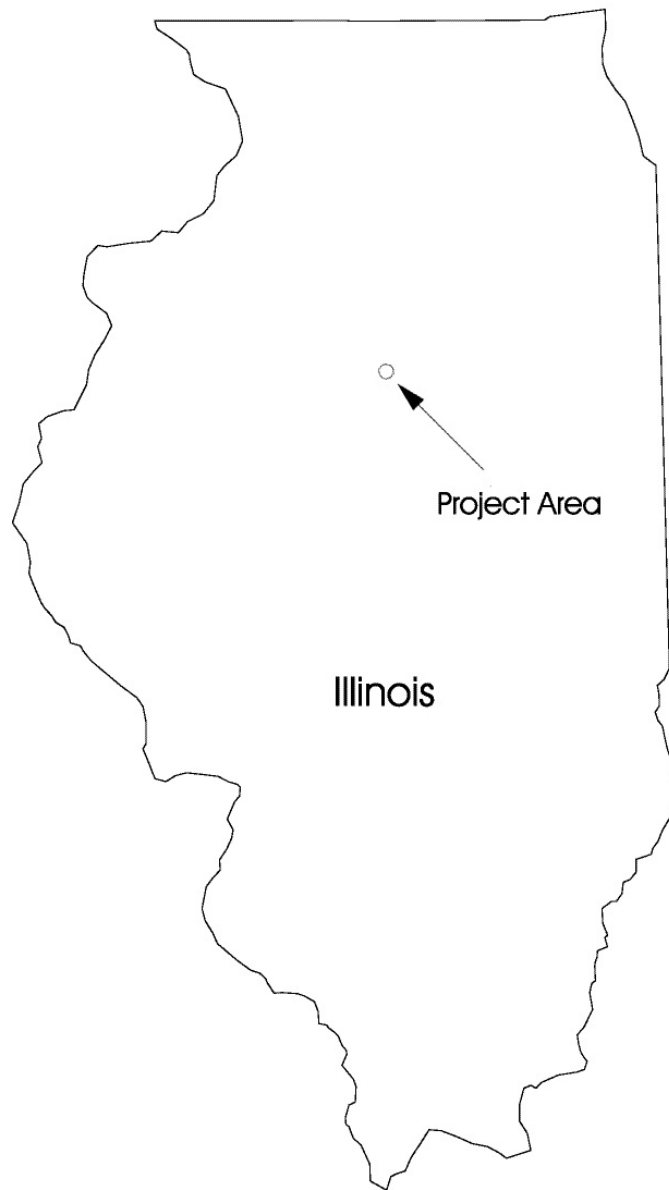


Figure 1: Kickapoo Creek (Illinois) Location

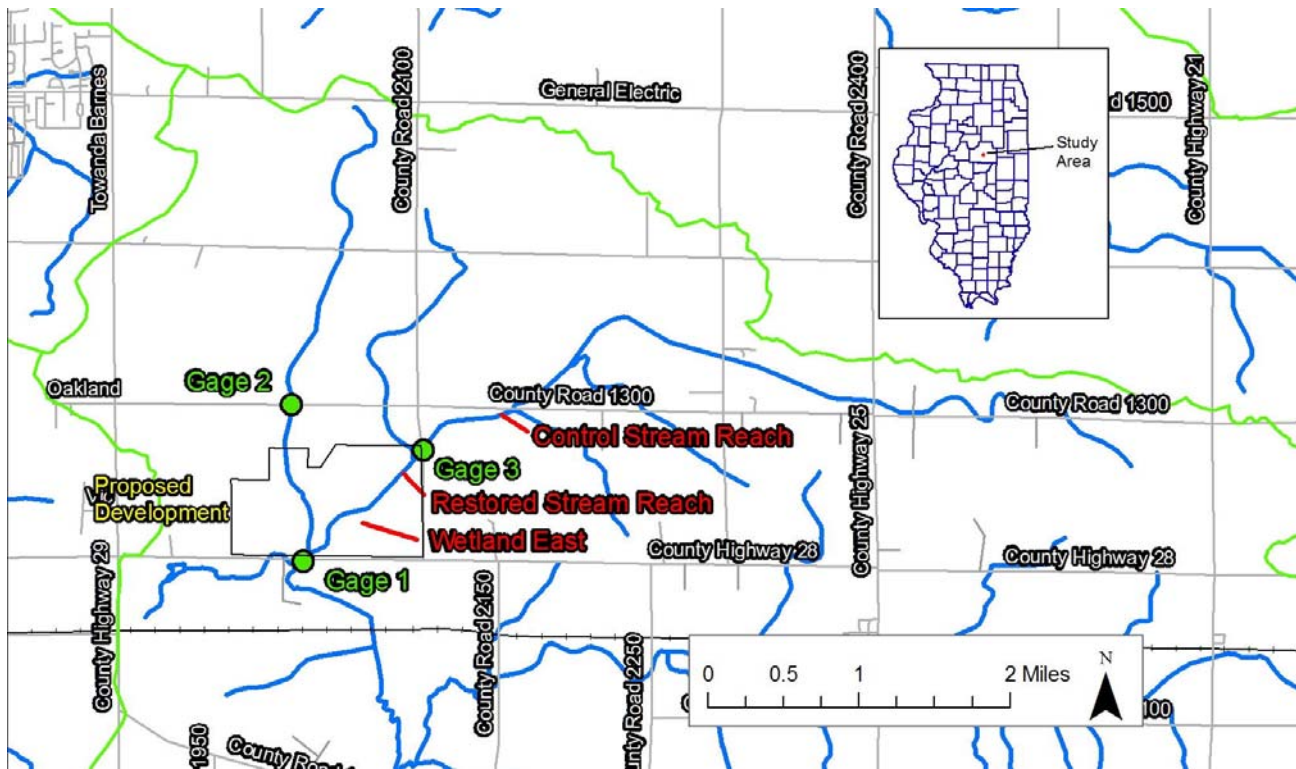


Figure 2: Kickapoo Creek Watershed Monitoring Network

PROJECT OVERVIEW

With Section 319 funding from the Illinois EPA and additional funding from other federal, state, and local partners, the City of Bloomington is developing wetland detention within a natural stream design for The Grove Residential Development in central Illinois. Runoff from the 460-ac (186-ha) Grove Development will be captured in large shallow wetland basins to manage both quantity and quality of stormwater runoff.

Stream restoration will convert two miles (3 km) of agricultural drainage ditches in the East and West Branches of Kickapoo Creek into meandering stream channels within an 80-ac (32-ha) park. New wetland basins will be created within the meander bends throughout the park to reduce stormwater runoff rates. The park landscape will maximize the enhancement of native wetland, riparian and aquatic species for the parks trail system.

Present sediment transport capacity in the restored stream segments will be maintained in order to prevent the loss of wetland plant communities and instream habitat resulting from excessive sediment deposition.

Monitoring will be conducted according to an essentially upstream/downstream design. Fish and macroinvertebrates will be monitored in the restored reach and in an upstream control reach. Sediment and nutrient concentrations and loads will be measured at stations upstream and downstream of the development area and at a third control station on the West branch of Kickapoo Creek. Effectiveness of created wetlands will be assessed by monitoring the concentration and loads of nutrients entering the wetland vegetation and the concentrations and loads entering the stream. Detailed monitoring of the vegetation community in the riparian plantings within the restoration area will contribute to better understanding of vegetation management in river restoration elsewhere in the state and region.

The project is currently in its first year of monitoring and is expected to continue through 2015.

PROJECT BACKGROUND

Project Area

The project area is located in the City of Bloomington, Illinois and includes 14.8 mi² (38.3 km²) or 9,472 ac (3,833 ha) of watershed area. At the USGS upstream gages, the West Branch of Kickapoo Creek drains about 3.8 mi² (9.8 km²) and the East Branch of Kickapoo Creek drains about 7.3 mi² (20.7 km²). A 460 ac (186 ha) residential development is planned for the area above the confluence of the North Branch and East Branch.

Relevant Hydrologic, Geologic and Meteorological Factors

The average annual rainfall of the area is about 44 in (112 cm). The 2-yr flood discharge of Kickapoo Creek is 700 ft³/s (20 m³/s) and the 100-yr flood discharge is 3,380 ft³/s (93 m³/s). The project is located in the Wisconsin glacial moraine within the Bloomington Ridged Plain. The Eureka and Normal moraines form adjacent low ridges that direct runoff. Peoria Loess soils (loam and clay loam) overlay the glacial till.

Land use

More than 90% of land (about 8,000 ac or 3,200 ha) is in corn and soybeans; there are no livestock operations in the project area. Existing and planned residential development comprises about 750 ac (304 ha).

Water resource and size

Kickapoo Creek is essentially a system of second and third order drainage ditches. The stream has been channelized entirely, receives extensive tile drain discharge, and is surrounded by row crops grown to the top of the bank.

Water use and present impairments

Documented water quality impairments include the stream fishery, sedimentation, instream habitat, and loss of channel stability and natural stream geomorphology. Nutrient and sediment pollution have not been documented within the project area, but have been reported downstream. The Illinois Department of Public Health has issued a fish advisory for PCBs along Kickapoo Creek. Several segments of the main stem of Kickapoo Creek are on the 303(d) list. Causes of impairment have been identified as fecal coliform bacteria, sediment, phosphorus, and dissolved oxygen.

Extensive residential development is expected to threaten water resources in the future due to increased rates of runoff, construction erosion, increased nutrients from housing infrastructure, and landscaping.

Pollutant sources

Sources of nutrients and sediments within the monitored area have not been specifically identified but row crops, stream channelization, and new housing development are the presumed sources. Sediment and nutrients from construction site erosion and yard landscaping from 750 acres of existing and newly initiated housing developments are anticipated to be significant problems.

Pre-project water quality

Pre-project water quality data do not exist for the project area. Pre-treatment fishery data collection began in the summer of 2006 and is scheduled for completion in summer of 2009. Stream water quality impairments will be assessed in late 2007, after the first year of water quality sampling that began in October 2006 at the USGS stream gages.

Water quality objectives

The overall goal of the project is to restore Kickapoo Creek and its adjacent wet prairie floodplain as a stormwater detention system for the residential development. The 80-ac (32-ha) restoration will transform a channelized agricultural ditch into two miles (3.2 km) of naturalized stream channel; adjacent wet prairie will capture the runoff from the streets and homes before entering the stream. Specific water quality objectives include:

- Restore the stream fishery to an IBI score of 38 – 40;
- Restore and maintain high-quality instream and riparian habitats;
- Maintain efficient sediment transport through the system; and
- Evaluate the erosion control practices approved by the City of Bloomington as applied to the construction site.

Additional objectives for the monitoring project include:

- Document the biological enhancement that results from stream and floodplain restoration from a channelized system dominated by row crops and invasive species to a naturalized floodplain system;

- Document the condition of both reaches of Kickapoo Creek before residential development begins on the East branch; and
- Determine the effectiveness of floodplain restoration to capture and treat runoff from residential development.

Project time frame

October, 2007 to October, 2015, with two additional years of monitoring possible.

PROJECT DESIGN

Nonpoint source control strategy

The principal nonpoint source control strategy is to construct a natural meandering stream channel with associated floodplain wetlands based upon sediment transport capacity and instream habitat enhancements. Stream restoration will convert two miles (3.2 km) of previously managed agricultural drainage ditches in the East and West Branches of Kickapoo Creek into meandering stream channels within an 80 ac (32 ha) linear park. Wetlands will be created within the meander bends throughout the park to reduce stormwater runoff rates from the Grove residential development. The park landscape will maximize the enhancement of native wetland, riparian and aquatic species for the parks trail system. The sediment transport capacity in the restored stream segments will be maintained in order to prevent the loss of wetland plant communities and instream habitat to excessive deposition of sediment from the upstream row crop area of the watershed.

During construction of the residential development, runoff and erosion controls will include silt fences, rock check dams, sediment basins, wide buffer strips, and reseeded. Runoff from the completed residential development will be captured in large shallow wetland basins created from the sediment basins used to trap runoff and sediment during the construction period so that runoff from a 100-yr rain event will be reduced to the flows resulting from a 3-yr rain event. Wetland basins will also provide treatment for sediment and nutrients in runoff from the proposed development area.

Project Schedule

Monitoring	Pre-Restoration			Post-Restoration
	2006	2007	2008	2009-2012
Fishery	X	X	X	X
Macroinvertebrate	—	X	X	X
Stream Gaging	X	X	X	X
Wetland Gaging	N/A	N/A	X	X
Physical Habitat	X	X	X	X
Floodplain Vegetation	—	X	X	X
Construction Site	N/A	X	X	X

Pre-restoration monitoring will extend into late 2008. Restoration of the East Branch will be completed in winter 2008/2009. Post-restoration monitoring will begin in 2009. Residential construction will begin in 2009.

Water Quality Monitoring

The monitoring project consists of two phases. Phase 1 monitoring determines the effectiveness of stream restoration on stream fisheries in the restored stream segments, sediment transport through the restored stream segments, construction erosion controls, and reduction of stream bank erosion by

revegetation. Phase 2 monitoring will evaluate the effectiveness of floodplain wetland restoration in capturing residential runoff after the housing development has been constructed and will address discharge, nutrient, and sediment reduction in the stormwater runoff by the constructed wetlands by monitoring the concentration and loads of nutrients entering the wetland vegetation and the concentrations and loads entering the stream.

Variables measured

Biological

Stream fisheries IBI (June and September, streams only)
 Macroinvertebrates (late summer, streams only)
 Stream habitat, and geomorphology (late summer, streams only),

Chemical and other

Suspended sediment concentration and load (base flows and flood events)
 Nutrient concentrations and loads (base flows and flood events)
 Total P
 Soluble P
 Total N
 Ammonia N
 Nitrite+Nitrate N
 Dissolved oxygen, pH, temperature, and specific conductance
 Discharge

Covariates

Precipitation
 Sediment particle size distribution
 Floodplain and riparian vegetation surveys (summer)
 Construction activities

Sampling Scheme

The fish population will be monitored in the restoration reach and in a control reach upstream of the proposed development area twice per year, in June and September. Monitoring procedures will employ electrofishing, following standardized Illinois Department of Natural Resources stream sampling protocol. The upstream reference site will reflect the changes over time as compared to the changes at the downstream treatment area.

Macroinvertebrate sampling will be performed by the Illinois EPA at the upstream control and downstream treatment sites on the East Branch during the late summer. The IEPA staff will use a 20-jab multi-habitat methodology.

Three sites are established for chemistry sampling and discharge measurements on the two upstream tributaries and on the main channel below the channel constriction. Streamflow will be measured continuously at these sites by USGS methods. Baseflow water chemistry will be characterized with bi-monthly sediment and nutrient grab samples, and stage-weighted event sampling will be conducted for storms. Dissolved oxygen, pH, temperature, and specific conductance will be determined concurrent with grab sampling upstream and monitored continuously *in-situ* at the downstream gaging station.

Additional gaging stations will be positioned in the waterway above and below a restored wetland to monitor discharge and nutrient load into and out of the wetland. Wetland sampling will document the concentration and loading of nutrients and salts entering the floodplain vegetation and the extent of wetland effectiveness in reducing the rate of stormwater runoff and pollutant concentrations entering the stream.

During Phase 1, vegetation monitoring of the floodplain will determine species composition and area of coverage for major species to ensure that the stream restoration meets project objectives. Qualitative and quantitative vegetation sampling will be conducted in the stream corridor in the restoration reach and control reach using a floristic quality assessment (FQA) to characterize the overall floristic integrity of the site. Quantitative vegetation sampling will be performed in conjunction with qualitative sampling to provide reproducible and consistent data collection for estimates of species' presence, frequency, relative density and cover.

Land treatment monitoring

Erosion sources from construction activities will be documented with photography during stream sampling events and after storm events. Construction activities will be tracked by photography twice monthly, with the GPS locations imbedded on the film. Infrastructure installations such as roads and sewers, housing excavations, and stream/wetland excavations will also be tracked via photography.

Modification since project started

Construction site monitoring has been expanded since project inception.

Progress to date

Two upstream and one downstream USGS gaging and automated sampling stations have been established, with real time uplink to the web. As of September, 2007, project staff have:

- Completed 1 year of discharge, sediment, and nutrient monitoring;
- Completed 2 years of fishery data collection at 6 sites representing upstream controls and downstream treatment;
- Completed stream geomorphology and floodplain vegetation surveys;
- Conducted detailed surveys of floodplain and channel dimensions for 14,000 ft (4,267 m) of channel;
- Performed particle size distribution analysis of stream bed and stream bank materials at 17 locations in the watershed;
- Located and documented stream erosional and depositional features throughout the watershed;
- Conducted floodplain borings to determine subsurface soil characteristics and erosion potential to determine bank stabilization requirements in the stream meanders to be constructed along two miles of floodplain;
- Conducted a GIS analysis of the watershed to identify locations of soils with high runoff rates and greater erosion potential; and
- Estimated annual sediment yield from sheet and rill erosion in upper Kickapoo Creek watershed

DATA MANAGEMENT AND ANALYSIS

The USGS will maintain the streamflow and water quality data in the standard USGS databases. Data will be provided in spreadsheet format on a CD to the IEPA for entry into STORET.

Fisheries data will be evaluated by the Illinois Department of Natural Resources using the revised Index of Biotic Integrity for Illinois, multiple fish population metrics, and standard statistical measures. Macroinvertebrate data will be evaluated using the Macroinvertebrate Index of Biotic Integrity that was designed to be sensitive primarily to nonpoint/habitat related disturbances. Illinois Environmental Protection Agency field staff use macroinvertebrate data to assess community structure and determine the relative quality of a stream compared to reference conditions.

Anova, regression analysis, and t-tests will be used to compare sediment and nutrient loadings at the stream and wetland gaging stations. Nutrient loadings will be based upon the discharge and nutrient concentrations of stormwater flows into and out of the wetland basins. Reductions in stormwater discharge rates, sediment loadings, and nutrient loadings will determine wetland effectiveness.

INFORMATION, EDUCATION, AND PUBLICITY

Both the Bloomington Park District and local environmental groups including Friends of Kickapoo Creek have requested annual reports on the project status and are actively involved in restoration and protection activities.

Radio interviews on local public radio were broadcast on May 10, 2007.

Project staff made a presentation on stream and floodplain restoration to Bloomington Park District staff and to Friends of Kickapoo Creek Partnership on May 23, 2007.

A project kickoff event with state and local media is scheduled for Oct. 2007.

TOTAL BUDGET

Item	Federal	Local
Restoration of streams(2 miles) and adjacent floodplains	\$1,900,000	\$1,266,667
4 years of stream and wetland gaging and vegetation monitoring (2006-2009) ¹	\$550,000	\$366,667

¹ Future years of monitoring scope and costs will be determined after review the first 4 years of data collection

IMPACT OF OTHER FEDERAL AND STATE PROGRAMS

The US Fish and Wildlife Service and the Illinois DNR have contributed \$430,000 to the stream restoration project through the Wildlife Habitat Restoration Program.

OTHER PERTINENT INFORMATION

The six developers donated 80 acres of park lands with associated park trails and educational center to the Bloomington Park District, representing an assessed value of \$1,760,000.

PROJECT CONTACTS

Administration

Amy Walkenbach
Nonpoint Source Unit Manager
Illinois EPA
P.O. Box 19276
Springfield, IL 62794-9276
Phone: (217) 782-3362
Fax: (217) 785-1225
Amy.Walkenbach@Illinois.gov

Jan Carpenter
Project Manager
Illinois EPA
P.O. Box 19276
Springfield, IL 62794-9276
Phone: (217) 782-3362
Fax: (217) 785-1225
Jan.carpenter@illinois.gov

Land Treatment

Brandon Lott
Farnsworth Engineering
Senior Project Engineer
7707 North Knoxville Ave., Suite 200
Peoria, IL 61614-2014
Phone: (309) 689-9888
Fax: (309) 689-9820
blott@f-w.com

Water Quality Monitoring

Don Roseboom
US Geological Survey
8709 West Johnson Farm Rd.
Peoria, IL 61607
(309) 657-6906
Roseboom@usgs.gov

Tim Straub
US Geological Survey
1201 West University Avenue
Urbana, IL 61801
(217) 344-0037
tdstraub@usgs.gov

