WATERLINES

News affecting the management and use of Indiana's water resources

DIVISION OF WATER
INDIANA DEPARTMENT OF NATURAL RESOURCES
WINTER 2009

2008: WHAT A YEAR!

While still in the midst of post-flood recovery, more storms, more record flooding, and widespread power outages wreaked havoc in Indiana during September, affecting nearly a quarter-million Indiana residents. The Lake County communities of Munster, Dyer, Gary, and Lake Station were hit particularly hard.

Home inundated by the Little Calumet River
(Photo by Doug McKinney, IDNR)

In mid-September, remnants of Tropical Storm Lowell and Hurricane Ike passed through the state. Moisture associated with the remnants of Lowell brought 3 to 5 inches of rain to portions of southern Indiana. Three days later, the remains of Ike passed over central Indiana, dumping brief, heavy rain in portions of northern and central Indiana and pummeling large portions of the state with hurricane-force winds.

Three-day rainfall totals in northwest Indiana were immense, ranging from 8 to more than 12 inches, swamping the Kankakee and Calumet river basins in the northwest corner of the state. The record flooding forced thousands of people from their homes and closed interstates and major roads. The high winds associated with these systems caused widespread power outages in central and southern Indiana.

A Presidential Disaster Declaration was issued as a result of the heavy damage, the third such declaration in 2008 for Indiana. Thirty-seven counties were included in the latest declaration. During 2008, all but 10 of Indiana's 92 counties were included in a Presidential Disaster Declaration.

Information includes excerpts from the Indianapolis NWS Monthly Report of River and Flood Conditions for September 2008.

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INDIANA STREAMSTATS NOW AVAILABLE TO THE PUBLIC

A new interactive United States Geological Survey (USGS) Web-based tool for determining flood frequencies on any stream or river in Indiana, *StreamStats*, uses cutting-edge technology to put stream information in the hands of users. It is a national application developed by the USGS that is being implemented by individual states to meet mission needs of state agencies.

StreamStats users can choose locations of interest from an interactive map and obtain information for these locations. If a user selects the location of a USGS data-collection station, the user will get previously published information for the station from a database. If a user selects a location where no data are available (an ungaged site), a Geographic Information System (GIS) program will estimate information for the site. The GIS program determines the boundary of the drainage basin above the site, measures the physical characteristics of the drainage basin, and solves the appropriate regression equations to estimate streamflow statistics for the site. The results are presented in a table and a map showing the basin outline.

StreamStats for Indiana was developed by the USGS in cooperation with the Indiana Department of Natural Resources and is now live on the Web at **http://water.usgs.gov/osw/streamstats/indiana.html.**

How is the information from *StreamStats* used?

The primary products delivered by *StreamStats* are streamflow statistics and basin characteristics. Examples of streamflow statistics include the 100-year flood, the mean annual flow, and the seven-day, 10-year low flow. Examples of basin characteristics include the drainage area, stream slope, mean annual precipitation and percentage of forested area. Basin characteristics are the physical factors that control delivery of water to a point on a stream. This information is used to protect people and property from floods and droughts, and to manage land, water and biological resources. *StreamStats* also provides descriptive information for data-collection stations, such as station name, identification number, latitude, longitude, and station type.

Engineers, land managers, biologists, and many others use streamflow statistics to help guide decisions in their everyday work. For example, engineers use streamflow statistics to map floodplains for cities and towns, and to design roads, bridges, and culverts. Scientists use streamflow statistics and basin characteristics to model the effects of changes in land use on streamflow, information that is valuable for planning purposes. Land and water-resource managers use streamflow statistics for design and management of water supplies, and for waste-water discharge permitting. Biologists use the information to determine flows needed to protect endangered aquatic animals and their habitat. Corporations use streamflow statistics to design and operate hydroelectric facilities and factories that use water or discharge waste into streams or bodies of water.

How do I use *StreamStats*?

StreamStats has an easy-to-use interface that operates through your Web browser window. You do not need to download anything to use it. The User Instructions link provides detailed instructions on use of the application and example outputs, which you should read before attempting to use *StreamStats.* Also, the *StreamStats* user interface contains a Help button in the upper right corner that gives access to additional information.

How are streamflow statistics determined?

The USGS currently operates a nationwide network of about 7,300 streamgaging stations, where streamflow is monitored continuously. Historically, the USGS also has operated more than 12,000

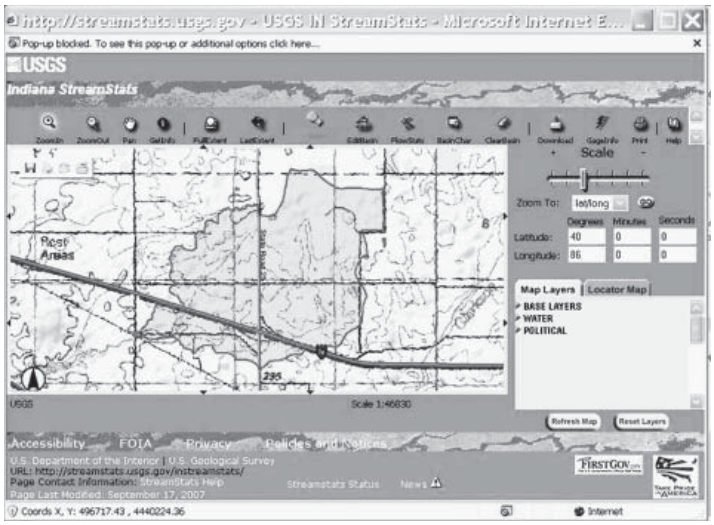
streamgaging stations that are not currently operational. In addition, the USGS operates thousands of partial-record stations where streamflow is measured periodically. Data collected at the continuous streamgaging stations and partial-record stations are used to calculate the streamflow statistics for the stations. These data may be accessed through the National Water Information System (NWIS) database at **http://waterdata.usgs.gov/nwis.**

A process known as regionalization is used to develop equations that can be used to estimate streamflow statistics for ungaged sites. Regionalization involves use of regression analysis to relate streamflow statistics computed for a group of selected streamgaging stations (usually within a state) and basin characteristics measured for the stations. Basin characteristics measured for ungaged sites can be entered into the resulting equations to obtain estimates of the streamflow statistics.

References to reports that contain regression equations for each state are provided in a Web page that you will view when you select a state from the menu on the ***StreamStats*** state application page. This page also contains a link to the application for the state. You should read the reports to understand how *StreamStats* provides estimated flows for data-collection stations and ungaged sites in the state.

How does *StreamStats* work?

StreamStats is a cooperative effort of the USGS and ESRI, Inc. It is an integrated GIS application that uses ArcIMS , ArcSDE , ArcGIS , and the ArcHydro Tools. It incorporates a map-based user interface for site selection; a Microsoft Access database that contains information for data-collection stations; a GIS program that delineates drainage-basin boundaries and measures physical and climatic characteristics of the drainage basins; and a GIS database that contains land elevation models, historic weather data, and other data needed for measuring drainage-basin characteristics and for locating sites of interest in the user interface.



StreamStat Web site

After *StreamStats* measures the drainage-basin characteristics, the values are input to a separate program named the USGS National Flood Frequency Program (NFF), which is a Microsoft Windows program that contains all of the USGS-developed equations for estimating flood-frequency statistics in the nation. NFF has been modified for *StreamStats* so that it can also contain equations for estimating other types of streamflow statistics. All of the equations in NFF are documented through links to each individual state from the NFF Web site. Output from NFF and from the Access database is presented to *StreamStats* users in a pop-up window on their computer desktop.

Information from USGS Web site

WORKSHOP

The Department of Natural Resources, Division of Water, will conduct a workshop for new officials and anyone else who wants a refresher on the basics of the National Flood Insurance Program and the application of floodplain regulations in Indiana communities.

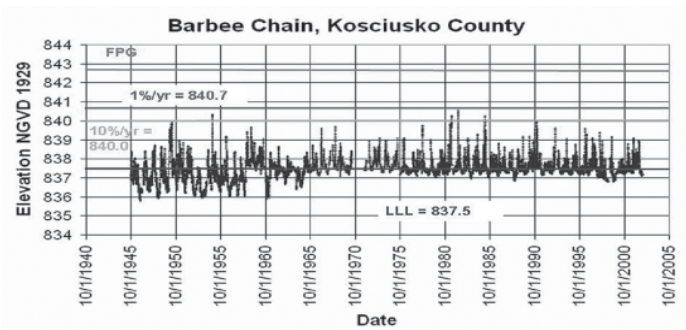
Jan. 13, 2009, 1– 4 p.m.
Indiana Government Center South
Conference Center, Conference Room B
402 W. Washington Street, Indianapolis, IN 47204

There is no fee for the workshop; however, registration is requested. Please register no later than Jan. 6, 2009, by contacting Anita R. Nance at **anance@dnr.in.gov** or (317) 234-1110.

LAKE-LEVEL DATA FOR NATURAL LAKES IN NORTHERN INDIANA

By David P. Nance, PG, Engineering Geologist, Project Development Section, IDNR, Division of Water

Have you ever wondered if your lake's water level is higher or lower than ever before? Or if the lake level is gradually rising or falling over time? The only way to know is by collecting a long-term lake-level record. Such a record exists for many natural lakes in northern Indiana. The IDNR Division of Water can help you find out more about what data are available for your lake and how you can use that information or continue to record more.



Lake-level graph for Barbee Chain

Daily lake-level elevation data for several northern Indiana lakes have been collected for more than 40 years. Graphing these data makes for easier understanding. Graphs showing the county-court-established average normal level as an elevation, along with the 100- year, or 1 percent annual chance, flood elevation and the Flood Protection Grade (FPG) elevation line for these lakes demonstrate that common weather conditions, while regionally observable in the data, often result in very different lake-level responses for lakes that are geographically close to each other. The relationship between the 100-year, or 1 percent annual chance, flood level and the higher-frequency water levels also can be seen in the graphs. In many cases, a difference of less than a foot in elevation can greatly alter flood frequency. The graphs also provide observable low lake-level periods and common low-level trends. For many lakes, low water level is much more problematic than high water. In all cases, lake-level data for a specific lake can add to the story and history of the lake over the period of observation, providing increased insight related to the unique circumstances that determine lake level.

Lake data for the Barbee Chain in Kosciusko County can be seen in the image above as an example of data specific to a lake system. The court-established lake level of 837.5 feet, the 10 percent, and 1 percent annual-chance flood-frequency elevations are included, along with the Flood Protection Grade, defined by county ordinance as 2 feet above the 1 percent annual-chance (100-year) flood elevation.

Several features can be seen on this graph. The lake-level outlet control structure was constructed in the late 1950s after a period of monitoring during which several extremely dry periods caused very low lake levels. During this same period, the lake chain also experienced two events that were near or above the 10 percent annual chance. The lake-level outlet control structure likely helped minimize the impacts of the droughts that occurred in the early 1960s. Afterward, seasonal low lake levels can be seen as typically less than a half-foot below the established level. On the high lake-level perspective, in a period of record that approaches 60 years, four events have clearly exceeded the 10 percent annual- chance elevation and two were less than one-tenth of a foot below the elevation. Three of the events that exceeded the 10 percent annual-chance elevation occurred between 1980 and 1985. These three events are seen on many lake-level records throughout northern Indiana. In the late 1990s, a seepage problem associated with the lake-level outlet control structure caused the lake level to fall below normal seasonal lows. This problem was addressed with a temporary repair in 1999. The outlet structure was rebuilt in 2006. A long gap in the period of record occurred in the late 1960s through the early 1970s. Additional short gaps also exist. The graph clearly shows that even with some data missing, the overall trend of lake level can be provided through this record.

By displaying graphs of data from several lakes or lake systems like the Barbee Lake example above, several interesting local and regional trends could be discussed, such as addressing the response of

the lake relative to the lake-level outlet control structure. For my position in IDNR, this is an important consideration. We want to know how the lake level responds to the lake-level outlet control structure. Documentation of lake level is a good way to understand the variation in lake-level and outlet conditions. It also can help determine if a problem exists with the outlet works or if the current conditions are within a "normal" range of expected levels for a specific lake. This can greatly assist us in understanding and addressing the concerns of citizens about a specific lake.

The state, through cooperative agreement with the United States Geological Survey (USGS), has collected data for many lakes or lake systems over relatively long periods. Presently, only a few lakes are monitored under this cooperative agreement. The cooperative effort to collect lake-level data resulted in 1988's publication of Annual Maximum and Minimum Lake Levels for Indiana, by Kathleen K. Fowler, which can be found at: **http://pubs.er.usgs.gov/usgspubs/ofr/ofr88331.** The need for this publication was likely influenced by the high lake levels between 1980 and 1985.

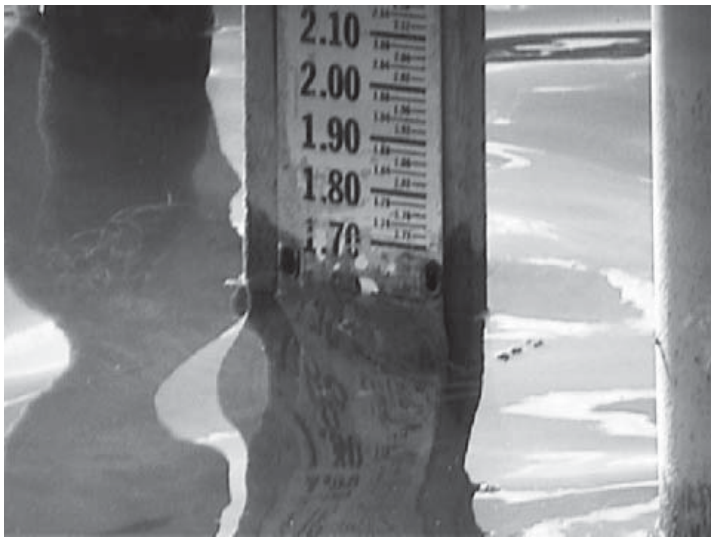
Lake-level data for a specific lake can provide useful planning tools for local zoning and development. Effective planning and zoning occurs only through wise local application of good data. Local knowledge of lake-level data and the ranges over time can help local officials determine the lake level at which specific sections of roads begin to flood, or the low lake level that may impede boat access to specific locations. By knowing the range of lake levels and the present level, a person can plan for the common or extreme highs or lows relative to the present elevation by simple addition or subtraction. They can then use the information to understand the relative risk long before the lake level reaches the important level for their activity or structure.

Lake-level records also could be helpful in helping people understand possible variations in water quality that may be influenced by inflow or lack of inflow. Lake-level records can indicate if lake-level trends, and therefore flow, are higher or lower than normal at the time of water-quality tests.

IDNR will assist local lake associations in understanding historic lake-level fluctuations for their specific public freshwater lake that has a court-established average normal level. Citizens can help this effort by volunteering to record lake levels on their lakes. IDNR staff are working with IDEM's Volunteer Lake Monitoring Program to help train interested citizens to collect, convert and record lake-level data. This additional training will include the needed conversions (datum) to add to a gage reading that will convert the numeric value to a sea-level value, as stipulated in the court-lake-level establishment and used for historic data. In that way, the new data will directly relate to the historic data. The local citizens will then be able to assist their neighbors in relating recent lake levels to historic readings.

There are basically two methods for recording lake-level data—either by using a fixed visual reference and recording by hand or using an instrument that both takes a reading and records the results.

Using a visual reference most often involves a measuring device called a staff gage. Most northern Indiana lakes with a court-established average normal lake level have a staff gage located on the lake. In many cases the judge has actually set conditions for a staff gage.



Typical staff gage
(Photo by David Nance, IDNR)

Gages are marked in feet, with tenths and hundredths of feet shown on the scale. An observer simply

records the point at which the water level meets the gage. Scum or debris coating the gage should be wiped off prior to recording the lake level.

The staff gage may become ineffective at extreme high or low lake levels, such as when the lake level exceeds the height of the gage. For extreme levels, a visual reference may include distance below a bridge, below the top of a seawall or above the bottom edge of the boat ramp, or any water-level measurement that could be measured relative to a normal lake level and then checked against a staff gage reading when the lake returns to a more normal level. Having knowledge of your lake will help you understand where objects exist that may provide a relative lake-level measurement that can then be easily converted to approximate elevation.

Using instrumentation to automatically record lake level at pre-set intervals has some definite advantages, but is not a replacement for understanding lake levels using a staff gage. Instruments, usually some type of pressure transducer and data logger, are available from several manufacturers with a range of price, features and complexity. A discussion of instrumentation would exceed the scope of this article. The USGS uses instrumentation for lake-level recording and can reactivate gages for lakes, providing the technical assistance to a lake association as needed for people to understand the data. The USGS service requires a local cost share to activate gages and an annual fee to maintain them. Other resources for instrumentation packages may become available as data recording increases.

Once the data are collected, they will only be of value if the quality of the data is verifiable and the data are available for use. Training, methodology, and equipment maintenance are the main points to consider for quality. An occasional confirmation of lake level or a staff gage survey by a licensed surveyor is always helpful in confirming the quality of the readings.

Compilation of data can be achieved at the local level; however, the Indiana University School of Public and Environmental Affairs (SPEA), through the Volunteer Lake Monitoring Program, can compile citizen-collected lake-level data for long-term records and maximize the utility of the new data as they relate to historic data. As an association develops a plan to collect, store, and use lake-level data, it also can report the data to SPEA for record keeping. That will allow confirmation and use of data by other sources, thus providing validity to the activity over time.

Interested individuals can obtain lake-level data with only minimal training. Such data can provide an important backdrop for planning and understanding several aspects of a specific lake and its associated watershed.

For additional information, please contact David Nance at **dnance@dnr.in.gov**

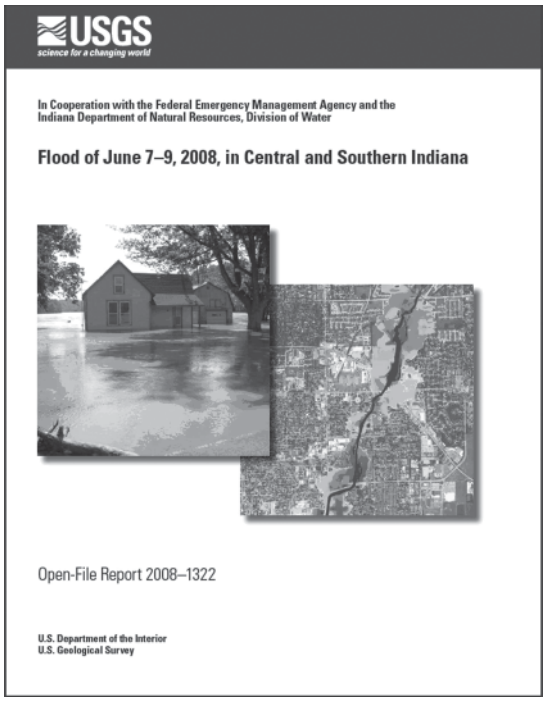
NEW CFMS

Congratulations to Indiana's newest Certified Floodplain Managers (CFMs)! **Roger Gage,** Building Commissioner for the City of Decatur, passed the CFM exam in May 2008, when offered at the annual conference of the Association of State Floodplain Managers (ASFPM) in Reno-Sparks, Nev. **Dustin Thurston** of RW Armstrong (formerly of IDNR Division of Water), **Brian McKenna** of Christopher B. Burke Engineering, and **Benjamin Stanley** of Brads-Ko Engineering and Surveying each passed the CFM exam offered at the Indiana Association for Floodplain and Stormwater Management (INAFSM) conference on Sept. 11, 2008. Also, **Mike Sears** of Morley and Associates, Inc. passed the CFM exam offered in Evansville on Oct. 29, 2008.

The Certified Floodplain Manager program is a national certification authorized by the ASFPM. Achieving the CFM certification demonstrates not only awareness of the National Flood Insurance Program, but also of comprehensive floodplain management. For more information on the CFM program, visit the Association of State Floodplain Managers (ASFPM) Web site at **www.floods.org.**

NEW USGS REPORT DOCUMENTS JUNE 2008 FLOODING IN CENTRAL AND SOUTHERN INDIANA

Given the severity of June 2008 flooding in central and southern Indiana, the U.S. Geological Survey (USGS), in cooperation with the Federal Emergency Management Agency and the IDNR Division of Water, prepared a study to document the meteorological and hydrological conditions leading to the flood; compile flood-peak gage heights, streamflows, and recurrence intervals at USGS streamgages and estimated streamflows and recurrence intervals at selected ungaged locations; construct flood profiles and peak-stage inundation maps; and summarize flood damages and impacts. The report is available at: **http://pubs.usgs.gov/of/2008/1322/**


USGS
science for a changing world

In Cooperation with the Federal Emergency Management Agency and the Indiana Department of Natural Resources, Division of Water

Flood of June 7–9, 2008, in Central and Southern Indiana

Open-File Report 2008–1322

U.S. Department of the Interior
U.S. Geological Survey

CONFERENCE CORNER

INAFSM

The 2008 INAFSM annual conference took place in Brown County State Park, Sept. 10-12. The successful event was jam-packed with helpful, informative workshops on floodplain and storm water issues.

Sheila McKinley, CBBEL, presenting at the conference (Photo by Darren Pearson, IDNR)

The following awards were presented: *Excellence in Stormwater Management* – Tim Stottlemeyer, City of Noblesville MSR Coordinator; *Outstanding Stormwater Project* – Berlowitz Drain Regional Detention Basins, Tippecanoe County Drainage Board (project owner) and Christopher B. Burke Engineering, Ltd. (lead consultant); *Excellence in Floodplain Management* – Hamilton County Drainage Board; *Outstanding Floodplain Project* – MRBC 2008 Flood Mitigation Master Plan, Maumee River Basin Commission (project owner) and Christopher B. Burke Engineering, Ltd. (lead consultant); *Excellent Strides in Floodplain Management Program* – City of Franklin and White County (tie); *Chairman's Award for Outstanding Service in Support of the INAFSM* – Matt Rummell.

2008 INAFSM Award Winners (Photo by Darren Pearson, IDNR)

For information about INAFSM and additional conference information, visit the INAFSM Web site at **www.inafsm.net.**

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Editor – Anita Nance

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