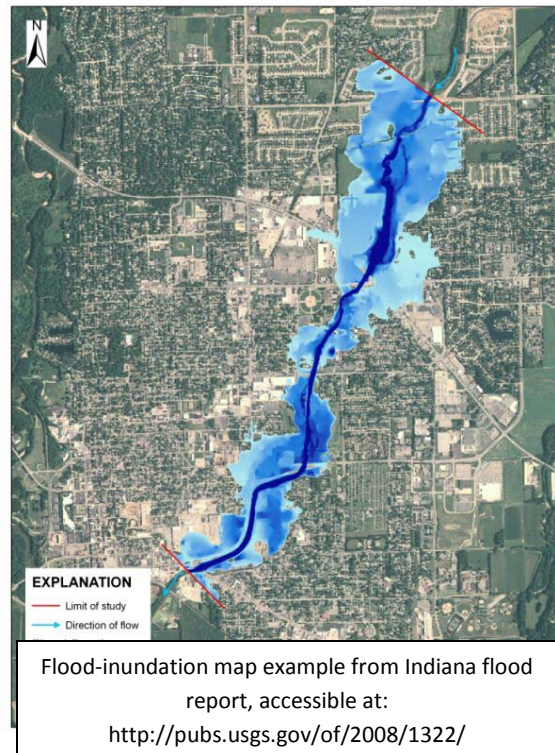


## U.S. Geological Survey Flood Inundation Mapping Applications in Indiana: Flood Science and Information for the 21<sup>st</sup> Century

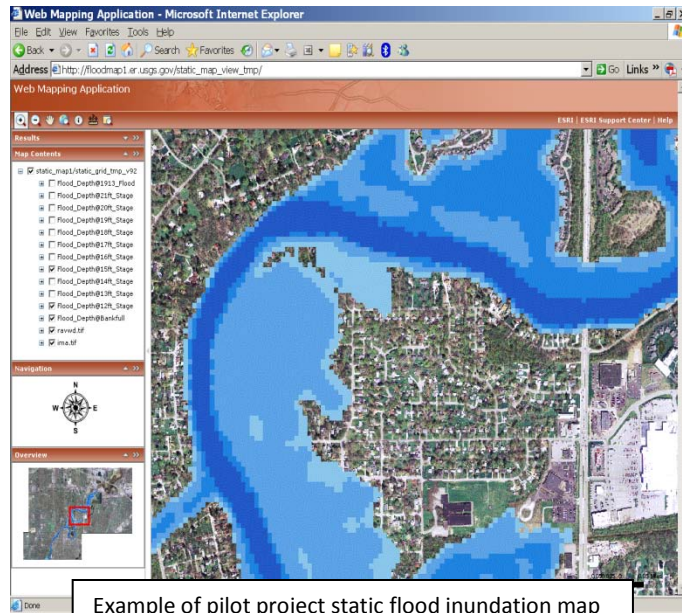
A powerful new technology for flood response and mitigation activities is the advent of digital geospatial flood-inundation depth and extent maps. Flood-inundation maps depict the approximate land-surface area that would be inundated at selected water levels, ranging from bankfull to the maximum observed or predicted water level. Following major flooding, inundation maps that depict the extent and depth of the flooding are useful for Federal, state, and local agency recovery activities and future flood-loss mitigation activities. Recent examples are published in U.S. Geological Survey (USGS) reports that documented record flooding in Indiana and Wisconsin in June, 2008. The maps are available in a form that can be viewed and printed and also in a digital Geographic Information System (GIS) format available for public download.

Another application of flood-inundation mapping is observed- and predicted-flood inundation maps that are linked to USGS real-time streamgage data and National Weather Service (NWS) flood-forecast information. This mapping application allows officials to make operational and public safety decisions based upon flood extents and depths. The ability to view observed flood-inundation maps allows safety officials and the public to implement evacuation plans when flood waters threaten a community. Predicted flood-inundation maps provide a valuable planning tool for community planners and floodplain managers. Using modern technologies allows either type of map to be displayed with enough detail to ascertain the effect of flooding at the level of individual streets and neighborhoods.



The U.S. Geological Survey (USGS) Indiana Water Science Center has developed a static flood-inundation map library for an 11-mile reach of the White River through metropolitan Indianapolis. Static map libraries consist of maps that have been created in advance of a flood that are ready to be served through the Internet— each library consists of a set of flood extent and depth maps at set water-level (stage) intervals (for example, a map for each one foot of stage). A user can view real-time or forecast stage data from a USGS streamgage or NWS flood forecast point and quickly access the map corresponding to the stage data. The pilot project represents a collaboration between a number of groups including the Indiana Silver Jackets, an inter-agency natural hazards communications team, the City of Indianapolis, Indianapolis Museum of Art, The Polis Center, Indiana Department of Natural Resources, Indiana Department of Homeland Security (IDHS), U.S. Army Corps of Engineers, National Weather Service (NWS), and USGS.

The project allows emergency management personnel and the public to view current and predicted extent and depth of flooding through a World Wide Web. The near real-time and forecast flood inundation mapping, in addition to being viewable through a Web portal, will be downloadable in the form of GIS files that can be imported into GIS applications such as the Federal Emergency Management Agency's HAZUS-MH hazard mitigation and loss estimation program. The pilot project combines real-time river streamflow and stage data from USGS streamgaging stations, NWS flood forecast streamflow and stage data, high-resolution digital elevation data, and a river hydraulic model to create the flood inundation mapping. The model is needed to extrapolate flood stages in the river reaches between streamgages. Phase one of the project—the development of a library of static flood maps—is complete; and the library has been delivered to partner agencies for testing and validation.



In addition to the Indianapolis flood-inundation pilot project, the USGS Indiana Water Science Center has proposed, in cooperation with the Indiana Department of Homeland Security and in partnership with the NWS and the Polis Center, the creation of static flood inundation map libraries for 20 NWS flood forecast points or observation points in Indiana. Because the forecast/observation points are collocated at USGS streamgages, the libraries will be relatable to historic and real-time USGS flood level data (<http://waterdata.usgs.gov/nwis/rt>) as well as NWS flood forecast levels. This project will produce map libraries that can be viewed interactively through the NWS' Advanced Hydrologic Predictive Service Web pages (<http://www.weather.gov/ahps/>) and also downloaded in a GIS file format for use in flood mitigation GIS tools.

The next step in this important flood science area is to create automated, dynamic flood inundation maps that run flood simulations and create maps “on the fly” during a flood, using real-time data. This next step is being taken by a second phase of the Indianapolis pilot project—a dynamic map application has been developed by the USGS, Polis Center, and Indiana University (IU) and is being tested on an IU super computer. The application is built upon service-oriented architecture (SOA). In computing, SOA provides methods for systems development and integration where applications package functionality as interoperable services. A SOA infrastructure allows different applications to exchange data with one another. The SOA infrastructure will make the dynamic flood inundation map application highly expandable on a state, regional, and ultimately national scale.

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