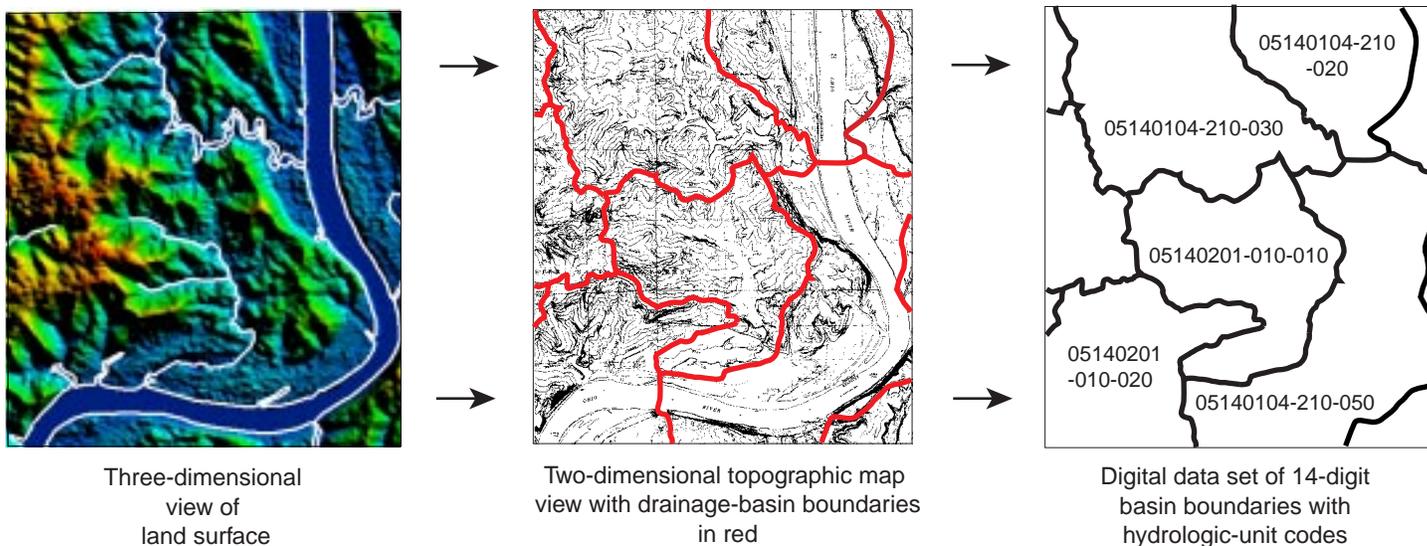


In cooperation with the Indiana Department of Environmental Management and the Indiana Department of Natural Resources Division of Water

## Digital Data Set of 14-Digit Hydrologic Units in Indiana

A hydrologic unit is an area of land that can contribute surface-water runoff to a designated outlet point. As part of an initiative to create a nationally uniform hydrologic-unit data base, the U.S. Geological Survey and the Natural Resources Conservation Service, in cooperation with the Indiana Department of Environmental Management and the Indiana Department of Natural Resources Division of Water, created a geographic information system digital data set of 14-digit hydrologic units in Indiana. The digital data set consists of arcs and polygons defining 14-digit hydrologic units in Indiana.



**Diagram illustrating development of hydrologic units, progressing from a three-dimensional land surface to a two-dimensional topographic map to a digital data set.**

### Introduction

A hydrologic unit (HU) is an area of land upstream from a specific point on a stream that is defined by a hydrologic boundary. The boundary includes all of the source area that could contribute surface-water runoff directly or indirectly to the designated outlet point. HU's are used by local, State, and Federal agencies and by private and academic interests for natural-resource, water-quality, and flood-damage activities; water-data management;

and geographic information systems-based (GIS-based) spatial analyses (U.S. Department of Agriculture, 1992).

Before 1999, the most-detailed statewide hydrologic-unit data for Indiana were published on a 1:500,000-scale map of 8-digit hydrologic-unit boundaries (U.S. Geological Survey, 1974). That map was part of a series developed by the U.S. Geological Survey (USGS) to provide uniform hydrologic-unit boundaries and to present them on nationally consistent base maps.

The 8-digit HU's in Indiana are identified by a unique 8-digit hydrologic-unit code (HUC) based on four levels of classification (fig. 1, page 3): regions, subregions, accounting units, and cataloging units (Seaber and others, 1987). During the mid- to late-1970's, the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) subdivided 8-digit HU's by adding three digits to identify a fifth level of classification, 11-digit HU's—watersheds.

Since that time, water-resources professionals have recognized a need for further delineation and subdivision of HU's in Indiana for research, planning, and regulatory activities. In 1992, the NRCS developed guidelines for mapping and digitizing a sixth level of classification, 14-digit HU's—subwatersheds (U.S. Department of Agriculture, 1992). In 1996, the USGS, the NRCS, the Indiana Department of Environmental Management, and the Indiana Department of Natural Resources Division of Water agreed to create a digital data set of 14-digit HU's in Indiana.

## Creation of Digital Data Set of 14-Digit Hydrologic Units

The USGS office in Indianapolis maintains a file of 1:24,000-scale topographic maps with hand-drawn drainage-basin boundaries for all waterways in Indiana with drainage areas greater than 5 square miles. Many basins have been subdivided into drainage areas smaller than 5 square miles. These topographic maps have been used to calculate drainage areas—an important parameter in many hydrologic analyses (Hoggatt, 1975).

A GIS base-map coverage containing coordinate points at every 7.5 minutes of latitude and longitude was generated. The coordinate points correspond to the corner vertices of 1:24,000-scale topographic maps for Indiana and the immediate vicinity. For each topographic map, a root mean square error (RMSE) was calculated on the distances between the four corner vertices and the corresponding coordinate points in the base-map coverage. RMSE values were 0.010 or less for 95 percent of the maps, indicating potential distortions of 20 feet or less. The remaining 5 percent of the maps had RMSE values between 0.011 and 0.016, indicating potential distortions of up to 32 feet.

The hand-drawn drainage-basin boundaries were digitized into the base-map coverage, using ARC/INFO<sup>1</sup> software

<sup>1</sup>The use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

**Table 1.** User-defined polygon attributes

Attribute name	Description	Example
HUC_8	8-digit hydrologic-unit code	04040001
HUC_11	11-digit hydrologic-unit code	04040001070
HUC_14	14-digit hydrologic-unit code	04040001070020
HU_NAME	Name of 14-digit hydrologic unit	West Branch Trail Creek
HU_ACRES	Area of 14-digit hydrologic unit, in acres	15349.2
NONCONTRIB_ACRES	Area of noncontributing part of 14-digit hydrologic unit, in acres	907.4

and adhering to the digitizing accuracy standard of  $\pm 50$  feet (U.S. Department of Agriculture, 1992). All drainage-basin boundaries were plotted on paper and overlain on the original maps to determine the accuracy of the digitized lines. Lines that did not meet the digitizing accuracy standard were redigitized and replotted. This procedure was repeated until all lines met the standard. A second person not involved with the original digitizing followed the same line-verification procedures for 36 percent of the original topographic maps. Less than 3 percent of these maps had errors, and those errors were corrected.

Each delineated basin was attributed with a 14-digit HUC assigned by NRCS personnel. Drainage basins with the same 14-digit HUC were merged to form the final digital data set of 14-digit HU's. For each topographic map, the HU boundaries and respective HUC's were plotted on paper and reviewed by NRCS personnel. Errors were noted and corrected, and new plots were produced and reviewed until no errors were identified.

NRCS personnel assigned each 14-digit HU a unique name based on the main waterway within that HU. Names were checked for accuracy by NRCS and USGS personnel.

## Digital Data Set of 14-Digit Hydrologic Units

The digital data set consists of polygons (areas) and arcs (lines) representing 14-digit HU's in Indiana. Each polygon has an associated record in a

polygon-attribute table (table 1) listing its 8-, 11-, and 14-digit HUC; the name of the 14-digit HU; the HU area in acres; and the noncontributing part of the HU area in acres.

Each arc has an associated record in an arc-attribute table (table 2, page 4) that identifies the arc as a 2-, 4-, 6-, 8-, 11-, or 14-digit HU boundary or the Indiana State line. Quality-assurance data regarding the digitization of each arc also are included in the arc-attribute table. The data set is documented and meets the Federal Geographic Data Committee standards for digital geospatial data sets (Federal Geographic Data Committee, 1998).

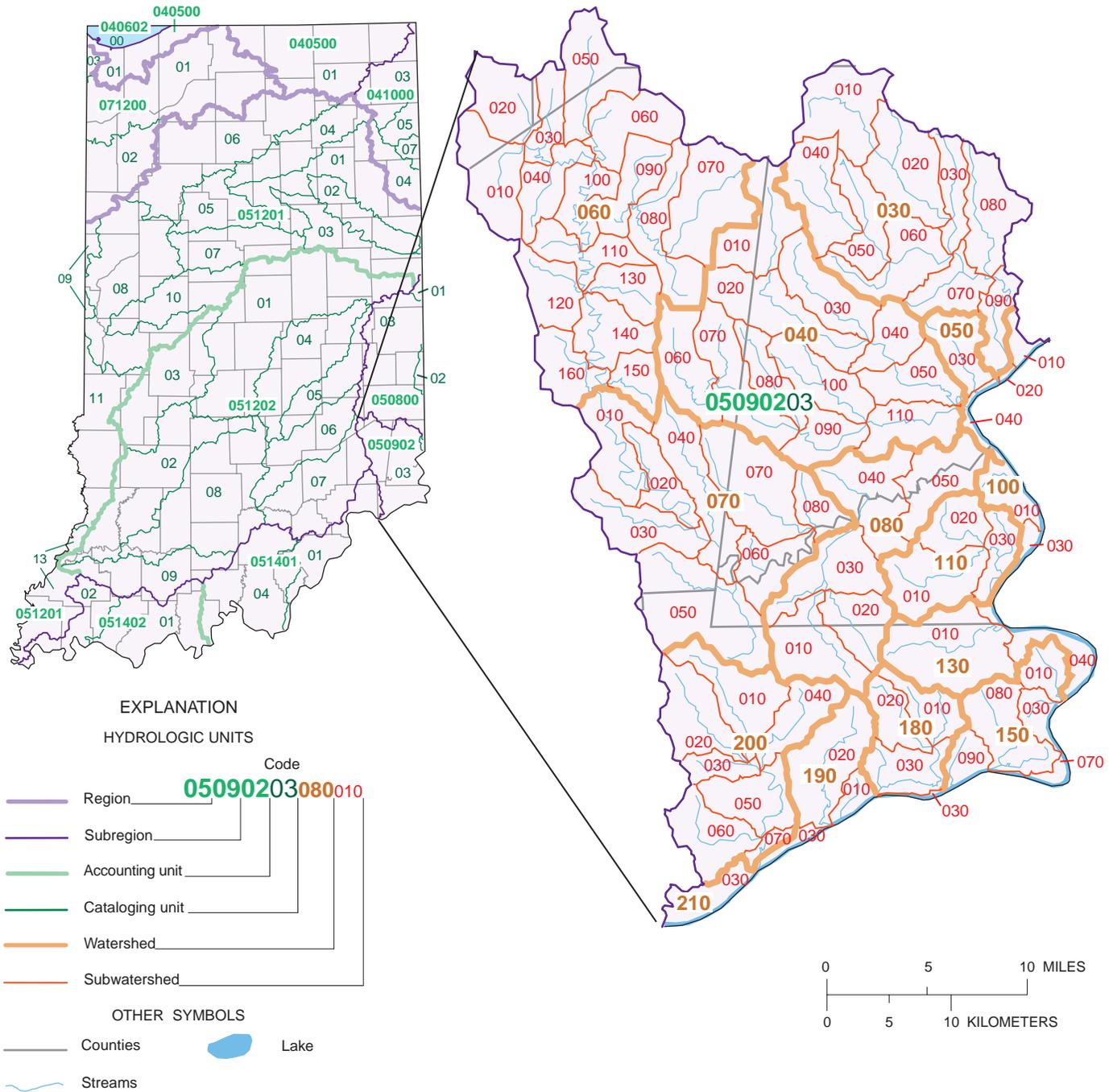
## Data Availability

This fact sheet, the digital data set, and the data-set documentation ("metadata") are available at the USGS Indiana District homepage:

<http://in.water.usgs.gov>

under the heading, "Indiana District Publications Available on the Web."

The HU data set for the entire State of Indiana is available for downloading as a compressed ARC/INFO export file (approximately 46 megabytes) or a spatial data transfer standard (SDTS) file (approximately 23 megabytes). The data set for the State also is divided along accounting-unit boundaries to provide smaller files for downloading (compressed ARC/INFO files, approximately 0.2 to 18 megabytes, or SDTS files, approximately 0.1 to 9 megabytes).



**EXPLANATION**  
**HYDROLOGIC-UNIT TERMS**

**Regions** are the largest drainage basins and contain either the drainage area of a major river or the combined drainage areas of several rivers.

**Subregions** divide the *regions* and include the area drained by a river system.

**Accounting units** divide or may be equivalent to *subregions*.

**Cataloging units** divide *accounting units* and represent part or all of a surface-drainage basin, a combination of drainage basins, or a distinct hydrologic feature.

**Watersheds** divide *cataloging units* and generally range in size from 40,000 to 250,000 acres.

**Subwatersheds** divide or may be equivalent to *watersheds* and generally range in size from 10,000 to 40,000 acres.

**Figure 1.** Hydrologic units in Indiana

**Table 2.** User-defined arc attributes

Attribute name	Description	Example
QUADNAME	Name of the topographic map on which the drainage-basin boundary was determined	CABORN
QUAD_PUB_DATE	Publication date of the topographic map on which the drainage-basin boundary was determined	1957
DIGITIZE_DATE	Date the drainage-basin boundary was digitized	19970616
RMSE	Root mean square error for the transformation from the topographic map to the digital coverage	0.009
ARC_QA_DATE	Date the digitized drainage-basin boundary was checked by someone other than the person who digitized the boundary	19980201
ARC_REMARKS	Relevant remarks regarding the digitized drainage-basin boundary	Divides near Ohio River, modified per 1978 edition of map
HU_DIV	Identifies arc as a 2-, 4-, 6-, 8-, 11-, or 14-digit divide or the State line	14

### Potential Need for Updates

Continuing natural processes and human activities often change drainage patterns and therefore alter hydrologic-unit boundaries. Such changes would necessitate periodic updates to maintain an accurate data set for hydrologic calculations. Revisions of this data set ideally would incorporate observations from and meet the needs of public, private, and government interests.

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