

WHAT'S HAPPENIN'



The Iowa Geological Survey's Geographic Information Systems Bi-Monthly Section Newsletter

The Iowa Geological Survey's GIS Section continues its efforts to better inform users of GIS data of changes, updates and new datasets. This month's edition of "What's Happenin'" will again focus on two new datasets recently completed by GIS staff. The first is the development of data related to Drainage Basins the second relates to a larger project in which Bedrock Geology is being mapped. Please address questions, concerns, or suggestions to Chris Kahle at ckahle@igsb.uiowa.edu, or Andy Asell at aasell@igsb.uiowa.edu.



In 1995 the GIS Section of the Iowa Geological Survey began working with Natural Resources Conservation Service (NRCS) data on a project that could help to answer the question of drainage basin interrelationships more clearly. The main thrust of this effort was to delineate 10 and 12 digit Hydrologic Units (HU), called watersheds and subwatersheds respectively, from the eight digit subbasin dataset that had already been completed by the USGS / Water Resources Council in 1974.

Why was this done?

After working to help clean up the eight digit dataset for Iowa, provided by the NRCS, the people of the Geological Survey and Iowa DNR worked out a plan to provide more detailed basin data. Their hope was to provide a deeper understanding of the interrelationships and factors that influence drainage areas as well as allow more precise analysis of water quality and drainage characteristics. The watershed and subwatershed hydrologic unit boundaries would provide a uniquely identified and uniform method of subdividing large drainage areas.

This data set could be used as a tool for water-resource management and planning activities, particularly for site-specific and localized studies, which require the amount of detail provided by a large-scale map. These smaller sized hydrologic units (up to 250,000 acres) were also becoming useful in many programs supported by the NRCS, USGG, state agencies and others.

The initial work done was to come up with definitions and standards for delineating. From the US Department of Agriculture's NRCS website come the following definitions: "**Watershed boundaries** define the areal extent of surface water

drainage to a point.” A **hydrologic unit** is defined as: “A drainage area delineated to nest in a multi-level, hierarchical drainage system.” A Hydrologic Unit Code (HUC) is the 8, 10 or 12 digit number that represents the HU. Overall size of watersheds and subwatersheds were standardized by the NRCS in the following way: “A Watershed’s normal size ranges from 40,000 to 250,000 acres. A Subwatershed’s normal size ranges from 10,000 to 40,000 acres, with some as small as 3,000 acres.”

The NRCS provided a preliminary 10 digit dataset as a template. Working from this, 10 and 12 digit Hydrologic units were delineated by digitizing the boundary lines on 7.5’ Topographic maps at a scale of 1:24,000. The Topographic maps were used as guidance to find the ridges that made up the geographic boundaries, as smaller drainage entities were visually identified they were digitized. The Digital Elevation Model (DEM) was also used to help select appropriate sized watersheds.

Resulting 10 digit HUs were attributed according to the predetermined 8 digit code, adding 2 digits that indicated which HU it was in the new grouping (01, 02, 03, etc.). This process was then repeated, working from the 10 digit code, for the 12 digit HU. After this processing was completed, over the course of eight years, the data was submitted to the NRCS for certification.

The progression in number of HUs, which increases the ability to selectively analyze, is pretty amazing. Starting from 65 delineated polygon 8 digit HUs, the number went to 414 delineated polygons for 10 digit HUs and finally 1,703 delineated polygons representing 12 digit HUs.

Developments since starting

While Geological Survey staffers were working on basin data for the State of Iowa, the Watershed Boundary Dataset (WBD) effort was initiated by the NRCS in 2000. The intent of defining hydrologic units for the Watershed Boundary Dataset is to establish a base-line drainage boundary framework, accounting for all land and surface areas and to assist in planning and describing water use and related land use activities.

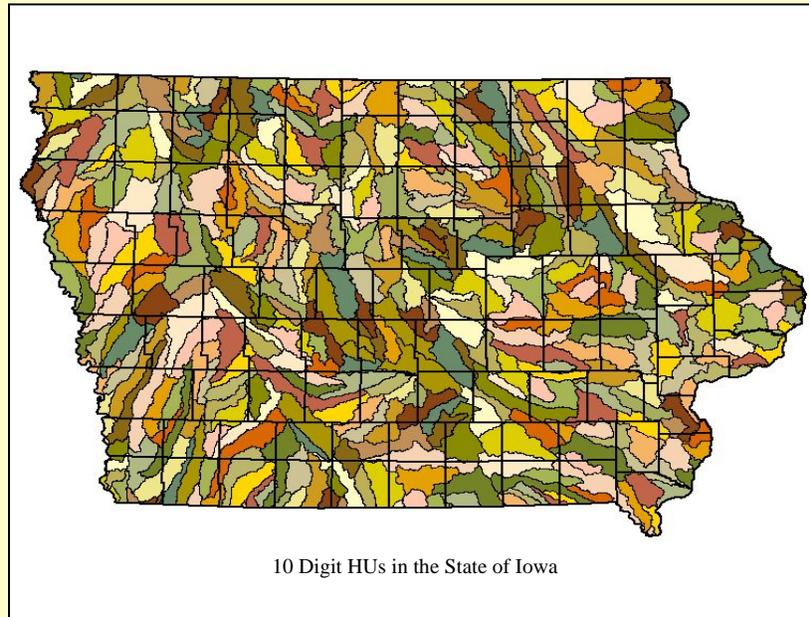
The NRCS works to coordinate individual states and incorporate these state datasets into a nationwide dataset. As watershed boundary geographic information system (GIS) coverages are completed, statewide and national data layers will be made available via the [Geospatial Data Gateway](#) to everyone, including federal, state, local government agencies, researchers, private companies, utilities, environmental groups, and concerned citizens. This data is also available at EPA’s Watershed Information Network that can be found at the following link <http://www.epa.gov/win/> .

The objectives of the WBD project are stated as follows:

- 1.) Create national, consistent, seamless, and hierarchical watershed boundary dataset based on topographic and hydrologic features across the country.
- 2.) Provide more detailed delineation (watershed and subwatershed) and in digital format for local use that is consistent with other national seamless databases.

A status map showing the progress of states in the nationwide project can be found at: ftp://ftp.ftw.nrcs.usda.gov/pub/wbd/status_maps/hucstatusstate.pdf

The 10 digit hydrologic units were completed and will be certified along with the 12 digit hydrologic units. These are completed and waiting to be certified by the NRCS. These will be certified when the border states of Wisconsin, South Dakota, Minnesota and Nebraska complete their state's boundaries. Since boundaries are defined by geographic features alone, they cross state lines. Those HUs that lie along the borders could have names and numbers change so 12 digit numbers have not yet been assigned to our data set.



Available Data/Resulting Products

This data is starting to be incorporated into various areas of study. Issues like water quality, along with questions pertaining to agricultural drainage practices are being examined. People are also starting to look at characteristics, such as land use, and its relationship and influence on the quality of the water in their particular HU.

Land Cover Data - There is a set of database files that have the Land Use characteristics for each HU. These are named in the following fashion:

For Land Use characteristics in HUC 8's in 1992 the database file is called huc8lu92.dbf, for 2000 and 2002 Land Use the files would be called huc8lu00.dbf and huc8lu02.dbf respectively. HUC 8 database files can link to the HUC_8_sub-basin shapefile by using the **ia_hu8_** field. For the HUC10 and HUC12 datasets the link would be the **ia_hu10_** and **ia_hu12_** fields respectively using the huc10lu** and huc12lu** shapefiles.

Basin Statistics - A project that compiled basin statistics was also undertaken. Statistics such as slope, density and relief characteristics were compiled for each subbasin, watershed, and subwatershed. Basin stats linkages are currently being worked on and anticipated to be completed within the next year.

Watershed Atlas - The resulting delineations can be viewed interactively with the IDNR Watershed Atlas at http://igsims.igsb.uiowa.edu/website/Watershed_Atlas/viewer.htm .

The watershed atlas was built in response to these datasets. The watershed atlas was developed “in an effort to make information on watersheds more readily available to the public..and to provide a mechanism where individuals, agencies, or organizations can readily obtain a variety of information and GIS data on watersheds from their personal computer, without having specialized GIS software.”

The contact for questions regarding drainage basin datasets and related data is Calvin Wolter. He can be reached via email at cwolter@igsb.uiowa.edu .

Where do I find the data?



Drainage basin datasets can be found on our FTP site at: <ftp://ftp.igsb.uiowa.edu/Basin/>

Drainage basin statistics can be found at: ftp://ftp.igsb.uiowa.edu/Basin/Support_Data/

An interface to all watershed data can be found at:

<http://www.igsb.uiowa.edu/nrgislibx/watershed/default.htm>

Revision of Bedrock Geology Nears Completion

For the past seven years, the staff of the Iowa Geological Survey’s Groundwater and Stratigraphic Studies Section (IGS-GSS) has been engaged in refining maps of Iowa’s bedrock geology. Expected to be completed early in 2005, this digital dataset will mark a tremendous stride towards understanding the extent and topography of geologic units at the bedrock surface and the overall depth to the bedrock surface. This dataset will also greatly aid in addressing environmental concerns such as groundwater availability, quality, and susceptibility and economic issues such as those related to aggregate exploration.

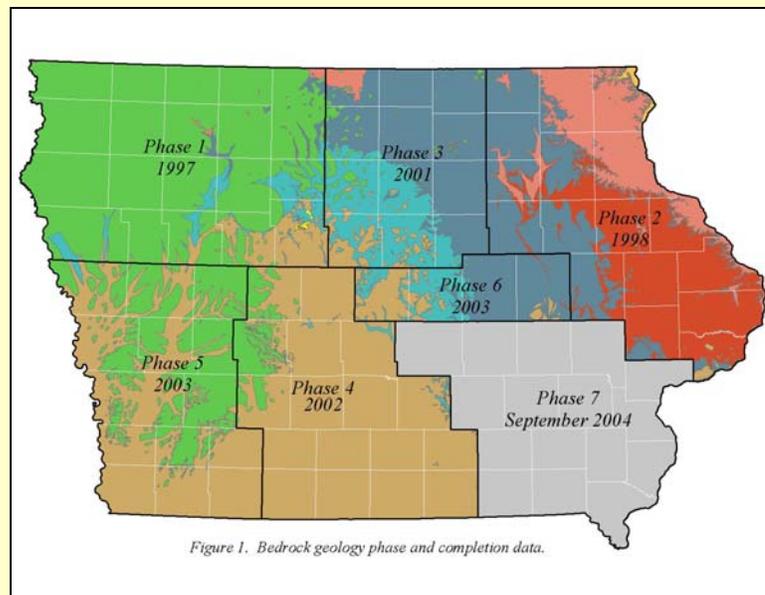
The IGS and its Involvement in the STATEMAP Program

The process of updating the bedrock geology map started in 1996 when the Iowa Geological Survey entered into the STATEMAP Program. This competitive grant program is administered by the United States Geological Survey (USGS) and provides a 1:1 Federal/State match in funding to state geological surveys. The funds awarded to state surveys are to be used for digital mapping initiatives that establish geological datasets deemed vital to the economic, social, or scientific welfare of the participating state. Under this program, the IGS has been able to capture funding for the abovementioned mapping of bedrock geology. In addition, these funds are used to

implement longer-term projects such as the completing a Surficial Geologic Map of Iowa, as well as near-term objectives of mapping the surficial geology in and around major transportation corridors, mapping complex surficial sediment packages on the Des Moines Lobe landform (the most recently glaciated area of the state) and very recently partnering with NRCS (Natural Resources Conservation Service) to map surficial geology in selected counties with ongoing soil survey updates.

Bedrock Geology Mapping

The state was separated into seven blocks of counties in order to make mapping of the entire state's bedrock geology less daunting. Emphasis was placed on grouping the counties into regions that are known to have comparable underlying geologic units. Figure 1 below shows which counties were organized into each phase of the seven STATEMAP contracts with the year each phase was or is scheduled to be completed.



For each phase of this project, reports have been generated that provide detailed information regarding the GIS and stratigraphic methods used to compile each map, the general history of Iowa bedrock geology maps, the improvements made over these preceding versions, and summaries regarding the bedrock stratigraphy and mapping units expressed in each map. Links to these map discussions are listed below in Table 1.

Data Products and the Schedule for Completion

PDF Versions of Phase Maps and Map Discussions - It is evident from the above map that the initial six phases of the bedrock geology maps have been compiled. These maps are available for viewing via the IGS website (see Table 1) but should be considered preliminary given that the mapping of the seventh and final component of the bedrock geology map (the remaining southeast portion of the state) will not be completed until this September.

Once the southeast portion of the state is finished, GSS staff will conclude the project by:

- edge matching all seven shapefiles to each other as well as bedrock geology maps from surrounding states,
- rectify any other geologic and topologic discrepancies within the files,
- merge the data into one, statewide shapefile,
- correlate the legends,
- clipping the resulting statewide shapefile by using individual county boundaries,
- performing the task of writing the metadata.

This process should be completed early in 2005.

Currently, the five preliminary bedrock geology maps and their associated map discussions are available in PDF format – here are the links.

- OFM-97-1** Bedrock geology of northwest Iowa, Digital geologic map of Iowa, Phase 1: Northwest Iowa. [[Pdf](#)] [[Map discussion](#)]
- OFM-98-7** Bedrock geology of northeast Iowa, Digital geologic map of Iowa, Phase 2: Northeast Iowa [[Pdf](#)] [[Map discussion](#)]
- OFM-01-3** Bedrock geology of north-central Iowa, Digital geologic map of Iowa, Phase 3: North-Central Iowa [[Pdf](#)] [[Map discussion](#)]
- OFM-02-1** Bedrock geology of south-central Iowa, Digital geologic map of Iowa, Phase 4: South-Central Iowa [[Pdf](#)] [[Map discussion](#)]
- OFM-03-1** Bedrock geology of southwest Iowa, Digital geologic map of Iowa, Phase 5: Southwest Iowa [[Pdf](#)] [[Map discussion](#)]
- OFM-03-2** Bedrock geology of east-central Iowa, Digital geologic map of Iowa, Phase 6: East-Central Iowa. [[Pdf](#)]

These files can also be accessed by navigating to the IGS' "List of Publications" at <http://gsbdata.igsb.uiowa.edu/gsbpubs/>, selecting "*Open File Maps (Digital Maps)*" from the "*Select complete catalog listing or select by category:*" drop-down list, then locating the corresponding catalog number listed in bold print in Table 1.

Shapefiles of the Bedrock Geology - The shapefiles representing Northeast Iowa and North-Central Iowa (Phases two and three) are the only two shapefiles currently available in the Natural Resources Geographic Information System (NRGIS) Library. Zipped versions of these shapefiles can be downloaded in one of two ways:

- Navigate to IGS' FTP site at ftp://ftp.igsb.uiowa.edu/GIS_Library/IA_State/Geologic/Bedrock/ and select either NC_Bedrock_geology.zip or NE_Bedrock_geology.zip
- Download the same files by navigating to the NRGIS Library at <http://www.igsb.uiowa.edu/nrgislibx/>, select "Geologic" from the "State-wide Data" list, then select either "NC_Bedrock_Geology" or "NE_Bedrock_Geology" from the ensuing list of files.

Shapefiles for Northwest, South-Central, Southwest, and East-Central Iowa (Phases one, four through six) will be added to the NRGIS Library once the metadata is compiled. Similarly, Southeast Iowa will be added once the mapping and metadata is completed this fall.

Other Data Products

If you read the map discussions listed in Table 1, you will gain insight as to how the process of mapping the bedrock geology was greatly enhanced by the use of bedrock topography shapefiles. The contour lines used to build the bedrock topography data layers were generated by synthesizing numerous data sources such as:

- well log data,
- cores,
- outcrop data found in soils coverages,
- bridge borings data and aggregate exploration from the Iowa Department of Transportation (IDOT),
- field notes from former and current staff members of the IGS,
- numerous hours of field observations.

When completing this project, IGS-GSS staff plan to merge these contour lines together into both line and polygon shapefiles. Both formats will provide government and private entities valuable information regarding future applications.

Contact Information

If you have any questions or data requests related to the bedrock geology and topography, you can contact geologists Ray Anderson randerson@igsb.uiowa.edu or Brian Witzke bwitzke@igsb.uiowa.edu via email.

