National Hydrography Dataset

The National Hydrography Dataset (NHD) is a comprehensive set of digital spatial data that encodes information about naturally occurring and constructed bodies of water, paths through which water flows, and related entities. The information encoded about these features includes classification and other characteristics; geographic names; positions, lengths, and areas; "reach codes" through which other information can be related to the NHD; and the direction of water flow. In addition to this geographic information, the dataset contains metadata and information that supports the exchange of future updates and improvements to the data. The data support many applications, such as:

- *Making maps*. Positional and descriptive data in the NHD provide the starting point for making many different kinds of maps.

- *Geocoding observations*. Much like street addresses provide a way to link data to a road network, the NHD's reach codes provide "stream addresses" as a means to link data to water features.

- *Modeling the flow of waters*. Information about the direction of flow, when combined with other data, can help users model the transport of materials in hydrographic networks, and other applications.

- *Maintaining data*. Many organizations would like to share the costs of improving and updating their collections of geographic data. Unique identifiers and other methods encoded in the NHD help to solve technical problems of cooperative data maintenance.
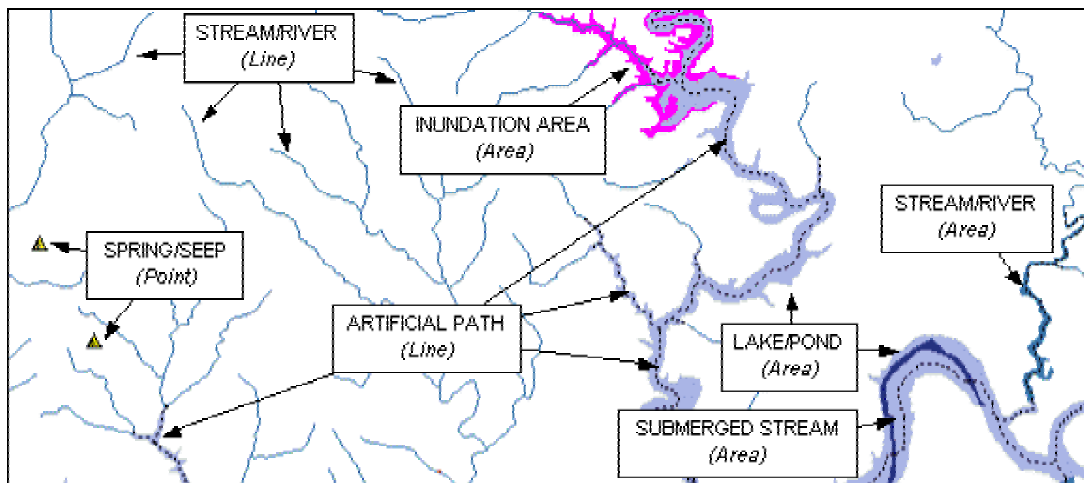

Figure 1. Examples of features found in the NHD.

NHD data, and related documentation, are available through http://nhd.usgs.gov. A map reference layer from the NHD also is available through the Geography Network (http://www.geographynetwork.com) as a map service (for display only).

Data Availability and Plans

Available Formats. "NHDinArc" data are distributed as tarred and compressed ArcInfo workspaces. Each workspace contains the data for a single hydrologic cataloging unit. Cataloging units, also known as subbasins, are drainage basins averaging 700 square miles (1,813 square kilometers) in area. Within a workspace, there are three ARC/INFO coverages plus several related Info tables. There also is a folder containing the metadata text files.

Available and Planned Data.

- *Medium Resolution Data.* Medium resolution data are based on 1:100,000-scale U.S. Geological Survey (USGS) topographic maps and the U.S. Environmental Protection Agency's (EPA) Reach File Version 3.
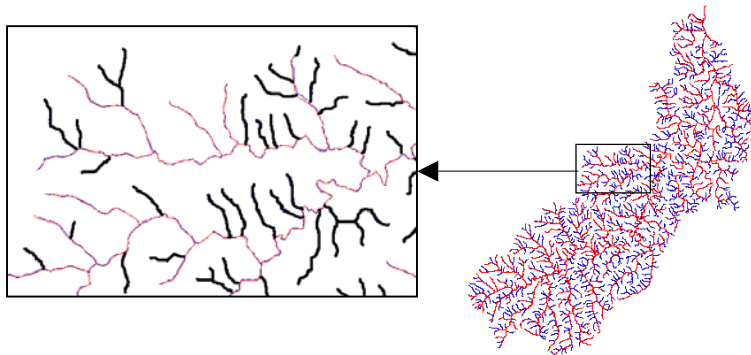

Figure 2. Comparison of the content of "medium resolution" NHD data (thin lines), and the content added (thick lines) in "high resolution" NHD data. The area shown is the cataloging unit for the Big Sandy in Kentucky (cataloging unit 05070204).

- *High Resolution Data.* High resolution data, typically developed from 1:24,000-scale USGS topographic maps (1:63,360-scale in Alaska) or 1:12,000-scale digital orthophotos, are being developed based on the availability of matching resources from partners. The first subbasins of high resolution data became available summer of 2001. Among Federal agencies, bureaus in the Department of the Interior support the development of high resolution data through the High-Priority Digital Base Data Program managed by the USGS. Much of this work now is dedicated to coverage of Alaska. The U.S. Forest Service (USFS) is working with USGS to develop high resolution data for National Forests. Where suitable digital base hydrographic data exist outside National Forest boundaries, USFS will develop NHD data throughout cataloging units that National Forests occupy in whole or in part. State agencies in California, Colorado, Florida, Georgia, Indiana, Kansas, Kentucky, Maine, Minnesota, Missouri, Nebraska, New Jersey, North Carolina, Ohio, Texas, Utah, Vermont, and West Virginia are cooperating with the USGS to develop high resolution data in parts or all of their States. Much of the USGS and USFS work will be done under contract with the private sector, helping to build additional options for organizations to develop and maintain the NHD.

  Organizations interested in partnering with the USGS to develop high resolution data should contact the USGS mapping liaison in their state; the list of liaisons is available at http://mapping.usgs.gov/www/partners/crreps.html.

Current Investigations

Migration to ESRI's Geodatabase. Over the next few years, USGS plans to migrate the NHD to ESRI's Geodatabase. The starting point for the design is the "ArcGIS Hydro Data Model", developed by the GIS in Water Resources Consortium. Information about the data model is available at http://utwired.engr.utexas.edu/crwr/cd_Consortium_2000/GisHydro2000.htm.

"Local Resolution" Data. Some organizations have expressed interest in developing "local resolution" NHD data at scales of 1:5,000 or better. The State of Vermont is investigating the means of developing these detailed data.

The following examples illustrate Federal activities related to tools for working with the National Hydrography Dataset (NHD) and use of the data.

WATERS. In 2001, the U.S. Environmental Protection Agency (EPA) launched the Watershed Assessment, Tracking, and Environmental Results System (WATERS) web site at http://www.epa.gov/waters. The site features map-based access to water quality information geocoded using the NHD. The site provides unified access to water quality information from several state and EPA databases, including those containing information about Total Maximum Daily Loads, Water Quality Standards, Water Quality (STORET), Nutrient Criteria, and Vessel Sewage No Discharge Zones. At this time, users can find information on waters classified by states as impaired (those waters not attaining water quality standards) in all states except Alaska. For selected States, users can find out about the purpose or use of each waterbody (such as whether or not it is designated for protection as a drinking water supply, for recreational use, or for fishing) and search for water quality information for a particular body of water. EPA will update WATERS as new information becomes available, eventually covering all 50 States, and will add links to data on polluted runoff, fish consumption advisories, facility discharge outfalls, and other information.

Figure 1. Using EPA's WATERS web site, the public uses the NHD to find the quality of surface waters where they live.

NHD Create and NHD Edit. Sponsored by the U.S. Geological Survey (USGS), these tools provide a means of creating and improving NHD data respectively. NHD Create is a set of ArcInfo Arc Macro Language routines and ArcView projects that aid the development of high resolution NHD data. The routines conflate reach codes and other information from

medium resolution NHD data to more detailed hydrography data, and create high resolution NHD data. NHD Edit is an ArcView-based tool that allows a user to make simple corrections to the NHD, such as changes in geographic names and flow direction, and provide the changes to the USGS for improving the NHD. These tools are intended for organizations that formally have agreed to develop and maintain the NHD.

NHD Reach Indexing Tool (RIT). EPA sponsored the development of this ArcView-based tool that simplifies and standardizes the process of geocoding water quality information with the NHD. The tool uses dynamic segmentation concepts and event tables to allow users to quickly and easily geocode observations along NHD stream reaches. Event tables allow multiple, overlapping observations about surface waters to be geocoded to the same stretch of stream. The tool produces "stream addresses" (in EPA-standard event table formats). These data can be stored in a relational database to support improved queries of water quality information, and allow State agencies to use the NHD to geocode water quality information as mandated by sections 303(d) and 305(b) of the Clean Water Act.

Figure 2. Using the Reach Indexing Tool, users can geocode their water data using the NHD.

NRIS–Water. The U.S. Forest Service has adopted the NHD spatial model for its Core GIS Data Standard for streams and waterbodies. The agency is incorporating the NHD spatial model as the basis for geocoding data to streams and lakes in its Natural Resource Information System (NRIS)–Water application. NRIS–Water promotes integrated management of aquatic resource information, including maps and related data about stream and lake systems plus water improvements and rights. Users will be able to analyze and display data at multiple geographic scales, both within and across administrative and jurisdictional boundaries. Through this application, the Forest Service supports field-level users on National Forests with a common set of basic data and data standards, in a common computing environment, and provides its employees, partners, and the public with access to data used for natural resource decision making. More information about NRIS–Water is available at http://www.fs.fed.us/emc/nris/water/.