Frequently Asked Questions about the NHD & WBD Datasets

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What is the National Hydrography Dataset?

The NHD is a digital vector dataset used by Geographic Information Systems (GIS) to define the spatial locations of surface waters. The NHD contains features such as lakes, ponds, streams, rivers, canals, dams, and stream gages, in a relational database model system (RDBMS). These data are designed to be used in general mapping and in the analysis of surface water systems.

NHDFlowlines are one of the most important features in the NHD because they contain flow direction and can form a geometric network. In mapping, the NHD is used with other data themes such as elevation, boundaries, and transportation to produce general reference maps. The NHD is often used by scientists using GIS technology to assess the surface waters. GIS technologies take advantage of the rich set of attributes and database relationships imbedded in the NHD to generate specialized information. These analyses are possible because the NHD contains a flow direction derived geometric network that traces the water downstream or upstream.

The NHD also uses a linear addressing system (known as Events) to link specific information about the water such as discharge rates, water quality, and fish population. Using the basic NHD attributes, flow network, linked information, and other

characteristics, it is possible to study cause and affect relationships such as how a source of poor water quality upstream might affect a fish population downstream. The features in the NHD are organized into polygons, lines and points. The polygons most commonly portray water bodies such as lakes and wide streams; while flowlines commonly portray stream flows. The flow lines are broken into shorter segments stretching from confluence-to-confluence. A confluence is where two or more streams meet or a place where the stream changes characteristics, such as a stream entering a lake. The segments are then linked together to trace the flow of water across the landscape. Flow lines attributed as artificial paths are generalized flow added inside water bodies to maintain the flow network.

The primary features making up the nation's surface water are labeled with nationally unique identifiers known as reach codes. These unique identifiers give features an identity for inventory and analysis. Water chemistry, for example, can be linked to a stream or a lake using reach codes. Many features also are labeled with the geographic name of the feature, such as the Ohio River. The feature names must be approved by the Board of Geographic Names (BGN) in order to qualify for inclusion in the NHD.

The geometric network contains linear measurements based on reach codes, making it possible to locate the position of a stream gage, dam, or other event attached to a reach code. Measures, known as M-Values in the NHD, are used for linear referencing and are similar to the address of a house on a street. By recording the measurements on a reach code it is possible to uniquely identify any position along a waterway. Linear referencing makes it easier to perform calculations in a GIS such as identifying dams upstream from a stream gage, and then determining the distance to those stream gages. The system of linear referencing also makes it easy for any agency to link data to the NHD without having to customize the NHD.

For more information about NHD features, see the Feature Catalog at: http://nhd.usgs.gov/userguide.html?url=NHD_User_Guide/Feature_Catalog/Hydrography_Dataset/Hydrography.htm.

What is the Watershed Boundary Dataset (WBD)?

The Watershed Boundary Dataset (WBD) defines the areal extent of surface water drainage to a point, accounting for all land and surface areas. Watershed Boundaries are determined solely upon science-based hydrologic principles, not favoring any administrative boundaries or special projects, nor particular program or agency. The intent of defining Hydrologic Units (HU) for the Watershed Boundary Dataset is to establish a base-line drainage boundary framework, accounting for all land and surface areas. At a minimum, the WBD is being delineated and georeferenced to the USGS 1:24,000 scale topographic base map meeting National Map Accuracy Standards (NMAS). Hydrologic units are given a Hydrologic Unit Code (HUC). For example, a hydrologic region has a 2-digit HUC. A HUC describes where the unit is in the country and the level of the unit.

"A hydrologic unit is a drainage area delineated to nest in a multi-level, hierarchical drainage system. Its boundaries are defined by hydrographic and topographic criteria that delineate an area of land upstream from a specific point on a river, stream or similar surface waters. A hydrologic unit can accept surface water directly from upstream drainage areas, and indirectly from associated surface areas such as remnant, non-contributing, and diversions to form a drainage area with single or multiple outlet points. Hydrologic units are only synonymous with classic watersheds when their boundaries include all the source area contributing surface water to a single defined outlet point."

The Watershed Boundary Dataset is being developed under the leadership of the Subcommittee on Spatial Water Data, which is part of theAdvisory Committee on Water Information (ACWI) and the Federal Geographic Data Committee (FGDC). The USDA Natural Resources Conservation Service (NRCS), along with many other federal agencies and national associations, have representatives on the Subcommittee on Spatial Water Data.

For more information go to
http://nhd.usgs.gov/userguide.html?url=NHD_User_Guide/Feature_Catalog/Watershed_Boundary_Dataset/Watershed_Boundary_Dataset.htm

What is the history of the NHD?

1988 - USGS completes national coverage of 1:100,000-scale (Medium Resolution) Digital Line Graphs (DLG's)
1992 - Environmental Protection Agency completes national RF3 coverage
1997 - USGS / EPA cooperative effort to combine elements of DLG and Reach File version 3.0 (RF3)
2001 - National coverage of 1:100,000-scale (Medium Resolution) NHD completed
2002 - USGS, USFS, State Agencies, and Others begin work to produce 1:24,000-scale (High Resolution) NHD
2003 - Feature Operational Database (FOD) is retired and Geodatabase comes online
2007 - National coverage and compilation of High Resolution NHD completed
2010 – Generation of a best available multi-resolution database that incorporates the 1:24,000-scale with larger resolution data.
2012 – Inclusion of the Watershed Boundary Dataset (WBD) that replaced 1:250,000-scale hydrologic units with 1:24,000-scale hydrologic units.

What is the history of the WBD?
Beginning in the 1970's, the US Geological Survey (USGS) developed Hydrologic Units (HU's) for the United States dividing the country in to 21 Regions, 222 Subregions, and 2,149 Accounting Units. During the late 1970's the Natural Resources Conservation Service (NRCS) initiated a program to further divide the HU's into watersheds and

subwatersheds. By the early 1980's, watershed mapping was complete for most of the US.

In the early 1990's, the advent of GIS made mapping of digital HU boundaries feasible and the NRCS started to delineate HU's to meet 1:24,000 National Map Accuracy Standards. The goal of this initiative was to provide a hydrologically correct, seamless and consistent national GIS watershed boundary database.

What are the advantages of the NHD?

GIS technologies take advantage of the rich set of attributes and database relationships imbedded in the NHD to generate specialized information. These analyses are possible because the NHD contains a flow direction derived geometric network that allows for tracing water downstream or upstream. It also uses an addressing system based on reach codes and linear referencing to link specific information about the water, such as water discharge rates, water quality, and fish population. Using basic NHD features like flow network, linked information, and other characteristics, it is possible to study causality (cause-and-effect) relationships, such as how a source of poor water quality upstream might affect a fish population downstream.

What is the difference between attributes and features?

A feature is a geometric representation of a surface water feature, like a lake, river, or swamp. Attributes are information stored in the database format and are linked to feature. For instance, a river feature could have attributes indicating its flow direction, length, and name.

What is a reach?

A reach is a continuous piece of surface water with similar hydrologic characteristics. Some unconnected (isolated) features are also reaches, for example, isolated lakes or streams. In the NHD, each reach is assigned a reach code upon being incorporated into the production data. A reach may be composed of a single feature, like a lake or isolated stream, but reaches are composed of a number of contiguous features due to the preservation of reach codes that occurred when the 1:24,000-scale NHD was created from the 1:100,000-scale NHD. A reach code is a 14-digit code comprised of two parts. The first eight digits represent the 8-digit HUC in which the reach exists, and the last six digits are a sequential numbers that are randomly assigned to the feature when reach codes are allocated during maintenance editing. Each reach code occurs only once throughout the nation, but a reach code may be on a number of contiguous features, if they all belong to the same reach. Once assigned, a reach code is permanently associated with its reach. If the reach is deleted, its reach code is retired.

What is the difference between Connectors and Artificial Paths?

The NHDFlowline feature type connector establishes a known, but non-specific (unseen) connection between two non-adjacent geometric network (flowline) segments that have flow. These features are usually associated with the results of a dye-trace injection that ties the two surface water features together through some groundwater connection. If there is a visible surface connection, example a culvert, manmade tunnel, or pipelines users should **not** use connector to define the interaction..

An artificial path is a flowline feature that represents the assumed and generalized flow through a 2-dimensional feature, such as a lake or a wide double-banked stream. The artificial path will carry the GNIS name of the major stream it represents and not the waterbody feature.

What is the difference between Pipeline and Underground Conduit features?

Underground Conduit is used to define a particular Karst system of flooded cave systems, where both the surface water entry (sinks) and exit (spring) can be well defined, but the connection in between the sink and spring may or may not be specific.

Pipelines are specifically man-made structures of steel, concrete, or polymers that direct surface water flows from one area to another. The NHD model offers various categories of pipeline.

Is the NHD useful for scientific research?

The USGS 1:24,000-scale printed topographic maps are the original source for the NHD. The stream network shown on the maps was collected using stereo imagery (leaf-off) and then field checked. Some people do not realize that an extensive field check was performed. In the compilation process, the streams were drawn first and then the contours were carefully drawn to reflect the drainage. So any data that is based on USGS elevation data – like DEMs – reflects the stream lines to the extent that the elevations are converted to a grid (10-meters for most of the country). The streams shown on the maps with blue lines represent areas where water is present much of the year. The contour crenulations on those maps indicate depressions where water might flow if it rained hard enough or there was a lot of snow melt.

The definition of perennial versus intermittent streams is remarkably consistent across the country. Perennial streams must have water ***all*** year long, except in periods of extreme drought. Intermittent streams have water ***most*** of the year; they usually dry up in the summer. These classifications were verified in the field. The field crews knew to look for signs of drought and they also knew to ask local residents about the nature of the stream, if there were any doubts about flow. They would ask things like, “Does that stream ever dry up?” Information for the whole country is generally consistent, but in the

eastern US, not every intermittent stream is collected, because perennial streams are so numerous and prominent. In the arid western US, intermittent streams and even ephemeral streams are very important and many more of those are being collected. These differences reflect the focus on water use by humans and biological systems.

Some complain that this is not “scientific”. But it is certainly empirical. If the field crew saw water in August when streams are driest, they assumed that it had water all year.If it was dry, they would question whether it was a period of drought and they would look for signs along the banks and the streambed to help determine the flow duration. Some people may want to define this classification in other ways. For example, how many cubic feet per second (CFS) does the stream flow; are there creatures or vegetation that indicate the classification, i.e. things that only live in streams with water year round; what is the morphology of the stream bed etc. But the NHD has millions and millions of streams, and it would be extremely difficult for anyone to collect information like that for even a small portion of the stream network. The streams in the NHD provide locations of channels that have water much of the year. Observations that the NHD does not represent all the channels that exist are probably true. Using elevation data, especially LiDAR data, one can generate almost any “network.” But are they “streams”? In most cases, the ephemeral or crenellated “streams” that may be generated and are said to be missing from the NHD, are more likely geomorphological features than hydrologic features from a practical point of view.

The positional accuracy of the NHD is also very good. Yes, the line work was simplified and generalized for display at 1:24,000-scale, but some recent studies have shown that much of the difference is the result of streams doing what they do – meander (migrate), flooding or huge downward flows can change the rivers course over time. A video of these studies can be found at: http://nhd.usgs.gov/videos_demos.html.

There are some differences in density across the country. Many are real differences based on the specific ground conditions; such as geology, soil compositions, or vegetation. In some areas, the NHD stream density is extremely low, but it turns out that the area is Karst geology or there is a deep layer of alluvium and in both cases, surface drainage is lacking. In areas where there was glaciation, there can be significant differences – central Iowa has a lobe of the last glacier that has low stream density compared to the area around it that has been highly dissected There are differences in density based on individual maps. This is the result of compilation differences based on different collection dates and sources and different people doing the compiling. In some cases more channels were shown on some maps than that of surrounding areas. The USGS is currently developing national-level flow accumulation data based on 4 factors (runoff, slope, soil permeability and rock depth) that can help determine potential densities. The preliminary data matches remarkably well to the densities found in the NHD. This data will allow USGS and the users of the NHD to improve the data so that artificial density differences can be identified and investigated further.

What is the positional accuracy of the NHD?

Original hydrographic data were compiled to meet National Map Accuracy standards (available here: http://nationalmap.gov/standards/pdf/NMAS647.PDF). These standards have been maintained in the process of creating the NHD. At 1:100,000-scale, ninety percent of well-defined features are within 167 feet (0.02 inches at map scale) of their true geographic position. USGS Map Accuracy standards for 1:24,000-scale require ninety percent of well-defined features to lie within 40 feet of their true geographic position based on the date of collection.

What sources were used to produce the data?

The NHD is a combination of USGS hydrologic digital line graph files (DLG) and EPA reach files, version 3.0 (RF3). Also used were; U.S. Forest Service Cartographic Feature Files (CFF) and USGS Tagged Vector Hydro (TVH) captured from 7.5-minute printed maps. Some states also contributed their own stream layer data to the compilation of the 1:24,000-scale NHD. The USGS files were used for spatial accuracy and the EPA files were used for attribute information.

Why was this dataset created?

The NHD was created to assist scientists in modeling hydrologic features and is also useful for cartographic mapping purposes. The geometric features that came from the USGS DLG files, combined with the flow direction, reach codes, and other attributes taken from the EPA RF3 file, make the NHD a powerful modeling tool.

In what scale are the data?

For the conterminous United States, Hawaii, and the Virgin Islands, medium and high resolution NHD data are available at 1:100,000 and 1:24,000-scale, respectively. NHD data are available for Puerto Rico at 1:20,000-scale, and at 1:63,360-scale in Alaska. Users are encouraged to work with their state's principal steward to produce and submit data at higher resolutions. In 2010, a decision was made to combine high resolution and local resolution into a single, best-resolution production database, which has led to some areas having larger than 1:24,000-scale data, example – Vermont state has data scaled at 1:5,000 for the entire state.

In what format are the data?

Data are offered as an ESRI file or personal geodatabase, but can also be downloaded or converted to shapefile using the NHD Utilities software. NHD is available as pre-staged State file-geodatabase extract and subregions (4-digit Hydrologic Units), or in a specified extent from the *The National Map* Viewer.

Who can I contact for NHD information?

To obtain further information about the NHD visit http://nhd.usgs.gov, contact the Natural Science Information network at http://ask.usgs.gov/sils_index.html, call 1-888-ASK-USGS, or email nhd@usgs.gov. You can also contact the Regional POC by looking on the stewardship map (http://nhd.usgs.gov/stewardship/#.VEFV3_ldX4I) and selecting your state.

In what coordinate system are the data?

NHD data is distributed by USGS in Geographic Coordinate System (GCS) in decimal degrees. The data is un-projected.

Upon what datum is the NHD cast?

NHD data is distributed with a horizontal datum of North American Datum of 1983 (NAD83). Some features may contain elevation attributes. Elevation attributes are collected in National Geodetic Vertical Datum of 1929 (NGVD29) in meters

How current are the data?

How current the data will be depends upon the collection date of the initial line work and whether this line work was updated when the DLG files were created by USGS. In addition, many states and federal agencies have been working to update portions of the NHD within their states; therefore, the vintage of the line work can vary from the 1950s to the present. The feature date (attribute: *FDate*) in the feature attributes indicates the date the feature was placed in the NHD production data, not the date of collection

How can the NHD be used to support modeling?

GIS technologies take advantage of the rich set of attributes and database relationships embedded in the NHD to generate specialized information. These analyses are possible because the NHD contains a flow direction derived geometric network that traces the water downstream or upstream. It also uses an addressing system to link specific information about the water such as water discharge, water quality, and fish population. Using the basic water features, flow network, linked information, and other characteristics, it is possible to study cause and affect relations, such as how a source of poor water quality upstream might affect a fish population downstream.

The Hydrography Event Management (HEM) Tool provides functionality for creating and editing events in the NHD. Events are informational data linked to the NHD using a linear referencing system on the reach codes assigned to NHDFlowline features. The use of events is a key advantage of the NHD and allows vast amounts of scientific information to be linked to the NHD while keeping the design simple and by making advanced analysis techniques possible. The HEM tool handles linear referencing mechanics to make working with events easy. The HEM tool works on point, line, and area events and allows events to be located interactively, imported, or calculated. An ID value is created that provides the link between the event location and the informational data tied to the location. In addition, metadata creation and network measures are supported by the HEM tool.

Can the NHD be re-projected to a different coordinate system?

Yes and no. Yes, if it is staged or extract NHD data, which can be re-projected using standard GIS tools or through distributed database processes to empty NHD templates. No, if it is JOB data (replica check-outs). These JOB datasets are NHD data being used for maintenance and returned to the USGS NHD Production Database. Because of the replication requirements, these data cannot be re-projected.

A reach has both a reach code (ReachCode) and a permanent identifier (PermID). What is the difference?

A reach code uniquely identifies each reach. This 14-digit code has two parts: the first 8 digits represent the 8-digit hydrologic unit code (formerly, known as subbasin or cataloging unit) in which the reach exists; the last 6 digits are a randomly assigned sequential number within that subbasin as the features are collected. Each reach code occurs only once throughout the Nation. Once assigned, a reach code is associated with its reach permanently unless the reach features are deleted, and the reach code retired.

Reach codes facilitate geocoding or linking of observations, such as a water quality sampling sites, to reaches. Reach codes form the basis of a national linear referencing system which supports linking such observations to a point along a reach, an entire reach, or groups of reaches.

Reach codes are stored in the attribute named "*ReachCode*". Assigned reach codes only exist in the NHDFlowline and NHDWaterbody feature classes. In addition to the reach code, the date on which the reach code was assigned to the feature is stored in the data element named "*ReachSMDate*" within the ReachCode Maintenance or Event Feature Class tables. The only link between NHD at different resolutions is the reach code. Once a reach is defined and assigned a reach code, only mapping errors and changes to the hydrography will cause the reach code to be retired. As reach codes change, they are tracked in a special table called NHDReachCrossReference, which allows users to backtrack assignment of a reachcode to a specific area.

Permanent Identifiers (PermIDs) store registry style strings consisting of 40 characters. These strings uniquely identify a single feature or *table row* within a geodatabase and across geodatabases. PermIDs allow features to be tracked in one-way and two-way geodatabase replication. Each reach code is supplied a PermID in the NHDReachCodeMaintenance table of the database. The field WBAreaPermanentIdentifier associates an artificial path to the containing Area or Waterbody feature.

Can I link my own data to the NHD?

Yes, the best way to link data to the NHD is using the linear reach addressing system. Reach codes are permanent, tracked, multi-scale, and form the basis of a controlled linear referencing system. The Hydrography Event Management (HEM) Tool provides full functionality for adding and editing events in the NHD. Events are informational data linked to the NHD using a linear referencing system on NHDFlowlines. The use of events is a key advantage of the NHD and allows vast amounts of scientific information to be linked to the NHD while keeping the design simple and by making advanced analysis techniques possible. The HEM tool handles linear referencing mechanics to make working with events easy. The HEM tool works on point, line, and area events and allows events to be located interactively, imported, or calculated. An ID value is created that provides the link between the event location and the informational data tied to the location. In addition, metadata creation and network measures are supported by the HEM tool.

Where can I find information about NHD attributes?

The NHD Data Dictionary provides details on all feature classes and attribute tables found in the NHD, and can be accessed at http://nhd.usgs.gov/NHDv2.2_poster_052714.pdf.

The current NHD Model (v2.2) is available in poster form from http://nhd.usgs.gov/NHDv2.2_poster_052714.pdf. The poster provides a diagram of the tables, the table items, the item definitions, and the relationships between the tables in the NHD data model.

The NHD Feature Catalog provides detailed descriptions of NHD features and their attributes.

Does the NHD contain data for Mexico and Canada?

The USGS along with their Mexico counterpart agency, Instituto Nacional de Estadística Geografía e Informática (INEGI), harmonized hydrography data for the U.S.-Mexican

border. The harmonized datasets (28 HU8s) are available for public download along the international border. The US data is from the 1:24,000-scale National Hydrography Dataset (NHD), while the Mexico data is from their 1:50,000-scale hydrography dataset.

USGS and USEPA are working with Natural Resources Canada (NRCan), Environmental Canada (EC), and Agriculture and Agri-Food Canada to harmonize trans-boundary hydrography data between the NHD and Canada's National Hydrographic Network (NHN). Across Canada, scale of data collection is not uniform and is dependent on the Province; however, all data is collected at 1:50,000-scale or better for the NHN. The final product will be complete and hydrographically correct drainage areas and network of the U.S.-Canadian border. As of July 2013, all 8-digit hydrologic units on the border areas, with the exception of the Lake Superior subbasins, are complete.

I see an error in the data. What do I do?

If you find an error in the NHD data, you may inform USGS by contacting your local NHD Partner Support Regional Point of Contact or you can inform the local state stewards where the data is at issue. Go to the NHD Stewardship web page to find your POC or State Stewards

How do I download NHD/WBD Data?

NHD/WBD Data can be downloaded by using The National Map Viewer or from ftp sites that contains Pre-staged data. For directions go to http://nhd.usgs.gov/userguide.html . Open the folder called "The NHD Viewer".

The National Hydrography Dataset (NHD) and Watershed Boundary Datasets are stored in a geodatabase implementation of the Hydrography (NHD) model. This provides great flexibility and efficiency to allow the data to work well in analysis using a geographic information system (GIS). To maximize the capability of the NHD, users should download the data in a file-based or personal geodatabase.

How do I use NHD/WBD data?

There are many ways to use the NHD data and it will ultimately depend on the output you are hoping to receive. For ideas on how to use NHD/WBD Data, go to http://nhd.usgs.gov/userguide.html.

How are partners using the NHD/WBD?

There are many different applications of the NHD/WBD, including StreamStats, NHDPlus, WATERS, NRIS, Basins, and New England SPARROW. For more information on these NHD applications go to http://nhd.usgs.gov/applications.html

The USGS provides users with access to an assortment of analytical tools that are useful for water-resources planning and management, and for engineering design applications, such as the design of bridges. StreamStats allows users to easily obtain streamflow statistics, drainage-basin characteristics, and other information for user-selected sites on streams.

Between 1996 and 2000, the Environmental Protection Agency (EPA), the U.S. Geological Survey (USGS), and other federal, state and local agencies collaborated to produce the National Hydrography Dataset (NHD), a comprehensive set of digital geospatial data about surface water features such as streams, rivers and lakes. These data can be used by water quality managers to make maps, perform upstream/downstream queries, and link other water-related information to the NHD network.

In 2006, this interagency collaboration produced NHDPlus, a suite of application-ready geospatial products that build upon, and extend, the capabilities of the medium-resolution NHD. NHDPlus integrates the NHD with the National Elevation Dataset (NED) and the Watershed Boundary Dataset (WBD). It includes an enhanced NHD stream network with improved names, value-added attributes (such as stream order), incremental drainage areas with landscape characteristics, and flow volume and velocity estimates for pollutant dilution modeling. EPA and USGS have linked many water quality databases to NHDPlus, including stream gaging stations, water quality monitoring sites, and impaired waters, enabling these databases to be queried and analyzed in upstream/downstream order. NHDPlus greatly enhances the ability of researchers and water quality managers to analyze and model water quality data. For more information on NHDPlus, visit www.epa.gov/waters. Click on the NHDPlus Quick Link on the right side of the web page.

Watershed Assessment, Tracking & Environmental ResultS (WATERS) is an integrated information system for the nation's surface waters. The EPA Office of Water manages numerous programs in support of the Agency's water quality efforts. Many of these programs collect and store water quality related data in databases. These databases are managed by the individual Water Programs and this separation often inhibits the integrated application of the data they contain. Under WATERS, the Water Program databases are connected to a larger framework. This framework is a digital network of surface water features, known as the National Hydrography Dataset (NHD) . By linking to the NHD, one Water Program database can reach another, and information can be shared across programs.

Originally introduced in 1996 with subsequent releases in 1998, 2001, and 2004, BASINS, or **B**etter **A**ssessment **S**cience **I**ntegrating Point & **N**on-point **S**ources, is a multipurpose environmental analysis system designed for use by regional, state, and

local agencies in performing watershed and water quality-based studies. This system makes it possible to quickly assess large amounts of point source and non-point source data in a format that is easy to use and understand. Installed on a personal computer, BASINS allows the user to assess water quality at selected stream sites or throughout an entire watershed. This invaluable tool integrates environmental data, analytical tools, and modeling programs to support development of cost-effective approaches to watershed management and environmental protection, including TMDLs.

The NRIS Water application is being modified to incorporate the NHD spatial model as the basis for geo-referencing data to streams and lakes. The 1:100,000-scale NHD is complete for the lower 48 states and will be flow validated by May of 2001. This represents a national wall to wall coverage of streams and their underlying spatial model (flow direction, level, etc.). NRIS Water V1.2 will be available for use with the 1:100,000 NHD data at this time.

This NHD-based version of the USGS SPARROW water-quality model aids the development of regional nutrient water-quality criteria and total maximum daily loads (TMDL) for New England streams.

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What is the cost of the data?

NHD and WBD data are public domain and available for free. The data can be used for any purpose. USGS has no restrictions on use.

How can I determine which subbasins I need?

Use the EPA's "Surf Your Watershed" site, the Hydrography Viewer or National Map Viewer.

What data are currently available?

Medium and high resolution NHD data are available at 1:100,000 or 1:24,000-scale for the conterminous US, and Hawaii, and the Virgin Islands. NHD data are available for Puerto Rico at 1:20,000-scale and data for Alaska are being produced at 1:63,360-scale.

Some regions or states may contain larger resolution data – what NHD refers to as “local” resolution. The NHD distribution database consists of the “best available resolution,” which may be greater than 1:24,000-scale. “Local” resolution is anything

greater than 1:24,000-scale data. To determine if data is at a higher resolution than stated, check the feature level metadata concerning the features. Most will have stated when/why a local resolution was captured.

Where can I download the data?

You can download NHD using any of the following options: Hydrography Viewer, NHD Pre-Staged Subregions, or State Extracts.

How should the NHD be cited?

Information:
U.S. Geological Survey, 2007-2014, National Hydrography Dataset available on the World Wide Web (http://nhd.usgs.gov), accessed [*Date*]

Data:
U.S. Geological Survey, 2013, National Hydrography Geodatabase: The National Map viewer available on the World Wide Web (http://viewer.nationalmap.gov/viewer/nhd.html?p=nhd), accessed [*Date*]

WBD data:
Coordinated effort between the United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS), the United States Geological Survey (USGS), and the Environmental Protection Agency (EPA). The Watershed Boundary Dataset (WBD) was created from a variety of sources from each state and aggregated into a standard national layer for use in strategic planning and accountability. Watershed Boundary Dataset for {county, state, or HUC#}, State [Online WWW]. Available URL: "http://datagateway.nrcs.usda.gov" [Accessed DD/MM/YYYY].

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What is the NHD Update Tool?

The NHD Update Tool is a USGS created toolbar designed for NHD maintenance editing operations. The toolbar includes operations for getting and submitting specific jobs (child replicas) to/from the USGS and editing the data. The tools include the appropriate model enforcement for feature-to-feature and reach code allocation enabling the tools to perform a number of operations during editing including generating feature level metadata, assigning new reach codes, and maintaining the data already created. The utilities include in the toolbar include geometric network generation,

development of M-values for edited features, and assigning new reach codes. The NHD Update Tool is available to signed partners with the USGS through stewardship agreements.

What is the WBD Update tool?

The WBD Update tool is used by WBD stewards to download and prepare to work on defining the hydrologic units. The guidelines the WBD editor must follow are provided in the "Federal Standards and Procedures for the National Watershed Boundary Dataset (WBD) "(http://pubs.usgs.gov/tm/tm11a3/). These tools are only available to signed WBD stewards and must go through a vetting and quality control process with the National Technical Coordinators before being included in the certified WBD data.

What is the NHD GeoConflation Tool?

Conflation in GIS terms is the transfer of attributes between two datasets to maintain the attribution in the more refined data. The GeoConflation Tool is one method available to update the National Hydrography Dataset (NHD) using larger resolution data than the original or source data. The tool was originally developed to automate the NHD Create Process used to generate the high resolution (1:24,000-scale) NHD data from the medium resolution (1:100,000-scale) NHD data. The current tools automate the conflation of attributes and also enforce the NHD data model integrity between different resolutions of hydrographic data. The basic goal of GeoConflation is to conserve assigned reach codes, whenever possible, by duplicating the attributes from the original (source) dataset to the modified (target) dataset. This allows the history of the reach codes, and by association any information tied to the reach code to be preserved. The GeoConflation process is user intensive, requiring the user to manually prepare their collected target data into a NHD database model with minimal attribution, perform queued edit reviews of features not caught in the automated matching process, and to be able to manually manipulate some data as necessary. Users wanting to use conflation instead of the NHD Update tool should contact their regional Partner Support POC for more information or contact NHD-GCT@usgs.gov.

What is the Hydrography Event Management Tool?

The Hydrography Event Management (HEM) Tool provides full functionality for adding and editing events in the NHD. Events are informational data that are linked to the NHD using a linear referencing system on NHDFlowlines. The use of events is a key characteristic of the NHD by allowing vast amounts of scientific information to be linked to the NHD while keeping the design simple and by making advanced analysis techniques possible. The HEM tool handles all the linear referencing mechanics to make working with events easy. It works on point, line, and area events and allows events to be located interactively, imported, or calculated. An I.D. value is created that provides the link between the event location and the informational data tied to the location. It also creates metadata linked to the event. The tool also provides network

measuring to determine distances through the flowline network. The HEM tool was originally developed by the Bureau of Land Management and is now being managed by the U.S. Geological Survey. For more information email hem@usgs.gov

What are the NHD Utilities?

The NHD Utilities is a suite of stand-alone and integrated software functions that were designed to help users work with the National Hydrography Dataset (NHD) data. The utilities require the presence of ESRI ArcGIS. Although originally created for partners to use during the stewardship process, these utilities now serve non-partner users when working with the NHD data for analysis and manipulation.

The suite includes the following functions:
Network Manipulation Utilities

- Network Builder – builds a geometric network based on the NHDFlowline feature class
- Build Flow – builds a connectivity table for NHDFlowline feature-to-feature connections
- M-Values Utility – Provides a utility to assign linear measures to NHDFlowlines based on reachcodes.

Format/Configuration Utilities

- PGD2SHP – Converts an ESRI NHD geodatabase to shapefiles and appropriate DBF tables
- SHP2GDB – Converts shapefiles and appropriate DBF tables to an ESRI file or personal geodatabase
- Dataset Merge – allows a user to merge separate datasets into one dataset and removes duplicate features
- Subset by Polygon – allows the user to separate out a single hydrologic unit from a larger hydrologic unit and maintain all reachcodes associated with the area of interest

Transfer/Transaction Utilities

- XML2GDB – used primarily in GeoConflation for transferring information from a NHD related XML workspace to a database
- XML Extract – used

What is the USFS Re-projection Tool Version 2.0?

The USFS Re-projection Toolbar changes geographic projection and can transform datum's using all available ESRI ArcObjects algorithms. It was developed by the U.S. Forest Service for the National Hydrography Dataset (NHD) NHDinGEO format, but can function on any personal or file geodatabase.

This is an add-on toolbar written for ESRI's ArcGIS 9.x and 10.0. The advantage is that the tool re-projects whole personal- or file-geodatabases at once, and updates the

metadata at the Geodatabase, Dataset, and Feature class levels in both the Data Quality and Spatial Reference sections of standard FGDC metadata--or creates its own metadata if there is none. Version 2.0 works on ArcGIS 9.2 while version 2.1 works on ArcGIS 9.3 and 10.0.

USGS does not provide technical support for third party tools including ones from other Federal agencies, but Partner Support can put users in contact with the USFS developers.

What is Geographic Names Information System?

The Geographic Names Information System (GNIS), developed by the U.S. Geological Survey in cooperation with the U.S. Board on Geographic Names, contains official naming information about physical and cultural geographic features in the United States and associated areas, both current and historical (not including roads and highways). The U.S. Board on Geographic Names is a Federal body created in 1890 and established in its present form by Public Law in 1947 to maintain uniform geographic name usage throughout the Federal Government. The database holds the Federally recognized name of each feature and defines the location of the feature by state, county, USGS topographic map, and geographic coordinates. Geographic names are regulated by the Board of Geographic Names and the NHD contains only BGN approved names. For further information on the BGN and the Geographic Names database please go to http://geonames.usgs.gov/.

Other feature attributes include names or spellings other than the official name, feature designations, feature class, historical and descriptive information. The Geographic Names database assigns a unique feature identifier (feature ID in GNIS and GNIS_ID in the NHD), that is a key for accessing, integrating, or reconciling GNIS data with other datasets. The GNIS is our Nation's official repository of domestic geographic feature names information.

Maintenance

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How is the NHD maintained and/or updated?

The NHD is an extremely large and comprehensive database containing millions of features. Building it required the cooperation of many government agencies at the Federal, state, and local level. These agencies banded together into a collaborative partnership to share data and resources, making it possible to complete nationwide

coverage. The U.S. Geological Survey played a key role in coordinating the partnership. Agencies such as the U.S. Environmental Protection Agency, the U.S. Department of Agriculture Forest Service, the U.S. Department of Interior's National Park Service and Bureau of Land Management, along with many state agencies played key roles in developing and building the NHD. These partnerships will remain intact to continue to maintain the NHD.

The USGS National Geospatial Technical Operations Center (NGTOC) has a NHD maintenance program that runs the data through a variety of maintenance and quality control checks including:

- Resolve line (1-D) and polygon (2-D) topology errors
- Resolve Gapped or Branched Reach Codes and GNIS NamesVerify all major GNIS Names exist in NHD
- Verify Geometric Network connectivity
- Check all reaches to ensure that they have MValues
- Check all WBAreaPermanentIdentifier's and correct or add as necessary
- Incorporate NOAA authoritative coastlines into the NHD
- Check all Coastlines (Coincident with 2-D features) and correct as necessary
- Split 2-D stream/rivers at subbasin boundaries
- Insure that offshore islands have coastline
- Hydro-Image Integration
- Network Improvement
- GazVector Integration

The NHD also includes a large, supported stewardship program where authoritative agencies can submit updates to the NHD production data. These stewardship's are based upon Memorandum of Understandings signed between the USGS and the authoritative agency. These MOU's are developed by the National Geospatial Program (NGP) Liaisons with the states and supported through the National Geospatial Technical Operations Center.

How does the NHD account for changes in landscape?

The primary responsibility for changing the NHD to match current landscape (also called ground-truthing) falls to the NHD stewardship in each state. Problems with data that are reported to USGS are often forwarded to the NHD stewards if a MOU exists in that state. The USGS NGTOC also has several projects concerning maintenance of the NHD. These NGTOC activities are coordinated with the state stewards through the Partner Support team.

Hydro-Image Integration is one of the NGTOC projects by which high resolution NHD data is visually compared to the most current imagery from the National Agriculture Imagery Program (NAIP). Hydro-Image Integration corrects major errors in the NHD data, such that 2-D streams are corrected if they are over 100 feet wide and deviate from the imagery by at least 1,000 feet. Lakes are corrected if they are over a square

kilometer, and the shoreline deviates from the imagery by 500 feet or more. New lakes are added to the NHD if they are over 500,000 square meters in size.

The USGS also collaborates with other authoritative sources to update the NHD. One example is the coastline updates through NOAA. NOAA to update coastlines using the NOAA mean high water (MHW) delineations from each Epoch. An EPOCH is a 19-yr evaluation of the rise and fall of sea water level through tide gauges. These delineations are evaluated then placed in the NHD Production data model.

What is NHD Stewardship?

Just as building the NHD required a large partnership across the nation, maintaining the NHD also requires an extensive partnership, and can best be accomplished by those closest to the hydrography. Users within the states and federal lands understand the hydrography around them and are motivated to ensure the accuracy of the NHD to meet their business needs; therefore, they are ideally suited to become the stewards of the data; an agency in each state will manage the maintenance activities within the state. The maintenance will be performed by that agency or other agencies in the state. The United States Geological Survey (USGS) will facilitate the overall process, providing national management, coordination, tools, standards, documentation, training, quality assurance, data archival, and data distribution. Updates to the NHD will be made by the stewards, transmitted to the USGS, processed, and made available in the national dataset distribution.