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by Jeff Simley, USGS

Flowlines and Lines in the NHD by Keven Roth

The NHDFlowline feature class is the heart of the NHD. The features were meant to provide a complete, connected, linear network and carry the reach codes that allow other detail to be referenced. The features in the NHDLine feature class can also be important. They provide information on structures or conditions that provide additional information about the network. In essence, the NHDLine features are treated as "events." In fact, they would be good candidates to become NHD events. They do not have reach codes, although they could very easily be associated with the underlying reach codes of the "primary" feature. The NHDLines "sit on top of" and generally do not "break" the primary NHDFlowline features. Pipelines were included in NHDFlowline because significant pipelines, like those in large aqueduct systems, were needed to account for all water flow. The intent was to capture the large pipelines that transport domestic or industrial water, which could include systems for power plants (penstocks), or as structures used to cross valleys or other streams (siphons). There are about 22,000,000 NHDFlowlines and 200,000 NHDLines in the NHD.

NHDFlowline feature types used for flow underlying NHDLine:

(1) A **StreamRiver** is a body of *FLOWING* water (distinguished from a LakePond which is a standing body of water).
(2) A **CanalDitch** is defined as an *ARTIFICIAL* and *OPEN* waterway.
(3) A **Pipeline** is a *CLOSED* Conduit.

NHDLine feature class contains flumes, tunnels, bridges, gates, lock chambers, waterfalls, rapids and other feature types. Where these line features exist, the underlying NHDFlowline feature is (or should be) continuous. A Flume, for example, will normally be found as a shorter segment of an overall CanalDitch where it crosses a StreamRiver.

A natural, flowing body of water is a StreamRiver, but if it is artificial and open, it is a CanalDitch. If it is closed, it is a Pipeline. NHD features are generally distinguished by ***form,*** *but* attributes are often used to describe the ***function*** *or purpose* of a feature. For example, there is no NHDFlowline feature type for "aqueduct" since an aqueduct is a function of a CanalDitch or Pipeline. The "type" attribute on CanalDitch and Pipeline describes the function or purpose. If an artificial, open waterway (CanalDitch) functions as an aqueduct (supplies domestic or industrial water) it would be further identified with an attribute of aqueduct. If a closed conduit (Pipeline) functions as an aqueduct, it would be identified as such using the attribute value. This is the same for the value 'stormwater' which also applies to both CanalDitch and Pipeline. The additional types for pipeline are Penstock and Siphon, but because they are always closed, those values do not apply to canal/ditch. See http://nhd.usgs.gov/NHDFeatureCatalog.pdf for a more complete description of the feature classification methodology which can be found in the introductory material. Some "best practices" and modifications to the current attributes and values are needed to clarify these features especially with local detailed information about culverts and storm water systems being incorporated into the NHD.

Hydrography Event Management Tool by Ariel Bates

The Hydrography Event Management (HEM) Tool Version 2.4 for ArcGIS 10 is now available!
The HEM Tool provides full functionality for adding and editing events in the National Hydrography Dataset (NHD).

Events are informational data linked to the NHD using a linear referencing system on NHDFlowlines. The use of events allows vast amounts of scientific information to be linked to the NHD. The HEM tool handles all 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. A number of state and federal partners have adopted HEM: Environmental Protection Agency (EPA) incorporated HEM to meet Clean Water Act reporting requirements, the U.S. Forest Service incorporated HEM functionality into their National Resource Information System (NRIS) Aquatic Surveys application, Bureau of and Management (BLM) incorporated HEM to support event creation for its Oregon/Washington Aquatic Resource Information Management System and is evaluating its use for a national Riparian Database, and the HEM Tool is used to georeference water quality data to the NHD, and this information is then used for Section 303(d) water quality reports on impaired waters.

The HEM effort is a unique collaboration between the BLM, U.S. Geological Survey (USGS), and the EPA that results in ongoing tool development and support to the expanding HEM user community. The USGS provides basic to advanced HEM training with easy to follow exercises. Contact Ariel Bates at atbates@usgs.gov.

NHD Rules: Do you know them? by Ray Postolovski

Have you ever asked yourself; "Can a StreamRiver exist within a SwampMarsh or should it be an Artificial Path?" or "Should the Artificial Path within a LakePond get its own Reach Code?" Well, soon you will have your answers to these questions and many more. You may be aware that the USGS is in the process of developing a new set of NHD editing tools to simplify and improve the workflow of maintaining the features in the NHD. The programming code, the graphic user interface (GUI), and the underlying rules driving how features and reach codes are delineated are all being changed.

In 2010, two committees were established to discuss and evaluate the existing Feature to Feature Rules and Reach Code Delineation Rules. They discovered how the rules have changed since they were originally created and how to better define the constraints of both sets of rules based on current needs. Many of the rules will remain the same, but there have been some important modifications to these rule sets. This article will not highlight those changes but will inform you that these rules have been documented and will be made available through the new NHDGeoEdit Tool Help feature.

Thorough documentation is very important to current and future stewards. A major goal of the NHD stewardship program is to provide user-friendly and comprehensive documentation at a user's fingertips. Help documentation is being created in tandem with tool development. This documentation will cover many aspects of the NHD from how to use the new tools to NHD concepts (such as the NHD feature rules) and everything in-between. The help documentation will be a living document, which allows changes to be available as soon as they are made. Access to the documentation will also be made available through the NHD homepage and the Stewardship site for non-editors.

So in the future, to answer the questions at the beginning of this article, all that is needed is to click the Help button in the new tools to get the answer or visit the website. This is another way of improving the NHD workflow and making it easier to produce a high quality NHD.

Watershed Boundary Dataset Integration Status Update by Stephen Daw

The WBD in the NHD was refreshed in late January and early February. This refresh represents a snapshot of the WBD from early November 2010 (it takes a few weeks to convert the WBD from its existing format into the new common vector model format). Every effort was made to include as many of the recent changes to the WBD as possible. Also, the border harmonization areas with Mexico and

Canada were included. The border areas are particularly dynamic at this time as harmonization takes place and in some areas imperfect data was initially used. Every effort was made to insure the best possible data be made available to NHD users. Still, because of changes and incomplete data, the WBD in the NHD is more for reference and informational purposes rather than for currency and accuracy. This will change once the WBD stewardship operations switch over from the NRCS to the USGS in late August. See the following image for a map showing changes to the WBD since the November refresh: ftp://nhdftp.usgs.gov/Workshops/Changes_WBD.docx.

The WBD editing tools continue to progress in their development. Beta testing of the tools will begin on March 7th. This testing is open to all interested parties. Please be advised however that beta testing will not be used to actually edit or update the WBD. All use of the WBD tools during the beta program will be for testing purposes only. The WBD tools beta program is expected to last approximately one month. During that time, we anticipate a couple of versions of the beta tools to be released based on immediate feedback from the testers. If you would like a beta copy of the WBD tools and are willing to provide feedback to their development, please contact Stephen Daw via email sgdaw@usgs.gov.

Wetlands Mapper

The U.S. Fish and Wildlife Service Wetlands Mapper integrates digital map data with other resource information to produce timely and relevant management and decision support tools.
See: http://www.fws.gov/wetlands/data/mapper.html Turn off the wetlands status and zoom-in to an area of interest. Click alternately on the Streets layer and the Topo layer. Note the use of the underlying hydrography used. If you can determine the source of this hydrography, send an email to Jeff Simley jdsimley@usgs.gov.

River Maps - Daniel Huffman

"Rivers have been a key part of urban life for centuries. They have provided us with drinking water, protection, and a transit network that links us from one settlement to the next. I wanted to create a series of maps that gives people a new way to look at rivers: a much more modern, urban type of portrayal. So I turned to the style of urban transit maps pioneered by Harry Beck in the 1930s for the London Underground - Straight lines, 45º angles, simple geometry. The result is more of an abstract network representation than you would find on most maps, but it's also a lot more fun. The geography is intentionally distorted to clarify relationships. I think it helps translate the sort of visual language of nature into a more engineered one, putting the organic in more constructed terms. Not every line depicted is navigable, but all are important to the hydrological systems shown." See
http://somethingaboutmaps.wordpress.com/river-maps/ and
http://www.maproomblog.com/2011/02/daniel_huffman_and_his_river_maps.php

Determining Drainage Area Using StreamStats

Determining drainage area is a vital task in the study of hydrology and related sciences. This used to be a labor intensive process until the advent of high quality digital elevation models. Even then, considerable expertise and time was required to generate a valid result. Now the task has become greatly simplified with the web-based StreamStats from USGS. The following exercise is a good primer for the use of StreamStats. In this case the drainage area on Boulder Creek at Broadway Street in Boulder, Colorado will be determined.

(1) Go to http://streamstats.usgs.gov. Be sure to read the associated documentation to understand the science behind StreamStats and the limitations of its use.
(2) Click on State Applications in the left panel.

(3) An interactive map of Fully Implemented StreamStats states is presented in green. Click on *Colorado*.
(4) After reading the text, click on Interactive Map. A new window will open with a map of Colorado.
(5) Useing the "Zoom-in magnifier", the first icon on the toolbar, to zoom-in on the Denver metropolitan area.
(6) Look for Boulder to the northwest of Denver and zoom-in on Boulder.
(7) Look for highway 93. This is Broadway Street, a major north-south thoroughfare in Boulder.
(8) Zoom-in very tight on the crossing of Boulder Creek with Broadway. This is just south of the junction of highways 93 and 119.
(9) If zoomed-in tight enough, you should see a light blue stream in the map mode overlaid by a dark blue "pixilated" stream. The dark blue stream is generated from a special digital elevation model used in StreamStats. This digital elevation model has been integrated with the National Hydrography Dataset to "hydrologically enforce" the elevation model for use in drainage area calculations.
(10) Click on the 12th icon in the toolbar, the Watershed Delineation from a Point tool. This will activate your cursor to find the upstream drainage area from a point where you click on a dark blue (dem stream) line.
(11) Go to where the dark blue line (Boulder Creek) crosses the red line (Broadway) and click in one of the dark blue pixels.
(12) Within seconds the drainage area will be determined by StreamStats and displayed. The user is responsible to determine if this delineation is reasonable.
(13) Click on the 13th icon in the toolbar, the Basin Characteristics tool. Within seconds a new window will open displaying the various basin characteristics that will be calculated. The third characteristic will be "Area that drains to a point on a stream in square miles".
(14) Click on Compute Parameters.
(15) Within second the parameters will be displayed. The answer is 135 square miles.

NHD Photo of the Month by Kathy Isham

This month's photo was submitted by Sheryl Boyack of the U.S. Geological Survey Utah Water Science Center. This is the Russian River in Alaska. To see the photo of the month go to ftp://nhdftp.usgs.gov/Hydro_Images/RussianRiver.jpg . The map was made by Kathy Isham. Submit your photo for the NHD Photo of the Month by sending it to krisham@usgs.gov. This will allow the program to build a library of real-world photos linked to the NHD.

January Hydrography Quiz / New February Quiz

In a repeat performance, Linda Davis of the Idaho Department of Water Resources was the first to correctly guess the January hydrography quiz as 135 square miles for the drainage area on Boulder Creek above Broadway Street in Boulder, Colorado. See ftp://nhdftp.usgs.gov/Quiz/Hydrography66.JPG. To determine the answer see the article on Determining Drainage Area Using StreamStats above.

Others with the correct answer were (in order received): Al Rea, Tom Denslinger, Pete Steeves, David Straub, Ken Koch, and Christina Boggs. Normally Linda would have been disqualified under the "two-in-a-row" rule, but then Al Rea would have to have been disqualified under the "wins-too-often" rule, as would have Tom, Pete, David, and Ken. So Christian Boggs get very honorable mention.

This month's hydrography quiz can be found at ftp://nhdftp.usgs.gov/Quiz/Hydrography67.JPG. We'll give drainage area another try. This time determine the drainage area of the Allegheny River above the

point where it and the Monongahela River form the Ohio River in Pittsburgh, Pennsylvania. It should take you only a couple of minutes to figure this out. Send your guess to jdsimley@usgs.gov.

Upcoming NHD Training

Hydrography Event Management tool 4-hour WebEx training.
Sign up at: http://nhd.usgs.gov/tools.html#hem Contact: HEM@usgs.gov
Getting Started Part 1 - April 13, August 17
Advanced Editing Part 2 - March 10, June 7, September 7
Data Maintenance Part 3 - March 23, June 22, September 28

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The NHD Newsletter is published monthly. Get on the mailing list by contacting jdsimley@usgs.gov.
You can view past NHD Newsletters at http://nhd.usgs.gov/newsletter_list.html
Jeff Simley, USGS, assumes full responsibility for the content of this newsletter.