

USGS National Hydrography Dataset Newsletter
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by Jeff Simley, USGS

Hydrography Seminar Series

The USGS will be presenting a seven part seminar series on the NHD and WBD starting February 19th. Episode 1 is called Water in Our World and will address (1) A brief overview of the importance of water in our world, (2) a history on how water has been represented in mapping, and (3) the strategy we are taking to represent water for science and resource management. This will be presented on February 19. Episode 2 is on Using GIS for Water Systems and will address (1) The context of hydrography in The National Map, (2) How water systems are represented in the National Hydrography Dataset and Watershed Boundary Dataset, and (3) Using GIS to consume this data. This will be presented approximately one month after Episode 1 on a date and time to be determined. Episode 3 is on The NHDPlus – Integrating the landscape and will cover (1) The added capabilities of NHDPlus, (2) the knowledge of the network, (3) the integration of terrain to produce catchments, and (4) the calculation of flow volume and velocity. It will be presented approximately one month after Episode 2 on a date and time to be determined. Episode 4 will be called Applications I – Use Case Studies in Solving Science and Resource Management Problems In Water. Episode 5, entitled Applications II will be a continuation of this topic. Both sessions will talk about applying the NHD, WBD, 3DEP, and NHDPlus to solving science and resource management problems in water. Episode 6 will be on Maintaining a Single National Data Set and Episode 7 will be on Emerging technologies, hydrography for the future, and the need for collaboration. Episodes 4, 5, 6, and 7 will also be spaced approximately one month apart.

For specifics on Episode 1, such as time, call-in number, and internet link, an email will be sent to readers of the NHD Newsletter with more information as soon as possible.

Forming Teams to Continue to Move the NHD Forward

Last month's NHD Newsletter discussed four initiatives being taken by the NHD Management Team to continue to move the NHD forward. These initiatives deal with (1) Assessing the current NHD data model for improvements that can be made, (2) Assessing the current NHD/WBD data stewardship program for improvement that can be made, (3) Completing a policy on hydrographic classification, and (4) Developing a multi-faceted data generalization capability. Each initiative will be studied by a team of subject matter experts. The leaders of these teams have been chosen and you are welcome to participate in these teams. The data model team will be led by Al Rea, contact ahrea@usgs.gov. The stewardship team will be led by Steve Aichele, contact saichele@usgs.gov. The hydrographic classification team will be led by Keven Roth, contact [kroth@usgs.gov](mailto:kr Roth@usgs.gov). The generalization team will be led by Pete Steeves, contact psteeves@usgs.gov.

Building a National Water Information System (NWIS) Drainage Area Database - by Karen Hanson and Curtis Price

For over a century, the U.S. Geological Survey (USGS) has measured water properties at stream gages. A gage's upstream drainage area is fundamental to explaining physical processes responsible for the conditions measured at the gage. Gage drainage areas have been estimated over the years using many different methods as the gage sites have been established over time. Many gages have a long period of record, and their drainage areas were determined prior to the availability of 7.5 minute quad maps. The drainage boundary is also important, as landscape characteristics in addition to area can also be critical in understanding data collected at the site and in developing "regionalization" models that predict flow and

water quality at ungauged sites. To date there has been no National program or database to store or distribute watershed boundaries for USGS stream gage sites.

For the past three and a half years the National Water Information System (NWIS) Drainage Area Workgroup members, comprised of 17 USGS representatives from the Office of Surface Water, Office Water Information, and NGP, have been consulting, evaluating and developing a methodology and data structure for creation of a high resolution national digital layer of NWIS gage drainage area boundaries. They have determined that the optimum approach to maintaining and distributing these data is to add USGS gage drainage area polygons and boundaries to the Watershed Boundary Dataset component of The National Map.

A pilot project is currently underway to develop gage drainage areas for a subset of high-value gages. This pilot uses a newly-developed automated approach which utilizes NHDPlus-derived datasets to delineate the boundary near the gage, and WBD geometry and "ToHUC" flow attribute to construct the rest of the contributing drainage area polygon. The resulting drainage area polygon conforms to the existing, reviewed WBD boundaries. Once this polygon is constructed, its area is calculated. The results of the process are being evaluated and validated with the assistance of 17 USGS Water Science Centers.

This spring, an initial load of over 4,000 sites will be hosted within the NHD Geodatabase WBD Feature Dataset, in four new feature classes that have been added to the WBD data model: NWISBoundary, NWISDrainageArea, NonContributingDrainageBoundary, and NoncontributingDrainageArea.

These consistent, best available scale drainage area boundaries and values built with a uniform approach from seamless National Map data layers (NHD/WBD, NED) and derivative datasets (NHDPlus) will be an enormous benefit to users of USGS gage data.

Status of NHD Update tool for ArcGIS 10.2.2 by Paul Kimsey

Software development for the NHD Update tool v6.2 for ArcGIS 10.2.2 continued through the end of the first quarter (October –December 2014). In January a decision was made to branch the code and not include new functionality for repairing the NHDReachCrossreference and NHDReachCodeMaintenance tables and reach partitioning. This new development turned out to be a much larger undertaking than originally estimated and was delaying the release of the NHD Update tool. The aforementioned functionality will be included in a future release.

Final testing of the v6.2 NHD Update tool is currently underway and the goal will be to release the tool to the external community by the end of the second quarter (March 31). The new version will include the ability to checkout new ArcGIS 10.1 jobs while still submitting previously checked out ArcGIS 9.3.1 jobs, and work with Esri File geodatabase. The development also addresses compression failures on submittal of jobs to USGS, runs new spatial checks in the QC suite and addressed various bugs identified through the use of the NHD Update tool v6.1. For any questions about the tool please contact Paul Kimsey (pjkimsey@usgs.gov) for further information.

Status of the GeoConflation re-implementation by David Anderson

The NHD GeoConflation tool development has been working through many major changes over the past year. The tool has been ported completely away from the use of ArcInfo Arc Macro Language (AML) scripts and has been reorganized to provide more user friendly interaction, especially with the queued edit and reviewer portion of the tool. The development team working on this project over the past year has converted several thousands of lines of AML scripts into comprehensive ArcObjects and Geoprocessing scripts that will preserve the effectiveness of the product.

In-house testing was completed December 30, 2014 and user acceptance testing was held January 7 through January 21, 2015. The results of the two testing periods lead the USGS to believe that a release of a very viable re-implementation is very close at hand. Currently, the USGS is resolving some issues found during the user acceptance testing period and rewriting documentation needed for the new tool. Upon final completion of these items the tool will be released to the conflation community and training sessions will be held monthly.

Announcements for the release of the tools, training sessions, and distribution will be on the MyUSGS Hydrographic Data Community (HDC). To log-in to MyUSGS go to <http://my.usgs.gov/confluence>. You must have a MyUSGS account in order to log-in. If you have any questions about the tool, the Hydrographic Data Community, or the training, please contact David Anderson (danderson@usgs.gov or nhd-gct@usgs.gov) for further information.

WBD Status Report by Stephen Daw

Over the months of December and January we have been working diligently to get all of the ToHuc updates into the WBD as well as fix some topological errors and missing lines around the Great Lakes. These updates are complete and into the WBD so that the February National Seamless extract will be the best extract so far. We are also hoping that the many Alaska updates to the WBD are also included in the National Seamless in the near future. We are working with the USGS Data Management group to get Alaska updated as soon as possible. The Alaska updates will include the first 14-digit HU's added to the WBD. Work continues on the WBD ArcGIS 10.2 edit tools. Builds have been tested and worked on throughout December and January. The latest build is looking very good. We hope to release the new tools in Q2 (ending March 31). Also on the horizon for FY15 is an ArcGIS 10.3 build of the WBD edit tools. Please feel free to contact Stephen Daw with any comments or questions (sgdaw@usgs.gov), phone 303-202-4418.

NHD Status in Stewardship Region 3 - Part 2 by Joel Skalet

The National Hydrography Dataset (NHD) Stewardship Region 3 consists of 17 states including Minnesota, Iowa, Wisconsin, Illinois, Indiana, Michigan, Ohio, Kentucky, Pennsylvania, New York, New Jersey, Massachusetts, Rhode Island, Connecticut, Vermont, New Hampshire, and Maine. Also there are several US Forest Service sub-stewardship activities occurring in many of the states. Many different forms of stewardship exist in this region and more information will come in future newsletters. Information here has been provided mostly by individual State Stewards.

Kentucky: The USGS recently awarded a grant for a third (and final) round of the NHD – Kentucky Karst Atlas Integration project. GIS data for the karst atlas (including data not yet incorporated into the layer on the GIS Portal) has been made available. Since last fall, the new LiDAR derived DEM data has been used when updating HU-8 subbasin delineations. This allows Kentucky to have up-to-date lake shorelines and stream channels with sufficient detail to locate culvert pipes. It also determines when features no longer exist. Delineating stream channels which pass through culvert pipes is needed if Kentucky Department of Water elects to pursue the construction of a new HU-14 watershed layer.

Since fall of 2011 Kentucky has been auditing the Geographic Names Information System names and IDs of each of the HU-8 subbasins. The audit involves comparing the NHD to the most recent GNIS data available at the time the basin in question was checked out for editing. The primary goal is finding unnamed NHD features which have a corresponding GNIS record and assigning the correct name as well as finding discrepancies between the NHD and the GNIS, such as GNIS ID and name being assigned to the wrong headwaters stream segment. The secondary goal is to find any issues with the GNIS, itself

such as duplicate records, records which appear to overlap, etc. and report these issues to the US Board of Geographic Names (BGN) for review.

Wisconsin: The Wisconsin Department of Natural Resources, which addresses water issues for the state, is not at a point to be actively involved in Stewardship, however the US Forest Service has been involved in editor training and plans to edit data within the USFS boundaries. The hope is that by the end of FY15 that WDNR will be able to put some decisions in front of management personnel and the leadership to move forward with NHD Stewardship. Potential resources might be made available at that time to begin formal Stewardship.

Currently the Wisconsin DNR (State Steward) and Chequamegon Nicolet National Forest (USFS) are working on an agreement in the form of a letter from the USFS to the DNR that states the terms of the agreement for NHD editing by the USFS. The USFS and USGS will establish a formal agreement/Memorandum Of Understanding that covers USFS participation as a 'sub-steward' of NHD. The USFS will begin editing data in a select area soon, and will share the proposed edits with the DNR before submitting the 'NHD job' (subbasin check out) back to the USGS. This will put to practice good communication plans. The DNR, USFS, and USGS will share developments concerning NHD stewardship and related data activities as they occur and are important to promote good communication about NHD editing and stewardship

Ohio: A new Memorandum Of Understanding is expected to be approved and ready for signatures before the end of the year. The formal Ohio partners will be:

- Ohio Geographically Referenced Information Program (OGRIP),
- Office of Information Technology (OIT),
- Ohio Department of Administrative Services (DAS).

State-level experts and technical resources will be primarily from:

- Ohio Environmental Protection Agency (OEPA)
- Ohio Department of Natural Resources (ODNR) in support to DAS.

The current goal will be for data to be maintained and improved by sub-stewards at the county level. Clermont County has begun NHD training. Other local, county, district, and regional groups will be encouraged to consider NHD stewardship, under review by state experts at OEPA and ODNR.

Since Ohio has good statewide lidar, much like Indiana, they are also looking at the Indiana activity to use lidar to update NHD. The new National Hydrography Requirements and Benefits Study (HRBS) should give valuable information for the future of NHD in Ohio.

Illinois: A recent project was started and completed in Illinois involving names in the NHD and the Geographic Names Information System (GNIS). This project was completed by a new student trainee (Physical Scientist) within the Illinois Water Science Center. They completed NHD stewardship training and the first assignment is to check on the names that were not consistent between NHD and GNIS.

Extensive updates were made to GNIS_ID and GNIS_Name attributes across Illinois. Existing NHDWaterbody and NHDFlowline GNIS_IDs in the NHD were compared with the complete GNIS ID list for the state of Illinois. Hundreds of stream, canal, lake, swamp, and reservoir names in the GNIS that did not yet exist in the NHD were identified. Where appropriate, these names and IDs were added to the proper features in the NHD. In total, 154 names and IDs were added to NHDFlowline features and 215 were added to NHDWaterbody features.

NHD Stewardship in Florida by Edwin Abbey

The editing team submitted 181,634 edits to the national database for features in Florida from April through September 2014. Editing took place in priority WBIDs (Water Body IDs) as provided by the Department of Environmental Protection (DEP) Watershed Assessment Section. In 2013, it was noted that the NHD database for Florida was lacking many named bay features. During April 2014 – September 2014, hundreds of bays were added to the NHD database. The Florida NHD Stewardship team is made up of Jeneane Carter (QA manager and editor), Jon Labie (editor), Maria Rivera (editor), Param Maharaj (editor) and Edwin Abbey (Project Manager).

Several outreach opportunities occurred between April and September 2014. Most of them were inquiries from within DEP. Notable examples are: (1) The NHD team solicited feedback from the State's Watershed Assessment Section to help guide decisions as to where to focus our editing efforts to be the most beneficial to end users. (2) The Southwest Florida Water Management District (SWFWMD) has a field biologist wanting to share GPS and other local knowledge gained from a Canoe Pathways project he is working on. This invaluable data can be incorporated into the NHD resulting in highly accurate delineation of water features providing modelers and cartographers alike a better experience with the database. (3) A representative from Alachua County provided local level surface water GIS data that the stewardship team can use as a reference to update the NHD in the near future. This local, on the ground knowledge helps refine the NHD and make it that much better for the end user. (4) The NHD team was contacted by the Office of Water Policy to assist with the use of the NHD in creating a database of their Minimum Flow Level (MFL) Lakes that occur within existing TMDL basins. Prior to this, the MFL data did not have a spatial component. Charts and tables were used to try to convey the representation of the lakes within the project. Now, with GIS, bridging the attribute tables with a shape that can be displayed on the screen provides a multitude of opportunities in management and representation of the project. (5) The NHD team provided the Division of Water Resource Management's Beaches, Mines and ERP Support Program's GIS team with custom code developed by the stewardship team to be modified for their own use. The code (WebMapper) obtains the coordinates of a point clicked within ArcMap and launches the default web browser pointed to a site that displays the coordinates in Google Maps, Bing Maps and Google Street View. The sharing of this script also led to the sharing of ideas and the eventual development of another GIS tool that, upon a click of a button on the ArcGIS map document, would provide an identification of a feature from a pre-determined data layer residing on the server without having to add and maintain that layer in the map's table of contents.

Go with the flow: See all 250,000 rivers in the US from news scientist.com

TWO hundred and fifty thousand rivers run through it. Usually when we run photos like this they depict the [wiring of the brain](#), but this, while bigger in absolute terms and smaller in complexity, is no less beautiful: it shows all the rivers in the US, coloured according to direction of flow (see <http://www.news scientist.com/embedded/us-river-flow>)

Andrew Hill of data-visualization outfit Vizzuality used the CartoDB platform and the National Hydrography Dataset, put out by the US Geological Survey, to create this amazing map. He says it was actually quite quick to make ([for details, see bit.ly/WaterMaps](#)).

The Network Value Added Attribute of the Month

Do you know your VAA's? This NHD Newsletter article is the twelfth in a series to describe each of the Network Value Added Attributes. The flow network embedded in the NHD is what gives the NHD its analytic power. The Network VAA's boost this power by pre-calculating a number of network

characteristics to make network analysis richer and easier to exploit. This month will examine FromNode and ToNode.

The flow network geometry of the NHD is made up of a series of connecting lines. The endpoints of these lines are marked with nodes that are given unique identifiers. The node at the top, or upstream, end of the line is called the FromNode. The node at the bottom, or downstream, end of the line is the ToNode. Also, when NHDPlus contains a "non-geometric connection" in the Plusflow table, the Tonode of the From-feature is equal to the Fromnode of the to-features -- even though the endpoints don't touch. If the line has no flow direction, the FromNode and ToNode are not assigned. Having these nodes makes it possible to construct a table of nodes for virtual network navigation. In this case, the ToNode of the upstream line would be paired with the FromNode of the downstream line. These relationships can be one-to-one, many-to-one – as in the case of convergences, and one-to-many – as in the case of divergences, and many-to-many – as in the case of convergences and divergences at the same node.

NHD Photo of the Month

This month's photo can be found at <https://www.flickr.com/photos/usgeologicalsurvey/15241108307/>. This beautiful display of surface water are the Falling Spring Falls in Falling Spring Falls Park, Virginia. Photo credit: Alan Cressler. Submit your photo for the NHD Photo of the Month by sending it to jdsimley@usgs.gov.

December Hydrography Quiz / New January Quiz

Linda Davis was the first to correctly guess the December NHD quiz with a drainage area of 334 square miles. This is easily determined using StreamStats. See <ftp://nhdftp.usgs.gov/Quiz/Hydrography113.jpg>. Linda is the NHD contact (with Danielle Favreau) for the state of Idaho. She has been working with Northwest hydrography data since the early 1990's. Linda is currently the GIS manager at the Idaho Department of Water Resources. She works with the streamstats application because it is used in the department by a variety of bureaus. The dam safety folks and the people in water management like the ability to create a watershed on the fly as well as the statistics that are given by streamstats.

Others with the correct answer (in order received) were: Evan Hammer, Barb Rosenbaum, Laurie Morgan, Marc Weber, Joanna Wood, Richard Patton, Kitty Kolb, David Straub, Calvin Meyer, Jenny Lanning-Rush, Matt Rehwald, John Kosovich, and Mark Mastin.

This month's hydrography quiz can be found at <ftp://nhdftp.usgs.gov/Quiz/Hydrography114.jpg>. It is a location on "Old Man River." Send your guess to jdsimley@usgs.gov.

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The NHD Newsletter is published monthly. Get on the mailing list by contacting jdsimley@usgs.gov.

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Jeff Simley, USGS, assumes full responsibility for the content of this newsletter.