USGS National Hydrography Dataset Newsletter
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by Jeff Simley, USGS

Stream Order Calculated for all Washington Waters by Anita Stohr

Strahler Stream Order is now an attribute on the high resolution 1:24,000-scale National Hydrography Dataset (NHD) for Washington State. This attribute is part of the NHD data model, but has been unpopulated for many years. Strahler Stream Order is a numerical measure of branching complexity commonly used as a surrogate for stream size and is also important in stream habitat analysis. In Washington, stream order ranges from a value of 1 (for the very smallest streams) to 10 (for the Columbia River). Some features like pipelines, coastline, or canal/ditches that should not participate in Stream Order will have a value of 0 or null. See ftp://nhdftp.usgs.gov/Hydro_Images/Fig4_strahler.pdf

There are a wide range of water management needs in Washington. Stream Order allows some users to display very small streams (such as those important to county government, headwater streams with intermittent flow, or those added through LiDAR), or to ignore them and look at just larger streams (if they are a State or federal agency doing analysis over a larger section of the state, or need the flexibility to target a certain number of stream miles in a watershed). Map applications are taking advantage of stream order to display more or fewer streams depending on zoom level.

The following are example screen shots of the Snake River drainage, the first using Stream Order to symbolize the layer. See ftp://nhdftp.usgs.gov/Hydro_Images/Fig1_w_streamorder_symbols.pdf and the second using the traditional FType field. ftp://nhdftp.usgs.gov/Hydro_Images/Fig2_w_ftype_symbols.pdf. The file ftp://nhdftp.usgs.gov/Hydro_Images/Fig3_WA_w_streamorder_symbols.pdf shows the entire state.

Strahler is not a perfect system for stream size. Areas with a denser network of stream lines will generate different stream orders than will a less dense network. Density independent values based on stream flow are available on 1:100,000 NHDPlus data, but are likely years away for high resolution data. Most HUC8 subbasins in Washington have a pour point with a stream order of 7 or 8.

Stream Order is stored in the value added attribute table NHDFlowlineVAA and is related to the NHDFlowline feature class by the common field Permanent_Identifier. It is generated from the NHDFlow table using python/SQL coding originally generated by Jay Stevens (BLM) to work against Oregon's Oracle database. Washington Department of Ecology staff re-wrote the code to work in its Microsoft SQL environment.

Next steps: The completed statewide NHDflowlineVAA has been provided to the USGS. It is planned to soon have that bulk loaded to the National Database, so that new extractions come with this newly created stream order data. Stream order maintenance can then be done when subbasins are checked out for edit. Washington also hopes to share code though USGS using a process that minimizes impact to state staff.

For more information, contact Anita Stohr at asto461@ecy,wa.gov.

May Status Report for the Network Improvement Project by David Kraemer

Region 7 was completed in May. The team is now working in Regions: 2, 3, and 4 (Eastern Seaboard and Great Lakes). Current issues: (1) Have put on hold all sub-basins along the northern border where the border is a 2-D feature, because both Canada and the United States have compiled overlapping polygons for these features. Once the Canadian hydrography has been moved to a different feature class those sub-

basins will be edited. (2) NHD Tool does not yet have available a "line to polygon" masking function; so are manually adjusting the coast line to the ocean polygon. (3) The NHD Stewardship page does not allow check-outs of adjoining sub-basins if those sub-basins are in different sub-regions. So the team has been unable to check the network connections between sub-regions. (4) The NHD Stewardship page is unable to extract the Lake Michigan sub-basin for editing. (5) Parts of Chesapeake Bay and Long Island Sound estuaries were missing and/or didn't match the coast line. Parts of the barrier island for Cape Lookout were missing. All of these coastal features will be fixed once the data becomes available.

The NHD as a Framework for Analyzing Surface Water Interactions - Idaho Diversions Pilot Project by Danielle Favreau

Over the last several years, it has become important to understand where water is being withdrawn, transferred, and consumed, as well as where it is returning to the system, known as return flows. These diversions are important in providing water for crops, drinking water, and aquifer recharge, and return flows affect water quality, recreation and fisheries. In an effort to better understand these relationships and improve the National Hydrography Dataset (NHD) representation of diversions, the U. S. Geological Survey (USGS) conducted a pilot project in Idaho with the Idaho Department of Water Resources (IDWR). The pilot project examined diversions for a selected area and an analyzed how they may be identified within the NHD.

The State of Idaho, U.S.A. has over 3.4 million acres of land that are irrigated with surface water diversions. With over 95,000 miles of streams and 15,000 miles of canals in Idaho, as well as numerous dams, reservoirs, pipelines and flumes, the water delivery system is complex and extensive.[i] The Milner-Gooding Canal in south-central Idaho has an initial capacity of 2,700 cubic feet per second and furnishes full water supply to 20,000 acres and supplemental supply for 78,667 acres.[ii] The area served by the Milner-Gooding Canal System was selected as the pilot project area.

The NHD depicts how water moves across the landscape and can be used to illustrate and model water interactions. The NHD can represent both natural and man-made features. This includes the location of a water withdrawal from the natural drainage system, the point(s) of delivery for the withdrawn water and in some cases where a portion of the diverted water is returned to a natural drainage system after use.

The NHD linework of the area served by the Milner-Gooding Canal system was overlaid on National Agriculture Imagery program (NAIP) 1 meter imagery. Using the imagery, lateral names, and local knowledge of the system, three types of diversion actions were identified: withdrawing, receiving and returning. A location where a canal or lateral diverted from a natural source or split into a lateral was considered a point of withdrawal. If water is added to the network or landscape, it was a point of receiving. A point of return is where water reaches a groundwater or surface-water source after release from the point of use and thus becomes available for further use.

Withdrawing, receiving, and return locations were successfully identified using this methodology. Project challenges included defining the terms withdrawing, receiving, and return, differentiating between a receiving vs. returning location, and determining where a lateral actually terminates. As use of the NHD has expanded, the need for the NHD Model to indicate where water is returning to a natural system or where it is being consumed has become more pronounced. The challenges encountered during this project have provided discussion points for NHD Model adjustments.

For more information, contact Danielle Favreau at Danielle.favreau@idwr.idaho.gov.

Alaska Hydro Image Integration – by Tony Litschewski

The USGS began the Alaska Hydro Image Integration project in Fiscal Year 2013 as an extension of the ongoing image integration project for the rest of the U.S. The goal of the project is to locate and resolve major errors in the Alaska NHD in preparation for production of the USGS's new series of digital topographic maps, the USTopo. The NHD is being reviewed against the most current SPOT imagery and updated using the following specifications:

(1) Realign (2-D) streams/rivers that are greater than 100' wide when the position of the banks have moved more than 750'
(2) Add new lake/ponds 400,000 sq. meters or larger
(3) Modify position of lake/ponds that are larger than 1.0 sq. km, that do not have an elevation value, if the shorelines are off more than 350'
~~(4)~~ Add new area of complex channels if total width of area is greater than 100'. For the most part, existing areas of complex channels will remain unchanged since partners with local knowledge have provided this compilation.

For Fiscal Year 2013, there are 412 1:25,000-scale USTopo cells which will have the NHD updated and used in the USTopo. A multi-year, statewide program will eventually result in updates to over 11,000 cells. Coordination with state partners through communication with the NHD Point of Contact for Alaska Hank Nelson, and USGS NSDI Partnership Liaison Rebecca Anderson has been critical in helping prioritize the workload and take advantage of partner updates. Goals for Fiscal Year 2014 include updating the extent of the ice mass features using the Randolph Glacier Inventory (RGI) as an authoritative source.

Recognizing that updating the NHD for the entire state of Alaska might be a daunting task, the USGS began investigating ways to improve production efficiencies and take advantage of breakline data being delivered as part of the IfSAR data acquisition. Dr. Kristina Yamamoto and Tony Litschewski designed, developed, and implemented an ArcMap model which uses NHD and breakline data to automatically search for the first three update specifications listed above. Use of this model essentially fully automates the inspection process and allows an editor to drive to areas in the NHD identified as having changed. The new workflow and use of this model has proven to save a substantial amount of production time. Other production teams have taken notice of the usefulness of the model and are currently investigating tailoring the model for use in their projects.

For more information, please contact Tony Litschewski at aalitschewski@usgs.gov, or 303-202-4292

USGS Hydrography Grants by Steve Aichele

During Fiscal Year 2013, The National Geospatial Program supported eighteen NHD and WBD projects across the country with almost $800,000 in grants. These projects focused on building stewardship; increasing the value of the NHD and WBD to users with improved attribution and improved feature content, particularly engineered features; and continuing to explore methods for extracting hydrographic features from LiDAR and IfSAR data. Each month the NHD Newsletter will examine two of the grants:

Several states have made significant steps toward adopting the NHD. In Oregon, after adopting the NHD as the state hydrography model, a series of projects are actively migrating data from agency databases to the NHD. The Oregon Department of Fish and Wildlife will migrate approximately 23,000 Fish Habitat Database (FHD) events and complete migration of 30,000 Fish Passage Barrier (FPB) events to the NHD. These will complement their migration of stream segments as Whole Stream Routes (WSR) as linear events. These three datasets, the FHD, the FPB, and the WSR, are critical to ODFW's management of fishery resources, as well as Oregon Water Resources Department's management of water rights and

points of diversion. These migration efforts will significantly increase use of the NHD in Oregon and make the NHD a critical element of water management in Oregon. Oregon Department of Geology and Mining (DOGAMI) will conflate its LiDAR-derived local-resolution hydrography to the NHD data model. This project introduces DOGAMI to the NHD editing process, and will allow DOGAMI to move toward fully adopting NHD for all its hydrography needs. The Oregon Department of Environmental Quality will be piloting migration of water quality, drinking water protection, and permitting sites from a Latitude/Longitude based system referencing 1:100,000 scale hydrography to high-resolution NHD events. This change will facilitate both TMDL modeling by DEQ staff and data transferability with other agencies. The pilot effort will happen in the Mid-Coast basin, and includes developing a protocol to apply statewide.

Rhode Island is commencing a local-resolution stewardship program, based on recent ortho and LiDAR collections. The University of Rhode Island (URI) and Rhode Island Department of Environmental Management (RIDEM) will be developing local resolution NHD from their 2011 LiDAR and orthoimagery. This effort initiates Rhode Island's stewardship activity and, in addition to improved data in the Blackstone River Watershed, will produce a report documenting the methodology for completing the effort statewide.

NHD Update Tool v6.0.1 for ArcGIS 10.1

The new NHD Update tool version 6.0.1 to work on ArcGIS 10.1 remains in development. New on-line documentation will be available through the NHD stewardship web site and through the NHD Update toolbar. For more information, contact Paul Kimsey at pjkismsey@usgs.gov.

Downloads of NHD Data from the USGS in April

During April there were 3,255 downloads of state-based high resolution NHD and 225 medium resolution downloads using file geodatabase. There were 1,914 subregion-based high resolution downloads and 128 medium resolution downloads for file based. There were 213 high resolution subregion and 28 medium resolution subregion downloads for personal geodatabase. That's a total of 5,763 datasets downloaded by FTP download. To give an idea of the geography this represents, it is the equivalent of over 4,330,000 quadrangles of coverage, all in a single month. Also during the period there were 2,996 downloads from The National Map viewer, with 2,342 by rectangle extracts of various sizes and 654 by subbasin or county. That brings the download total to 8,759 or April.

NHD Photo of the Month

This month's photo features Maroon Lake and the Maroon Bells located near Aspen, Colorado. It was submitted by Matthew Hoagberg. To see the photo of the month go to ftp://nhdftp.usgs.gov/Hydro_Images/Maroon_Lake.jpeg. 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.

April Hydrography Quiz / New May Quiz

Becca Conklin of the Washington State Department of Ecology was the first to guess the April NHD Quiz as Moosehead Lake in Maine. See ftp://nhdftp.usgs.gov/Quiz/Hydrography93.jpg Becca is the Surface Water Quality Standards coordinator for Washington State's Department of Ecology. She primarily coordinates policy and rule development, but does a bit peripheral GIS work coordinating with the agency staff to be sure the Standards are being displayed accurately during the transfer to NHD. Although Becca now lives in the beautiful Pacific Northwest, she is a native New Englander and recognized the lake.

Others with the correct answer (in order received) were: Al Rea, Jim Sherwood, Evan Hammer, Tom Denslinger, Dan Button, John Lynam, Dave Straub, Michael Smith, Richard Patton, Matt Rehwald, Florence Thompson, Claire DeVaughan, Joanna Wood, Roger Barlow, Steve Shivers, Ken Koch, Janet Brewster, and Dennis Dempsey.

This month's hydrography quiz can be found at ftp://nhdftp.usgs.gov/Quiz/Hydrography94.jpg . What is the name of this large lake that measures 349 square kilometers impounded behind a dam (the thick red line is actually coded as non-earthen shoreline). This is not too far from the Atlantic Ocean. The green polygons are more likely to be called a swamp rather than a marsh. Send your guess to jdsimley@usgs.gov.

Thanks to Anita Stohr, David Kraemer, Danielle Favreau, Tony Litschewski, Steve Aichele, and Kathy Isham.
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.

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[i] http://www.idwr.idaho.gov/waterboard/WaterPlanning/PDFs/2010_Resource-Inventory.pdf

[ii] http://www.idwr.idaho.gov/waterboard/WaterPlanning/CAMP/ESPA/