USGS National Hydrography Dataset Newsletter
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by Jeff Simley, USGS

Building the High Resolution Coverage

Work on integrating hydrography sources and building the high resolution National Hydrography Dataset for the United States is moving steadily forward. Of the 2,263 subbasins covering the nation, 1,713, or 76%, are now available. An additional 215, or 9%, are currently in-work. This leaves 335, or 15%, yet to enter work. An additional important measure of progress is the number higher level hydrologic units that are complete, giving users larger sections of the landscape to model. The nation is subdivided into 21 hydrologic regions. Of these, four are complete; Region 12 – Texas-Gulf, Region 14 – Upper Colorado, Region 20 – Hawaii, and Region 21 – Caribbean. Additionally, Region 13 – Rio Grande, has one subbasin remaining. These regions are then subdivided into 220 hydrologic subregions, of which 94, or 43%, are complete. However, an additional 45 subregions need just one or two more subbasins to become complete.

Selected NHD Papers from the ESRI User Conference

National Application of New England SPARROW Catchment Delineation Method – Al Rea presenting for Richard Moore, USGS:
SPARROW, or Spatially Referenced Regressions on Watershed Attributes, is a highly successful and popular GIS-based model used in a variety of studies, most notably Total Maximum Daily Load studies involving nitrogen and phosphorous. It began life using the RF1 database, a precursor to the NHD, has evolved using the NHD in what is known as the New England method, and is now being enhanced using NHDPlus. An important aspect of SPARROW is understanding how the chemicals on the landscape contribute to values found in the stream. This is done on a reach-by-reach basis by looking at the polygon on the landscape that locally drains into each individual reach. Thus, the landscape is subdivided into a continuous series of polygons organized by the reaches in the NHD network. To get these polygons, digital elevation data is used to calculate each mini-basin, known as a catchment. The elevation data is first enforced to flow into the NHD stream network and create divides according to the basin boundaries found in the Watershed Boundary Dataset. The New England approach somewhat exaggerates the terrain data with deepened trenches in the streams and heightened walls at the divides in order to create more well-defined characteristics for subsequent calculations. When compared to a variety of other techniques in various landscapes, this method consistently produces superior results. An effort is underway to use the approach to produce a national set of catchments based on the medium-resolution NHD. To date, 2,161,911 such catchments have been produced. These will become a companion product to the medium-resolution NHD, along with catchment attributes, hydrologic derivative grids and reach flow estimates. Contact Mr. Moore at rmoore@usgs.gov.

Covered by WATERS – Thomas Dewald, EPA:
WATERS is the Environmental Protection Agency's Watershed Assessment, Tracking, and Environmental ResultS system. It integrates EPA's water program data through linkages to the surface water drainage network represented by the NHD. EPA has done this in support of the Clean Water Act to make data about the nation's water available to scientists and the public. It can be accessed through http://www.epa.gov/waters/ and in the future will be available through new data exchange mechanisms and enterprise data architectures, greatly extending the availability and applications of these important data holdings. With AskWATERS, the public can ask a question about water quality and then receive an answer or report. WATERS provides access to 19 different water databases, although not all can be linked to the NHD. Most familiar of these databases are the Impaired and Assessed water databases, which are available as shapefiles including NHD linear addresses. WATERS provides a number of

services including maps, data downloads, documentation, tools, and reports. Coming soon are tools for Water Program Identify, Upstream/Downstream directions, and Total Waters. Also look for the NHDPlus in WATERS to provide pre-calculated network attributes to speed up analysis processing. Some of the applications of WATERS include showing the overlap between assessed waters and drinking water intakes, and effluent guidelines. Contact Mr. Dewald at Dewald.Tommy@epamail.epa.gov.

National Hydrography Dataset – Plus: Powerful Applications Made Affordable – Al Rea presenting for Cindy McKay, Horizon Systems Corporation:
The NHDPlus is an initiative by the Environmental Protection Agency to evolve the basic medium-resolution NHD framework into a more applications-ready database by updating the flow network and calculating additional attributes and related data files. This enhanced data will add to the power of the NHD by providing pre-calculated network characteristics that will speed up GIS analysis operations plus provide related data files on reach-catchment polygons and characteristics that can be used to calculate flow values. The result will allow the EPA, USGS, and many other users of the NHD to rise to yet another level of sophistication in modeling the hydrologic environment. To do this, the process will integrate the National Elevation Dataset and Watershed Boundary Dataset with the NHD to define and relate flow over the landscape with the NHD stream flow network. The NHDPlus will address: (1) An improved medium-resolution flow network, (2) A series of value-added attributes used in network calculations, (3) Reach based catchment polygons that can be used to collect surface data such as precipitation or fertilizers into the hydrologic network, (4) Catchment characteristics that help classify and define the nature of the catchment, (5) Flow direction and flow accumulation grids calculated off of the NED, (6) Node elevations that allow a z-dimension profile of the NHD, (6) Streamgage links that provide real-world inputs to modeling algorithms, and (7) Flow volume and velocity estimates that allow the building of a transport model. The value-added attributes will consist of two-dozen values categorized by analysis, navigation, and display capabilities. Analysis will include such things as stream order, total upstream miles, and distance to sink. Navigation will include the level-path for main channel routing. Display will provide a generalization key to allow smaller scale maps to be made for the base 1:100,000-scale database. Flow estimates will be based on the Unit Runoff Method and the Vogel Regression Method. Transport modeling will benefit greatly from the NHDPlus, allowing fate transport and dilution modeling, risk and vulnerability assessment, and estimation of spill impacts. One interesting example of how velocity estimates can be used to rectify the stream network density is to use a minimum flow volume, such as 2 cfs, to select streams for portrayal. This would provide a stream network of some consistent level of flow. Contact Ms. McKay at ldm@hscnet.com.

National Hydrography Dataset-Based RiverSpill – Bill Samuals presenting for Rakesh Bahadur, SAIC:
The RiverSpill time-of-travel spill model is being updated to use the NHDinGEO format. This initiative was started in 2000 to address drinking water security with ICWater - the Incident Command Tool for Protecting Drinking Water sponsored by the U.S. Forest Service and involving a number of other Federal agencies including the USGS and the EPA. The system is based on using mean flow volume and velocity attributes linked to NHD flowlines. USGS real-time stream flow gages indexed to the NHD will be used so that travel time and concentration is based on flow conditions at the time of the spill event. Public water supply intakes, water treatment sites, distribution systems, HazMat sites, dams, pipelines, bridges, and railroads are included with the NHD surface water network to build a complete GIS of relevant data. Both stand-alone and web-based versions are being developed. Contact Mr. Bahadur at bahadurr@saic.com.

Building a Repository to Share Hydrologic-Related Geospatial Data – Mark Olsen, MN Pollution Control Agency:
Minnesota's Pollution Control Agency and Land Management Information Center are working cooperatively with the USEPA to develop the systems and methodologies necessary to support hydrologic-related geospatial data flows via the National Environmental Information Exchange Network.

A common repository will be developed for features and activities (events) that are geographically referenced to Minnesota's 1:24,000-scale NHD data. The Exchange Network will be used as the mechanism for sharing these data, using an XML schema consistent with the FGDC's Hydrographic Data Content Standard. This system will also serve to manage updates and enhancements to Minnesota's 1:24,000 NHD data. This allows Minnesota to coordinate and consolidate updates through a single process and authority. Events can then be modified to ensure they are referenced to a consistent source. Finally, this system will serve as the mechanism through which local changes to the NHD are sent to USGS for integration into the national NHD repository. Contact Mr. Olsen at mark.olsen@pca.state.mn.us.

Answer to July Hydrography Quiz

Bruce Tuttle of the Idaho Department of Water Resources in Boise, Idaho retains his unofficial status as the nation's leading expert in identifying hydrographic features. Bruce correctly guessed the hydrography image attached to the July 2005 NHD Newsletter as being Yellowstone Lake in Yellowstone National Park, Wyoming. As in the previous month, Bruce replied with the correct answer within one hour after the NHD Newsletter was sent. Al Rea of the USGS in Boise, Idaho then replied a few minutes later with the correct answer. Yellowstone Lake is the largest natural freshwater lake in the United States that is above 7,000 feet and is one of the largest such lakes in the world. Geologists indicate that large volcanic eruptions have occurred here on an approximate interval of 600,000 years, the most recent of these was 600,000 years ago. Ash from this huge explosion, 1,000 times the size of Mt. St. Helens, has been found all across the continent. The magma chamber then collapsed, forming a large caldera filled partially by subsequent lava flows. Part of this caldera is the 136-square mile basin of Yellowstone Lake. The original lake was 200 ft. higher than the present-day lake. It is thought that Yellowstone Lake originally drained south into the Pacific Ocean via the Snake River. The lake currently drains north from its only outlet, the Yellowstone River. Mapping of the lake bottom has revealed a variety of faults, hot springs and craters. In a recent scientific report (Morgan et al., 2003), one feature was informally named the "inflated plain" by USGS researcher Lisa Morgan. In mapping the entire lake, she and her colleagues identified a region about 2,000 feet long that rises about 100 feet above the lake floor. Seismic images of the lake sediments in this area show that they were tilted, hinting that the region may have been pushed up or "inflated." The images appear to indicate that the uplift is associated with accumulation of gas from Yellowstone's hydrothermal (hot water) system.

Recent and Upcoming NHD Workshops and Papers

August 31, Lafayette, Louisiana – USGS Workshop,
http://www.rac.louisiana.edu/wrkshpwebpage/nhd/nhd.html, 8 hrs.
September 13, 14, 15, Sacramento, California – USGS Workshop, contact Carol Ostergren at costergren@usgs.gov. 8 hr. workshops on Sept. 13 and 15, 3 hr. manager overview on Sept. 14.
October 5, St.Cloud, Minnesota – Minnesota GIS/LIS Conference,
http://www.mngislis.org/conf2005/conf2005.htm
October 10-12, Kansas City, Missouri – URISA's 43rd Annual Conference,
http://www.urisa.org/Annual_Conference/annual.htm

Thanks to Tommy Dewald, and Terry Higgins.
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.