USGS National Hydrography Dataset Newsletter
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by Jeff Simley, USGS

The NHD in Water Resources IMPACT

The March issue of Water Resources IMPACT published by the American Water Resources Association is dedicated to the National Hydrography Dataset. The magazine contains six articles that demonstrate how the National Hydrography Dataset is used by scientists around the nation. Articles and principal authors include: Applications of the National Hydrography Dataset at the U.S. Environmental Protection Agency by Thomas G. Dewald, Using the NHD as a Tool for Fisheries GIS Data Evaluation and Management by Lidia Szabo Kraft, Utilization of the National Hydrography Dataset in the United States Forest Service by Brian Sanborn, The Upper Neuse Watershed Evaluation Tool: Putting the Power of the NHD to Work in Local Watersheds by Silvia E. Terziotti, and Using the NHD to Create an Arc Hydro Network for the St. Johns River Water Management District by Sandra Fox.

BLM Uses the NHD to Analyze Potential for Dams

The Bureau of Land Management is studying the electrical power generation capacity of 38 dams on its lands throughout the western United States. In order to determine the potential for power generation, a historical record of streamflow is needed. This streamflow record can be easily accessed from the National Water Information System at http://waterdata.usgs.gov/nwis/sw. But first, it is necessary to determine which streamgages apply to the dam in question. To do this, the BLM snapped the dam location to the NHDFlowline and navigated the network upstream and downstream. The navigation path was then cross-referenced with streamgage locations and the appropriate streamgages were identified for further analysis. The entire process for the 38 dams took three hours, including the downloading of data and setting up the GIS session. Traditionally the streamgage identification process would have taken a week using paper maps (assuming you had them), and a couple of days using visual analysis in a GIS.

The Importance of Change Management to the NHD

The National Hydrography Dataset is distinguished by several innovations that make it a cutting-edge GIS model. One of the most overlooked characteristics is the ability to handle change management. Anyone who has been around GIS databases for any length of time knows that eventually the data will have to be edited, often repeatedly, and that the cost of those edits is an unexpectedly high burden on resources. One of the biggest components of that burden is the cost incurred by failing to properly manage what has been edited. The founders of the NHD were well aware of this and so designed the NHD to include data management mechanisms that would help users and editors efficiently track the history of data edits. Since the NHD is intended to be a perpetual living database, and one that would by nature see frequent edits, change management was of paramount concern.

Change management occurs at two levels: one is behind the scenes using SDE data versioning, and the other is an explicit view of this process presented to the user. Basically, the NHD is designed to convert the behind the scenes record keeping to something the user can work with. Editing can take one of two basic forms: one is batch processing on the database to update the data with new attributes or incorporate model upgrades, and the other is the user-performed editing on their GIS. In either case, it is essential that the editing is taking advantage of change management to preserve and even enhance data integrity. The NHD Geo Edit tool now becoming available is critical to the integrity of the NHD because it performs the rigorous NHD change management process more or less automatically for the editor, freeing the editor to concentrate on the hydrography rather than the record keeping.

What people are saying about the NHD

"…thanks again for the excellent job you did at the workshop. I told the guys here how effortlessly you made the training seem when we were really covering some very complex ArcGIS geoprocessing tasks. I am still blown away by how much you guys have leveraged the functionality in the ESRI geodatabase and how you are able to distribute that to your customers. Quite honestly, that was the first time I've had access to good topological data to explore the geometric network and linear referencing tools. The data model you guys designed is also very impressive, especially the feature level metadata." – State GIS Manager

Answer to February Hydrography Quiz / March Quiz

Matt Heberger was the first to correctly guess last month's hydrography quiz as the Grand Canyon section of the Colorado River (see ftp://nhdftp.usgs.gov/Quiz/Hydrography9.pdf). Matt works in the water resources group at CDM of Cambridge, MA. CDM is a consulting, engineering, construction, and operations firm providing services to public and private clients worldwide. Matt performs hydrologic and hydraulic analyses, floodplain mapping, watershed modeling, and water supply planning. Others with the correct answer were James Seay, David Asbury, Dan Saul, Ellen Lesch, M. Butler, and Roger Anzzolin.

The Colorado River is the primary river of the American Southwest, draining somewhere in the vicinity of 242,000 square miles of land. The headwaters of the Colorado River are located in Rocky Mountain National Park in Colorado. The major tributary to the Colorado River is the Green River. Where the Colorado River enters the Grand Canyon at Lee's Ferry, its altitude is 3,110 feet, having dropped over one mile since its beginning. The river will drop another 2,200 feet before it reaches the other end of the Grand Canyon at Grand Wash Cliffs, 277 miles away. The river then flows southwestward toward the Gulf of California and the Pacific Ocean (the key word here is "toward"). The river contains alternating sections of rapids and calm sections. The depth of the river varies from 6 feet to 90 feet, with the average being about 20 feet. The rapids are the shallow sections and the calm sections tend to be the deepest parts. Some deep holes have also formed at the base or foot of some of the more major rapids. The rapids represent only 10 percent of the river's total length through the Grand Canyon, but are responsible for more than half of the total drop in altitude. Before construction of the Glen Canyon Dam above the Grand Canyon, the river would carry 500,000 tons of silt and sediment per day on average. That's the equivalent of a loaded railroad hopper car passing by every 17 seconds. The peak flow rate of the Colorado before construction of the dam would normally be around 85,000 cfs for the month of June. By examining river sediments, scientists have determined that on a number of occasions over the past 4,000 years, the river reached peak flow rates of over 250,000 cfs. The peak flow rate through the Grand Canyon after construction of the dam is normally around 30,000 cfs. Construction of the Glen Canyon Dam may have adversely affected the ecology of the Grand Canyon. Flash floods that would at one time scour the inner-canyon clean and deposit fresh sand along the beaches no longer occur. The water temperature, which used to get as warm as 80 degrees F, now averages around 42 degrees F. Because of the changes in the water temperature some of the native fish that used to inhabit the river have become extinct and still others are endangered. The Rainbow Trout, a non-native species which was introduced by man, thrives in the colder waters and makes it even more difficult for the native fishes to survive. See http://www.kaibab.org/misc/gc_coriv.htm.

The March quiz is located at ftp://nhdftp.usgs.gov/Quiz/Hydrography10.pdf. Can you identify where this is? We are looking at the medium-resolution NHD. There is a major hydrographic feature just to the north of this image. It has be left off otherwise it would be a giveaway. Send your guess to jdsimley@usgs.gov.

Upcoming NHD Workshops

Santa Barbara, California – April 4, 5 & 6, 2006. Contact Carol Ostergren at costergren@usgs.gov.
Manhattan, Kansas – April 6. Contact Ingrid Langraf at imlandgraf@usgs.gov
Salt Lake City, Utah – April 20, 2006. Limited to the U.S. Forest Service.
Austin, Texas – May 1, 2006. 16th Annual Texas GIS Forum. Contact Claire DeVaughan at cdevaugh@usgs.gov.
Rolla, Missouri – May, 2006. Contact Ray Fox at rfox@usgs.gov.
Houston, Texas – May 9, 2006. Various NHD papers. American Water Resources Association. See http://www.awra.org/meetings/Houston2006/index.html.
Morgantown, West Virginia – May 16, 2006. Contact Evan Fedorko at Evan.Fedorko@mail.wvu.edu.
Camp Hill, Pennsylvania – May 17, 2006. 2006 Pennsylvania GIS Conference. Demonstration. Contact David Terrell at dterrell@usgs.gov.
Trenton, New Jersey – May 19, 2006. Contact Roger Barlow at rbarlow@usgs.gov.
Coeur d' Alene, ID – Summer, 2006. Contact Frank Roberts at fmroberts@cdatribe-nsn.gov.
Salem and Portland, Oregon – Summer, 2006. Contact Nancy Tubbs at ntubbs@usgs.gov.
Olympia, Washington – Summer, 2006. Contact Sam Bardelson at stbardelson@usgs.gov.
San Diego, California – August 7-11, 2006. ESRI User Conference. Various NHD papers. http://www.esri.com/events/uc/.
New Mexico – September 11, 2006. Contact Gary Kress at gekress@usgs.gov.

Note: Between March and September 2006, classes in the NHD Geo Edit tool will be taught in Oregon, Washington, Connecticut, Delaware, New York, Minnesota, Florida, Pennsylvania, and Wyoming – Contact Carl Nelson at cwnelson@usgs.gov. Classes in Kansas, Nebraska, Utah, Idaho, Alaska, and Montana - contact Paul Kimsey at pjkimsey@usgs.gov. Classes in New Mexico, Texas, and Colorado - contact Bill Smith at wjsmith@usgs.gov. Classes in Arkansas - contact Tim Hines at thines@usgs.gov.

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