USGS National Hydrography Dataset Newsletter
Vol. 10, No. 2, December 2010
by Jeff Simley, USGS

LiDAR and the NHD by Keven Roth

LiDAR data is being used more frequently for hydrography. Potential users may be wondering if—and how much—LiDAR can improve their own work. There are a number of variables to consider, but from an overall perspective, the costs and benefits of LiDAR should be the deciding factors. LiDAR is not inexpensive, and in these budget-conscious times, it is relevant to ask if LiDAR will provide data that goes beyond other available data sets. In this respect, LiDAR can be useful at relatively larger scales where the accuracy of individual features is the primary concern. And LiDAR data has its own limitations. LiDAR is essentially a method for ascertaining elevations, not hydrology, per se, and the lower elevations of bowls or channels it identifies are not necessarily water bodies. LiDAR also has limitations, for example, in areas of heavy tree cover. It does not see through the trees, and consequently, the data for these areas must be calculated.

LiDAR-derived hydro is beginning to be added to the NHD. For example, New Jersey NHD was completely updated using LiDAR-derived data. Some smaller areas in Iowa, incorporated into the NHD also are based on LiDAR. Other states may also be using LiDAR data that has not been used for NHD development. Two come to mind. Tennessee is developing LiDAR data for the state, and North Carolina developed LiDAR data for western counties and is working on the user requirements for the rest of the state. So how does the LiDAR-derived NHD data compare to the high-resolution NHD which is based on the 24K maps?

The accuracy of the original 24K maps was based on the National Map Accuracy Standards (NMAS) which states that 90% of the features tested must be within 40 ft of the true ground position. NMAS only applies to “well-defined” points but it can still be a useful measure to compare the horizontal position of streams. LiDAR data for Iowa and New Jersey was “buffered” by 40 ft on either side of the NHDFlowline. The original 24K-based NHD data was “clipped” using this buffered distance and statistics were computed.

In New Jersey, the Rancocas Creek drainage area, which is in the west central part of the State, was evaluated. The original 24K NHD had 708 miles of NHDFlowlines. When the 24K NHDFlowlines were clipped using the 40ft buffer of the LiDAR data, there were 468 miles of NHDFlowlines or 66% of the total stream miles that were within 40 ft of the LiDAR-derived NHDFlowlines. A 50ft buffer included 548 miles of NHDFlowlines or 77% of the total stream miles that were within 50 ft of the LiDAR-derived NHDFlowlines. A visual check revealed that the portions of the original NHDFlowlines that were more than 40ft or 50ft from the buffered LiDAR-derived data represented short, meandering segments along the stream. Many of these channels were not visible on aerial photographs because of tree cover or lack of a distinct channel.

For the Iowa catchment, of 55 miles of flowlines, 48 miles are within 40 ft of the LiDAR data or 87%. All of the streams in the NHD exist in the LiDAR in basically the same place with the same connectivity; the main differences are where some of the older, original streams have actually been straightened and turned into "waterways". The LiDAR data has 138 miles of streams or about 2.5 times as many miles as the original data. All of the additional streams are classified as "ephemeral" and most are grassed waterways that are common in farmland in the Midwest.

In these two examples, the basic stream network in the 24K NHD matched the LiDAR-derived network very well. The New Jersey LiDAR data did improve representation of the smallest meanders and added

ditches, especially around cranberry bogs. In the Iowa data, the main difference was the addition of ephemeral, agricultural waterways. There is no doubt that LiDAR data can enhance the level of data, especially for modeling. However, this review indicated that LiDAR data added refinements in specific areas but tended to corroborate, rather than change, 24K-based NHD data. The question for potential LiDAR users will be whether it offers enough refinement to justify the added cost. As current LiDAR projects develop, and others come online, the answer to this question may be more substantive.

NHD Management Team Meeting

The NHD program is managed with input from a multi-agency steering committee known as the NHD Management Team. Members are Jeff Simley, USGS; Tommy Dewald, USEPA; Brian Sanborn, USFS, Dan Wickwire, BLM; Ricardo Lopez, New York City; and Mark Olsen, Minnesota. This team met in early December to discuss current operations and the future of the program. Assisting in the meeting was Karen Hanson from the WBD program, Paul Kimsey and Stephen Daw from the National Geospatial Technical Operations Center, and Keven Roth serving as a consultant. Based on a week of meetings and discussions, the following topics emerged as key to the continued success of the NHD and WBD:

Integrate the NHD and NED – utilize the integration work for USTopo for public distribution
Complete the NHD network - create a fully functioning, fully connected national river network
Increase web functionality – services for data delivery, navigation, events, catchment delineation
Centralize NHD/WBD – “one-stop shopping” for everything NHD and WBD related
National reach address database – a “one-stop shopping” for all events linked to the NHD
High resolution NHDPlus - first build Value Added Attributes for the nation, then more of NHDPlus
Stewardship – need to make more widespread and successful to ensure geometry and network integrity
Communication – the relentless pursuit of educating people about the NHD and WBD
NHDGeoEdit Tool – this is a critical resource that requires the upmost attention
LiDAR – need guidelines for hydrography
Flood Mapping – this is a significant national issue in which the NHD/WBD needs to play a bigger role

Projects for NHD and WBD

An outcome of the NHD Management Team meeting is to develop a slate of projects for the upcoming fiscal year starting next October. The following projects will be managed as part of the NHD and WBD programs. Those marked * are new projects.

Complete Network*	Focused effort to create full network
Generalization-Cartography	Implementation for cartography
Hydrography/Elevation Integration	Ensure integration meets mapping and science needs
Image Update Process	Ensure NHD is up-to-date with imagery
Maintain Update Process*	NHDGeoEdit Tools/Process Maintenance/Enhancement
Maintain WBD Tool*	Tool/Process Maintenance/Enhancement
NHD Gaz Integration	Functioning Names/NHD system
NHD Management	Supervisor and manager support
NHD/WBD Data Delivery	Dataset Download Management
Open Source Solutions	Explore alternative development methods
Stewardship	Community based data maintenance support
WBD Gaz Integration	Functioning Names/WBD system
WBD Leadership/Operations	Provide WBD program leadership and operation support

Communication*	Improve knowledge of NHD/WBD
Conflation Enhancement*	Modernize Tool/Process
Data Model Review	Continuous advancement of the NHD/Vector model
Delivery Services*	Develop highly capable web data delivery
Multi-Resolution Dataset	Implement a single dataset
NHD Standards	Refine Hydro standards and content to keep NHD relevant
NHD/WBD Canada/Mexico Integration	Complete building cross border HU's
Revamp NHD/WBD Web Site	NHD/WBD web site and continued maintenance
Simplified NHD*	Develop easier use of NHD in mapping and science
Stewardship Editing Support*	Support incoming edits (WET)
WBD Enhancements*	Coastal improvement, basin transfer codes, tools
Web Edit Tool Phase 2	Transfer the Alabama tool to national use
Content-Capability	Ensure NHD is capable of addressing user needs
Integrate Streamgages/Dams	Index and QC
LiDAR Best Practices for Hydrography	Develop guidance for hydro extraction
Long Term Editing Requirements*	Develop next generation edit tools
NHD/WBD Integration Enhancements*	Adding pour-points and navigation tables
Represent Major Water Diversions	Include and index water diversion systems
Generalization for Hydrology/Modeling*	Develop generalization to meet modeling needs
High Resolution NHDPlus*	Participate in community efforts to build Hi Res NHDPlus
Integrate National Wetlands Inventory*	Build data model then spatially integrate
Value Added Attributes*	Build specific VAA's to create better network functions
Application Services*	Create access and build services to function on NHD
ArcHydro River*	NHD/WBD influence on development
CUAHSI Hydro Information System*	Focus on use of hydro events
Integrate Other NWIS Data*	Integrate water quality stations
Water Census of the United States*	Work to geospatially enable the Water Census

USGS Reorganizes to Better Address Science Strategy

On October 1, 2010, the USGS realigned its organizational structure around the themes identified in the USGS Science Strategy http://www.usgs.gov/start_with_science/. In 2007, the USGS developed this science strategy outlining major natural-science issues facing the Nation and focusing on areas where natural science can make a substantial contribution to the well being of the Nation and the world. These areas include global climate change, water resources, natural hazards, energy and minerals, ecosystems, and data integration. To better address this strategy in an integrated manner, the USGS has transitioned from a discipline-based organization to a more issues-based organization as follows:

Ecosystems http://www.usgs.gov/ecosystems/
Climate & Land Use Change http://www.usgs.gov/climate_landuse/
Energy, Minerals & Environmental Health http://www.usgs.gov/resources_environhealth/
Natural Hazards http://www.usgs.gov/natural_hazards/
Water http://www.usgs.gov/water/
Science Quality and Integrity http://www.usgs.gov/quality_integrity/
Core Science Systems http://www.usgs.gov/core_science_systems/

The NHD and WBD are placed under The National Map component of the National Geospatial Program within Core Science Systems.

WBD Integration Status

The following is an updated integration schedule. Feel free to contact Stephen Daw at sgdaw@usgs.gov with questions or if you need clarification of a particular task.

Tasks	Estimated completion date
Reach Migration	January 28, 2011
• Final ReachCode Migrations	January 14, 2011
• Final fixes	January 28, 2011
WBD in NHD database refresh	January 14, 2010
WBD beta tools release	January 10, 2010
• Beta testing	January 2011
• Refinements/fixes	February 25, 2011
Check-in/Check-out process development and implementation	March 25, 2011
• In-house testing	February 2011
• Beta testing	March 2011
Final tools testing	April 29, 2011
• Full process testing w/ReachCode tools	April 2011
Tools training	June 24, 2011
• Training development	February 2011 – May 2011
• Training documentation creation	February 2011 – July 2011
• Scheduled training events	June 2011
Final load/Operations switch over	August 29, 2011
• WBD editing moratorium for submittal to NRCS	July 29, 2011
• Final database load	August 1 – August 22, 2011
• Final testing	August 22 – August 26, 2011
• *USGS WBD Stewardship operations begin*	*August 29, 2011*

The latest version of the WBD is: WBDHU12_01Dec2010_ArcGIS9.2_File.gdb.zip and this file can be found at: ftp://gateway2.ftw.nrcs.usda.gov/Gateway/WBD/

NHD Photo of the Month

This month's photo was submitted by Stephen Daw, the USGS point of contact for stewardship of the Watershed Boundary Dataset. The photo shows an unnamed intermittent stream flowing into Wheeler Lake, which itself drains into the Middle Fork of the South Platte River near Alma, Colorado. To see the photo of the month go to ftp://nhdftp.usgs.gov/Hydro_Images/WheelerLake_Intermittent.jpg . Submit your photo for the NHD Photo of the Month by sending it to krisham@usgs.gov.

November Hydrography Quiz / New December Quiz

Bryan Anderson of ATA Services in Denver, Colorado was the first to correctly guess the November hydrography quiz as the west end of Long Island Sound just east of New York City. See ftp://nhdftp.usgs.gov/Quiz/Hydrography64.pdf. Bryan has worked at the U.S. Geological Survey's National Geospatial Technical Operations Center since 2005 as the Task Lead for ATA Services, the contractor that provides many excellent developers to the USGS. His primary responsibility includes managing the Oracle databases and ArcSDE instances for the National Hydrography Dataset as well as other spatial datasets, including The National Map. He has been married to his wife Holly for 18 years and has a 12-year old son Evan. He loves the outdoors and enjoys trail running, skiing, mountain

climbing, and mountain biking where he has finished the Leadville 100 (that's 100 up and down miles at 10,000 feet altitude) for the past 6 years in a row.

Others with the correct answer were (in order received): Joanna Wood, Steve Shivers, Joe North, Dave Hockman-Wert, Linda Davis, Ken Koch, Gerry Daumiller, David Straub, Seth Hackman, Tom Denslinger, Mike Eberle, Jim McDonald, Richard Patton, John Kosovich, Nancy McWhorter, Roger Barlow, Tom Christy, and Harry Spanglet.

This month's hydrography quiz can be found at ftp://nhdftp.usgs.gov/Quiz/Hydrography65.pdf. This NHD data is a truly remarkable feat thanks to Tim Hines and Pete Steeves and their colleagues above the 49th parallel. Name the river in dark blue and for extra credit what's unique about it. Send your guess to jdsimley@usgs.gov.

Upcoming NHD Training

January 11 – 12: NHD Maintenance and NHDGeoEdit Tool - Salt Lake City, Utah. Contact Cindy Clark or Bill Smith wjsmith@usgs.gov 303-202-4493.
January 12-13: HEM 2 Day Classroom – Denver, CO - Sign up at: http://nhd.usgs.gov/html#hem
Contact: HEM@usgs.gov
February 16: Basic HEM Functions - 4 Hour WebEx, Sign up at: http://nhd.usgs.gov/tools.html#hem
Contact: HEM@usgs.gov
March 10: Advanced HEM Functions - 4 Hour WebEx, Sign up at: http://nhd.usgs.gov/tools.html#hem
Contact: HEM@usgs.gov

Thanks to Keven Roth, Stephen Daw, and Kathy Isham.
The NHD Newsletter is published monthly. Get on the mailing list by contacting jdsimley@usgs.gov.
This offer is not available in Illinois.
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.