Hydro Seminar Series Episode 3

Jeff Simley: [0:10] Hello, this is Jeff Simley from the US Geological Survey, and welcome to the Hydrography Seminar Series. This is session three, recorded July 30th, 2015. Your hosts for these sessions are myself, Jeff Simley, and Al Rea. The agenda for today is, we start off with a brief introduction, and then Anita Stohr will talk about putting NHD to work in the state of Washington. This will be about a 20 minute talk. This will be followed by discussion, questions, and answers. And then that will be followed by two lightning talks, the UFINCH - Adjusting Unit Flows in NHD Plus by Dave Holtschlag, that will be a five minute talk. And then that will be followed by Local-Resolution NHD Stream Delineation from Lidar by Susan Phelps, that will be another five minute talk.

[0:53] The purpose of these seminars is to share success stories from users who have solved real world problems using hydrographic data. Also, to provide information on the NHD, WBD, and related products. And thirdly, to provide a forum for users similar to what might be encountered in a conference setting.

[1:11] These topics include hydrology, resource management, pollution control, fisheries, emergency management, mapping, and elevation/hydrography integration. Formats for these series are use cases, underlying technology, the lightning talks, and collecting feedback from users on these sessions. You can find out more about the hydrography seminar series by looking at the NHD website, under the hydrography seminar series tab, that'll give you information about all past and upcoming seminars. Also, you'll find information in the NHD Newsletter and mailing list for the NHD Newsletter, so if you get the NHD Newsletter you'll get a notification about these. Also the American Water Resources Association and other organizations will have information about the seminar series. And then contact info from the webinar sign up, which means that if you signed up for one of these seminars, we'll send you an email letting you know about future sessions. We expect to give these about every six to eight weeks and after the seminar is over with there'll be questions and answers that you can ask via the chat feature in the webex.

[2:22] So today's Seminar is Putting NHD to work in the state of Washington by Anita Stohr. Anita Stohr is the National Hydrography Dataset steward for Washington State. She works in the geospatial and environmental systems support unit within the Washington Department of Ecology, and coordinates NHD use and improvements in all state and private lands. Prior to her role as the state steward, she worked as a senior hydrologist performing water quality and quantity modeling. So Anita go ahead.

Anita Stohr: [2:51] Okay, thanks. Washington State adopted the NHD as its standard hydrography dataset in January of 2011, and since that time the states focused on the associating the highest priority water resources, human health, and fisheries datasets to the NHD. We've also been correcting the largest errors in line work, and providing access to a wide variety of users. Washington has a wide variety of landscapes, water

types, and resources which led to the development and use of many GIS hydrography datasets early on.

[3:29] This first slide shows the photo of Puget Sound. The Department of Ecology samples water quality here and around the state. In Puget Sound, a float plane is used to collect many of the samples. Sample points are attached to the NHD, but they used to be on our own hydrography layer which was called BOSWIS(sp?) Forestry is also a big industry in the state and our Department of Natural Resources manages forestry. So this photo here shows the Lewis River watershed, they need to know where streams are located to manage riparian buffers and road maintenance associated with logging activity. And they care not only about the large streams, but they care about small streams like this, this is a small headwater stream in the Willapa watershed and its called one of our tight end headwater streams, and they're important for protecting species such as the Pacific Giant Salamander.

[4:29] If you go over to the east side of the state, it's a lot drier and there's a lot of irrigated agriculture.

[4:42] Even though when you look from aerial photos lots of these streams look small to folks, if we go and zoom in I'm going to zoom in to one of these streams with the road crossing this is what one of those looks like in June of this year. During snow melt those streams get pretty big and then they'll dry up lots of times by the end of the year, depending on how much irrigation is being pumped into those streams.

[5:07] We also have a lot of Hydro power. This is the Rocky Reach Dam on the Columbia River in Eastern Washington. We also have small dams that are monitored by our dam safety unit. This is the Hofer diversion dam over in Walla Walla Basin.

[5:26] It's on the Touchet River over by wine country. These diversions, even though it's a dam, it's also got a fish passage associated with it, it's got two water diversion associated with it, and information about screening to protect fish.

[5:44] Then finally salmon. This is a picture of the Skykomish system and anglers out fishing for salmon on the west side of the state. Salmon also migrate up through the Columbia River, all along here, up into ...this is a picture of the Yakima system. That has salmon in it, and also is used as a major irrigation source.

[6:09] Having these separate GIS hydrography layers is OK when you doing separate management, but they're expensive to maintain, and we have a lot of data in common. We had a lot of problems we wanted to solve, like having [indecipherable 01:54.05] get our data on the same hydrography database set.

[6:29] In January of 2011, a bunch of agencies got together, and we adopted a national hydrography data set as a state standard. We're still moving towards there. Not everybody has been able to get all of the way there, because it's expensive. The idea is we're trying

to get to maintaining one copy for the state and be attaching individual agency business needs through linear referencing.

[6:58] Today, I wanted to touch on three of our areas water diversions, fish distribution and stream order. Everyone wants to know where water's diverted, so that's one of the things we did first. Washington has been moving water rights, points of diversion, and places of use information from paper documents to digital map form for many years.

[7:20] If you look over on the left, here, that's what that looks like. These were needed especially for court cases, adjudications, and to evaluate new water rights and transfers. These were all on a map with the polygons being where water was used, and all of these little triangles being diversion points.

[7:42] They were not associated with the NHD the diversion points and many of them were only located to the centroid of a quarter section. If you wanted to know which rights diverted from a particular stream network, for example, you couldn't do that. If you go over to the right side, this picture is the NHD. These little red dots are the older system, our GWIS system.

[8:10] You can see some of those red dots are on the stream and some are just located like this, a little quarter section that has a whole bunch of dots on it. If I was interested in knowing, "What are all the water rights diverted from maybe this stream network here?" I wouldn't be able to do it. I could try to select all of those, but I don't know, of these, if it's really going on this river system or this river system.

[8:36] Although the legal documents, a lot of them, had stream names, lots of times those were spelled different ways or they were missing, and there was just really no way to get all the diversions on a particular stream.

[8:50] We got a grant from the USGS to go and import those to the NHD. We use the Hydro Event Management Software available through USGS, and this comes as a tool bar. We imported all of those surface water points of diversion in 25 foot increments. We created a feature class from our old points of diversion which was named this, the [?] SDE point.

[9:30] We had a link field, our unique identifier, We had our NHD data, our network data here. Then we set a search tolerant. This says 25 meters, but we actually used 25 feet. Then we pulled in everything that was within 25 feet, snapped it to the stream.

[9:48] If the stream name from NHD matched the one on our original record, then this is good and we're fine to go. If they didn't, that was a manual check. Then we went and save that 25 feet as an attribute on that database, and then went to 50 feet and pulled the next set in. We had a measure of how close that was at the beginning.

[10:18] We manually check all diversion that didn't have a name match and any diversion that were over a thousand feet away. We also had to manually check all lakes diversions

that didn't have a name match and any diversions that were over a thousand feet away and we also had to manually check all lake diversions.

[10:28] We had problems with springs. Some of the springs were just little dots, mixed with streams. A lot of those, if they were close enough, those diversions were snapped the to the end of the closest stream network. It was a lot of research by Brad Carlson in a our water resources program to go through and look at the legal documentation to find out where those were.

[10:57] In the end, we have 37,000 of these located. This is a piece of data that is associated them. Each of those point features has, of course, a reach code and a measure. They also have a URL that links into a web map that gives you a lot more information about that diversion.

[11:19] It has a quantity on it down here, the cubic feet per second quantity. Most of you in the West probably know our water law is what's allowed when it was permitted, and it's not the actual amount withdrawn. You have to know something about our water law in order to use those quantities.

[11:40] A portion of our diversions have quantity meters on the them, and that's what this field this here, reporting status. There's no reporting, or it's metered. Ecology requires metering as a condition for all new surface water rights now it does. Originally, it used to be just our larger surface water diversions and diversions from areas that have fish stocks that were classified as critical or depressed.

[12:10] I'm going to show, this the webmap that it goes to. If you click that link, you get popped into this, which is called Water Rights Explore. It shows you where the particular location is, gives you some more information about it, and it also usually gives a list of documents that you can click on. I can go here, click on the certificate, and get the original document that comes with that water right.

[12:40] We are uploading a portion of these to the national map, into the NHD point event feature class layer. We decided to just the largest ones, because a lot of them are pretty small. On national scale, that was more important. We chose ones that had a water quantity greater than 10 cubic feet per second, or the quantity is greater than 5 cubic feet per second and metering is required. We removed claims that were not metered.

[13:13] Moving on to fish distribution. Salmon and steelhead fisheries in Washington are important for both commercial and recreation users. These fish are co managed by Washington State Department of Fish and Wildlife and treaty tribes in Washington.

[13:32] This SalmonScape web map, which released last year and shows fish distributions that are all located on NHD through linear events. This was a huge deal.

[13:44] Prior to this project, the State Department of Fish and Wildlife had its own fish distribution on their own hydrography layer called str24. Northwest Indian Fish Commission had their own fish distribution on another hydrolayer called CHEOPs.

Though a grant with EPA, a team was put together to jointly map this distribution onto the NHD.

[14:08] You can see there's different distributions, depending on which species of salmon you have. Under this map right now is fall Chinook streams. If we click on spring Chinook streams, it's a totally different type of map. there's more of them in Eastern Washington.

[14:32] Where these species live, along with timing of spawning and rearing, affects not only the fishing seasons, but it affects even the logging regulations, temperature and dissolved oxygen limits on point source discharges to the stream, and also timing of construction projects near those streams.

[14:52] They've got their distribution, a bunch of attributes. You can get NHD reach code measures for those. They also continue to store an LLID code, which is a whole stream identifier that's important for them to link back to their historical data.

[15:15] One of the things that we were able to do, since we had NHD and fisheries on the same map this is just an example of something that we could do really fast last year was to be able to produce a web map for water quality grant applicants.

[15:30] There was a project where we were soliciting folks that wanted to get grants, and there was a particular buffer requirement for those to go through. I just kept this one in here for documentation that you guys can read later if you want.

[15:48] Essentially what it was is we needed to put out a map with four different groups of buffer requirements. If you were going to apply for grants, this is how big your buffer was going to need to be. It needed to be something easy that we put up on our GIS, online for folks to get. All of these categories the 35 minimum buffer, the 50, the 100 could all be derived from NHD and from fish distribution.

[16:21] These pieces of it, category A, constructed ditches, intermittent streams and ephemeral streams. Those were all in the FCode, FType in NHD. Perennial waters are too. With salmon information, we needed this third category with the wider one, for the perennial, intermittent and ephemeral waters that also had fish attached to it.

[16:50] This probably took just a few weeks. They guy, Dustin Bilhimer in our water quality program, put this together. This was a map with just NHD streams, salmon only, NHD with no salmonids. He combined it together and put it out into an ArcGIS online map with instructions for grant applicants.

[17:16] Those grant applicants could go in, zoom in, had different color codes for the different riparian buffers. They could go into their own area and find out, "If I'm going to apply for something in this area, that's what it needs to be." It was a real successful collaboration between our agencies to put this out.

[17:37] The other thing, we had kind of a side benefit from this project. Especially the canal ditch features and making sure those were right, became really important, so we've doing a lot of irrigation district mapping and recoding. If you were on a canal or ditch, that buffer requirement was smaller, and so that's led to really improving a lot of our FCode and FType information.

[18:09] For stream order, the Strahler stream order, the states of Washington and Oregon calculate Strahler stream order on the high resolution NHD. We provide that to our state users and to our USGS point of contact to be loaded into the NHD flowline value added attribute table.

[18:34] People wonder, "How did this come about?" There was two main things. We had a need for stream order internally, and, in reality, was a self defense mechanism for me. I was being faced with the questions on this slide, and I was a new steward, and actually I was surprised that I was getting these.

[18:56] If we look up on the fifth area here, this was a slide that I got from the US Forest Service. The US Forest Service does all of the NHD mapping on federal lands, and I do it on state and private. There's areas that we call the checkerboard regions, where its ownership goes in and out of federal ownership. They generally have less streams on their maps.

[19:28] They said, "Can we delete all of these little black lines? Those aren't really streams." That was interesting.

[19:38] At the same time, the USGS was going through its network improvement project, which was doing a lot of quality control on flow direction across the country, to prepare for a new NHDPlus. This is one that I got from them, "Can we delete all this with red Xs over, because these aren't real streams."

[20:05] For this one I looked at the aerial photos looked like and it was like, "Well, there's all these green areas there. Actually they might not be super big streams but they're definitely aquatic habitat. This little streams originally were imported from our department of natural resources, our logging...and they do protection of other aquatic species.

[20:29] We pulled all those in, because they had said, "We only want to be part of this if you have our streams," so we couldn't get rid of those. At the same time, when I had people trying to remove streams, I had other folks...this is a picture from Clallam County, up the Elwha River Basin.

[20:46] They've done a good job of generating streams from LiDAR. In this one, the red streams were existing NHD, and the blue were LiDAR generated streams that they wanted to add. One of my fears was that I didn't want to be deleting the streams, and then have somebody add the same streams in later.

[21:11] I needed to do this. I looked at this. How do we code NHD Flowline to accommodate users needs to see different levels, different density levels, and to incorporate LiDAR? I wasn't sure what to do, so I went and took this to our Pacific Northwest Hydro Framework meeting.

[21:34] In Washington and Oregon, the state and federal partners meet once or twice a year to go over NHD issues and help each other figure out what to do. I made this slide and I looked at five different ways of coding those lines so that people could choose to see more or less. I had one that I called density independent on this side, and I had the density dependent one on this side.

[21:59] What I mean by that, if you look at this picture and you all know this when you go across lengths from one county or one township to another, one state to another, people map things at different densities.

[22:13] You can go and have an artificial line right down here, where one side is dense and one side is not dense. Ideally, we'd have something that would get the same code, no matter what your density was.

[22:26] First I looked at those, and one value I thought it would be great, because of my former work doing water modeling stuff, was mean annual flow. This was a value that was available on NHDPlus data sat, but it was only available on the medium resolution, the 1:100K data.

[22:46] It looked good, but it looked like it was going to be years before that came to the high resolution data sat, and we needed in the high resolution data sat.

[22:54] I also looked at periodicity. There's a code at NHD for perennial, intermittent and ephemeral, but in Washington, we've only used perennial and intermittent. We don't have good rules for what's ephemeral and what's not ephemeral. There's also been some legal issues around the use of the word "ephemeral," so we didn't have that.

[23:20] The other thing I looked at was there was a group at USGS, Larry Stanislawski's group, that was going through and generalizing, picking streams that would be displayed on the 1:24k National Map. I thought, "Well, that would be great. If they're going to select the ones would appear on a 1:24k Map, if I could go and select those and run stream order on just those, that would be great."

[23:48] But, they weren't really selecting them and then flagging those. They were actually doing a generalization process, and selecting and removing some vertices, and so it wasn't really something I could actually select from.

[24:01] I ended up looking at the density dependent side. I looked at stream level, which was a value in the NHD data model, in the value added attribute table, but it had been set up for NHDPlus processing and pretty much everyone said not to use it.

[24:21] We ended up with stream order. This was one which was requested by the most users. It was already in the in the NHD Data Model. Jay Stevens, who works for BLM Oregon, already had a process in place and had run stream order on about half of the State of Oregon.

[24:45] We just went for it. I said, "Well let's just do it," and I did. I was smart enough to ask Jay first, "Wow, since you've done half of Oregon, do you wanna just do Washington while you're at it?" He said, "I'll help you get it set up there, so you can do it yourself." [laughs]

[25:05] So this is what it looks before NHD, and then this is what it looks like with stream order on it. It might not be perfect, but it sure works for 90 percent of the problem. This is the NHD Flowline value attribute table with the permanent identifiers and filled out stream order.

[25:29] The way we did this, the process is we run stream order by four sub regions. We will go and download a copy from a pre stage sub region from USGS. It comes with the NHD flow table, and it's all based on this. We copy that over to our server, and I have a little stream order toolbox.

[25:57] I'll run a QAQC on that to make sure that all the network ends and pour points are valid. Then I run a stream order script that goes and generates this table here, which has stream orders and permanent identifiers. Then I can join my NHD flowline using on permanent identifier and draw it up. For some basins that is all that has to be done.

[26:27] In some basins with a lot of irrigated areas, when that canals cross each other, lots of those can artificially make the streams too large. These are obvious errors. In that case, we go and we make a copy of this geo database that we can edit it on, and go through and delete the flowlines that cause these man made canals to create incorrect stream orders.

[26:52] We'll delete those, and then USGS also provides a group of NHD utilities, and I'll re run this build flow utility and rebuild the flow table. When I've done that I repeat from this above. I'll go and copy that flow table over to our server and rerun it.

[27:12] When we're satisfied that it's complete, I run final Python script to copy to stream order as the new attribute under flowline and also put it on to the VAA table. Then I share those with Oregon and USGS.

[27:32] That is the end of the Washington's presentation. Are there any questions?

Jeff Simley: [27:38] One of the things that we'll do, Anita...thanks a lot for going through that, very interesting. For the questions we should have people taping questions into the Q&A tab. Al Rea and Susan Buto are monitoring that. Al or Susan, do you have any questions that have come up yet?

Al Rea: [27:59] None yet. Has everyone found the Q&A tab? If you maximized the screen to see Anita's slides, then you need to put your mouse to the top of the screen and a little pull down thing will show up. There's a little Q&A thing there.

Anita: [28:26] While we're waiting for Q &A, I put some acknowledgements on the last page there. There's a list of folks that helped out with the different pieces. Otherwise, this probably wouldn't have...this definitely wouldn't have happened.

Al: [28:45] Anita, we still haven't gotten any questions in but this is Al. I'll just go ahead and ask you a little bit about the web map that you put on ArcGIS Online. I think you mentioned that in your newsletter article a couple months ago, but maybe we could share the URL for that. Could you just talk a little bit about how people are using that?

Anita: [29:14] There's was one I mentioned in the newsletter and that was a different one. The one in the newsletter that I mentioned is our feature service that we put out. We do have an NHD map cache for the State of Washington that's out there for folks. If you're using ArcGIS Online, you can just pull back to again get any maps you want to use.

[29:39] This one that I showed here is a separate web map that was just used for that one project. We have different web maps for different uses. That one, for that water quality buffer was a separate one, but we do have what I mentioned in the newsletters.

[29:59] We have a cache, which is really helpful. Many users can pull that into any kind of web mapping software they want to. We have a hydro and labels for that separately.

Al: [30:16] Looks like Sue's having a little trouble getting un muted, so I'll go ahead. We have a question from David Anderson who asks, "Can you share the toolbox that you used for stream order?"

Anita: [30:35] Yes, I could. You would just like the toolbox and the associated Python code for that?

Al: [30:46] Mm hmm.

Anita: [30:56] That Python code...this is kind of interesting.

[31:03] Jay Stevens had gone through and written the original Python code for the stream order. In Oregon, they use the Oracle system for their SDE database, and so he had done it with that. When he transferred the code up to us, we use a SQL Server SDE database, so one of the folks on our staff here, Darby Veeck, rewrote that code on something that worked on our system.

Al: [31:34] OK, thanks. Any more questions?

[31:40] [silence]

Jeff: [31:50] This is Jeff Simley, Anita. I was just following up on the stream order. How do you account for divergences in the network with the Strahler stream order?

Anita: [32:03] The divergences carry that same stream order. The stream goes down and it's a seven, it carries through those. Braided streams end up having the higher stream order. The braids in the stream, when they diverge and come together, they carry that same stream order.

Jeff: [32:30] Are there any other questions, Al?

Susan Buto: [32:34] I have a question for you. Can you briefly elaborate on legal issues that you mentioned with the use of the term "ephemeral?"

Anita: [32:44] I was just told not to do it, and it had something to do with water quality regulations in our state law. I was told not to use it about a year back, so I just didn't. I think we would start to use it if we had some good rules for figuring out what is ephemeral and what's not.

[33:12] If we could go through and have some automated process to say, "This group is a ephemeral, would probably go back and say, "This is, this is what we'll do." I think the definition of ephemeral had something to do with how many days of rain. It wasn't a map based criteria at all. You had to use rainfall over a certain number of weeks.

[33:48] I don't know. It wasn't going to work, and they didn't want me to go there.

Susan Buto: [33:52] Fair enough. I thank you.

Al: [33:56] Another question that has come up is, "Would the presentation be available online?" We will post the presentation on the website for the seminars, which is on the main NHD website. Near the bottom, on the left hand side, there are links. Near the bottom, there's one for the Hydro Seminars Series. We will be posting the presentation there.

[34:29] We're also trying to get recordings posted, but that's taking us a while. I know we promised earlier to get the earlier seminars posted, but we have to comply with Section 508, making them accessible and closed captions. We're having trouble getting all of that done, so it's been a bit of a delay on that. We will hope the recordings up there pretty soon.

Jeff: [35:10] Any more questions come in?

Al: [35:16] No.

Jeff: [35:17] OK, good. Anita, thanks a lot. Once again, as Al just point it out, this material will be available to you through our website. Be sure to go to nhd.usgs.gov, look for Hydro Seminars Series, and you'll find information posted over the next few weeks on this presentation that Anita gave. You can learn more about it.

[35:37] I'm sure, Anita, that you'd be happy if people contacted you personally if they had questions about your work in Washington.

Anita: [35:43] Yeah, that'd be just fine.

Jeff: [35:46] Next, we're going to move on to what we call a lightning talk, and this is going to be a brief five minute presentation.

[35:52] The first one is by Dave Holtschlag. He's a surface water specialist from the USGS Michigan Water Science Center. He holds a bachelor's degree in forestry from the University of Missouri and master's degrees in forest hydrology from the University of Minnesota, and systems science engineering from Michigan State University.

[36:11] Dave is an accredited professional statistician by the American Statistical Association. As part of his professional and principle development, Dave has successfully completed 40 courses through Stanford online and Coursera. He began his carrier with USGS in 1976 studying floods and established 45 technical reports on the survey.

[36:31] Dave's talk is about UFINCH, a method for simulating and adjusting unit flows in networks of channels described by the NHDPlus geospatial framework, using continuous daily flow data at USGS streamgages. Dave, go ahead.

[36:48] [silence]

Al: [36:57] Dave, are you muted?

[36:58] [silence]

Al: [37:05] Dave, we're not hearing you.

Jeff: [37:14] All right, if we're not getting Dave on, we can go ahead with Susan Phelps to talk about her talk. Going once, going twice, Dave are you on? Susan, how about you?

Al: [37:31] I'll switch it over to Susan. Dave, if you can try and figure out your audio problem while we do Susan's.

Anita: [37:45] Are we hearing Susan?

Jeff: [37:47] Susan, are you on the line?

Susan Phelps: [37:53] I don't need the lecture mode. That might get it back.

Al: [37:56] Want to hit *5?

Recording: [37:58] The conference is no longer in lecture mode.

Woman: [38:01] Are Susan and Dave on now?

Dave Holtschlag: [38:03] Yes, we're on. I'm on.

Woman: [38:05] Everybody, we had to take the conference off of muting of everyone, so if people can please mute your telephone lines we'd really appreciate it. It cuts down on feedback and accidental coughs, dog barks, and hold music.

[38:20] Please don't put us on hold if you have hold music, and mute your phone lines. If you can't mute with your phone you can dial *6 into your phone, and that will mute it on this conference line.

[38:30] You want to go back to David or stay with Susan?

Jeff: [38:33] We'll go with Dave, since we've introduced Dave, got him all set up, and everybody's all excited to hear this. We'll go ahead with Dave, as soon as we get this first slide ready to go here.

Al: [38:46] Dave, I just made you presenter again.

Dave: [38:54] Can you see my presentation and hear OK?

Jeff: [38:57] Yes.

Dave: [38:58] That's great. UFINCH is a standalone computer application intended to run on windows PC. It's written in a Matlab programming environment, but does not require Matlab on your local computer to use it.

[39:14] I am developing a report. It's currently in colleague review. I expect to release it sometime early next year, which will provide the software, as well as providing documentation.

[39:26] UFINCH is intended to be used for streamflow record extension of daily unit values from a base gauge at the outlet of a basin to the upstream flowline described in NHDPlus. Also could be use for hydrograph comparison and record analysis.

[39:42] Flow at the outlets is expected to be representative of water yields throughout the basin. If we have estuary flows, that would probably be a problem, or if it were heavily regulated, that would also be a problem. Testing so far, it's been on basins that have a 3000 square miles or less drainage area.

[40:02] I'd like to provide an overview of the functionality, graphical user interfaces, and user options to UFINCH. This is the main graphical user interface. The user would select the two digit hydrologic regions from this drop down menu. UFINCH would then create the map.

[40:25] If you didn't know exactly which region you wanted to use, you can display a map of those regions. You can display the flowlines and streamgages on the same map,

specify a water year to highlight the streamgages as they were active in that water year on the map.

[40:43] Both the flowlines and the streamgages are in active coverage, depending on selection of this radio button. If you select streamgages, it'll pertinent information to that streamgage. If you click on it, the gauging number, name, user record, some other information you might need. Otherwise, the flow attributes will be displayed.

[41:04] When you select base streamgage, it will highlight that entire network up at the streamgage that's going to be modeled and indicate the number of flowlines. This area you would read 15 minutes flow values. If flow value [indecipherable 00:36:56.15] did not exist on your system, UFINCH would go out and retrieve an inventory of daily values at the station that you selected for the base gage.

[41:29] It will then interpolate that to unit values. Unit is in 15 minute values. That particular time increment was chosen because flowlines and velocities in NHD, median resolution, usually accommodate at least one time step in the interval.

Woman: [41:49] Can people please mute your phone lines? We're hearing conversations in the background. Thank you.

Dave: [41:54] You can systematically adjust the velocity and compute travel time within that network to specify a simulation period, and then simulate the flow for that interval. You can select, using the same map interface and streamgages, say upstream, for a comparison. Then another interface can be launched for a streamflow comparison.

[42:21] Just a quick comparison. This is some of the graphs that you'll see when you highlight it. This is streamflow HUC4, that they can be selected from the two digit HUC the map of that HUC4 base gage and some of the other things we've been discussing.

[42:36] This is a map that shows the comparison, hydrographs. The measure flows in blue, simulator flows in red. There is a statistical procedure you can use to adjust the flows to more closely match measured flows. This shows the effect of that correction on the empirical cumulative distribution function.

[42:57] Summary, UFINCH is highly automated for simulating flows, retrieves information that you're going to need, computes travel times, simulates flows, and provides a mechanism for adjusting. Potential for quality assurance streamflow records and extending streamflow data. Any requests for information or questions to follow up, I have contact information below. Thank you.

Jeff: [43:27] Thanks, a lot. We'll just hold this slide up for second, so people can take a look at Dave's email address. If you have any questions for him, contact him directly or contact us here at the USGS. We can forward that information off to Dave, and you can learn more about it. We'll also have Dave's presentation posted at the website. Look for that and you can review the material he just presented.

Dave: [43:49] Thanks a lot.

Jeff: [43:50] Thanks, Dave. Next we are going to turn our attention to LiDAR derived hydrography from Susan Phelps. Susan Phelps is a geographic information system manager at AECOM's Raleigh, North Carolina office. She is certified geographic information systems professional, as well as a certified flow plan manager with over 15 years of experience in GIS and water resources.

[44:15] Over the last nine years, Ms. Phelps has served as the NHD technical discipline lead and assistant project manager for local resolution NHD project in several states, including Indiana, Mississippi, and North Carolina. Susan is going to talk about local resolution NHD stream delineation from LiDAR based terrain sources. Susan, go ahead.

Susan Phelps: [44:37] All right, thank you Jeff. As Jeff mentioned, I'm going to talk about how we've been using LiDAR to create local resolution NHD. First, I want to talk really briefly about why local resolution NHD is important. What are some of the drivers behind it?

[44:54] First of all, enhance quality and content of hydro data. It's especially needed at the local level. Also, uniform mapping to support resources and policy decision making across large jurisdictions. Also, we have a lot more capability with hardware and software to help process and analyze the large hydro datasets, and then the websites to help distribute and maintain that data.

[45:24] Lastly, we have more accurate framework layers like LiDAR and [indecipherable 00:41:04.16] to help support the creation of local res NHD.

[45:32] We talked a little a bit about why it's important. Now I want to talk a little bit about the approach that AECOM has used for LiDAR based local resolution mapping of NHD in North Carolina, Mississippi, and Indiana.

[45:47] First, obviously, we needed to collect all the base data that plan to use for the project. If the LiDAR has not already been processed and hydro corrected, then we will import that data into our proprietary software program called WISE. That gives us the ability to blend different terrain sources and create seamless elevation products from the back end.

[46:12] We'll import that LiDAR data into WISE, build our TINs, and hydro correct the elevation data, at which point we can start to generate a reference files for local res NHD. Reference files are going to include the hydro corrected DEMs and hillshades.

[46:32] We're also able to generate six acre basins and guide streams. We use those to help with determining the upstream limits and general stream locations, basically making sure that we have complete coverage for a basin.

[46:48] One thing I want to mention here is that the six acre limit is not set in stone. What works in one state may not work in another, so that upstream limit can be customized to

meet whatever the stakeholders needs are. There's a quick example under here. This is just your DEMs and hillshades, and then I've got six acre basins and guide streams here.

[47:15] Some other products that we can generate from the hydro corrected terrain data are flow accumulation grids and flow vectors. We don't typically use those for digitizing local res NHD, but we do have clients that have found this helpful for modeling purposes on the back end. This is just a quick example of a flow accumulation grid that's generated from the hydro corrected data.

[47:42] We have all of base data process for the project, and we're ready to start digitizing the local res NHD. In doing that, we're using the imagery, the hydro corrected DEMs and the hillshades as the primary data source for the horizontal stream locations.

[48:02] We are also using those LiDAR automated guide streams and the 24K to help indicate where the stream should be digitized and how far up into the basin we should digitize features. The basic process is we start at the upstream end point of the guiding streams and work our way down to the next confluence.

[48:25] We work from confluence to confluence, basically until all of those guide streams are represented in the local res NHD. If we do have local hydro data, if it's accurate enough, we will use that as a basis for local res NHD flowlines, and then just extend those reaches up to the upstream limit of our guide stream. Also, we want to reference the 24K to make sure that we're capturing all those streams that are still visible in the imagery and the terrain sources.

[48:58] What are some of the challenges that we've seen with LiDAR based NHD? One of the biggest ones we've seen are the areas where the streamflow has been altered. These are particularly prevalent in the urban areas and agricultural areas.

[49:14] We found that the guide streams are typically not as accurate in these areas, so we do have to rely more on the imagery and the base DEMs, hillshades, and local data. The good thing about if you have newer LiDAR, your man made canal ditches will show up a lot better in the LiDAR.

[49:36] If you have new construction, like highways or neighborhood, they also going to be more visible. You still may not be able to see where the pipelines are. In those instances, the local stormwater data can be very helpful.

[49:50] That was all I have for today. I have my contact information here. If anyone have any question or want any more information, feel free to contact me. Thank you.

Jeff: [50:03] Susan, thanks a lot. That was a great presentation, and I'm sure that people are going to learn a lot more about that. By the way, in case you're interested in seeing the direct result of this work, you can download NHD data over Southern Indiana. It reflects hydrography that AECOM added to the NHD on behalf of the state of Indiana. You can directly look at some of those results that way.

[50:26] If you'd like to contact Susan, or contact us and we'll get you in touch with Susan, you want to learn more about local resolution NHD derived from LiDAR based terrain data.

[50:37] Those were our presentations for today. Before we depart, we want to have you take a quick poll as to how you viewed this presentation today and suggestions to the future.

[50:52] There are three things that we want you to address here. One is which part of the session was most valuable to you, which of parts of the session were least valuable to you, and what topics are you interested in learning about more in the future.

[51:07] Speaking of the future, our next seminar is going to be on September 24th, also a Thursday at same time, two o'clock Eastern time. Our plan is to be talking about SPARROW modeling. This involves transport of nutrients, particularly nitrogen and phosphorus, through the nation's waterways. How can we model that transport of nutrients using those SPARROW modeling systems? Look forward to that.

[51:33] We hope to have a couple of more lightning talks just to add to the variety of information we're presenting. I ask that you stay tuned for more information about that. You can find out about it through our website. You'll also be receiving an email from us. I'm reminding you that there's an upcoming seminar, and also information about this past seminar and how to access all the materials that we're posting online.

[51:56] Anything else to add from the team here? I want to thank Allison, Susan and Al. You guys have anything else to add?

AL: [52:06] The polling questions should be showing up as a tab on your meeting there on the right hand side. Hopefully, you'll see those and you can answer those. It doesn't look quite...

Woman: [52:34] We have seven people finished already, so I think it's worked OK.

Jeff: [52:38] We're going to leave those questions up, to allow people to take time to fill out the survey here. We'll give you a little bit of time.

[52:48] Other than that, we'll close it for today. Appreciate everybody joined this call. Hopefully, you've learned a lot. We've all learned a lot and appreciate the speakers and all the great work that they've done. Are very dedicated to the NHD, to WBD, and to mapping in the United States. We appreciate all that good work. Thank you and goodbye.