Hydrography TWG Meeting
September 10th, 2020, 9am (MDT),
Idaho Water Center, Boise

Attendees:

Danielle Favreau – IDWR
Linda Davis –IDWR
Christy-Ann Archuleta – USGS
Josh Enterkine – BSU, Boise Center Aerospace Laboratory
Silvia Terziotti – USGS
Sabine Krier – Coeur d'Alene Tribe
Mike Woodford – ITS
Brittany Gold – USGS
Lily Niknami – USGS
Kim Jones – USGS
Rebecca Anderson – USGS

Presentations

- **The Shape of Water *Elevation – Derived Hydrology Acquisition Specifications*** (*Christy-Ann Archuleta and Silvia Terziotti* – USGS*)*
    - Goal – To create hydrographic features that are horizontally and vertically integrated with a 3DEP bare-earth digital-elevation model**.** And to create Elevation-Derived Hydrography (EDH) that will be suitable to use as breaklines: for processing for pre-conflation of features to the NHD and for hydro-enforcement of DEMs.
    - New Specification documents are available regarding Acquisition Specifications https://pubs.usgs.gov/tm/11/b11/tm11b11.pdf and for (READ) Rules Representation, Extraction, Attribution and Delineation https://pubs.er.usgs.gov/publication/tm11B12
    - Please see attached slides for presentation details. Presentation also available at: *Presentation may be found at* https://www.youtube.com/watch?v=qzUp2vTf7Yc
    - **Questions:**

Q – Will the tools that you described to create the EDH for NHD be released to the public?

A – That is the plan, but the tools are now in development. Some of the contractors have tools but they are still in development and not in a form that is easily releasable.

Q – How do you get from EDH to NHD? IS EDH a vector line type?

A – EDH is a vector derived product, it does have a network and z values with every vertex, so it is similar to a 'stripped down' version of the NHD

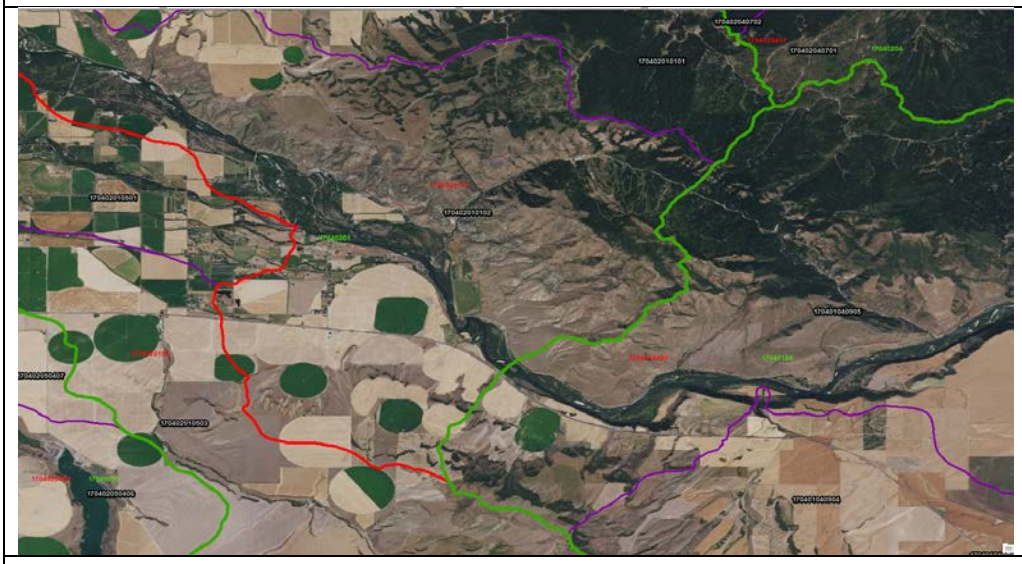
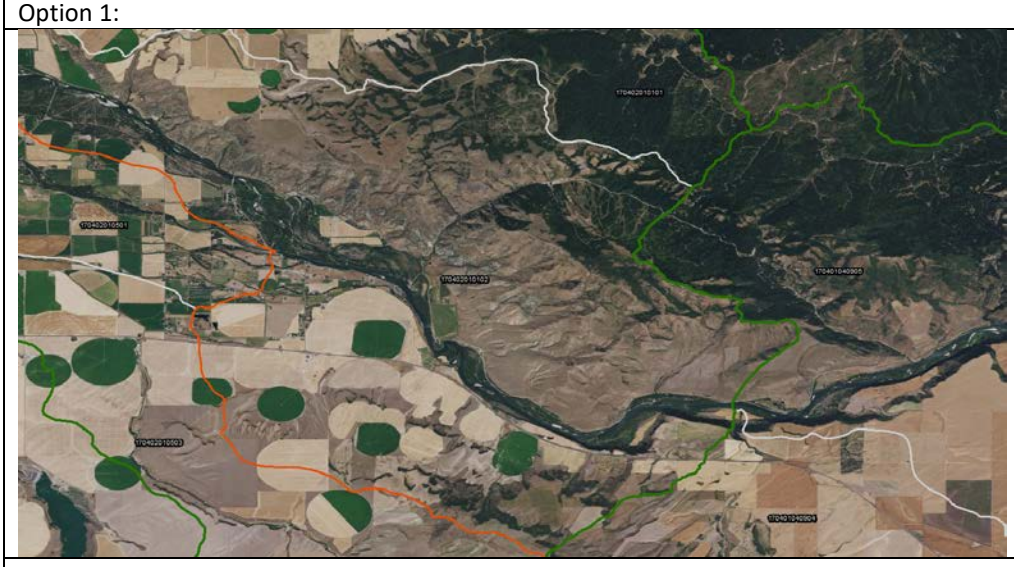
Q – How do you get the attributes transferred between NHD and EDH?

A – Geoconflation is used to transfer attribution between NHD and EDH. With EDH there can be additional linework that was not in the original NHD, these new segments can be attributed by state stewards or through the NHD editing process. USGS is working to make the geoconflation process easier. Since EDH is topologically similar to the NHD, that removes some problems.

Q – I believe Idaho is not on track to have full Lidar coverage by 2023? Are there acquisition standards for Lidar that is used in the EDH process?

A – The 3DEP (2Q or better) standards are what is needed – it is currently 1m in the continental US, 5m for Alaska. USGS has been working with federal agencies that have large tracts of land to get Lidar acquired. Tom Carlson (USGS) is the liaison and 3DEP contact for Idaho.

- **Proposed Changes to WBD Boundaries in Idaho** (*Kim Jones and Brittany Gold* – USGS)
    - Short presentation on the History of the development of the WB WBD Sub-basins (HU8s) and why the review has occurred.
        - Original source data, a 1:250K dataset.
        - Review is part of the quality control checks for the NHDPlusHR as well as in preparation for the development of Elevation Derived Hydrography (EDH).
    - Review of proposed changes

Change Group 1:
General Location: Intersection of T04N40E, 04N41E, 03N40E, and 03N41E
Current WBD

Option 1:

Option 2:

It appears that the original 8-digit boundary for 17040104 was based on the HUC250K dataset which breaks at a minor tributary. Propose to adjust boundary to a more predominant feature like the confluence upstream with Antelope Creek (Option 1) or the downstream diversion into Dry Bed Canal (Option 2).

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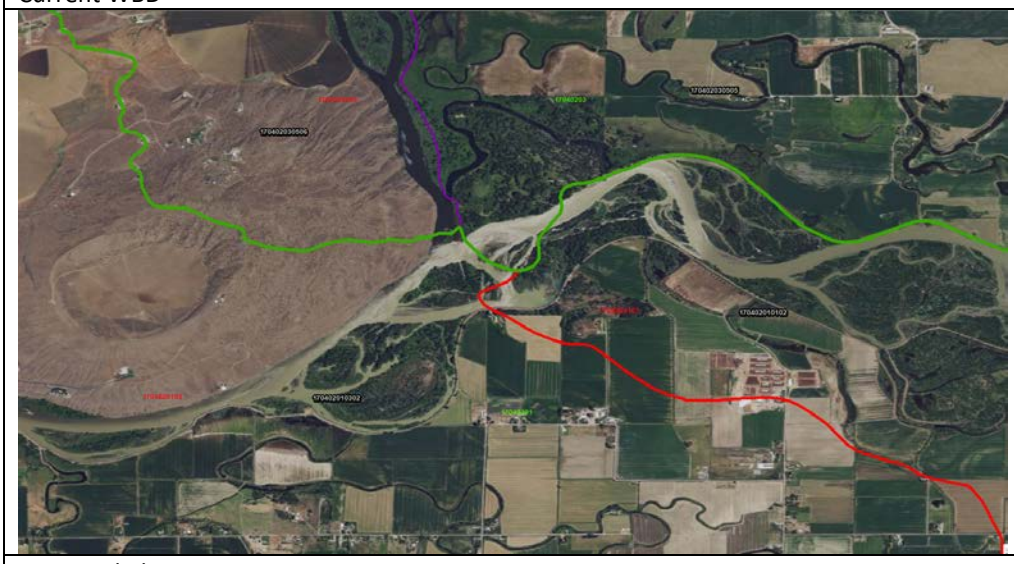
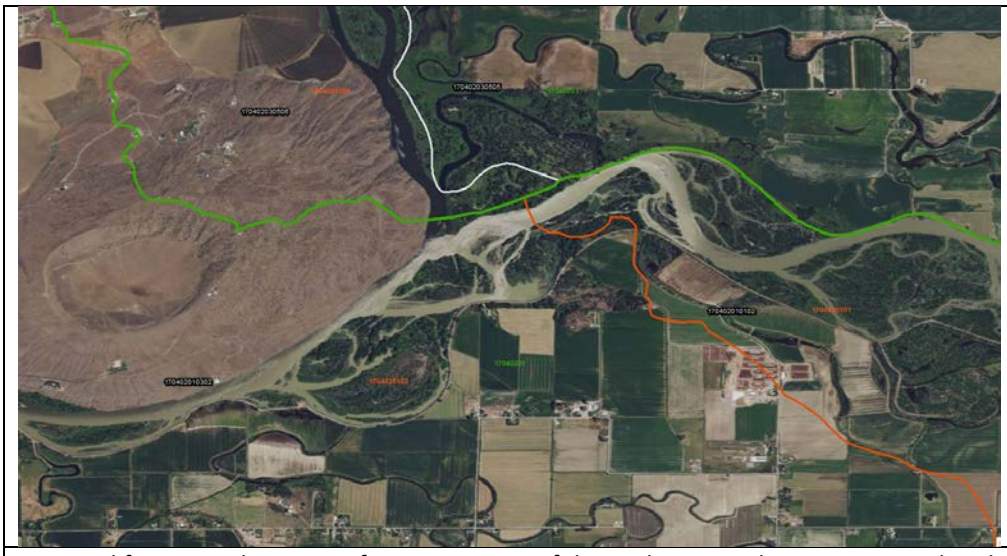
Change Group 2
General Location: 05N38E Sections 13 and 14
Current WBD



Proposed Changes



Modification is due to significant migration of the Snake River. The current WBD break for 17040203 (Lower Henrys) is cutting across the Snake River. This creates an issue for 17040201 (Idaho Falls) because the Snake River starts in 17040201, flows into 17040203 and then back into 17040201.

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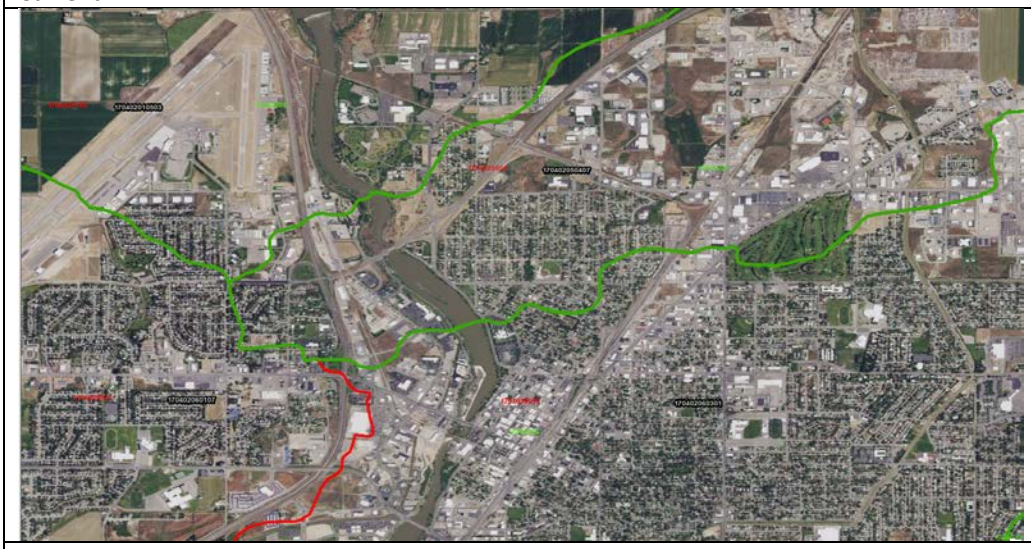
Change Group 3
General Location: 02N37E12, 02N37E123, 02N38E7, 02N38E18
Current WBD

Proposed Changes

The WBD NTC felt that it made more hydrologic sense to break Willow Creek out as a standard 8-digit HU instead of lumping a very small part of the Snake River within this unit. We would like the WBD Technical Working Group to take another look at this area to see if they are in agreement with this adjustment or if there is a valid reason to keep a small portion of the Snake with Willow Creek

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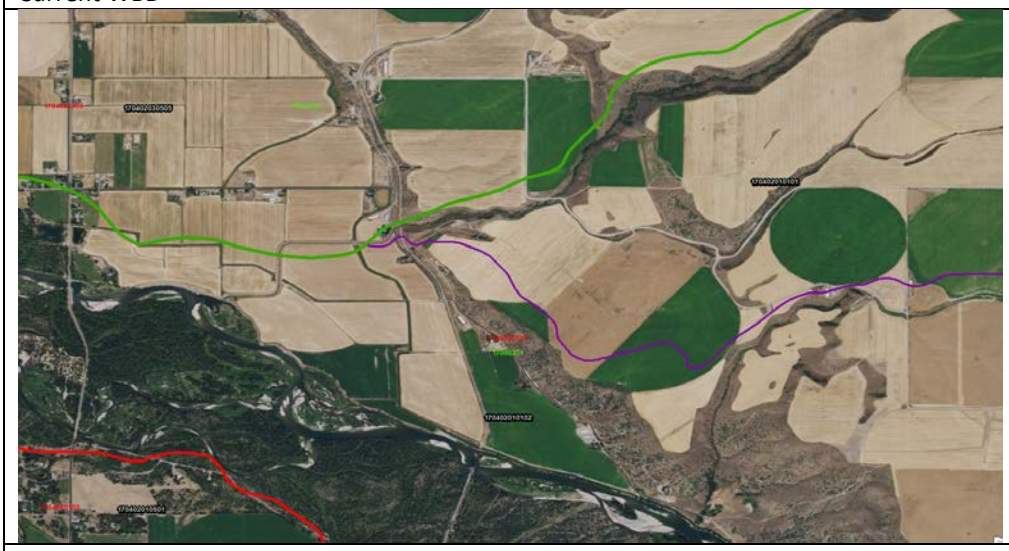
Change Group 4
General Location: 04N40E Sections 10, 15, 16
Current WBD

Proposed Changes

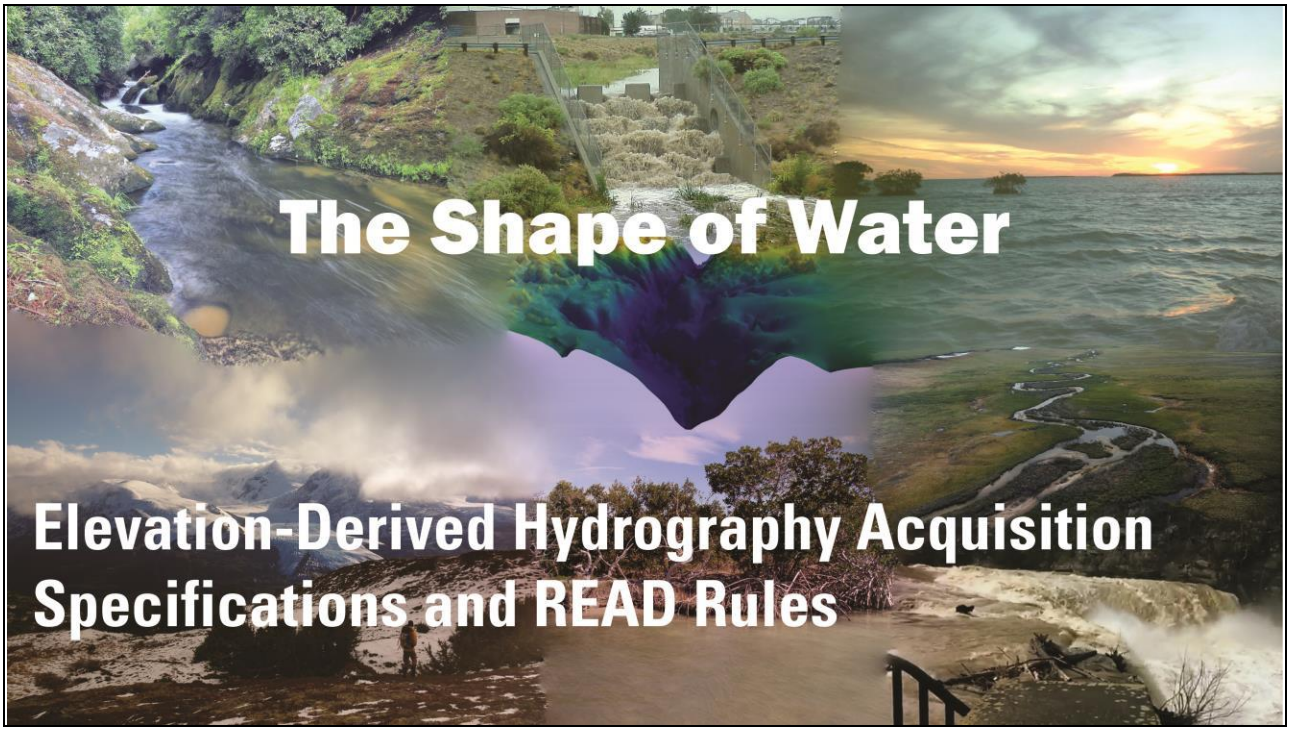
Change is based on the 3DEP data which indicates that the boundary should be moved to the north.

- Please review these proposed changes by downloading the information posted here, under Meeting Documents.

TWG General Updates *(Danielle Favreau – IDWR)*

- NHD/WBD
  - Model 2.3 has been released!
    - Statewide extract still at Model 2.2. Make sure is dated after July 1, 2020 to get Model update.
  - Highlights:
    - NHD: Drainageway Ftype and Fcode
    - NHD:Modifications of Sink/Rise Fcodes
    - WBD: GNIS_ID replaced with ReferenceGNISIDs
    - New HU types: Urban, Indeterminate
- NHDPlus HR
  - Region 16 & 17 in beta. Working on refresh cycle.
  - NHDPlus map service now available
  - VAA Webpage
- Markup Tool
  - For submitting small edits to all 3 datasets.
- NHD/WBD Tools Status
  - Editor Tools: All require ArcGIS 10.5.1
    - NHD: version 6.7.3.0
    - WBD: version 2.9.2.0
    - GeoConflation: 3.4.2.0
  - Tools available from nhd.usgs.gov
    - HEM: version 2.12.1.0
  - Training: Will begin again in Nov. Email NHD.WBD@idwr.Idaho.gov if interested.

Next TWG March 11, 2021


The Shape of Water
Elevation-Derived Hydrography Acquisition Specifications and READ Rules

National Geospatial Program
National Geospatial Technical Operations Center

Presentation for the Idaho Hydro Technical Working Group

September 10, 2020

Silvia Terziotti, Raleigh, North Carolina
and
Christy-Ann Archuleta, Rolla, Missouri

USGS

I'm Christy-Ann Archuleta , and I am presenting with Silvia Terziotti to share information about the elevation-derived hydrography specifications, and their applications for elevation and hydrography geospatial projects

Introduction

Current Efforts – Elevation-Derived Hydrography

- **Goal:**
  - To create hydrographic features that are horizontally and vertically integrated with a 3DEP bare-earth digital-elevation model.
  - Elevation-Derived Hydrography (EDH) will be suitable for:
    - use as breaklines to hydro-flatten digital elevation models,
    - processing for pre-conflation of features to the National Hydrography Dataset, and
    - hydro-enforcement of digital elevation models.

USGS

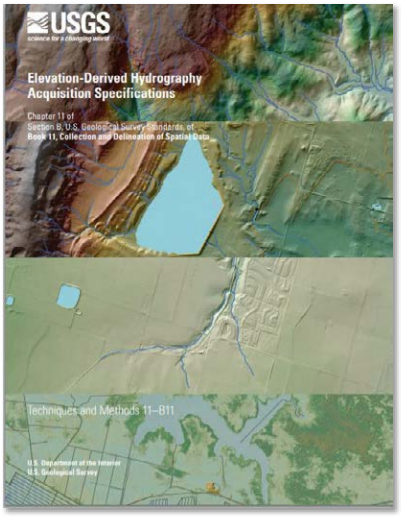
The USGS is currently working toward producing better aligned hydrography and elevation products, by creating a system to acquire elevation-derived hydrography also referred to as EDH, which is horizontally and vertically integrated with 3DEP bare-earth digital-elevation models and also aligns with National Hydrography Dataset requirements.

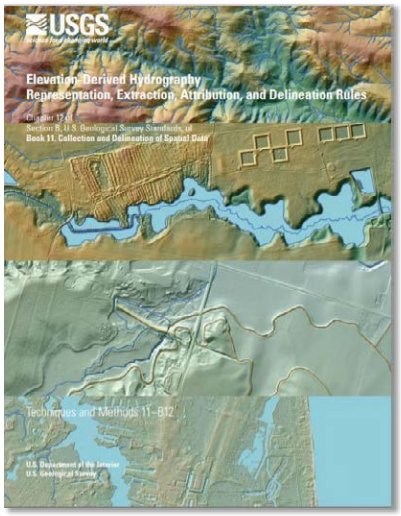
There are 3 main products that elevation-derived hydrography can be used for:

as breaklines to hydro-flatten digital elevation models,
processing for pre-conflation of features to the National Hydrography Dataset, and
hydro-enforcement of digital elevation models.

Introduction

Elevation-Derived Hydrography Specifications and READ Rules





USGS https://pubs.er.usgs.gov/publication/tm11B12 https://pubs.usgs.gov/tm/11/b12/tm11b12.pdf

In order to help meet the vision of the USGS for well integrated elevation and hydrography data, we have recently published two new specification documents.

These new specifications connect the dots between existing lidar and NHD data. The new documents are,

- The Elevation-derived Hydrography - Acquisition Specifications, and the
- Elevation-derived Hydrography - Representation, Extraction, Attribution, and Delineation (READ Rules)

So now lets jump into the contents of the specifications

Specifications

List of Specification Categories

- **Collection Area**
  - Concurrent w ith lidar BAA or other new lidar collection
  - From previously collected elevation data
- **Spatial Reference System**
- **Attribute Table Structure**
- **Feature Codes and values**
- **Delineation of hydrographic feature**s
  - LBS Hydro-flattening
  - Elevation-derived Hydrography
    - Minimum features
    - Additional features
    - Ancillary data sources
    - Special Cases
- **Topology**
  - Topology rules
  - Z-Values
- **Positional Assessment**
  - Positional assessment and reporting
    - Vertical
    - Horizontal
  - Alignment
  - Completeness
- **Metadata**
- **Delivery products and formats**

USGS

This table shows what is covered by the EDH Acquisition Specifications.
The Specs do not tell a user how to create the hydrographic features, but it describes what requirements need to be satisfied in order for the finished hydrography data to be submitted to the USGS as an elevation-derived hydrography deliverable.
The specifications help the USGS acquire data that has consistent attribution that is compatible with NHD, meets a minimum required collection criteria, and meets horizontal and vertical positional requirements.

Specifications

Feature Types - Elevation-Derived Hydrography

- Features are limited to those that can be identified from a lidar-derived elevation surface, with flexibility for additional features.
- Codes allow for elevation and hydrography treatments.
- Each of these features is defined in detail within the READ Rules Document.

Domain value	Feature description
FClass	
1	NHD feature (will be used for conflation).
2	Non-NHD feature (outside of collection criteria).
9	Nonhydrography feature (elevation dataset limitation).
EClass	
0	Not used for elevation derivatives.
1	Used for hydroflattening (3D polygon).
2	Hydrographic feature used for elevation purposes, other than culverts or those used for hydroflattening.
3	Culvert—used for hydroenforcement.
9	Elevation dataset limitation.

Elevation source data	Source
Hydrography delineation method	Method
User-defined code	UserCode
Free-text space for user comments	Comments

Features required for hydro-flattening	
Description	**FCODE**
Lake/Pond	39000
Reservoir	43600
Sea/Ocean	44500
Stream/River	46000

FCode	Desc
0	User-defined feature[1]
33400	Connector
33600	Canal/ditch
34300	Dam/weir
36100	Playa
37800	Ice mass
39000	Lake/pond
42800	Pipeline
43600	Reservoir
44500	Sea/ocean
45000	Sink/rise
46000	Stream/river
46800	Drainageway[1]
53700	Area of complex channels
55800	Artificial path
Assigned based on adjacent features[2]	Culvert[1]—adjacent feature description
991	Low-confidence area (predetermined)
992	Low-confidence area (sparse bare earth)
993	Low-confidence area (snow covered)

USGS

In the table on the right, you can see the types of features recommended for collection in the EDH Specs. This list of features includes those that can be derived from elevation data and correspond to NHD Fcodes or lidar base specifications. NHD features not found on this list, are difficult to derive from elevation data.

The EDH coding system allows for the collection of various types of hydrography data that can be used for different purposes. For instance, using EDH Fclass, Eclass, and FCodes, you could have features for conflation into the NHD, you could have your own project features for use outside of the USGS, and you could store breaklines for hydroflattening or hydroenforcing your DEMS.

The EDH FCODEs match the fcodes -- and are defined the same way -- as in the NHD, which facilitates conflation of EDH into the NHD.

The coding system allows for the collection of features outside of these specifications as well. Users can add their own codes that can be tracked outside of the NHD, or additional NHD codes that weren't included in the EDH specifications.

Specifications

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USGS

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993	Low-confidence area (snow covered)

1) The coding system provides for the ability to use the features as elevation breaklines which meet Lidar Base Specification breakline requirements for hydroflattening. The features listed in the lower middle table are those needed for hydro-flattening a DEM surface to meet LBS.
2) There are also codes that can be used for hydroenforcement, for instance you could use these codes to find culverts to hydroenforce a DEM.

So if a lidar project collects EDH data, this data can be used both as breaklines for elevation purposes such as hydroflattening, --- AND for conflation into the NHD, and for other purposes that meet user needs outside of the USGS.

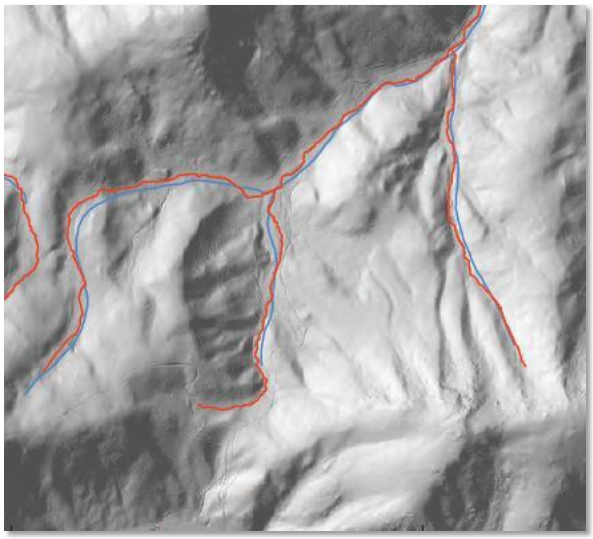
Specifications

Delineation of Features - Minimum

- Minimum Set of Features:
  - The minimum required set of **hydrographic features will match the density of existing NHD HR** following "Standards for National Hydrography Dataset" (converted to real world measurements)
  - Removal of features that are no longer present.
  - Addition of visible features should follow the 'READ Rules' for connectivity and attribution.

USGS

Using NHD as a guide (in blue), better geometry is added, new features added, others deleted if appropriate



For elevation derived hydrography, there is a minimum set of features required for collection, although, as stated before, people can collect additional features outside this baseline collection set.

1. The minimum set of features is comparable to the density of what is currently in the NHD database. Although we use the NHD as baseline set of features, the feature alignment must match the bare-earth 3DEP dem horizontally and vertically, and a z-value is required on every vertex.
3. Features no longer present in the lidar-surface must be removed, and
4. Features that meet READ rules that were not present in the NHD data set will be added.

Specifications

Delineation of Features - Additional

Additional features must meet these requirements:

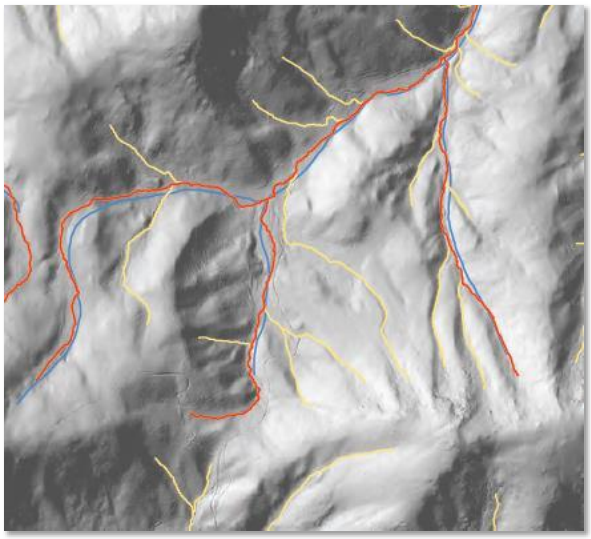
- A Feature must be visible on the DEM
OR it should be present in an accepted ancillary data source,
OR it is necessary to provide valid network connectivity.

- The method used to define feature extents must be identified in the Method field.
  - Examples: a regression model to determine headwaters, curvature (or other geomorphic algorithm) to delineate stream reaches, or flow direction and accumulation of a drainage path.

- The features should be compared to the 3DEP bare-earth elevation surface to check the accuracy of the method used.

USGS

New linework follows visible channels in the elevation. Z-values and FCodes are added. Drainageway used if needed.



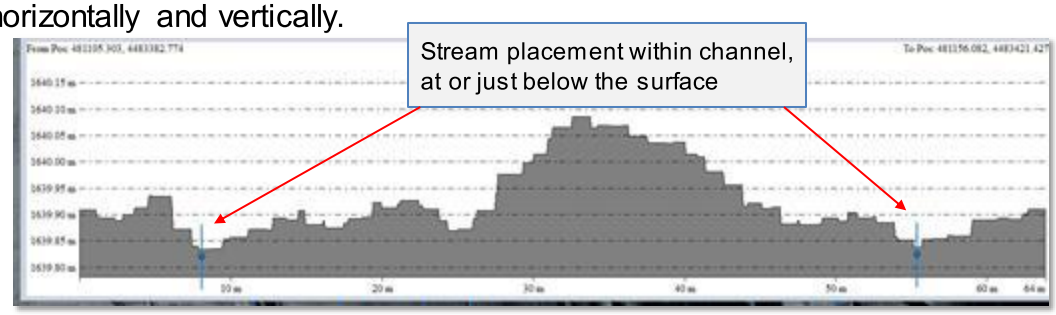
To try and avoid over-mapping,
Additional features above the minimum set of features must also meet these requirements:

A Feature must be visible on DEM,
OR if not visible on DEM it should be present in accepted ancillary data source,
OR if not visible on DEM or ancillary, it can be collected if it is necessary to connect a hydrologic network.
In this example, the yellow features would be additional features added to the baseline geometrically corrected NHD features, in red, recognizing that additional linework will be added that may not be a verified stream channel. The drainageway code has been introduced to allow for features that may need verification later.

Specifications

Alignment Requirements

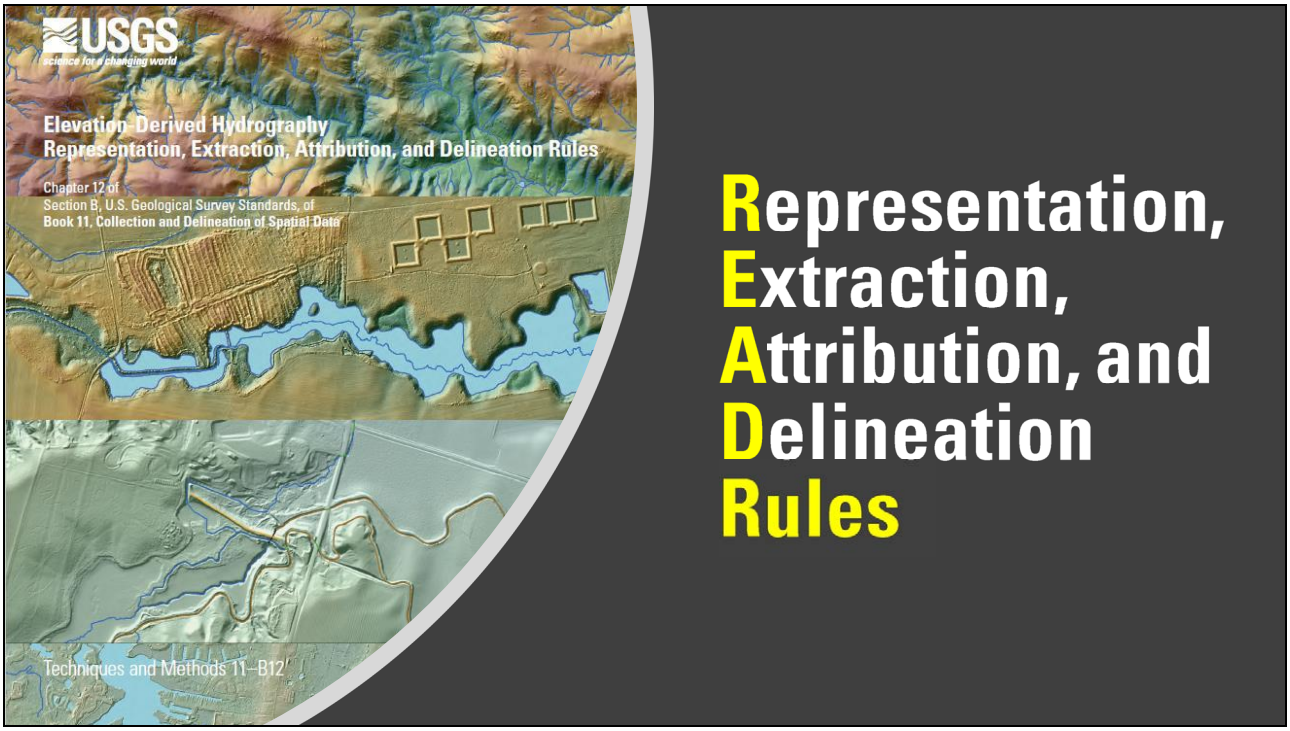
- All features shall
  - align with DEM and current NHD where appropriate,
  - have a downstream orientation,
  - edge match between project areas, and
  - be logically and spatially consistent with the elevation data, both horizontally and vertically.



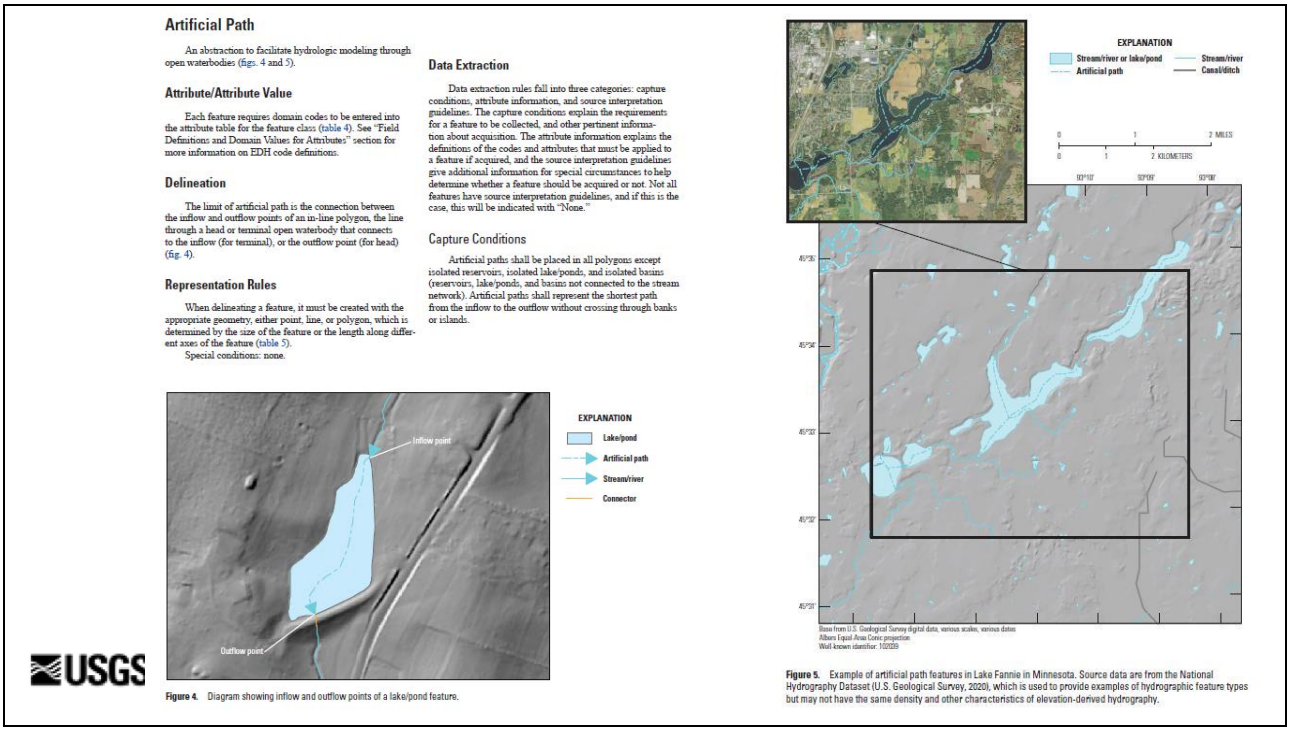
USGS

For our alignment requirements, all features must align with the DEM and with the current NHD where appropriate –
Although we do not want correctly placed EDH geometry moved to snap to incorrectly placed older NHD features.

All features must have a downstream orientation, they must match between project areas, and be logically and spatially consistent with the elevation data both horizontally and vertically.



Next we will describe the companion document to the specifications --the READ Rules.



Artificial Path

An abstraction to facilitate hydrologic modeling through open waterbodies (figs. 4 and 5).

Attribute/Attribute Value

Each feature requires domain codes to be entered into the attribute table for the feature class (table 4). See "Field Definitions and Domain Values for Attributes" section for more information on EDH code definitions.

Delineation

The limit of artificial path is the connection between the inflow and outflow points of an in-line polygon, the line through a head or terminal open waterbody that connects to the inflow (for terminal), or the outflow point (for head) (fig. 4).

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 5).

Special conditions: none.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with "None."

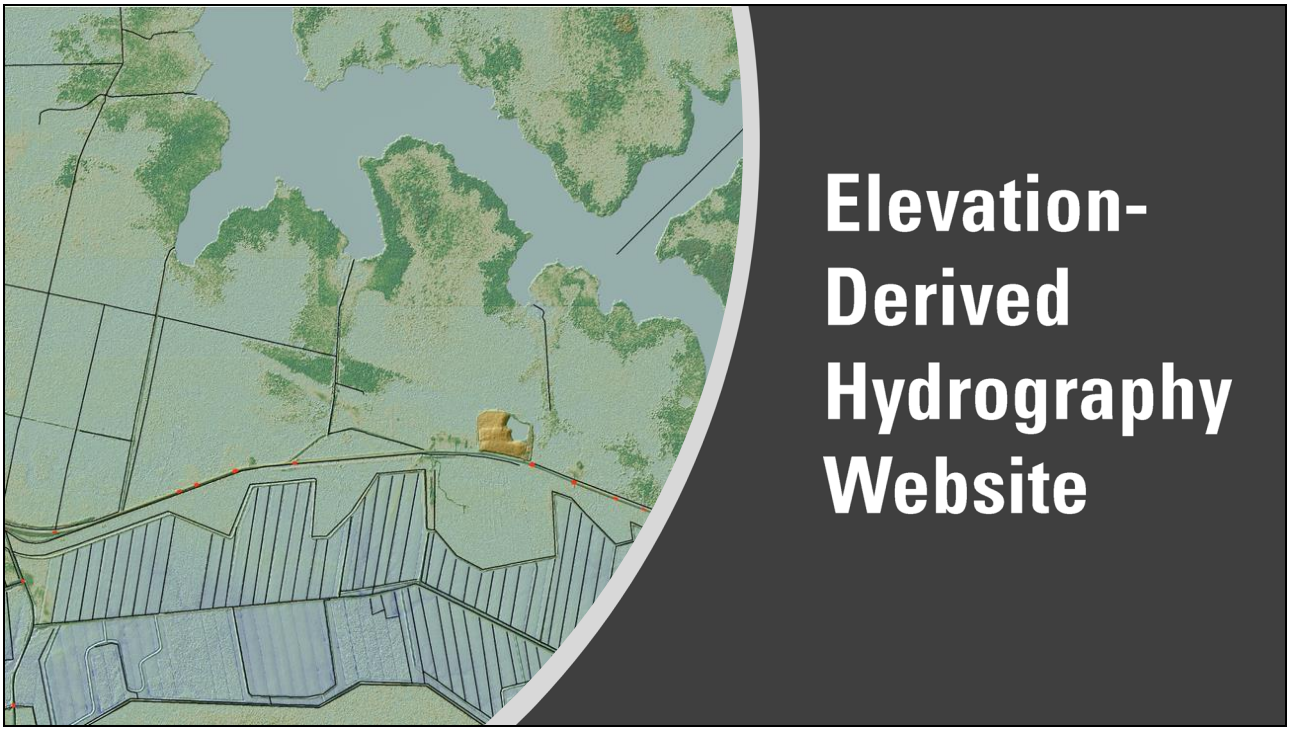
Capture Conditions

Artificial paths shall be placed in all polygons except isolated reservoirs, isolated lake/ponds, and isolated basins (reservoirs, lake/ponds, and basins not connected to the stream network). Artificial paths shall represent the shortest path from the inflow to the outflow without crossing through banks or islands.

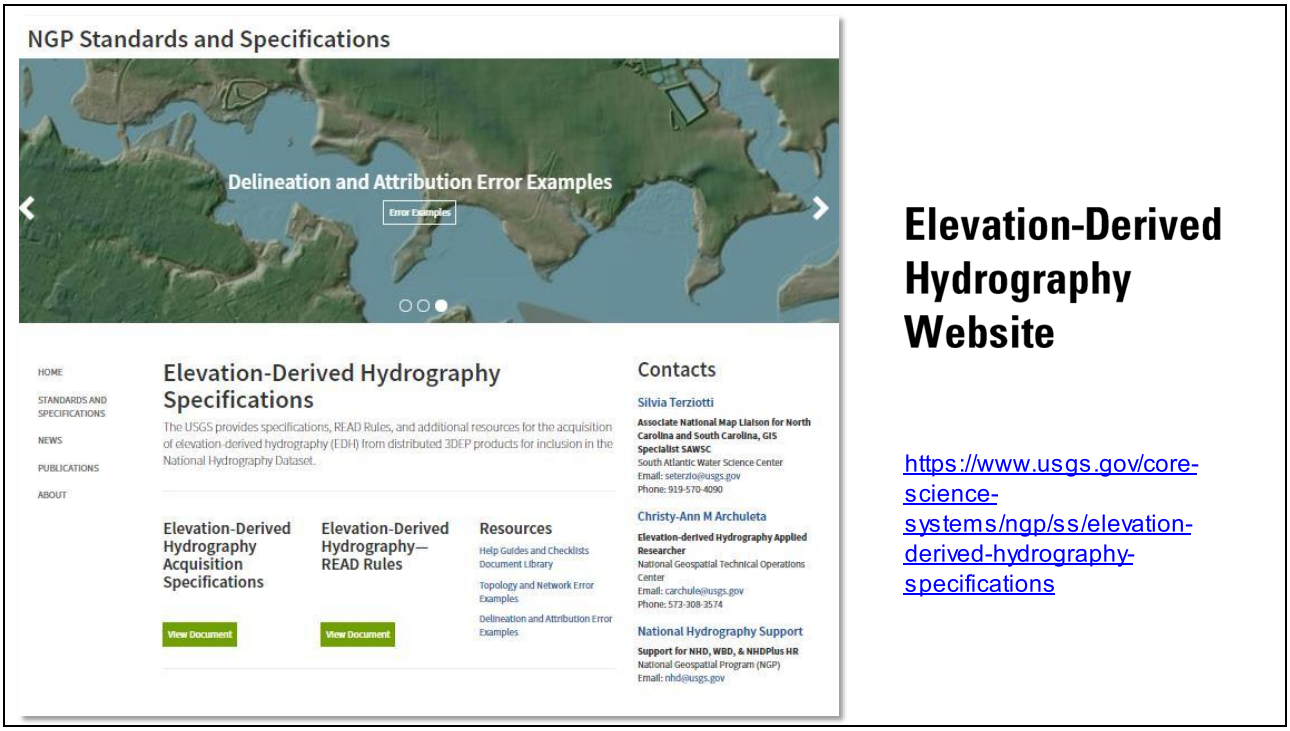
Figure 4. Diagram showing inflow and outflow points of a lake/pond feature.

Figure 5. Example of artificial path features in Lake Fannie in Minnesota. Source data are from the National Hydrography Dataset (U.S. Geological Survey, 2020), which is used to provide examples of hydrographic feature types but may not have the same density and other characteristics of elevation-derived hydrography.

The READ Rules describe in detail all of the features that are to be collected and the parameters for collection. The document is designed so each feature type can be separated as a whole from the rest of the document and used by a technician who is working on a specific feature type. So, if you have someone who is working on stream/rivers, they can take that section from the document and have all of the information they need for collection. This is very similar to the way the 1999 NHD Standards were set up, if you are familiar with those.



Online resources are also being developed to support the Specs and READ rules.



Elevation-Derived Hydrography Website

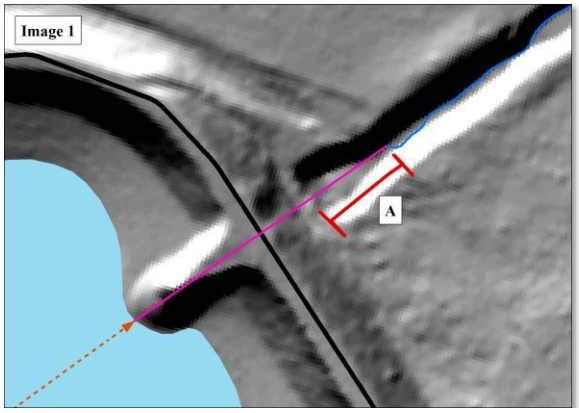
https://www.usgs.gov/core-science-systems/ngp/ss/elevation-derived-hydrography-specifications

We have recently made public a website where you can access the specifications documents, and also find additional resources, such as examples of errors that can be encountered while producing EDH data.

Error: Dam connector length

Issue: Connectors through dams or berms that extend too far in one or both directions across the obstruction.

Solution: If a connector feature is required through a dam or berm, it should only extend the distance across the dam structure, and no further (but be sure to connect low points on both sides).



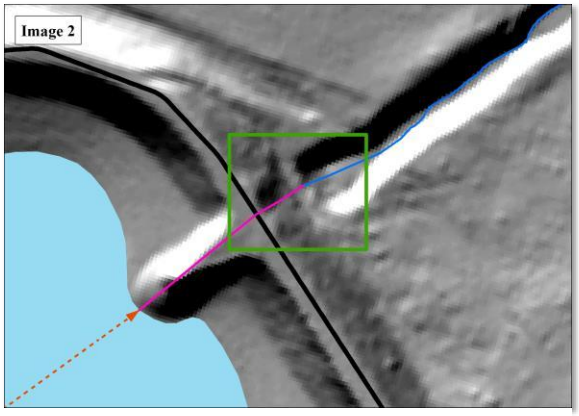
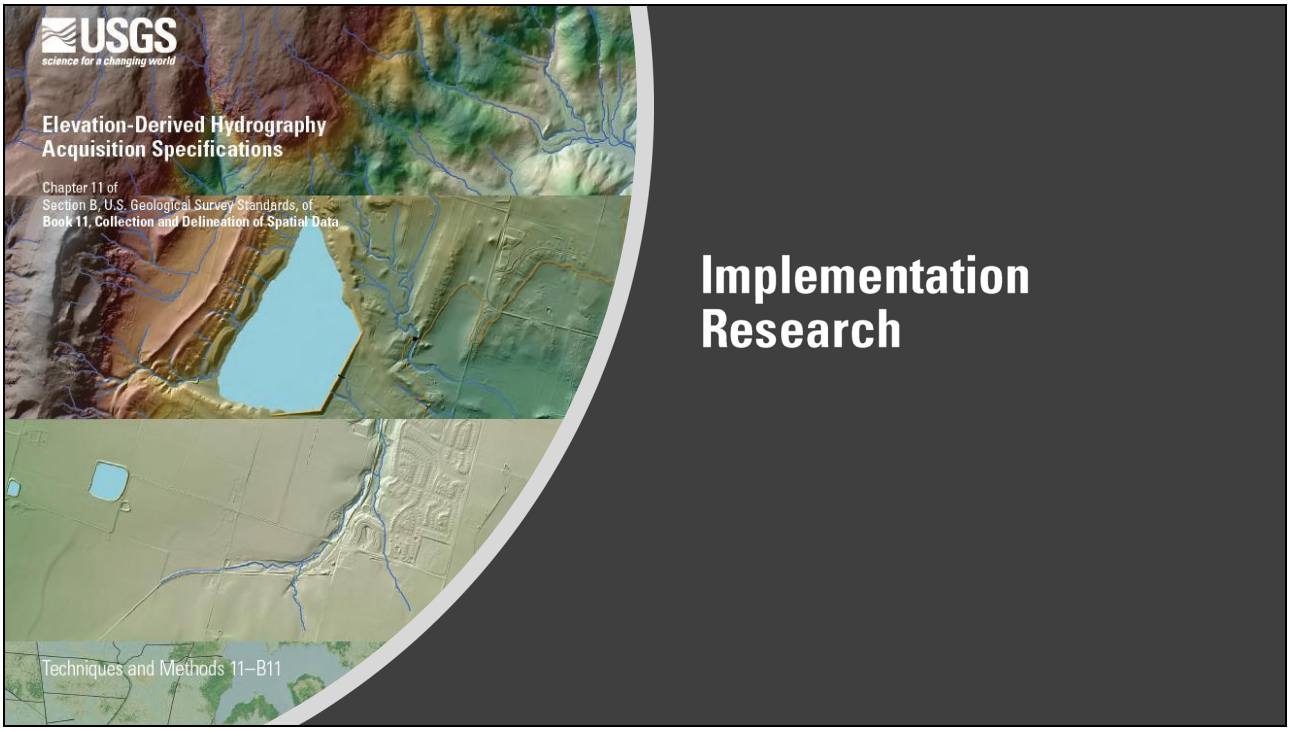
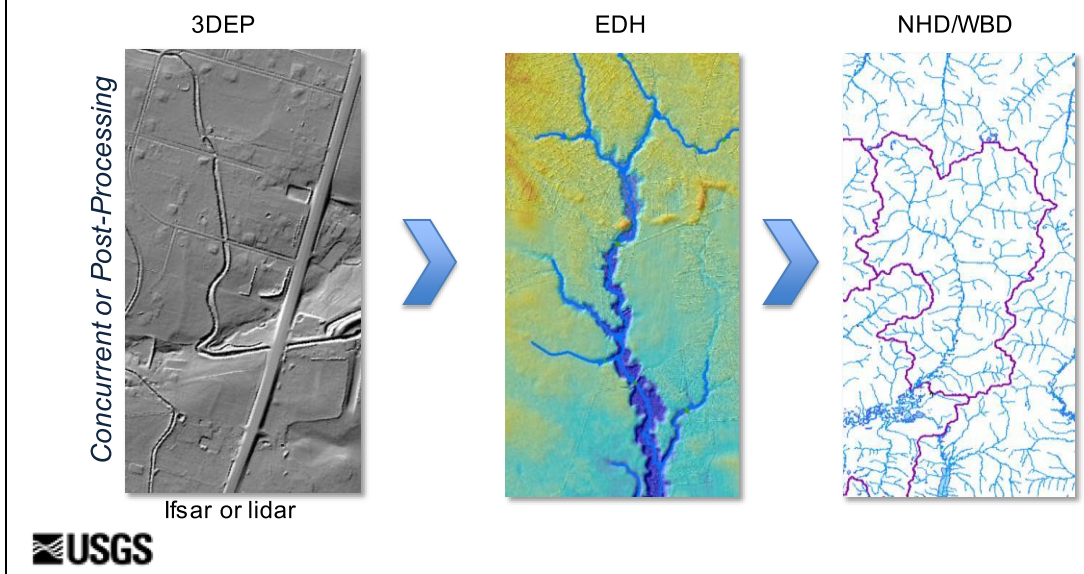


Image 1 is an example of a dam connector that is too long, ending past the edge of the dam. Image 2 is an example of a correctly delineated dam connector, ending at the edge of the dam.

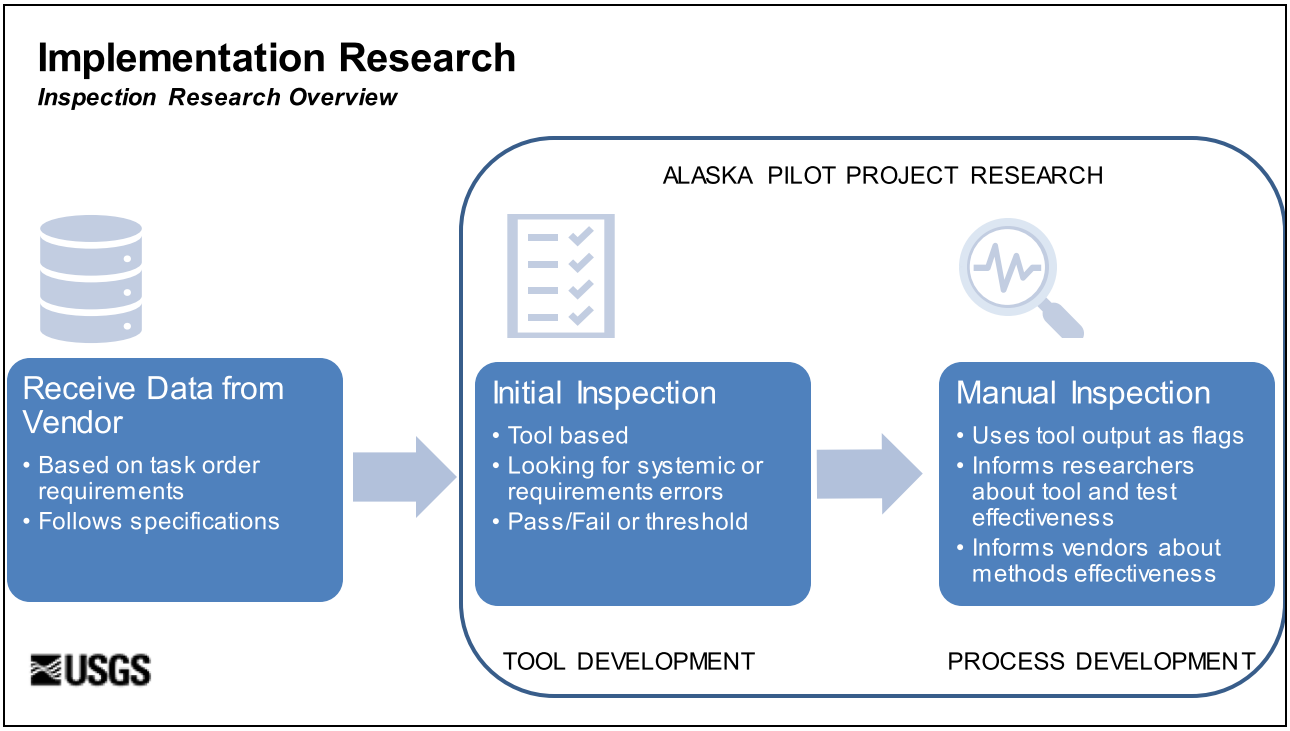
Here is an example of one of the error explanations we provide on the website. This one is for determining the correct length of connector feature through a dam, between a waterbody and a stream.



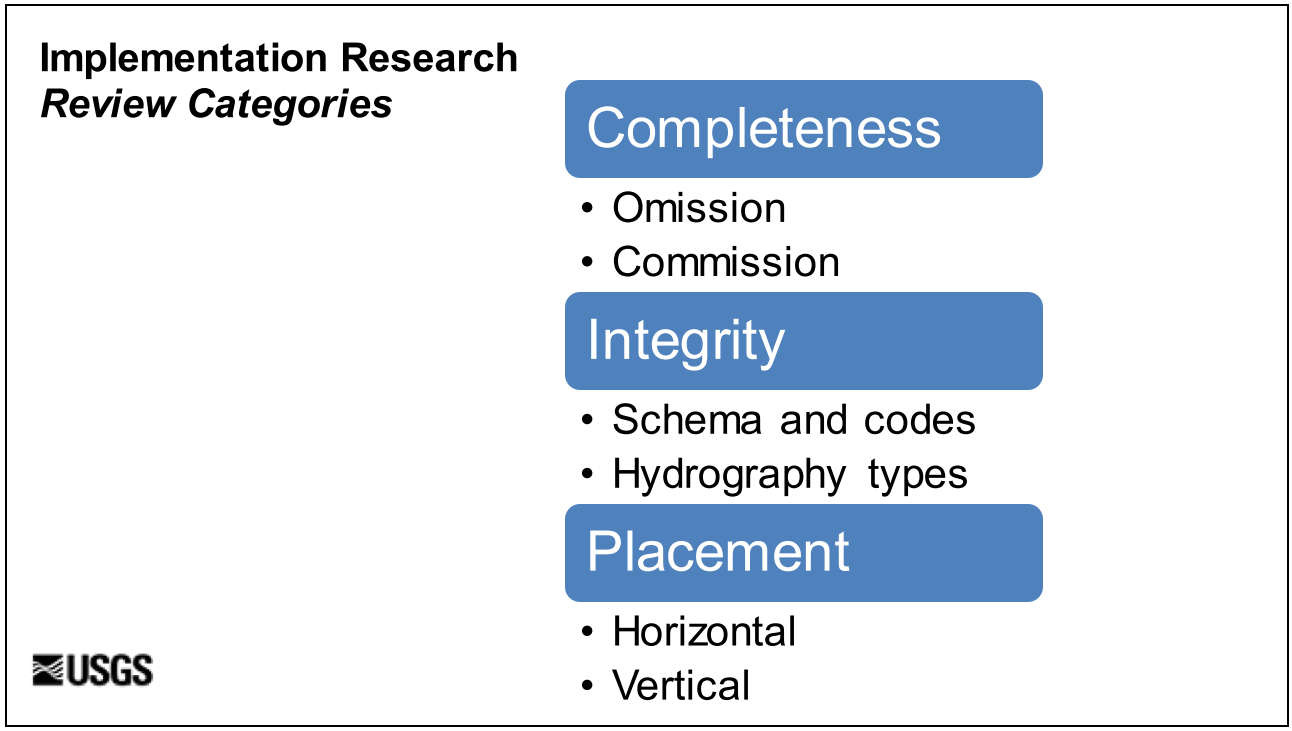
Now, I will pass the presentation over to Silvia Terziotti, so she can provide information about implementation research and applications for EDH data.



Now that the USGS has specifications for the acquisition of EDH data, we have begun some pilot projects to explore collecting hydrography data from elevation data, storing it in the EDH format, and converting it to NHD data. This requires a robust inspection process -- complete with tools -- to ensure the best possible data is available for NHD and for use as breaklines for elevation derivatives.



Our current pilot is in the Kobuk River Region of Alaska, and our research is currently developing the EDH inspection process and inspection tools for automation. As a part of our implementation research, we are trying to not only provide assessment data to inform our inspection process, but we are trying to provide meaningful feedback to the contractors so they can improve their collection process as well.



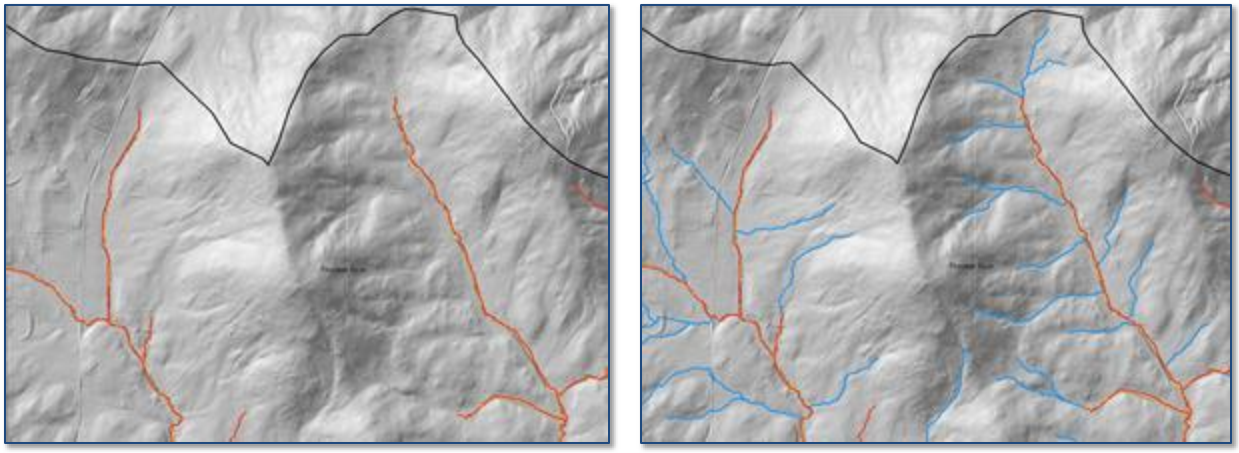
- The inspection process looks at three basic categories of errors: completeness, integrity, and placement.

In other words, we check that all of the features that should be there, are there.

We check the that the correct codes are used for the correct types of hydrography, and

that features are the placed in the correct location, both horizontally and vertically.

Implementation Research
Review Categories: Completeness



USGS

For the completeness category, we have several things to consider.

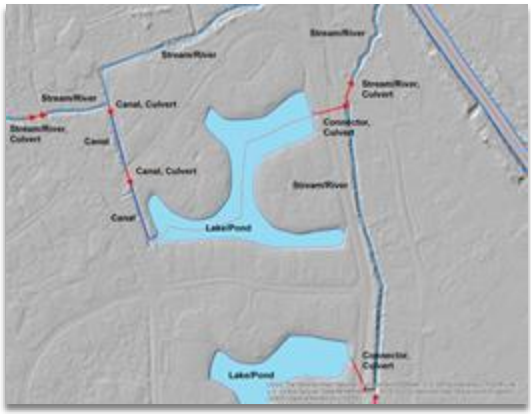
- Have all of the previously collected NHD features been captured, and, if so, are they correct according to our current specifications and requirements

- Have all additional features, not present in the NHD, which meet the specifications and requirements, been added?
- Have feature been removed which shouldn't be there
- And, have we increased the density of features appropriately for the resolution of the source data

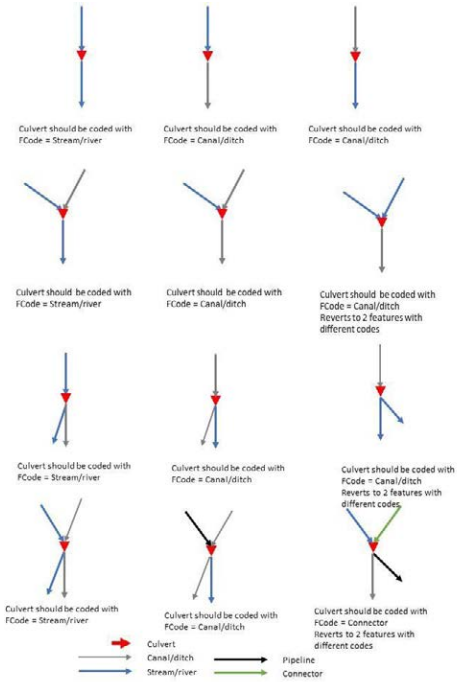
- In this example, on the left are the original NHD lines adjusted to match the elevation surface. The figure on the right shows the increased density of features. Features that meet the specifications and were not included would be an omission error.

Implementation Research
Review Categories: Integrity

Culverts



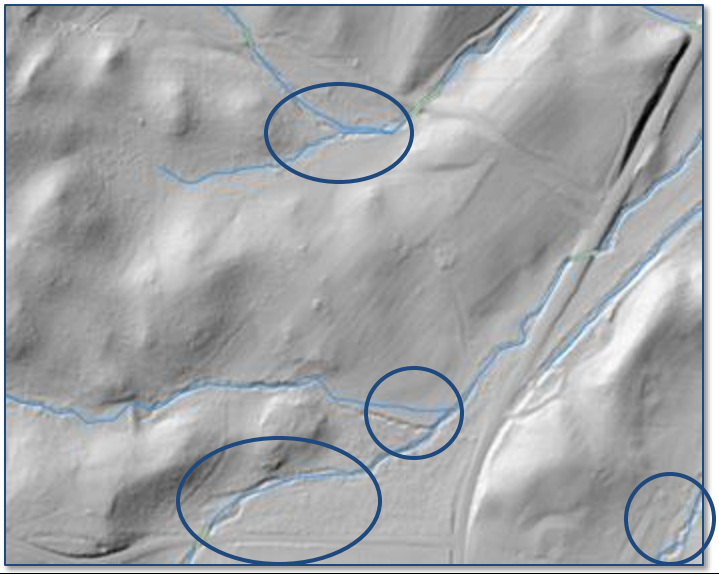
USGS



For the data integrity category, we check to make sure the features are being collected according to the coding specifications.

In some cases, such as culverts, there are very specific rules describing how the codes should be applied based on characteristics of the feature, and our integrity tests check to make sure the rules were followed appropriately.

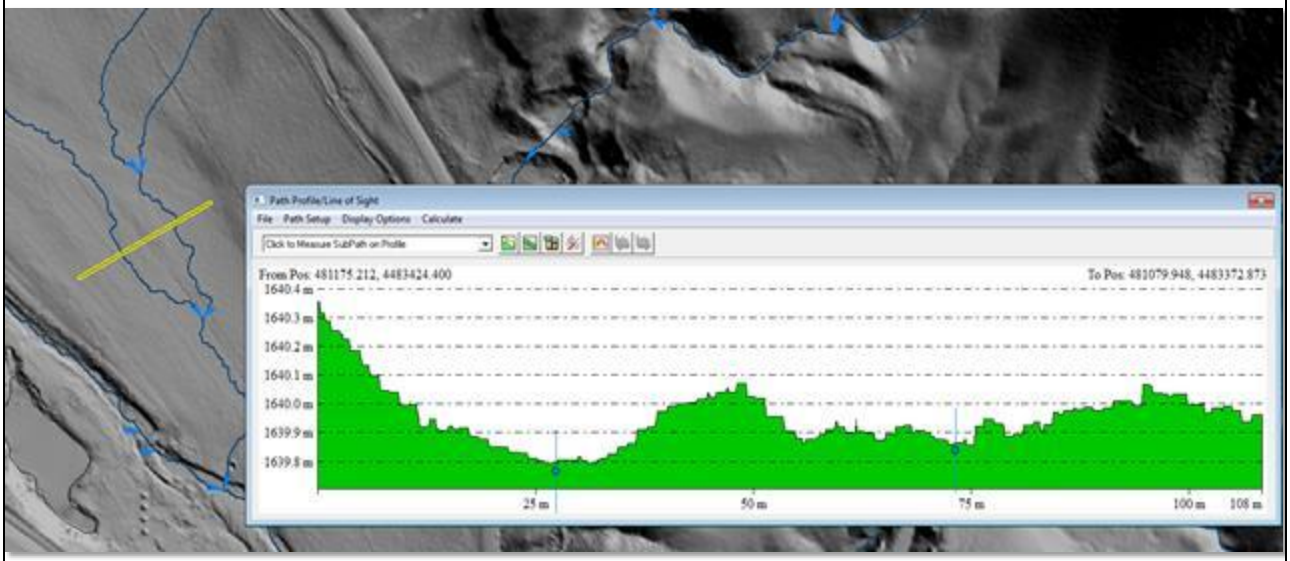
Implementation Research
Review Categories: Placement - horizontal



USGS

Our final category for evaluation is horizontal and vertical placement. For horizontal placement, we look at the integration of the drainage network with the elevation surface by examining the geometry. In this example, you can see a number of places where the drainage lines were not placed properly in their channels. This is sometimes easily seen with visual inspection, but we rely on tools to generate flags to guide us to where problems might be.

Implementation Research
Review Categories: Placement - vertical

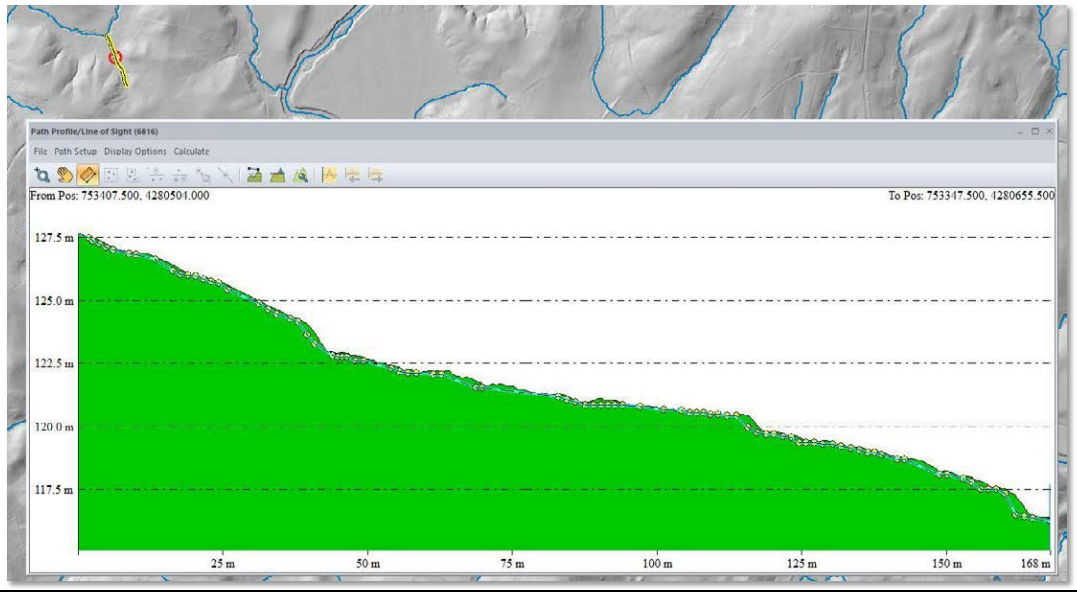


We also look at the *vertical* alignment between hydrography features and the DEM.

In the left of the image are you can see several blue streamlines, two of which are intersected by a yellow cross section line.

In the graph below and to the right, you can see two blue points which represent the intersection of the streams and the cross section, both of which are within 1-meter below the surface of the DEM.

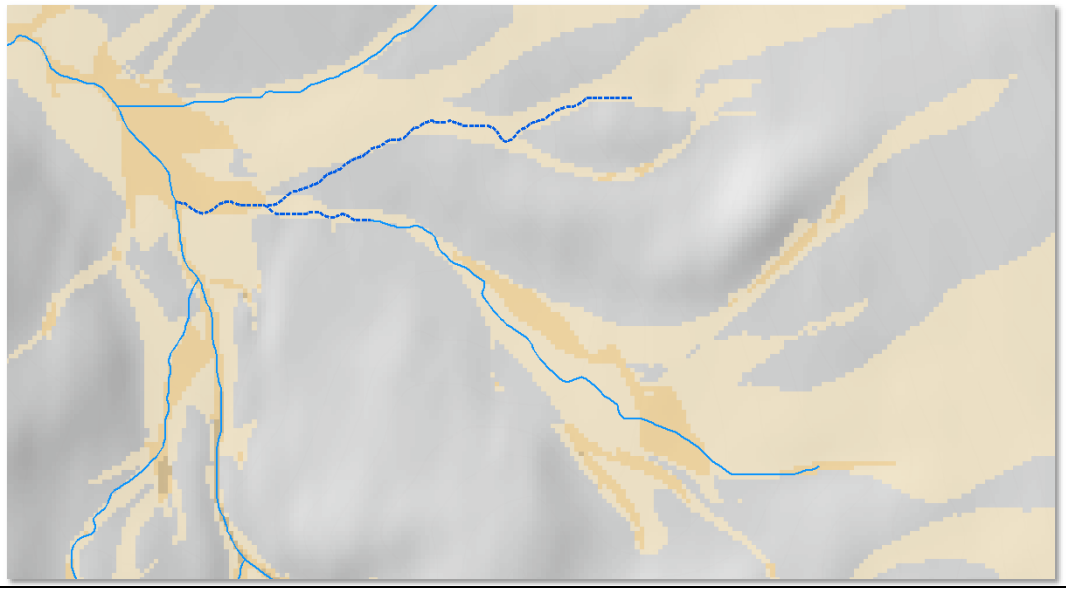
Implementation Research
Review Categories: Placement - vertical



For vertical placement, we also consider how the drainage network flows across the terrain. Z-values should be monotonic, in other words each z-value should be lower or equal to the preceding value in a downhill direction.

In this example, above the graph, you can see the stream highlighted in yellow. In the graph you can see that this stream is monotonic, and that the profile points are flowing in a downstream direction. Each dot on the graph represents a vertex on the stream.

Implementation Research
Ongoing



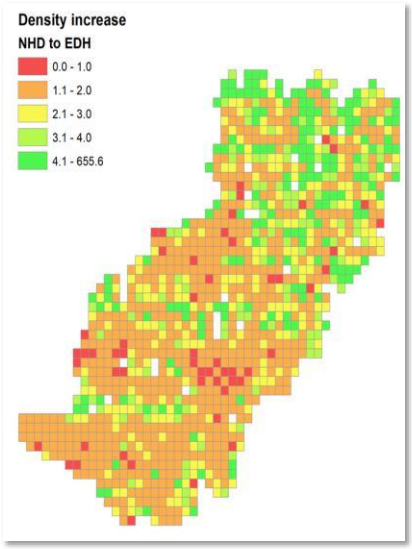
While our pilots are ongoing, we are doing research to improve our tools, and to develop new tools such as this one that uses geomorphons, Dinfinity, and curvature to evaluate the horizontal placement of streams within channels.

We are also working collaboratively with other groups to explore topics and methods such as Machine Learning to streamline the inspection process.

Implementation Research—*Inspection Tools*

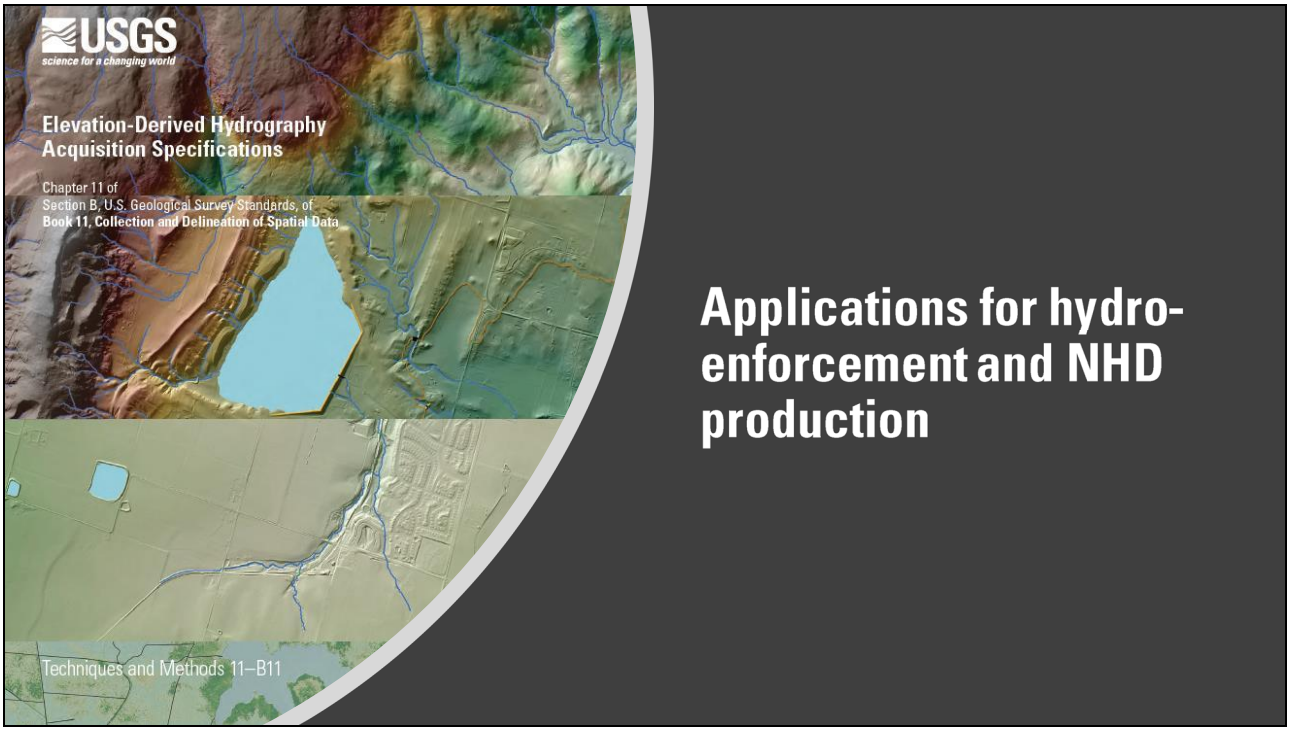
- **Feature Density**
- **Horizontal Placement**
- **Vertical Placement**
  - Monotonicity
  - Z-values: Stream vertices, lake boundary vertices
- **Topology**
  - Vertex spacing
  - Feature relationships (overlapping features)
  - XYZ coordinates of intersecting features
  - Basic topology rules
  - Geometric network

USGS



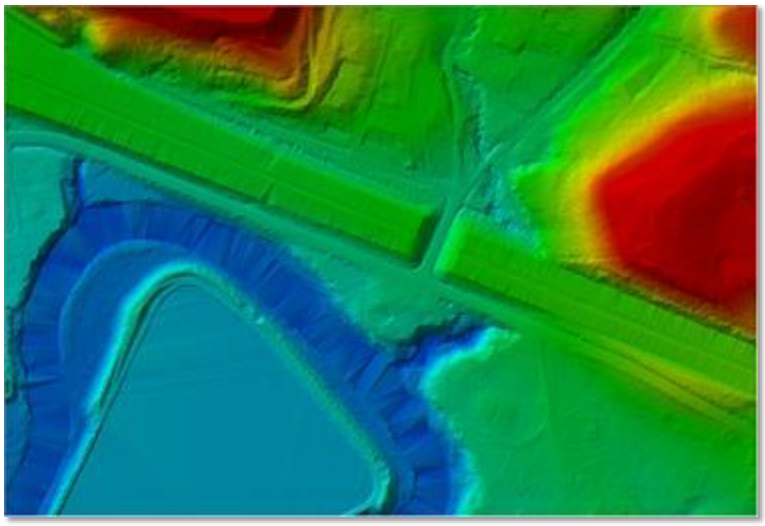
Our tools are currently being developed using the Alaska Ifsar EDH pilot project data, but tools will function in future projects with lidar EDH data.

The tools we have currently developed include tools to look at feature density, horizontal and vertical placement, and topology issues.



And now I will provide information about applications for EDH data.

Hydroflattening – meets the 3DEP program needs

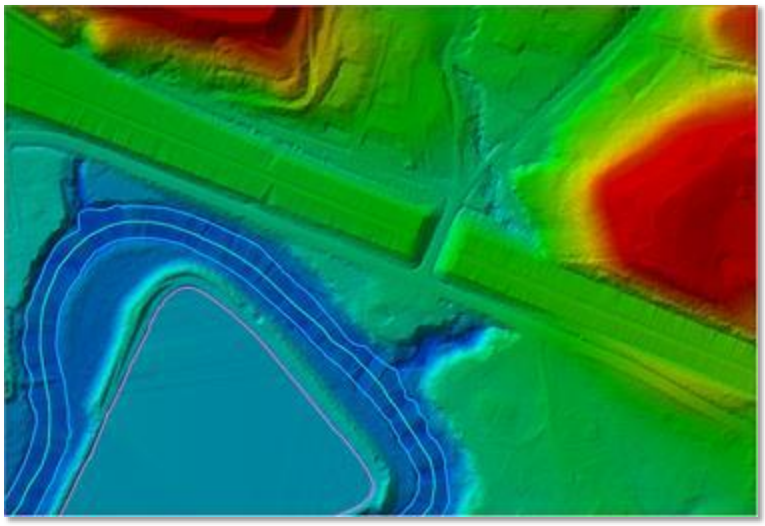


USGS

EDH data can be used as breaklines, which allow for hydroflattening water surfaces on a DEM. In other words, it makes the water have a smooth, cartographically pleasing surface.

This example shows what a lake/pond feature looks like before hydroflattening.

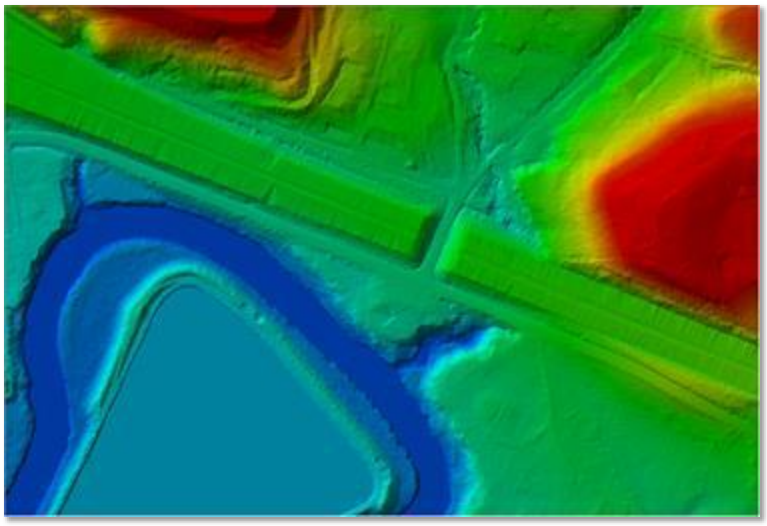
Hydroflattening – meets the 3DEP program needs



USGS

Here you can see that a double line stream and a lake boundary were added for use as hydroflattening breaklines.

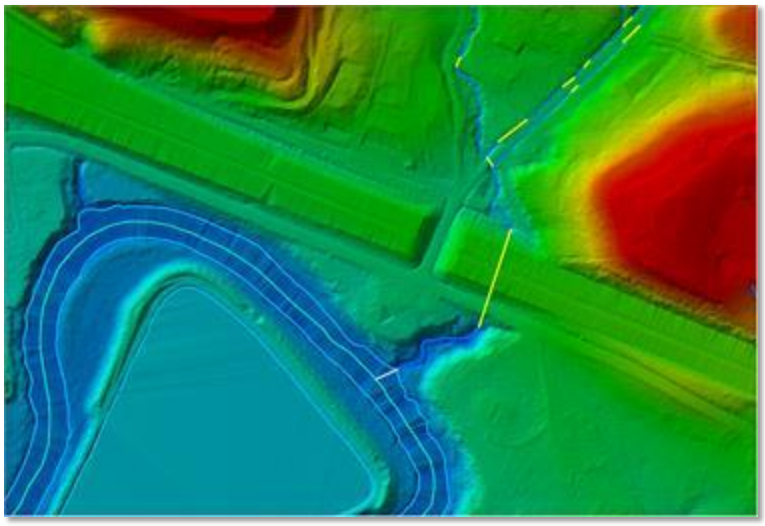
Hydroflattening – meets the 3DEP program needs



USGS

And here you can see the smooth appearance of the lake and stream after hydroflattening.

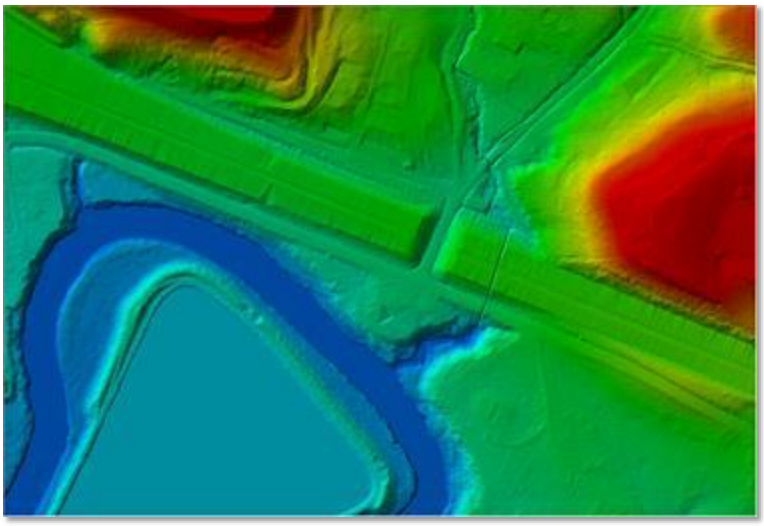
Hydroenforcement – necessary for derivatives



USGS

Here you can see that culverts and streams were added for use as hydroenforcement breaklines.

Hydroenforcement – necessary for derivatives



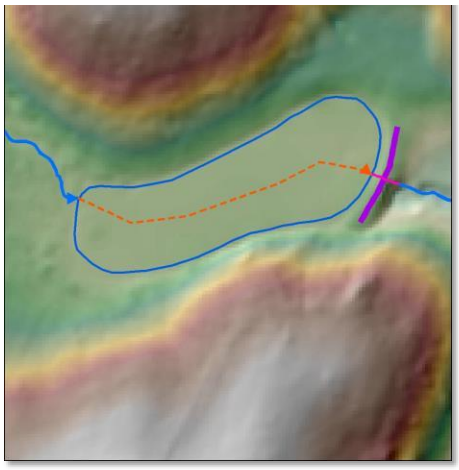
USGS

Roads often act as barriers to the flow of water on a DEM, and with hydro-enforcement using EDH data, it's possible to cut through the barriers on the elevation surface and allow the water to flow through its natural channel.

Applications
Waterbody Example

FClass	FCode	EClass	Description	Source	Method	UserCode
1	39000	1	Lake/pond	Required	Required	--

Domain value	Feature description
	FClass
1	NHD feature (will be used for conflation).
2	Non-NHD feature (outside of collection criteria).
9	Nonhydrography feature (elevation dataset limitation).
	EClass
0	Not used for elevation derivatives.
1	Used for hydroflattening (3D polygon).
2	Hydrographic feature used for elevation purposes, other than culverts or those used for hydroflattening.
3	Culvert—used for hydroenforcement.
9	Elevation dataset limitation.



As mentioned before, a primary goal of the specifications is the integration of elevation and hydrography data. Coding and defining special cases and features are specifically defined in the specifications to meet this goal.

In this example the EClass of 1 is used to identify any waterbody that should be used for hydroflattening (if collecting the lidar concurrently), or is imported from the lidar source (if EDH is being created from an existing lidar dataset).

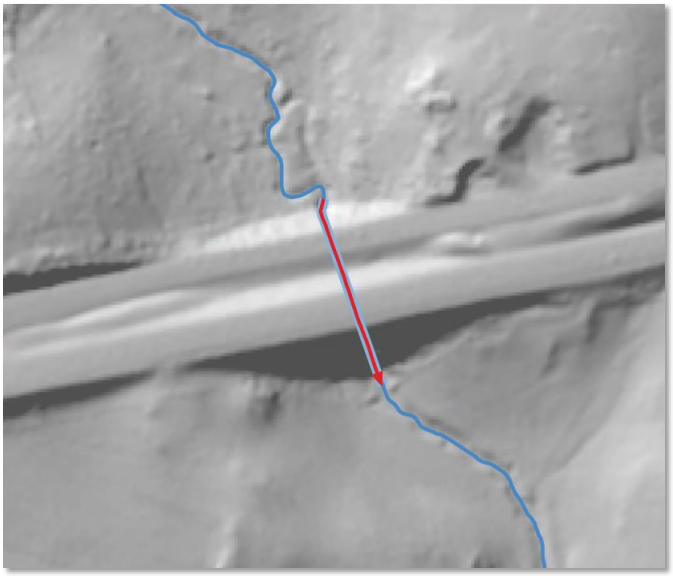
Applications

Indefinite Surface and Subsurface Connections

Constructed – Culvert features

- For a surface to be suitable to model the flow of water, areas within a bare-earth digital elevation model (DEM) that create a blockage to flow through the surface must be removed.
- The most common surface features that block flow across a DEM are roads or railroads.
- Finding the location of culverts and small bridges within a surface beneath transportation corridors or other features is a critical step in hydro-enforcement.

USGS



Most EDH features characterize water in a well defined drainage network, but in less defined areas, there may barriers to flow, or difficult to detect channel areas on the DEM surface, and indefinite surface and subsurface flow features can be used to traverse these areas.

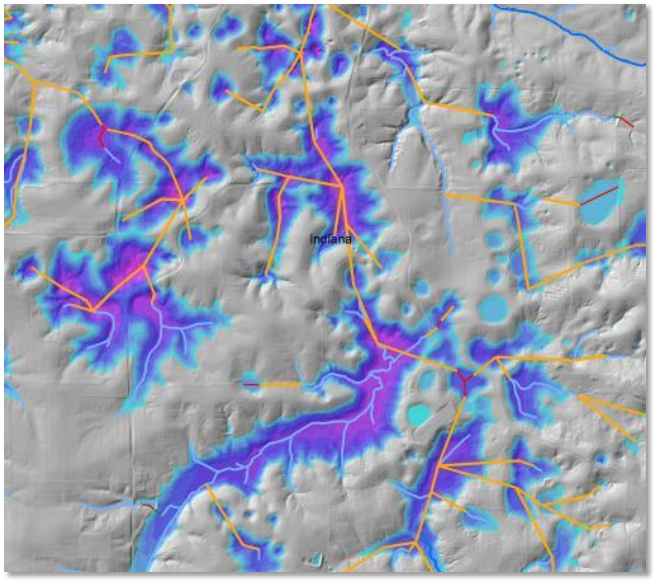
The most common type of Indefinite Subsurface Connection is a Culvert

The specification document has detailed instructions and figures to help users identify culverts and place them correctly within the EDH network so that they are spatially integrated with the elevation surface.

Applications

Indefinite Surface and Subsurface Connections

Natural – underground conduits



Another type of indefinite subsurface connection is the underground conduit, which should be used for natural underground drainage paths or to breach other types of features that naturally block the flow, such as landslides, moraines, glacial till, or other naturally occurring berms.

The underground conduit is also used where subsurface flow is the connection between upstream and downstream surface network features – this is common in karst terrain.

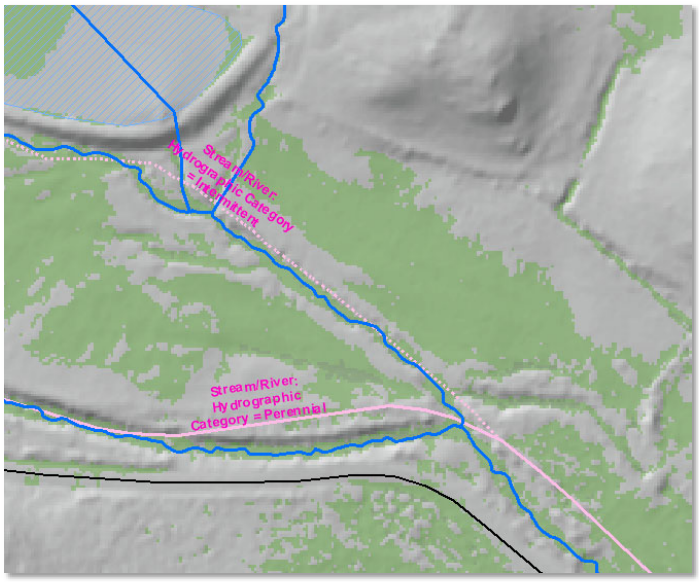
Applications

Preservation of NHD feature codes

Preconflation processes

- Because the hydrography features collected for EDH are limited to what can be derived from an elevation surface, FCodes may require updates so that information already in the NHD is not lost during the conflation process.
  - Preconflation processes are being developed to automate the transfer of NHD codes.
- Culverts must also be preserved as NHD events
  - Preconflation processes will retain the location of the culverts for future use.

USGS



Pre-conflation processes are being developed to transfer existing Fcodes to the new linework collected through EDH. This will be automated based on conflated feature Reachcodes.

Other features collected for EDH that are not in the NHD, currently just the culvert features, will be converted to NHD Events at the time of conflation.

Implementation Plans

Currently -

- Tools and QC procedures are being developed for Alaska and a couple of pilot areas.
- We are doing research on how to make the NHD conflation process easier, faster, and more scalable with EDH data.

Future -

- Nationwide lidar acquisition, slated for completion in 2023, is funded through congressionally appropriated funds (through the 3DEP BAA).
- The USGS would like to encourage the collection of hydrography with lidar in the future – currently working towards a plan to do this.
- We hope to initiate additional pilot projects to continue to test and refine the process.

USGS

Now that we have published 2 specification documents, we are planning for the next stage.

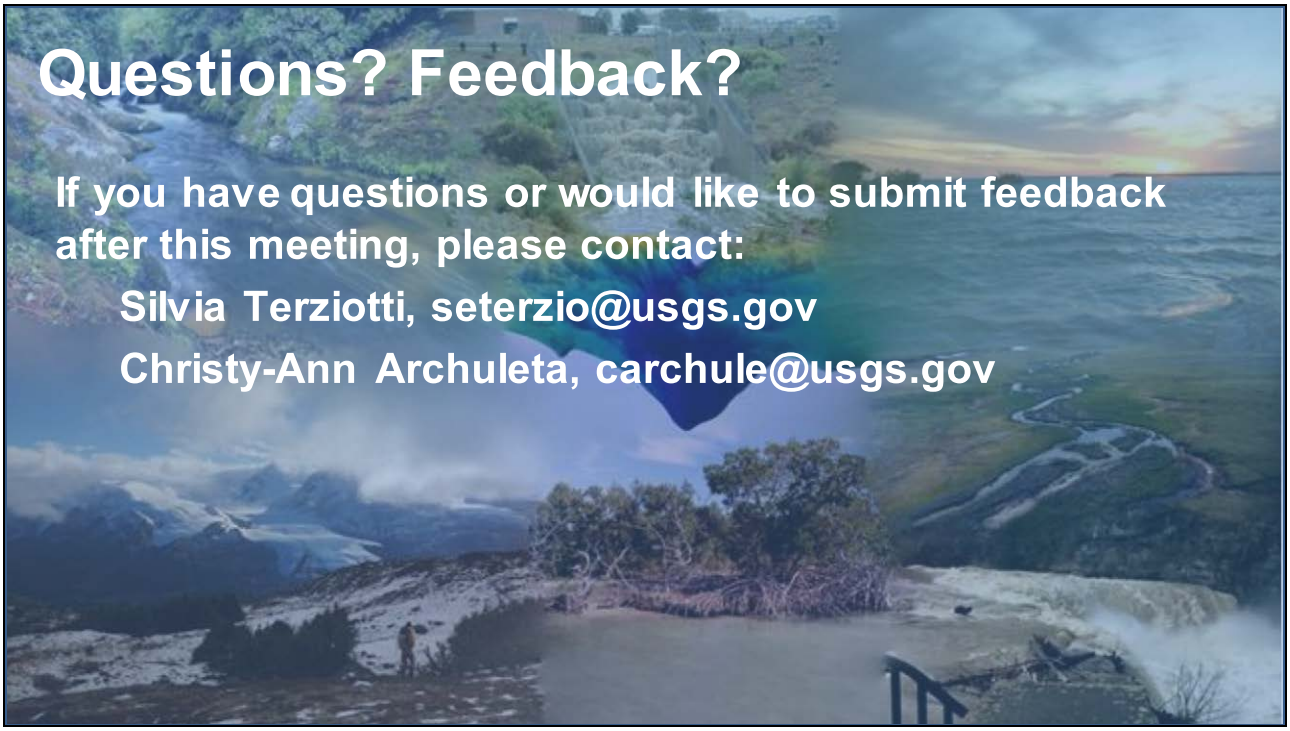
Our goal is to eventually provide funding for EDH, however we don't have the mechanism to do so at this time.

We will be working on a Call for Action plan that will outline the steps and resources needed for the 3D National Terrain Model, including EDH partnerships. The target is to complete the plan by early spring 2021.

3DEP BAA funds are Congressionally appropriated for, and remain focused on, lidar acquisition and the goal to complete nationwide lidar data acquisition by 2023.

We are doing research on how to make the NHD conflation process easier, faster, and more scalable so it works better with EDH data.

We are very interested in talking with our NHD stewards and partners about their interest in updating the NHD with EDH data, and learning more about their plans and ideas.


Questions? Feedback?
If you have questions or would like to submit feedback after this meeting, please contact:
Silvia Terziotti, seterzio@usgs.gov
Christy-Ann Archuleta, carchule@usgs.gov