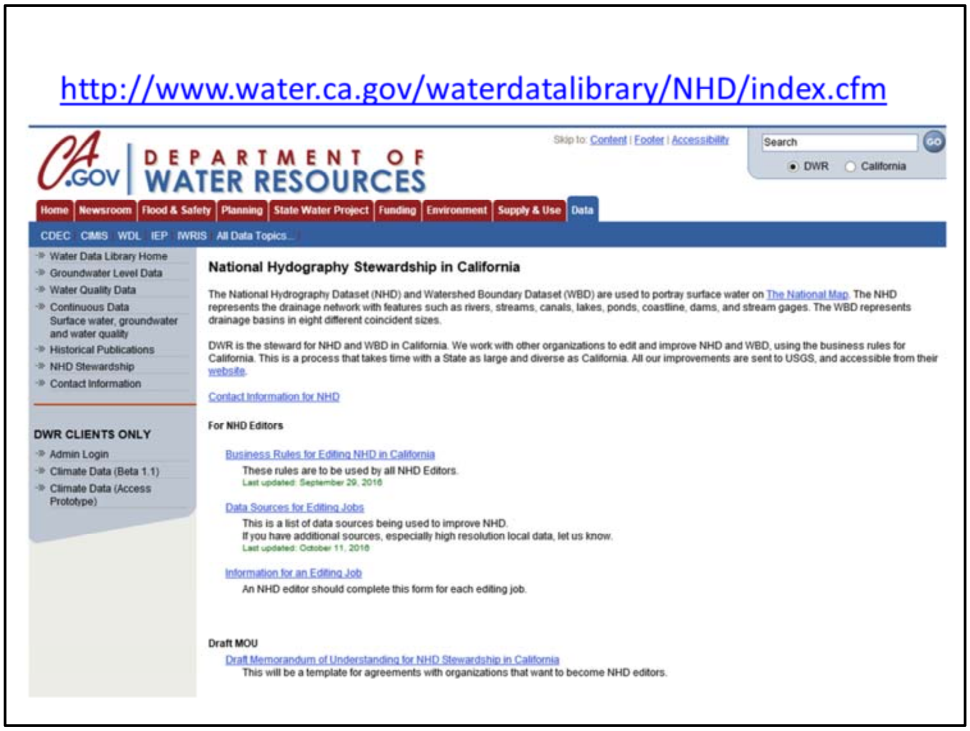
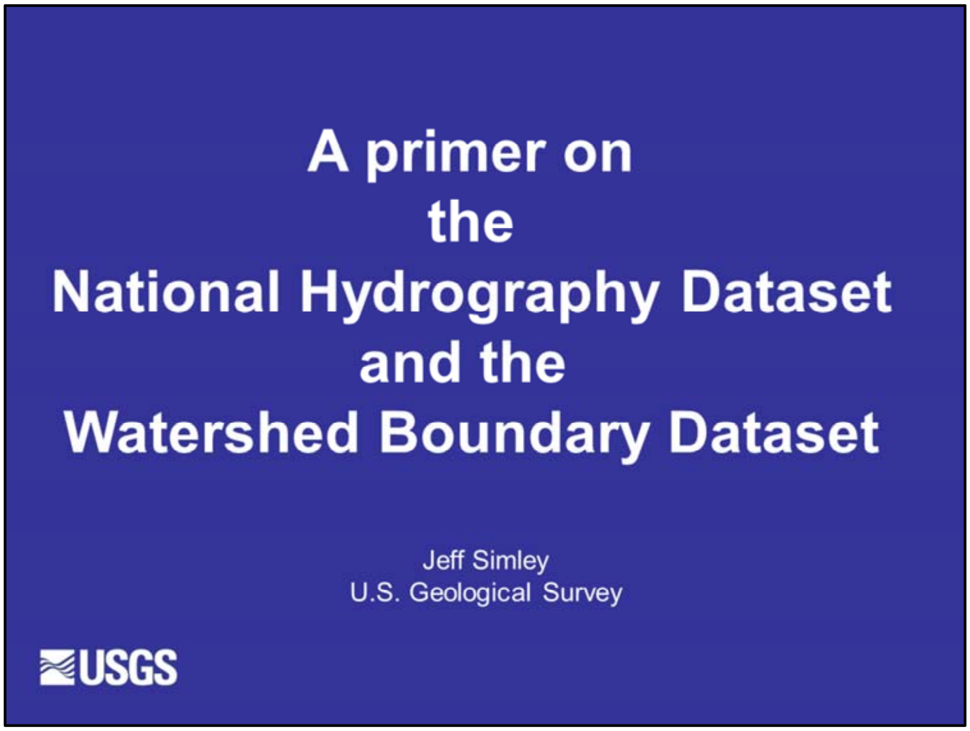
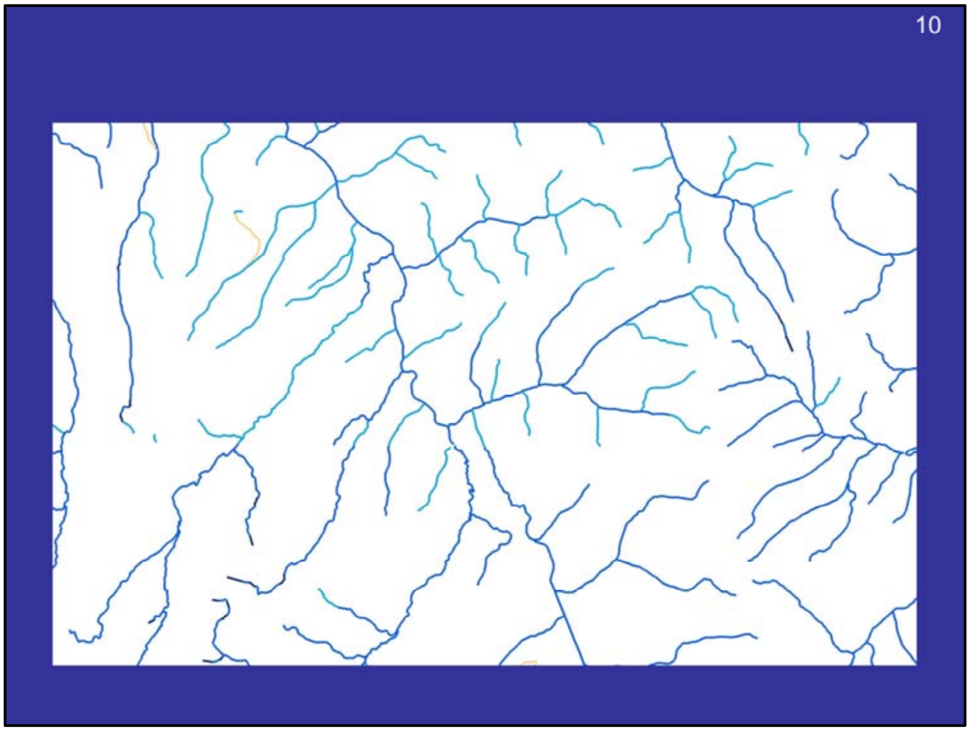

Thank you for inviting me to talk about the National Hydrography Dataset and the fairly-new California NHD stewardship program. I will present on what the NHD and its companion Watershed Boundary Dataset is and contains with just enough detail so you can start generating your own ideas of how this can be used as a framework for your wetlands data. Please feel free to interrupt me at any time if you have a question or need clarification.  If I use too many acronyms or slip into jargon, please stop me!




The California NHD Stewardship Program became effective in fiscal year 2016-2017. Stewardship of the California portion of the NHD is officially the responsibility of the California Department of Water Resources. Organizationally the program sits in the Division of Statewide Integrated Water Management, Integrated Data and Analysis Branch, the same branch that hosts the Water Data Library. I am a GIS specialist for DWR; prior to taking this position in 2016 I served as the GIS support person for the Bay-Delta Office. I will talk a bit more about the stewardship part later, but first, here is a quick primer on the NHD and the WBD.

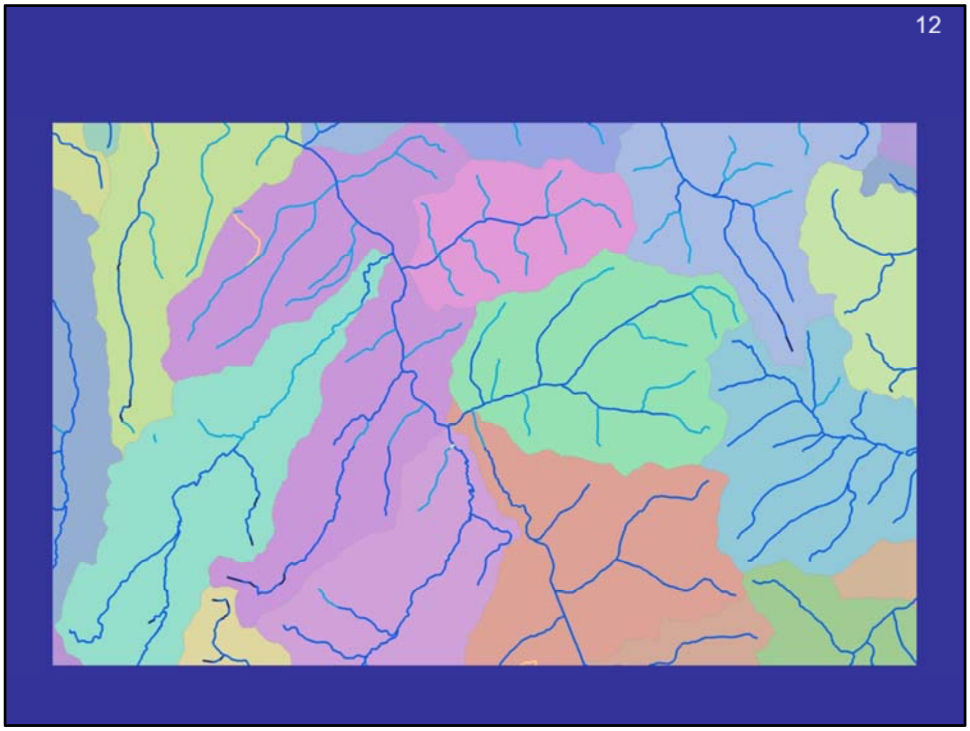



Our stewardship program covers both datasets. The WBD steward for now is Lorri Peltz-Lewis, formerly of the Bureau of Reclamation and now with the U.S. Forest Service. The WBD has a rigorous certification process, and the stewardship transition will take additional time. We will not be updating the WBD until after we update the hydrography to the 1:24,000 scale. These slides are taken from a presentation prepared by Jeff Simley, the former Hydrography for USGS, now retired. Jeff used to travel around the country teaching workshops on the NHD and its applications. In his retirement I understand he is writing a book on the NHD. I will not cover all the material in these slides in detail but I am including them for your future reference. I will talk through these fairly quickly.



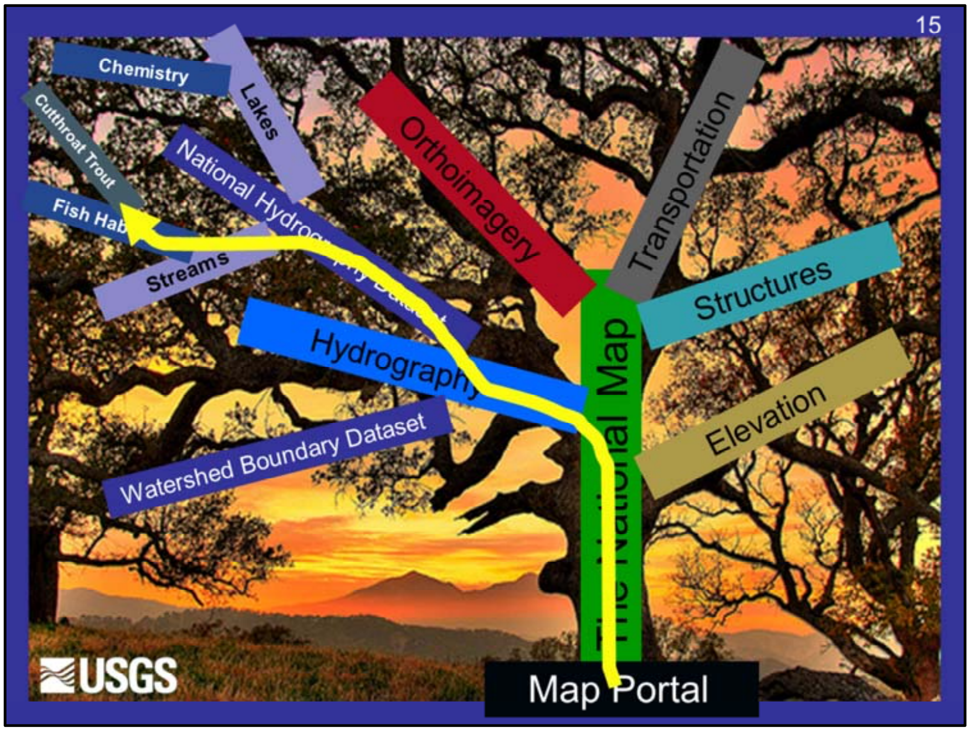

The National Hydrography Dataset is a dynamic database that depicts the surface water throughout the geographical United States as a connected drainage network. It is designed to be used in ArcGIS software, which is a proprietary product, but the geometry and attribute tables are also available in shapefile format so that it can be used in non-proprietary programs, and also as map services on the web which can be viewed in a browser. The full network functionality only works in ArcGIS.


An important companion to the National Hydrography Dataset is the Watershed Boundary Dataset.  It depicts the drainage basins of the U.S.




Combined, these two datasets provide a comprehensive understanding of surface water and generally make up the hydrography theme of geospatial data.


Combined again with the National Elevation Dataset, it is possible to get an excellent portrayal of the topography for the nation using this triad of datasets. These datasets form the foundation of the National Map.




Think of the National Map as the trunk of the tree, a kind of mother board for geographic information [animate] that contains all the elements of geospatial information, including elevation [animate], structures [animate], transportation [animate], orthoimagery [animate], boundaries and so forth.

Included is hydrography [animate], which is primarily composed of the National Hydrography Dataset [animate], and the Watershed Boundary Dataset [animate].

The National Hydrography Dataset describes water largely as lakes and streams [animate], but as we shall see, also many other features.

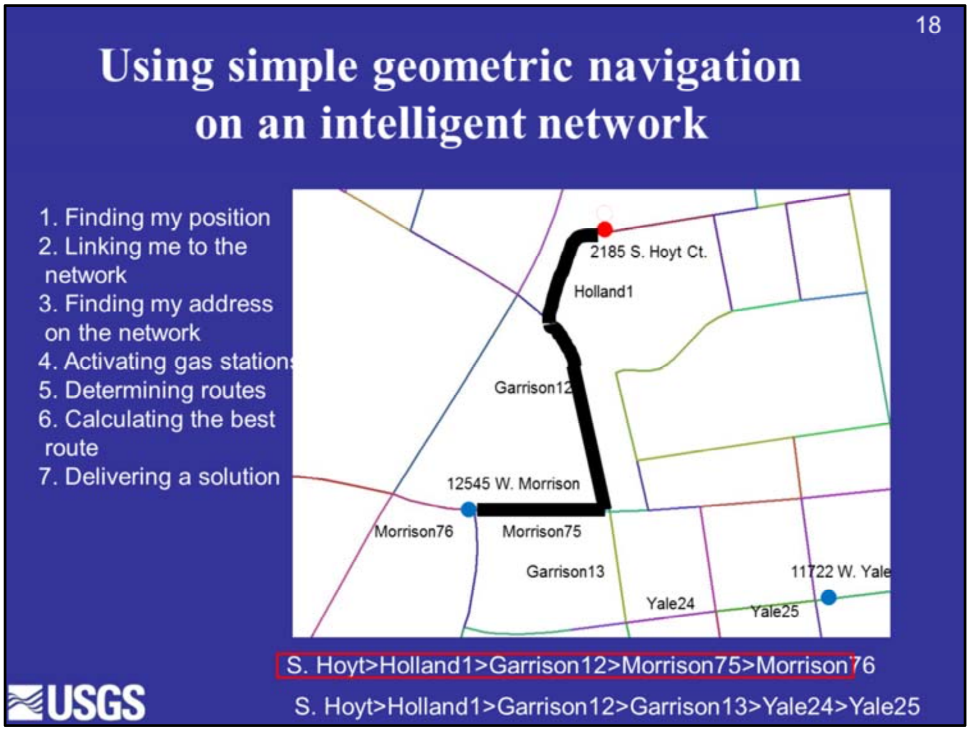
It can also contain other valuable data such as water chemistry [animate] and fish habitat [animate] when linked to the NHD. This makes it possible to identify a specific species, such as cutthroat trout, [animate] in the nation’s waterways.

These data have formed an elaborate information system. The information can be accessed through what in GIS terminology is called a map portal [animate]. This map portal provides access to specific information [animate], such as where cutthroat trout are located in the United States.

It's very important to understand that the NHD and WBD are designed to serve as the geospatial foundation for a water information system, not just lines for a map.


The National Hydrography Dataset works in much the same way you use the GPS in your car. Like the GPS in your car it allows you to solve navigation problems.

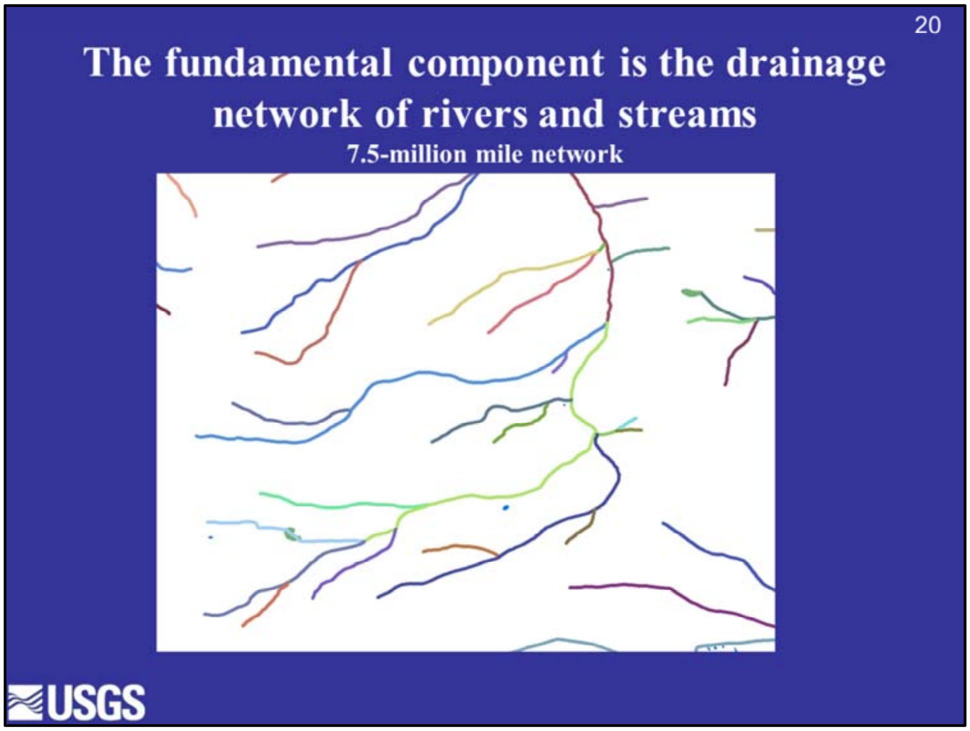

Say for example you want to find out how to get to a gas station. You are at a certain location and the gas station is at a certain location. The task is to find the route between the two. In the GPS system, it is done by using the 4 million mile road network of the United States stored in the GPS.




The GPS knows your position on the surface of the earth [animate]; but what you really want to know is specifically where you are on the network of roads [animate]. In other words, not just where you are in space but where you are on the network. Your position on the network is identified with a network address [animate].

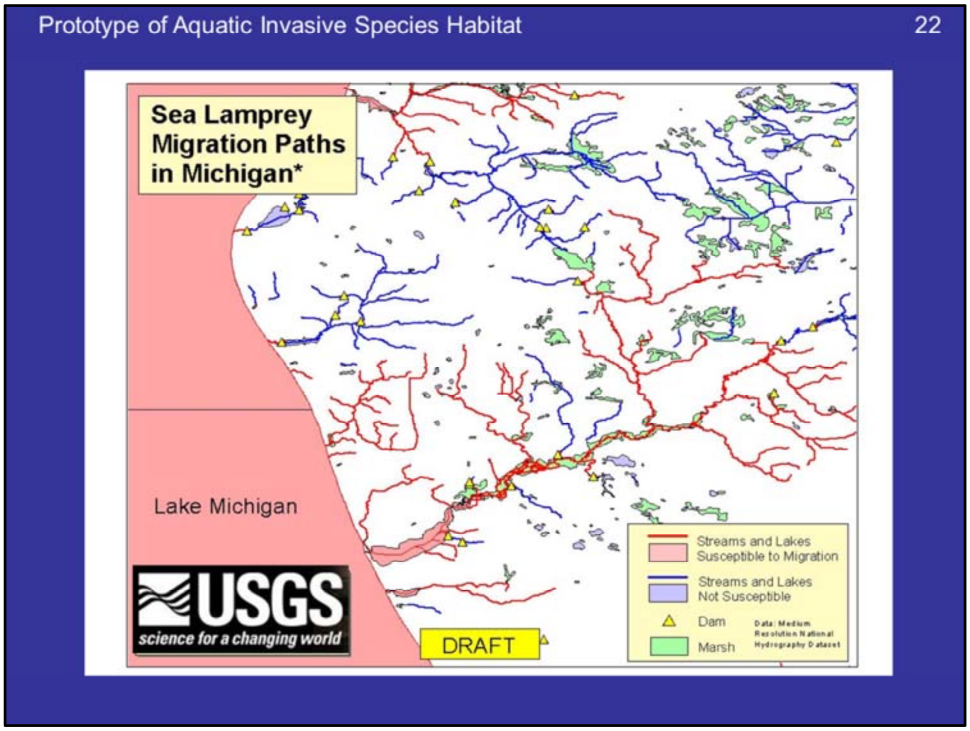
The next thing is to find out where the gas stations are [animate]. The gas stations are also located on the network and have network addresses.

The GPS in your car works by determining the navigation solutions [animate], and then finding the optimum solution [animate]. It then plots the route [animate] and solves your problem – which is how to get from where you are to a gas station.

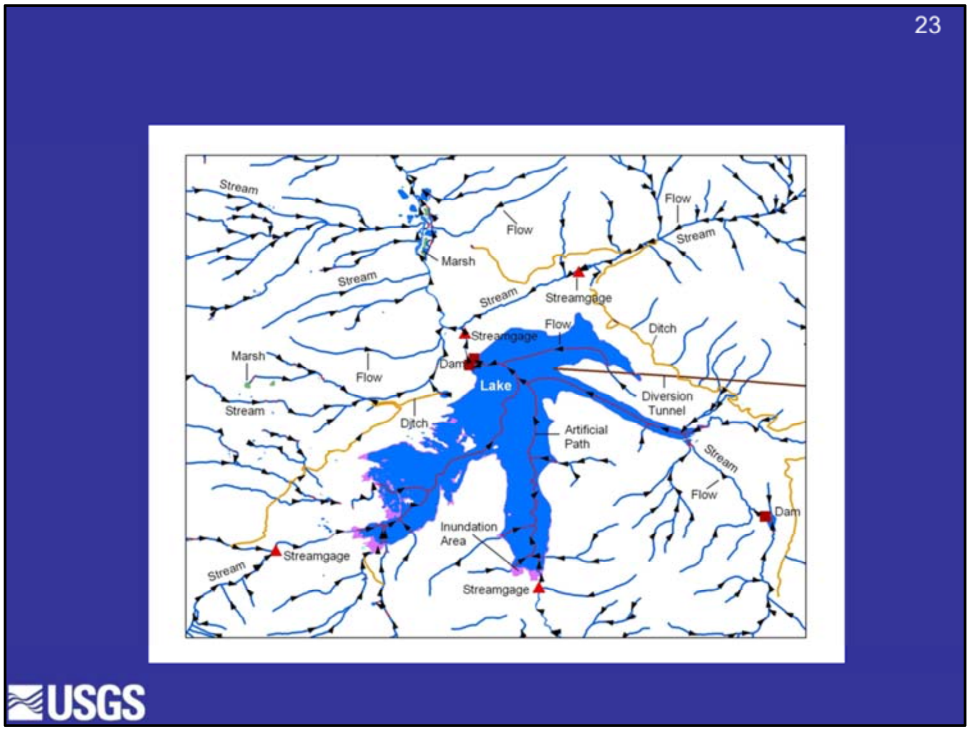



The NHD really works the same way. But instead of using a 4 million mile road network it uses a 7.5 million mile stream network.

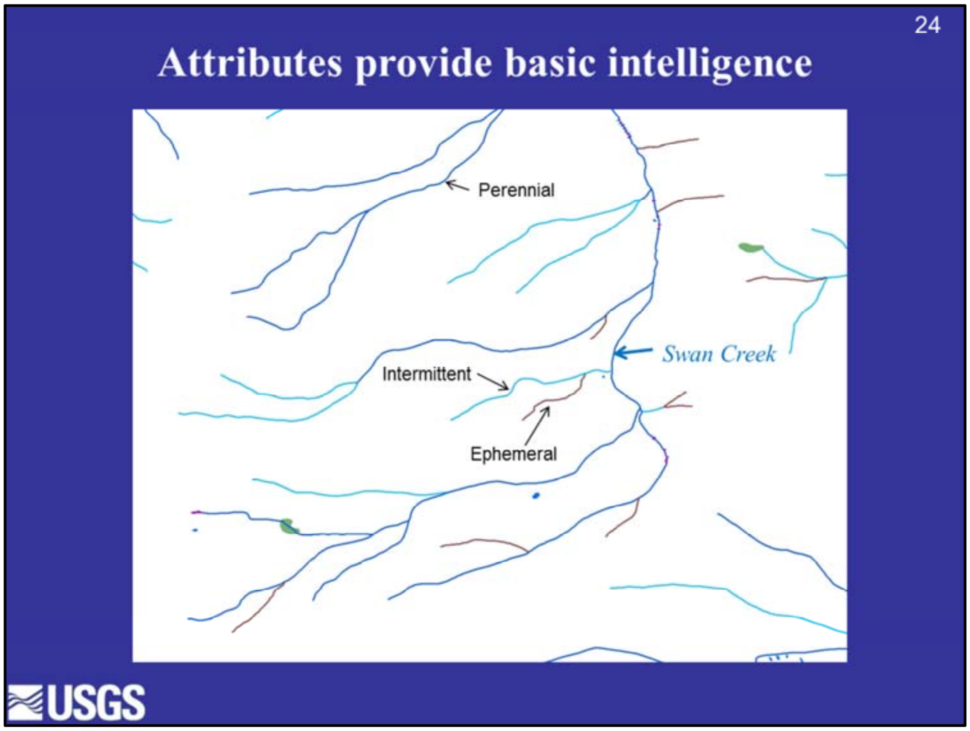

A key function of the NHD is to navigate the network to discover, for example, where a toxic spill will flow downstream. []



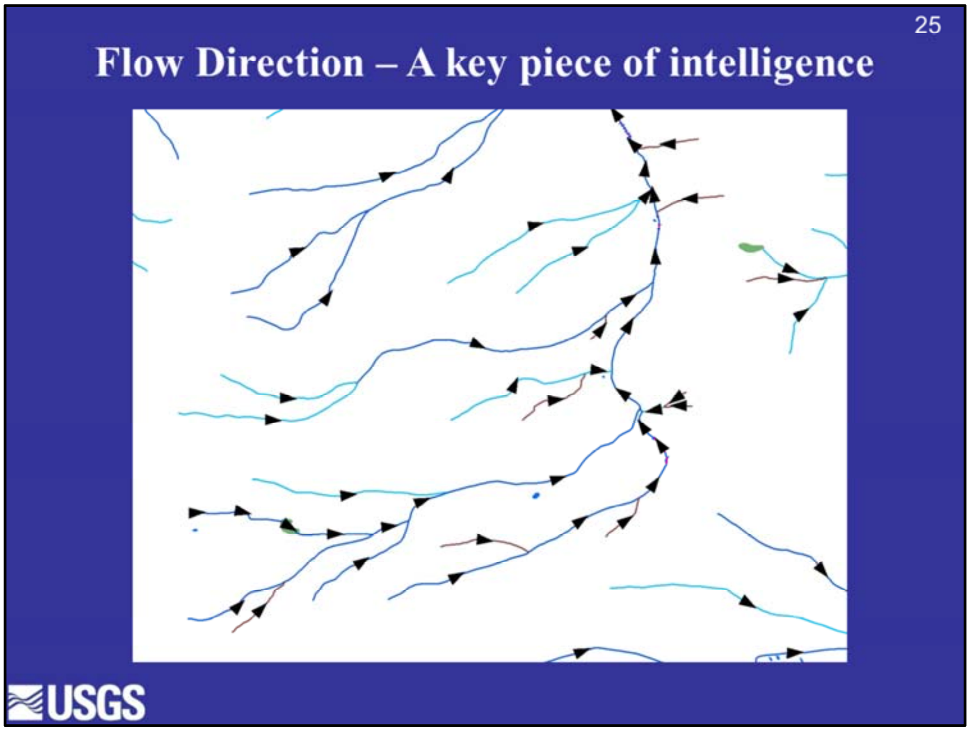

Or how invasive species will navigate upstream. [] In Michigan there is great interest in the potential migration paths of Sea Lamprey. Theoretically, the Sea Lamprey cannot migrate upstream beyond a dam. Knowing the location of all the dams on the network makes it easy to determine what part of the network is susceptible and not susceptible to migration. This prototype shows waters in red that theoretically are susceptible to Sea Lamprey.



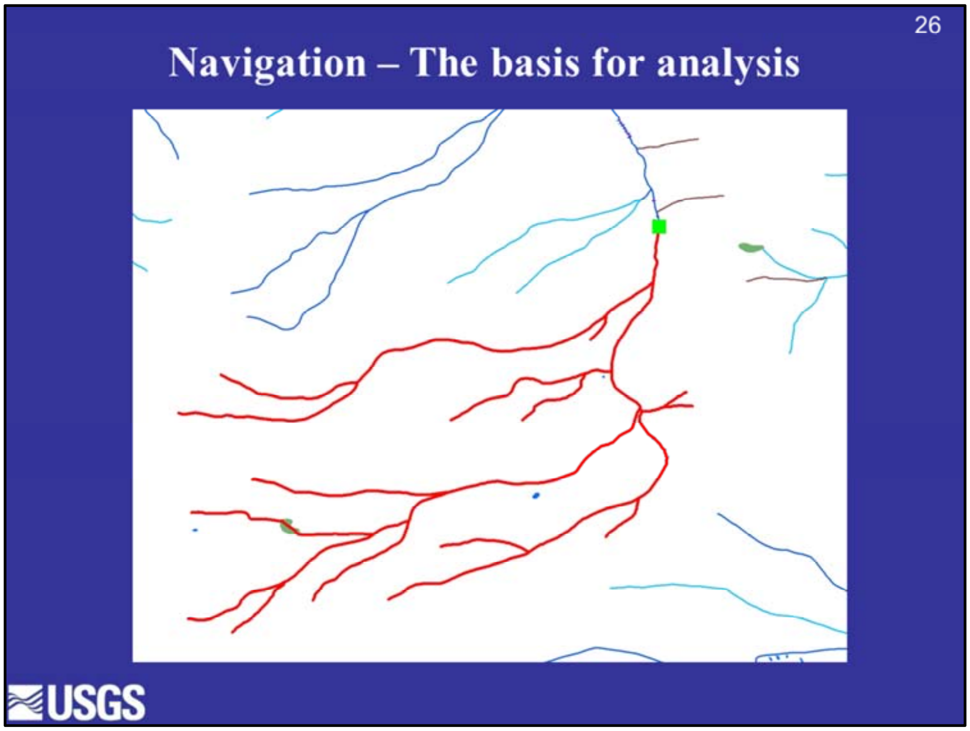

The NHD is all about water. [ ] As a component of The National Map, the NHD assembles the surface water features of the United States into a relationally structured dataset that makes it possible to see and understand the nation’s rivers and waterways as an integrated network. In this map, for example, we see a large lake and a stream network around that lake. We see that there is a ditch and a diversion tunnel; there is a marsh, there are stream gages, and dams. It’s the same kind of information we find on a USGS topographic map, and comprise the basic features that make up the surface water hydrography of the United States.



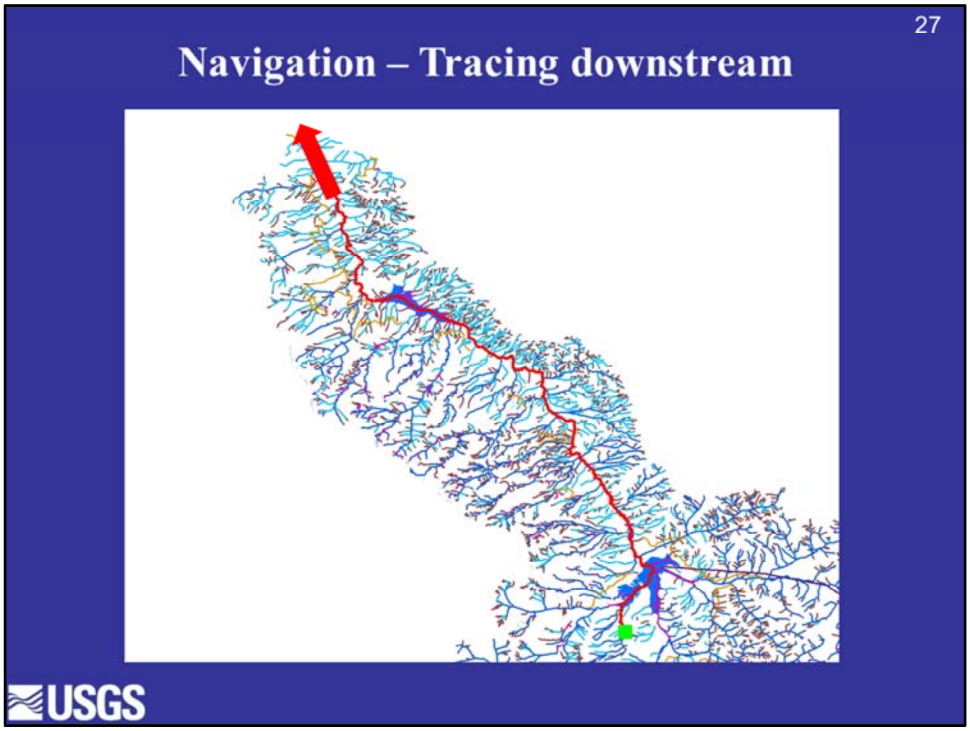

The flowlines in the NHD are central to how the NHD works. Basic information is contained in these flowlines such as the name of a creek [animate]. Information classifying the flow of water [animate] is also included.



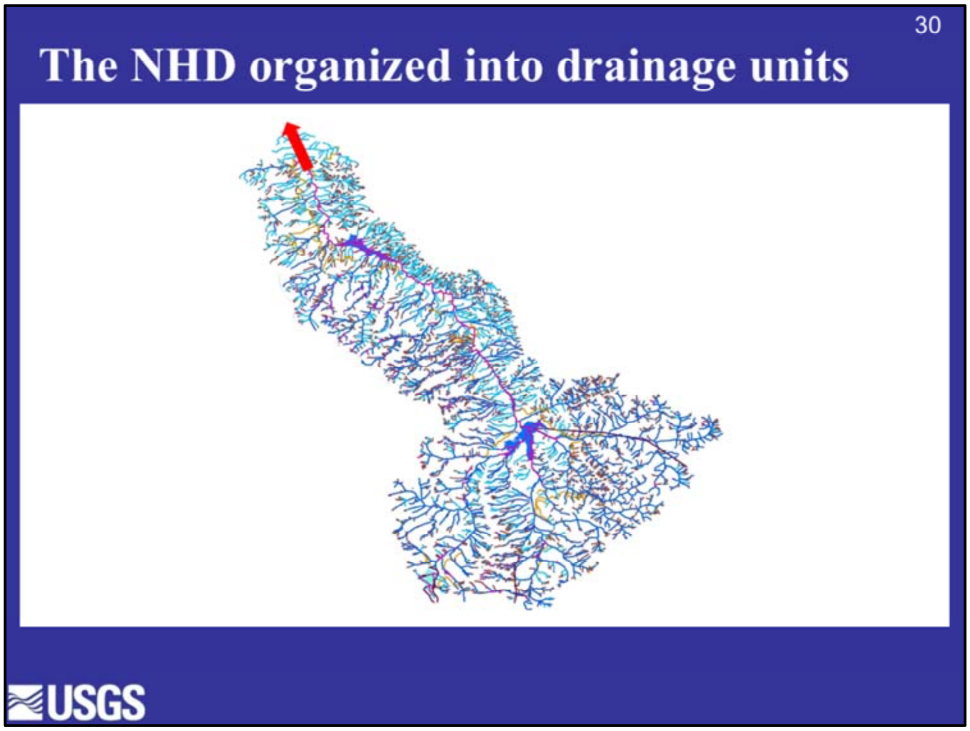

Another unique, and critical, piece of information is the direction of flow for these flowlines, and the connection between the flowlines. This is how the network is formed.



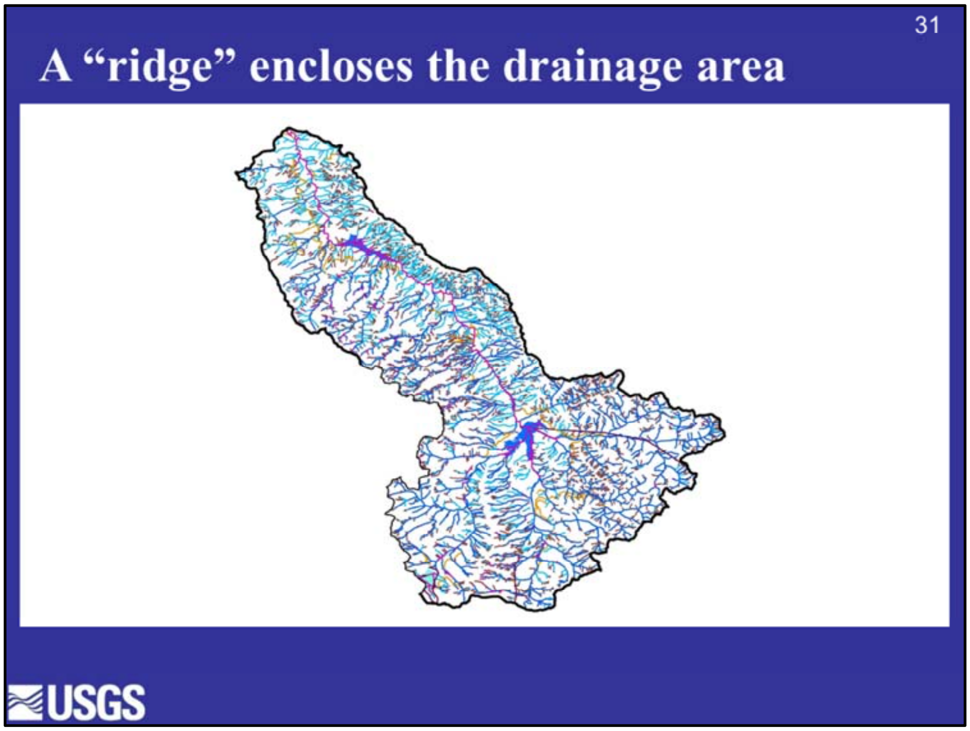

This makes it possible to navigate the network, such as finding all streams upstream of the green dot.



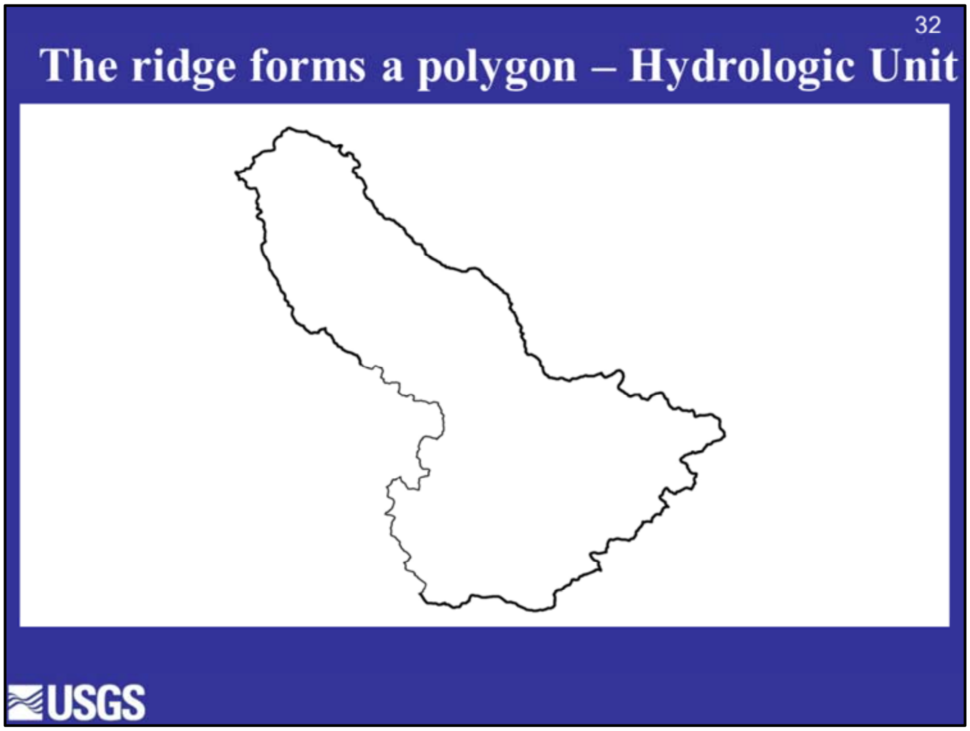

Or flowing downstream from that same green dot.



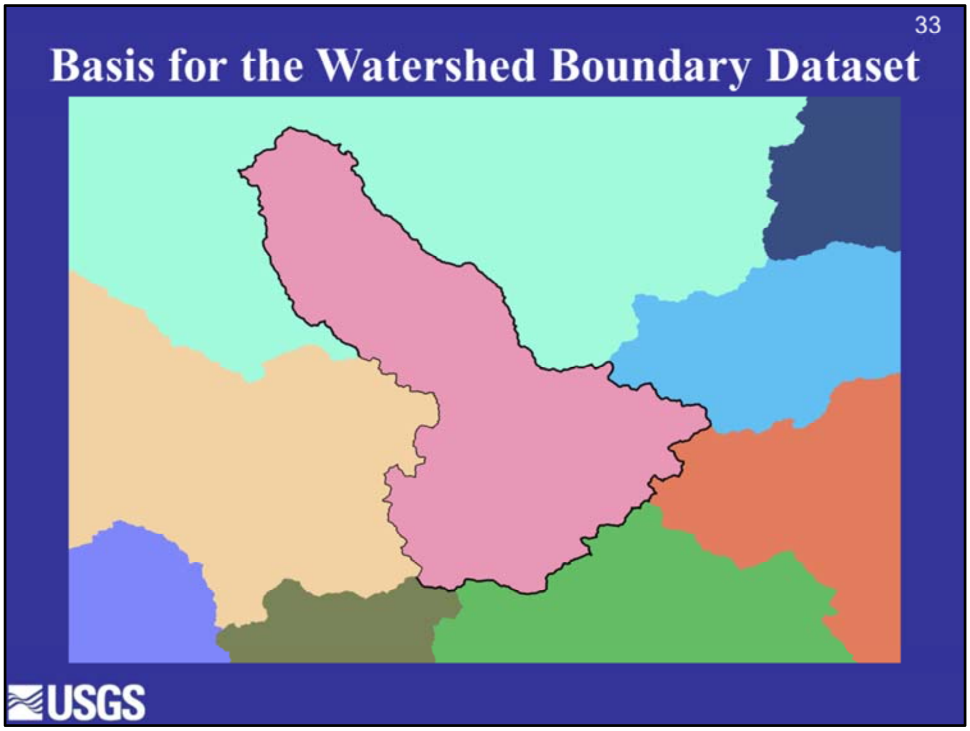

The rivers and streams of the NHD are set into a vast network of connections. All the streams you see here are connected to the red arrow, known as the “pour point”.



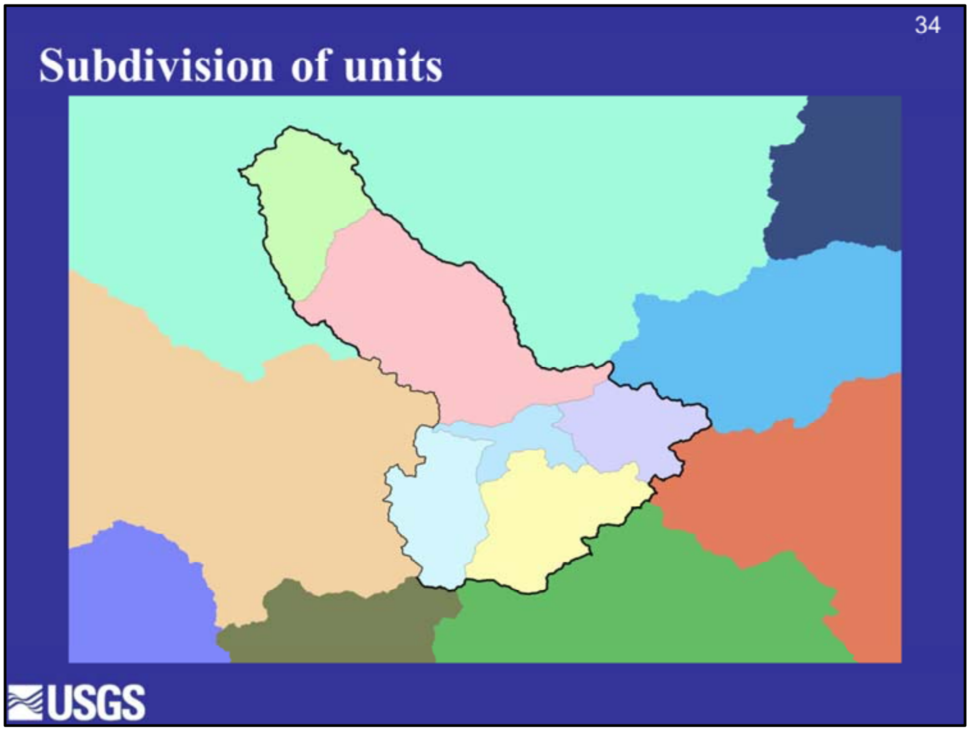

All of the streams start at a ridge that encompasses the basin.



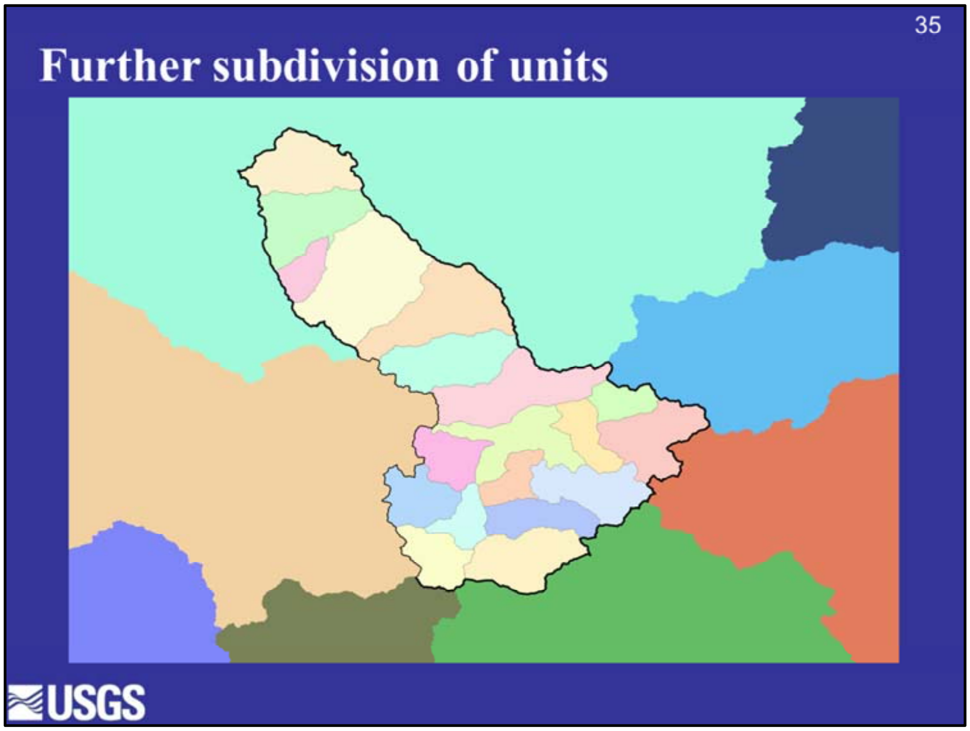

This ridge is the foundation for defining drainage basins.



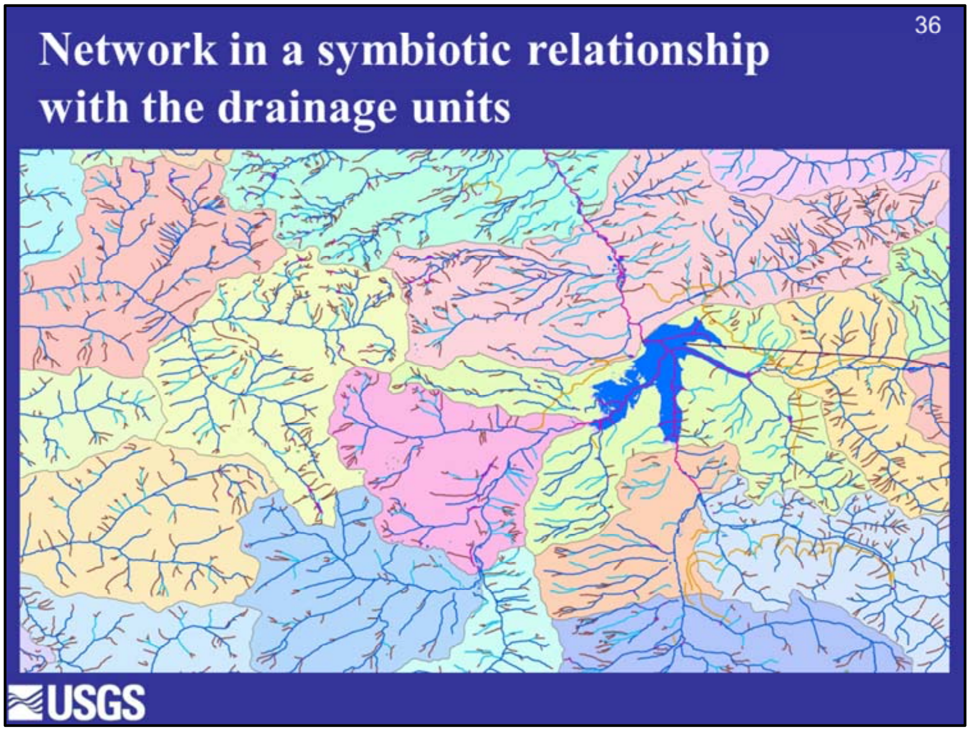

The combination of all the basins forms the Watershed Boundary Dataset, or WBD for short.



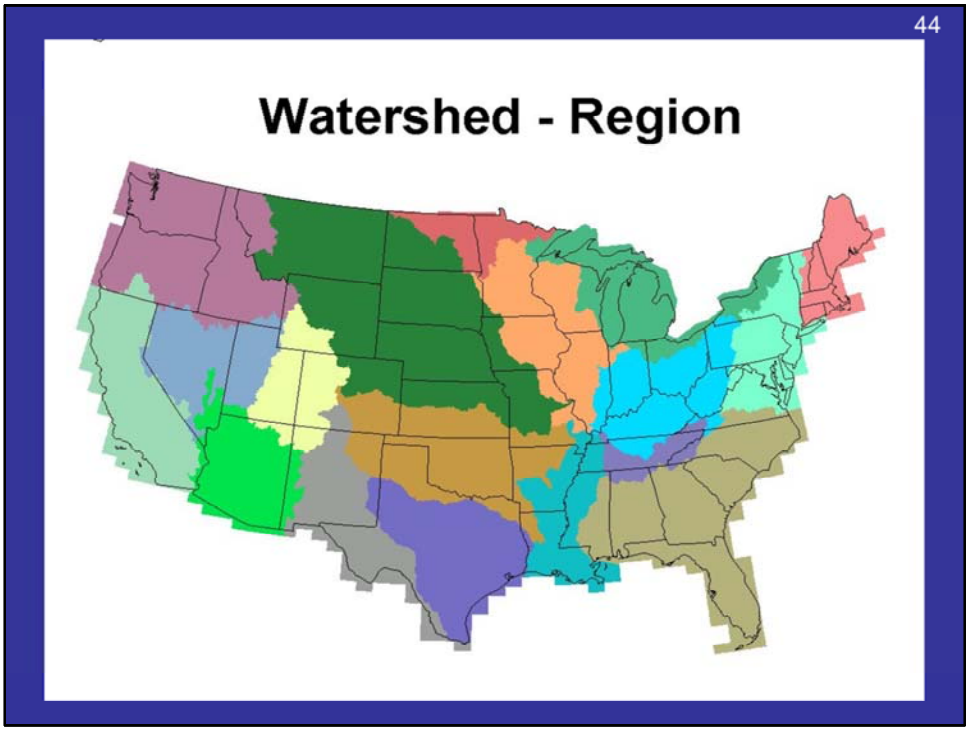

The organization of the basins, or watersheds, …




…can be scaled in a hierarchical system subdivided into smaller units or collapsed into larger units.

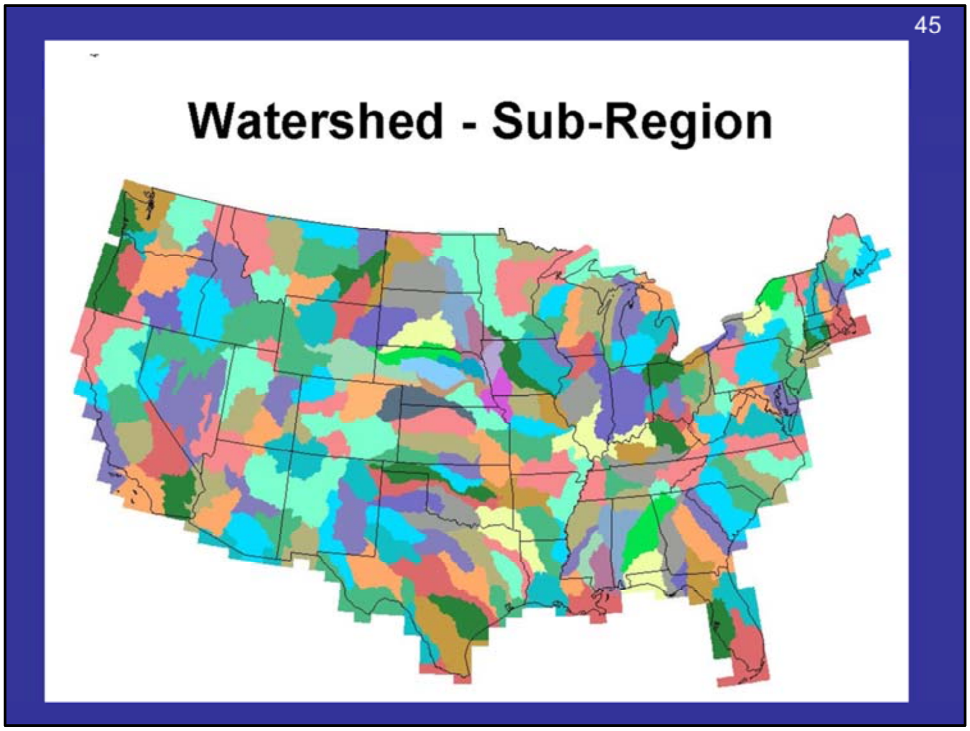



When the NHD and WBD are displayed together, it is easy to see how branches of the flow network fit into the hydrologic units.



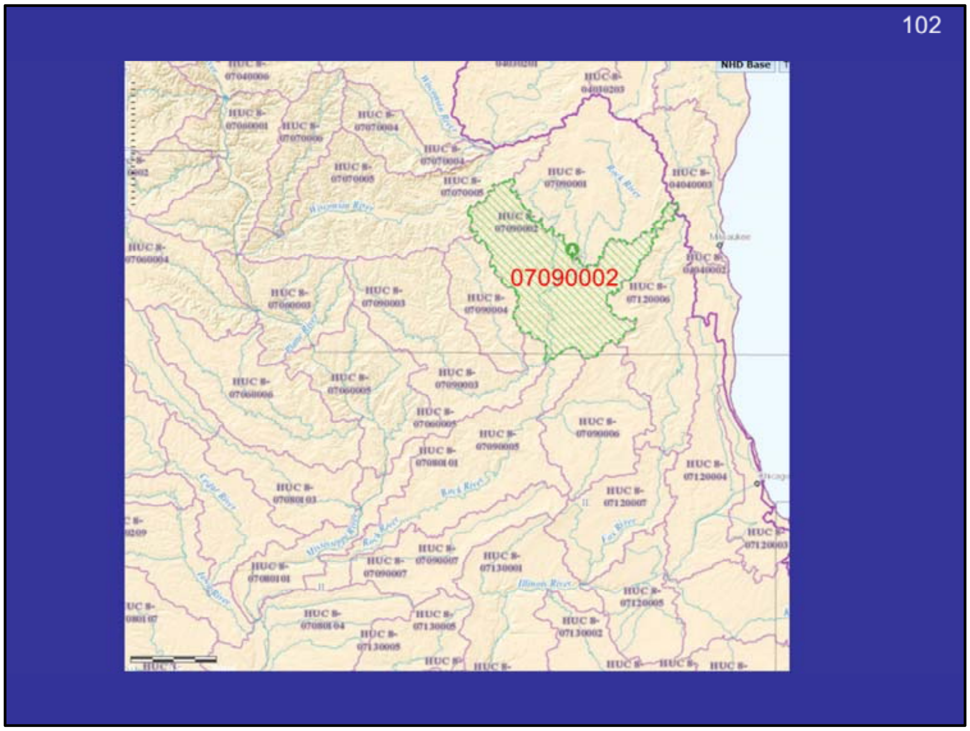

Now let's look at the big picture of hydrologic units. Here we see the conterminous United States divided into 18 hydrologic units known as Hydrologic Regions. These units are a big help in managing data.


This is how it looks in The National Map viewer. Each unit is identified with a two-digit code. For example, the Upper Mississippi Region shown in green is Region 07. There are additional hydrologic regions for Alaska, Hawaii, Puerto Rico, the Virgin Islands, and the Pacific Island Trusts. And there is coordination with Canada and Mexico to harmonize with their national datasets. Most of California falls within Region 18.

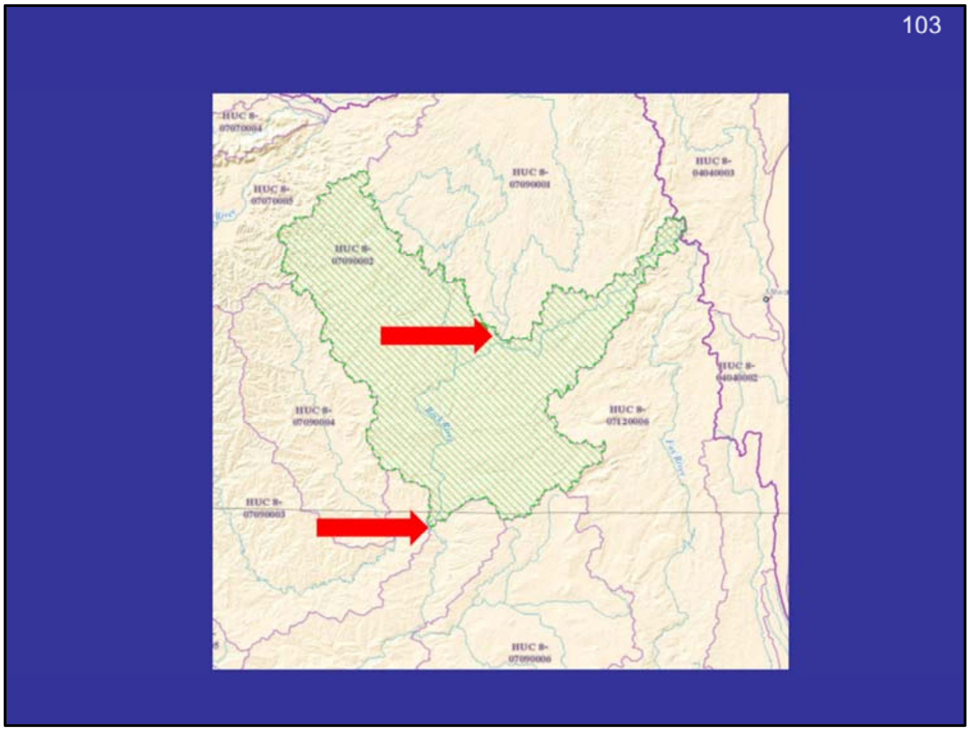



We can then subdivide the Hydrologic Regions into subregions. There are about 220 of these subregions, and they make a very handy way to download the NHD.


This is how it looks in The National Map Viewer.  We are going to look at a Subregion within Region 07.  Subregions are identified with a four-digit code.  This is the Rock River Subregion,  shown in green, and is Subregion 0709 [animate]. (This is not in California by the way.)



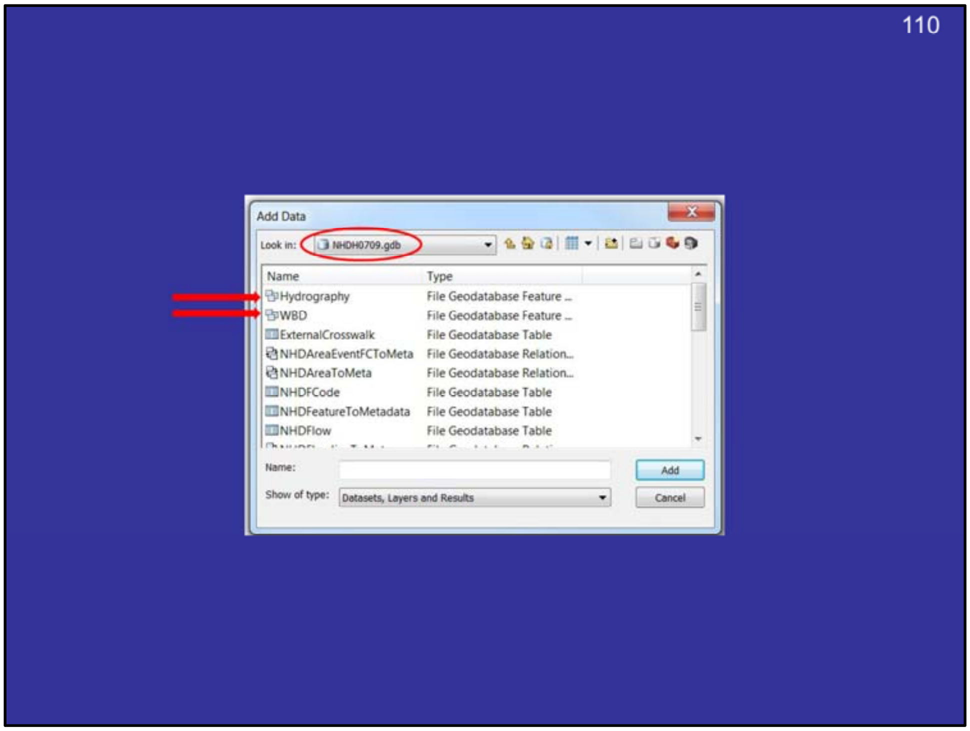

Within Subregion 0709 we are going to skip the third level of the hierarchy and step down to the fourth level of the hierarchy. This is called a subbasin and is identified by an eight-digit code. Our subbasin of interest, shown in green, is 07090002. [animate].



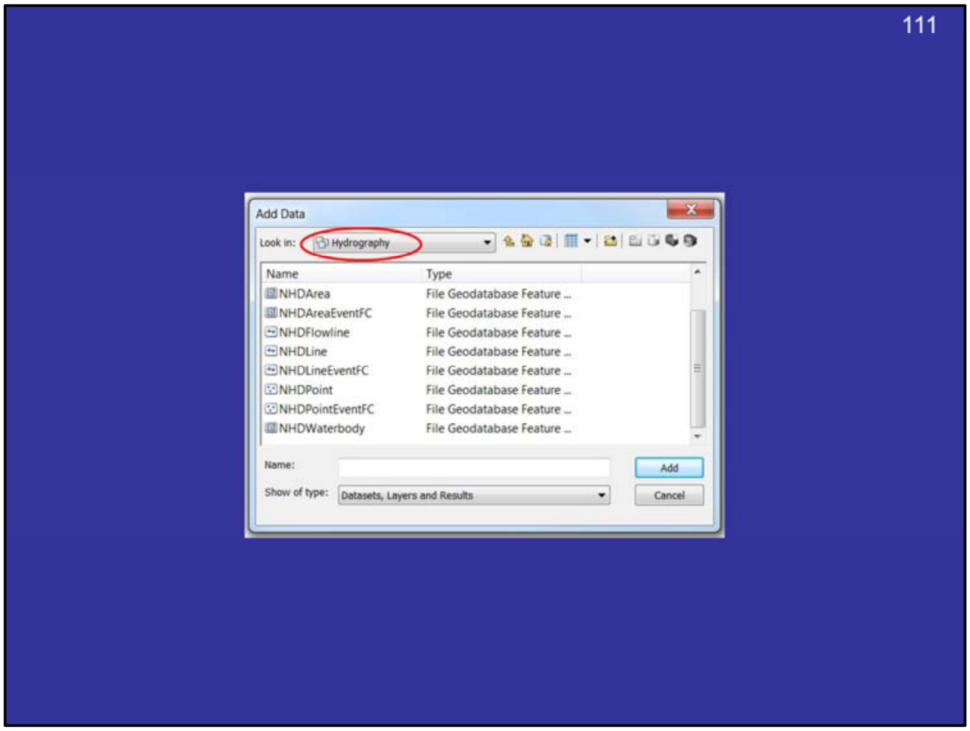

Here is 07090002 in more detail. The subbasin, also known as an “Eight-digit HUC”, is a common unit for studying water.

Note that it is a chained subbasin in the middle of the Rock River drainage. Water flows in [animate] and then out [animate] of the subbasin.

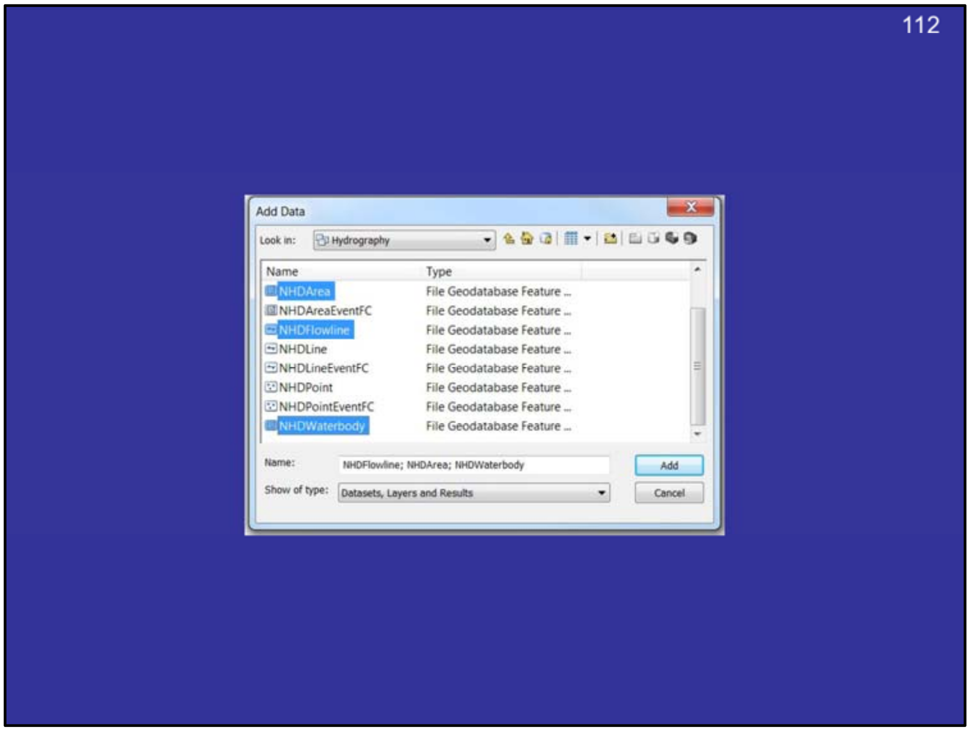

Now let's go back to the "Four-digit HUC", or subregion 0709.  This size unit has become a standard for downloading the NHD.  Let's download 0709 and look at it more closely in a GIS.



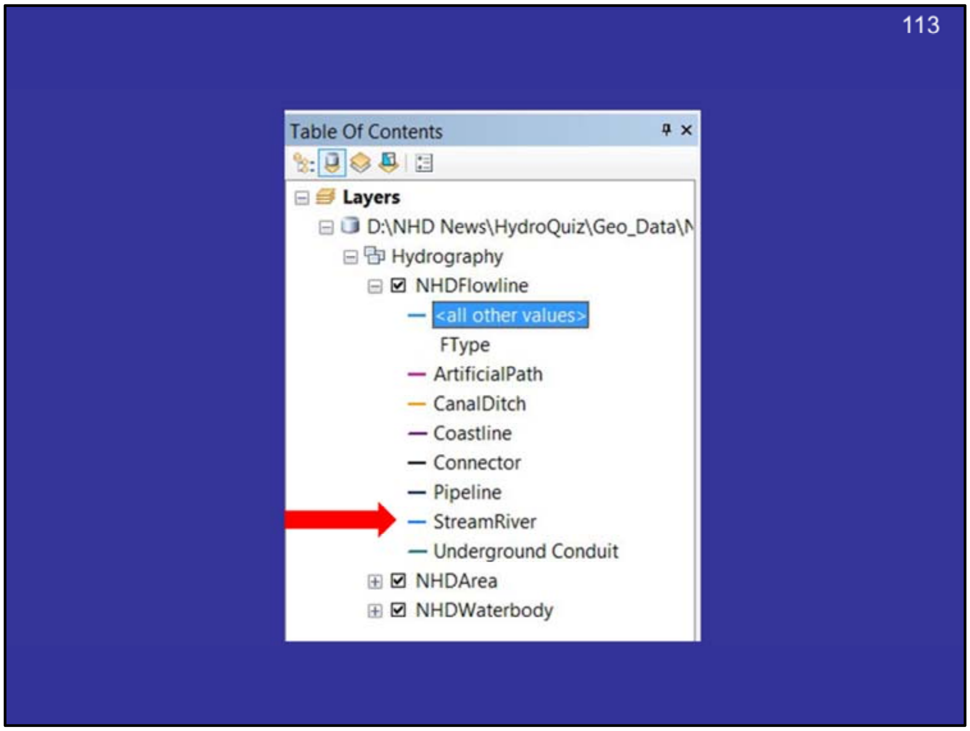

We have downloaded 0709 [animate] as a geodatabase and see that it contains two Feature Datasets. One is the NHD [animate] titled hydrography, and the other is the WBD [animate].




Within Hydrography we can see that the data is broken up into several Feature Classes representing polygons, lines, and points.

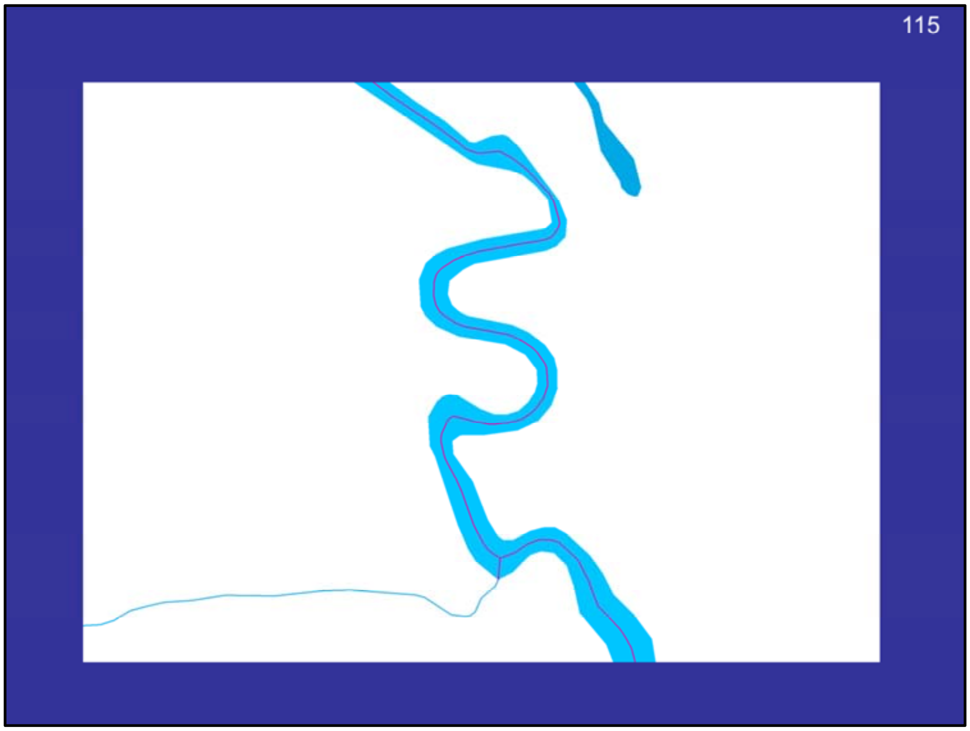



To begin with, there are three feature classes that we want to work with. They are NHD Area, NHD Flowline, and NHD Waterbody.

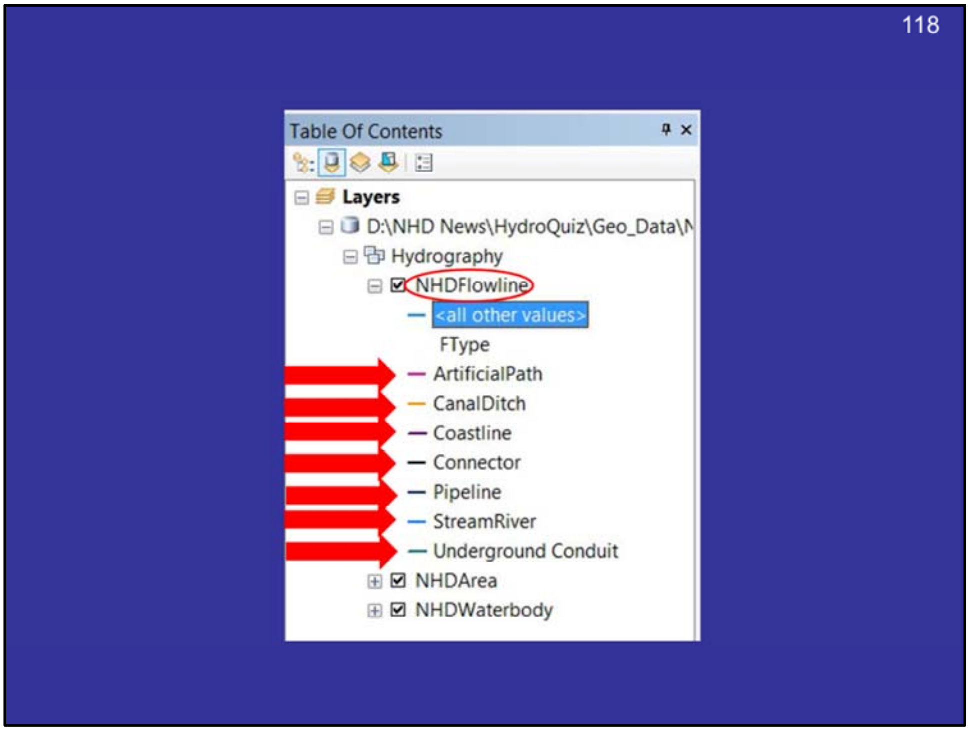



Let’s start with NHD Flowline.  This is perhaps the most important part of the NHD because it represents the drainage network that transports surface water across the landscape.  A key feature is Stream/River [animate].  These are streams that for the most part are less than 50 feet wide and are represented in our GIS using lines.

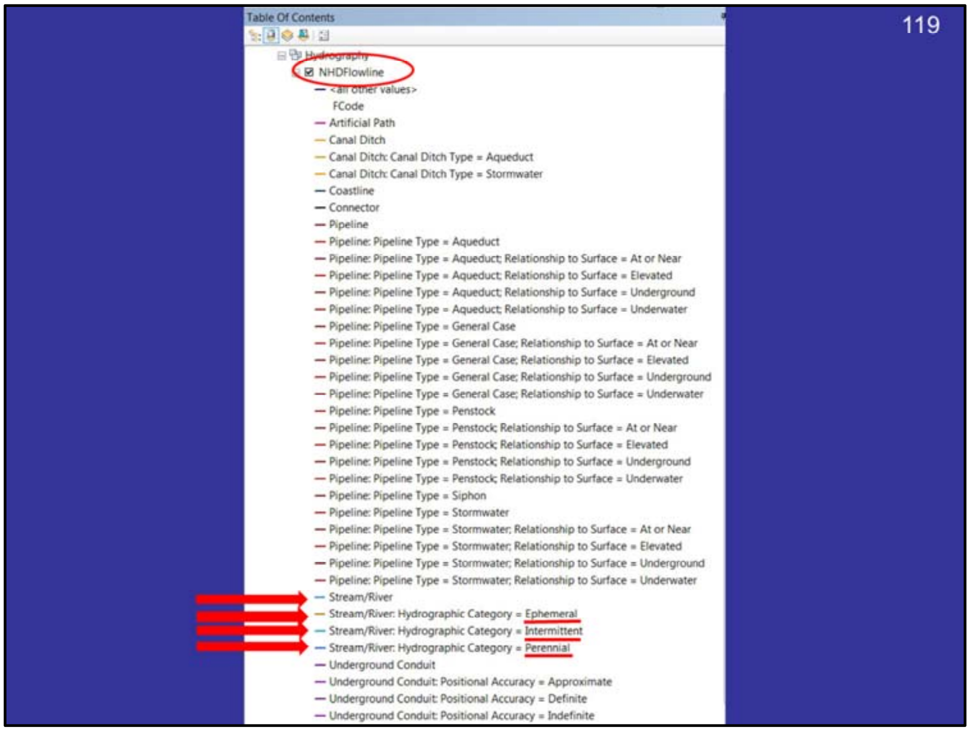

An example looks like this [].



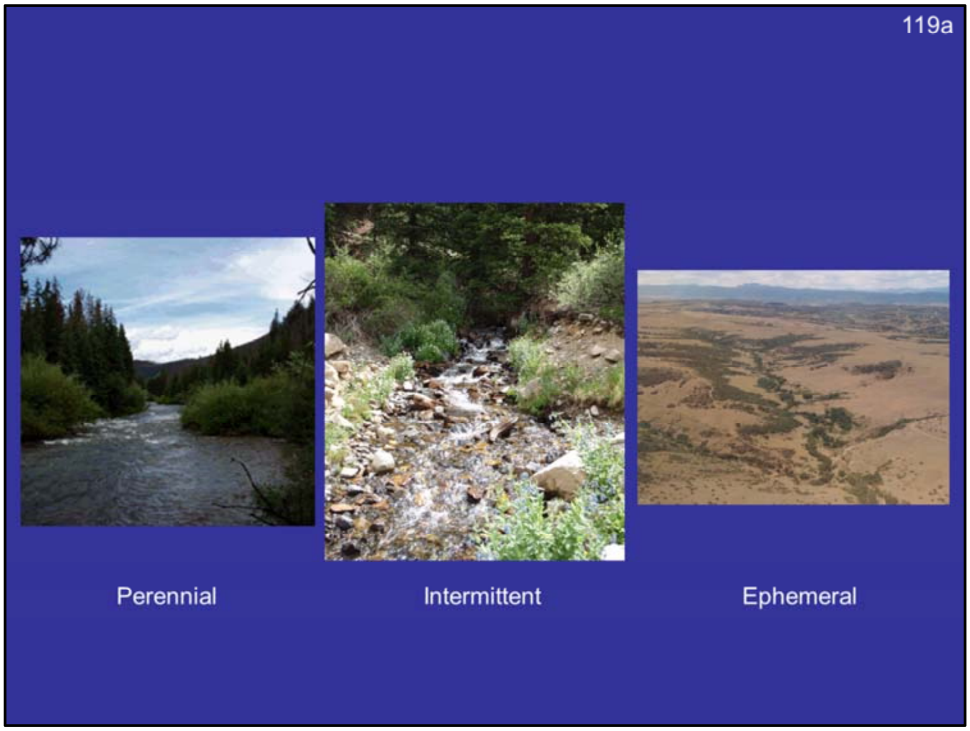

There is another type of stream. A stream that is more than 50 feet wide. It is represented as a polygon. It looks like this. In our data model we don’t have a way to represent this type of polygon stream as a network. To do that we create a “centerline” for the stream as seen in the red line in the middle of the stream. This is called an Artificial Path. This allows us to use a line for the network.



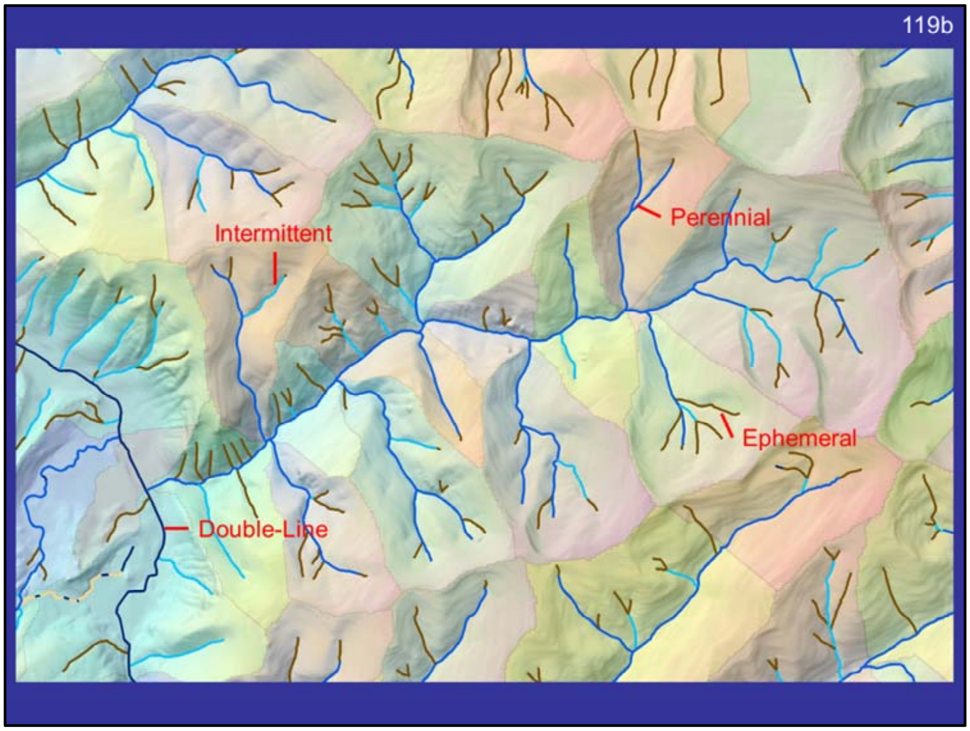

Here we see how Artificial Path [animate] fits into the data model. Along with Stream/River [animate], other network features are Canal/Ditch [animate], Underground Conduit [animate] or underground river, a water Pipeline [animate], a Connector [animate] for when we know the network connects, but can't represent the actual connection, and finally the Coastline [animate].



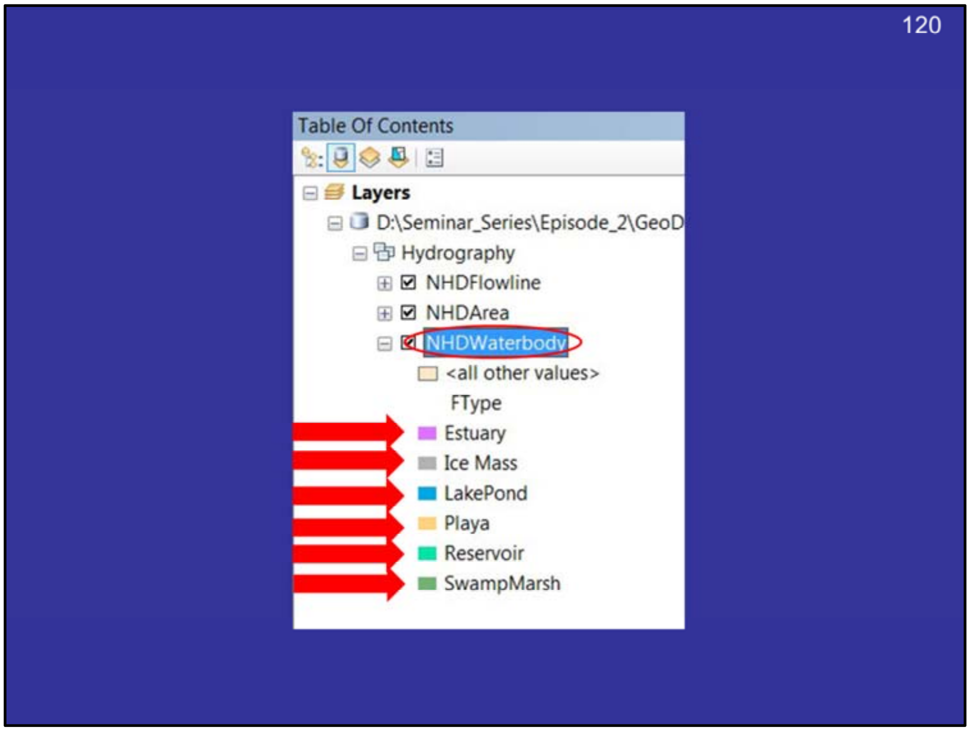

Here is a “secondary” view of the NHDFlowline Table of Contents.  Let’s take a look at Stream/River and note that there are four kinds of Stream/River.
[animate]The first is the general case of Stream/River.
[animate]Then there is a Stream/River with perennial flow.
[animate] Next is Stream/River with intermittent flow.
[animate] And finally Stream/River with ephemeral flow.



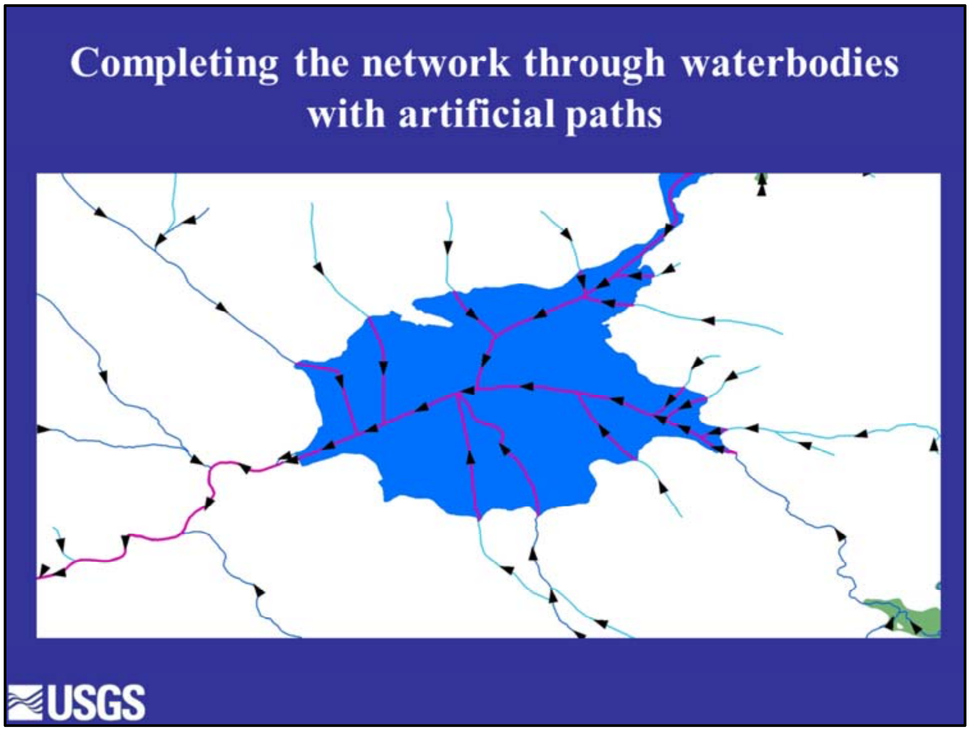

Here are some examples of perennial, intermittent, and ephemeral streams. These codings in the NHD are extremely important because all streams are not alike. They can be very different, and sometimes might not even seem to qualify as a stream, but by coding as stream based on its flow conditions we can better characterize streams.



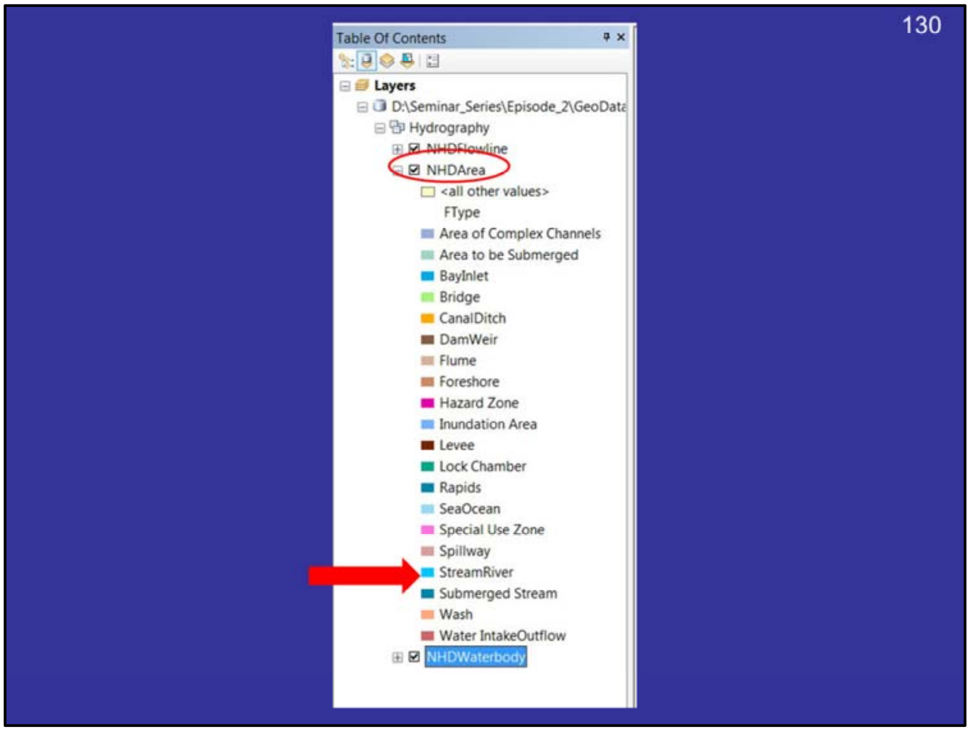

This is an example of how the perennial/intermittent/ephemeral coding is used in the NHD.  The perennial streams are in blue, the intermittent streams are in light blue, and the ephemeral streams are in brown.  Additionally [animate] a double-line stream is shown in dark blue.  Double-line streams are normally considered perennial by nature of their size.




Let’s now talk about NHDWaterbody. These represent features on the landscape that can best be described in a GIS as polygons. They include [animate] Lake/Pond, [animate] Swamp/Marsh, [animate] Estuary, [animate] Ice Mass, such as glaciers, [animate] a Playa, or dry lake bed, and [animate] a Reservoir, which in the NHD is not a lake behind a dam, but rather an area 100% surrounded by a man-made structure, such as a berm.



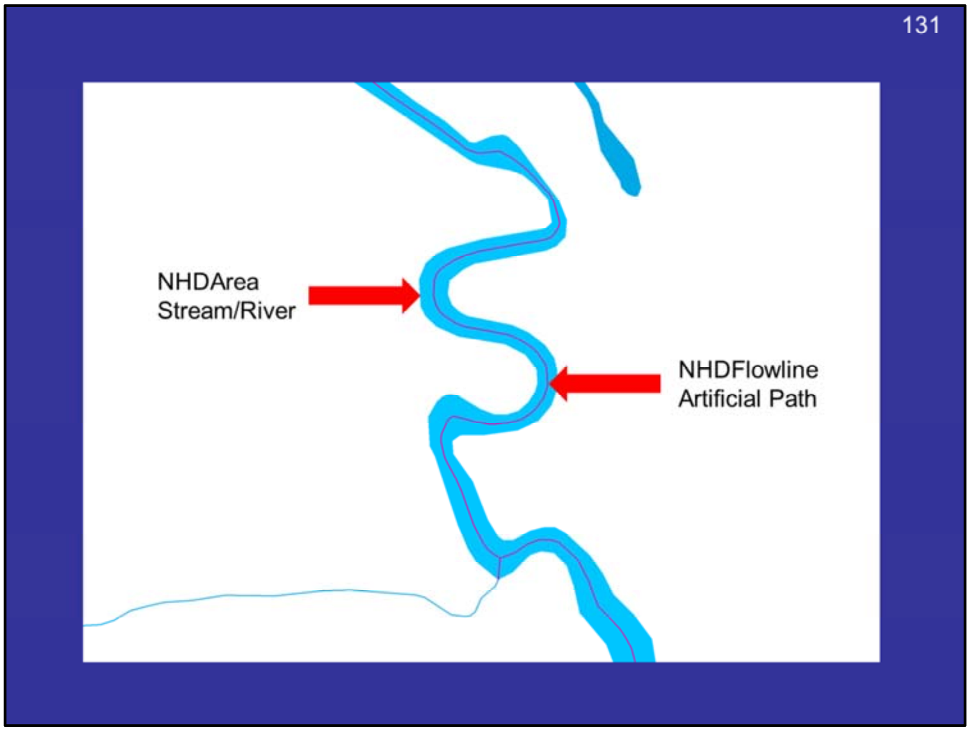

To do this we use the NHDFlowline feature Artificial Path to connect the network and provide flow direction for the network, which flows through the waterbody.



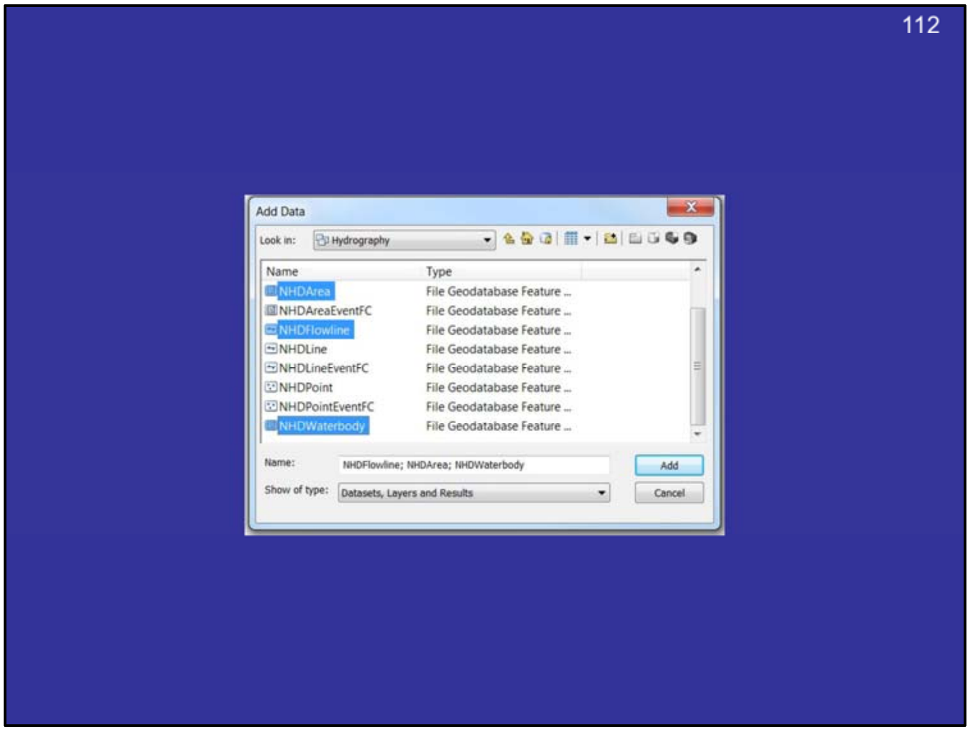

Similar to NHDWaterbody is NHDArea. These are also polygons representing aerial features of the real world. What makes these features different is that they are sort of a “minor” class of area features and in most cases scientific data is not linked to them, whereas NHDWaterbody features do tend to have scientific data linked to them. The distinction between NHDWaterbody features and NHDArea features is not black and white.

Take a minute to scan the list of NHDArea features. []

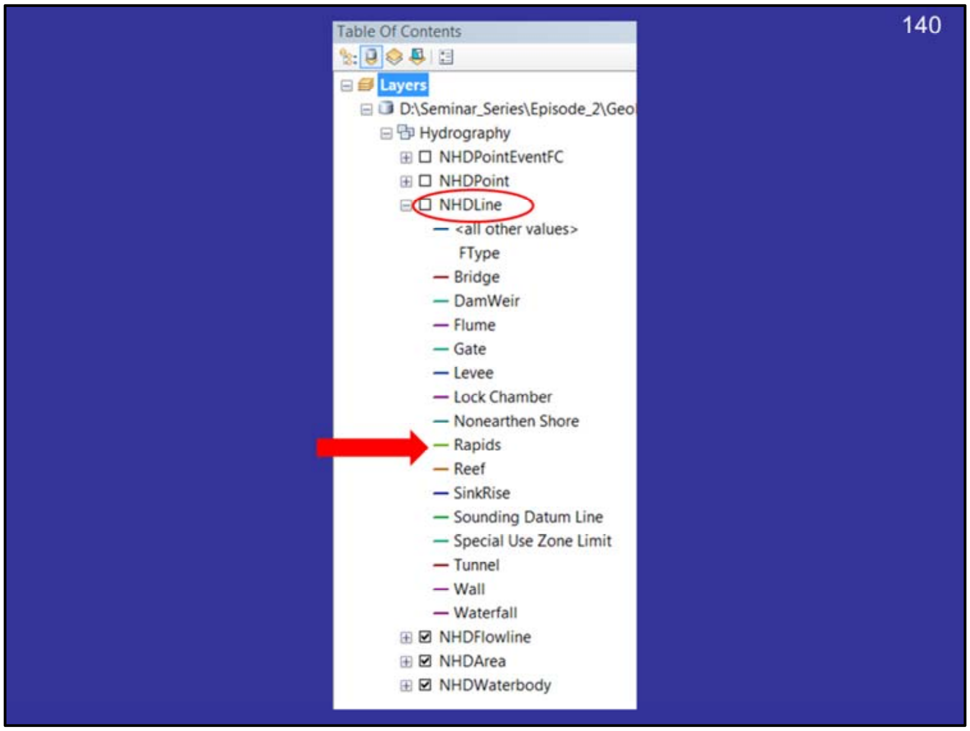
[Animate] Note that a very important feature is Stream/River.



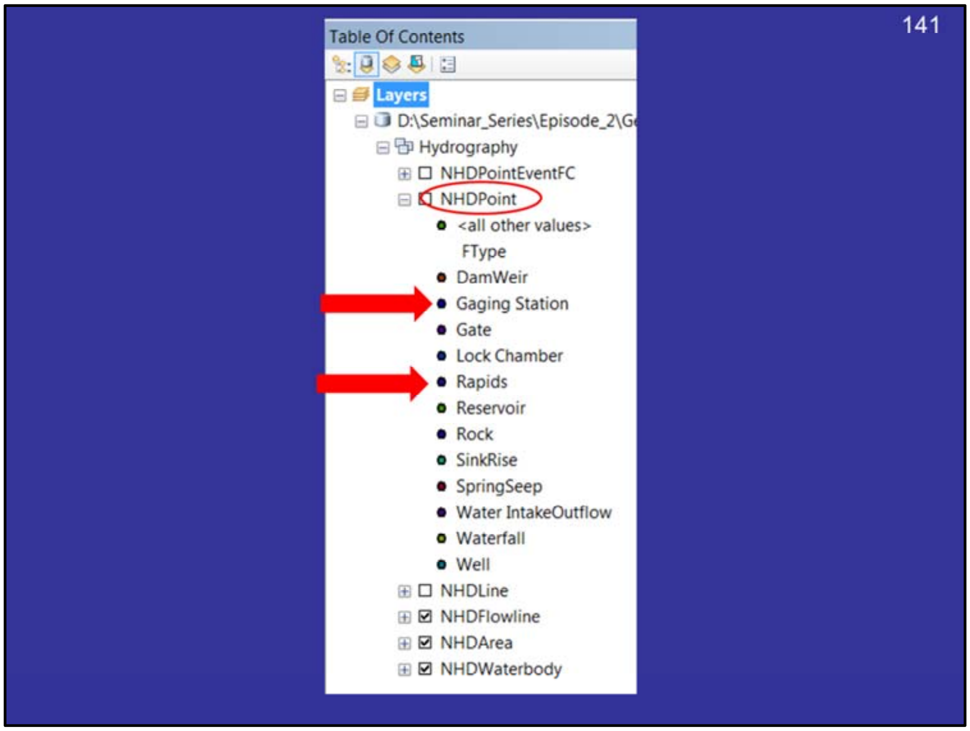

An NHDArea Stream/River represents the aerial extent of a double-line stream. But all the information about the stream is carried by its Artifical Path [animate]. The name of the stream, the flow direction of the stream, the network path, and all scientific data linked to the stream is carried by the Artificial Path. In the NHD data structure, the Artificial Path representing the double-line river, and the NHDArea Stream/River, are linked so a GIS can always relate the two.




We have just examined the three main components of the NHD: NHDFlowine, NHDWaterbody, and NHDArea.




Now let's look at a secondary group of features in the NHD starting with NHDLine. Take a look at this list of features []. These tend to be line features that are not a part of the flow network, but rather are for descriptive purposes. [Animate] For example look at Rapids. This describes a stretch of river as having rapids and this line feature is overlaid on top of the NHDFlowline line feature using the overlay functionality commonly used in GIS. Rapids simply describes the feature on the landscape and makes it easy for a cartographer to symbolize this stretch of water.

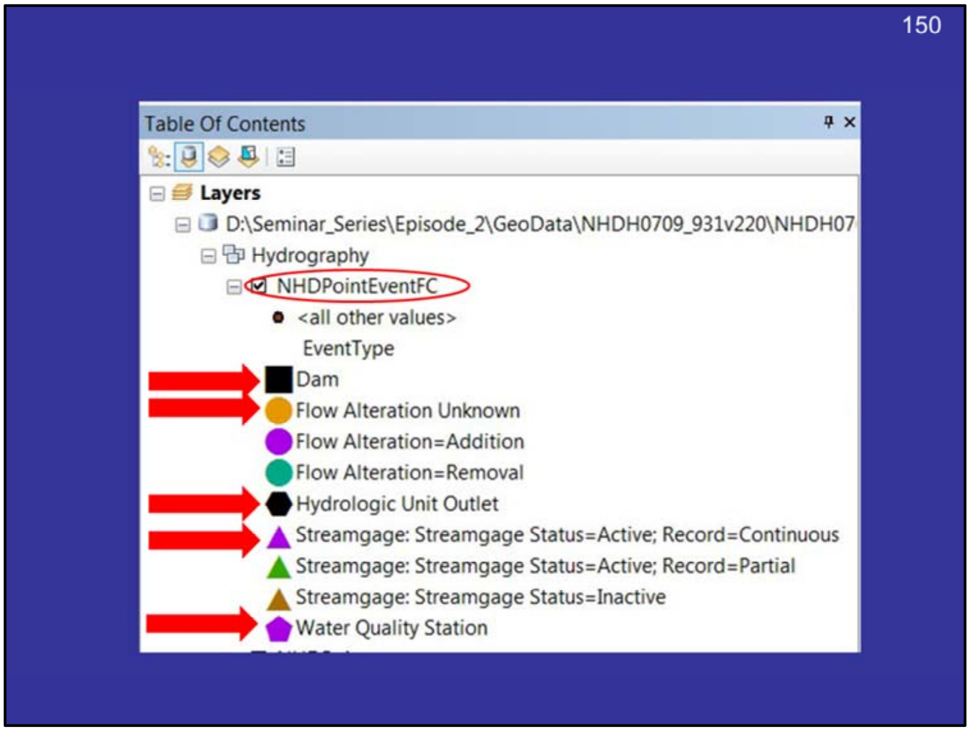



Next, let's look at point features. Point features are just that, points in a GIS. Once again [animate] let's look at Rapids. In this case the rapids are a very short stretch of river better represented by a point rather than a line. Point features are not a part of the network, but rather are mainly for descriptive purposes.

Let's look at another point feature [animate] – a Gaging Station. A Gaging Station is a location on a river where the flow-volume of the river is measured. Usually in cubic-feet per second. The measurement of a river can only be on a river, not any point in space.

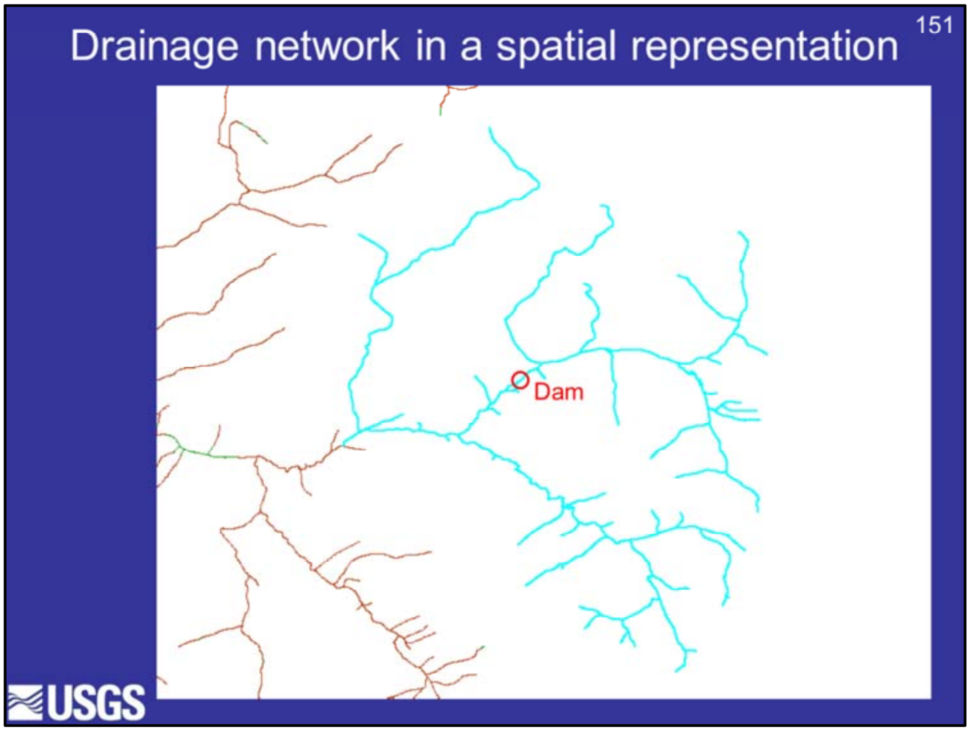
The flow-volume can also be used to characterize the river, so we know how much water flows through it. Additionally, scientists will want to "discover" the gage when doing network analysis.

To make the gage more practical in GIS analysis, the gage is perhaps better represented at a special point on the network, rather than simply a point in space.

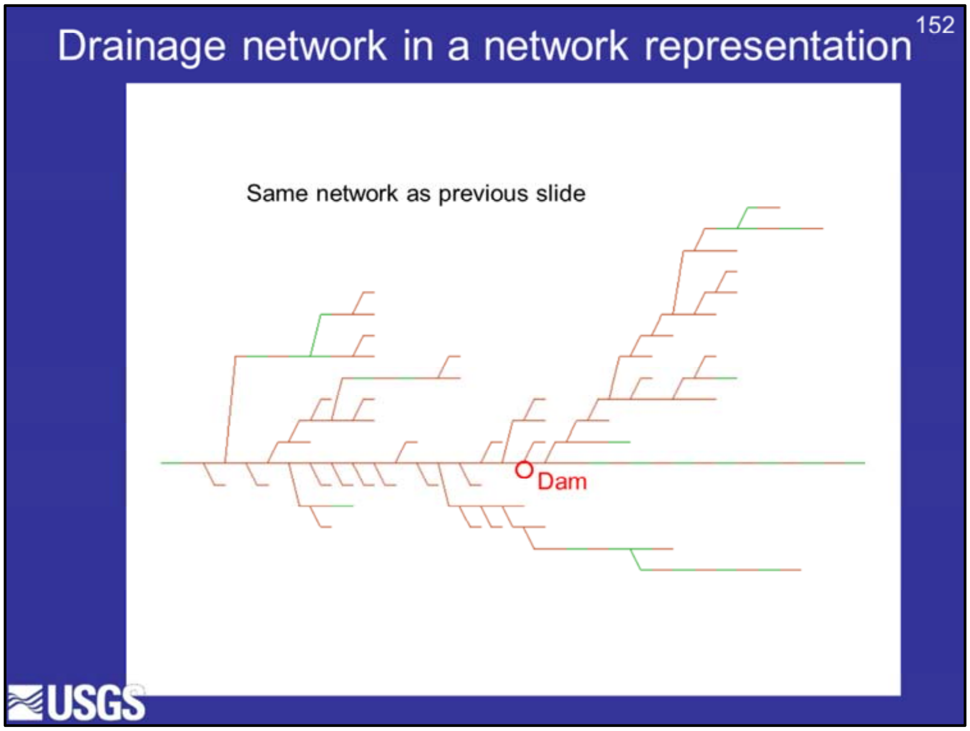



These significant points on the network are known as Events and are stored in a feature class known as NHDPointEventFC.  They have a position in space, but they also have a position on the network.  This position on the network makes it possible to find the event when doing network analysis.

Several features lend themselves to network analysis such as [animate] a Dam, because a dam can stop the network, [animate] a Flow Alteration such as a diversion, because this can change the path of the flow, [animate] a Hydrologic Unit Outlet because this indicates when a network transitions into another watershed, [animate] a streamgage because this characterizes the amount of flow, and [anaimate] a Water Quality Station because this can characterize the constituents in the flow.

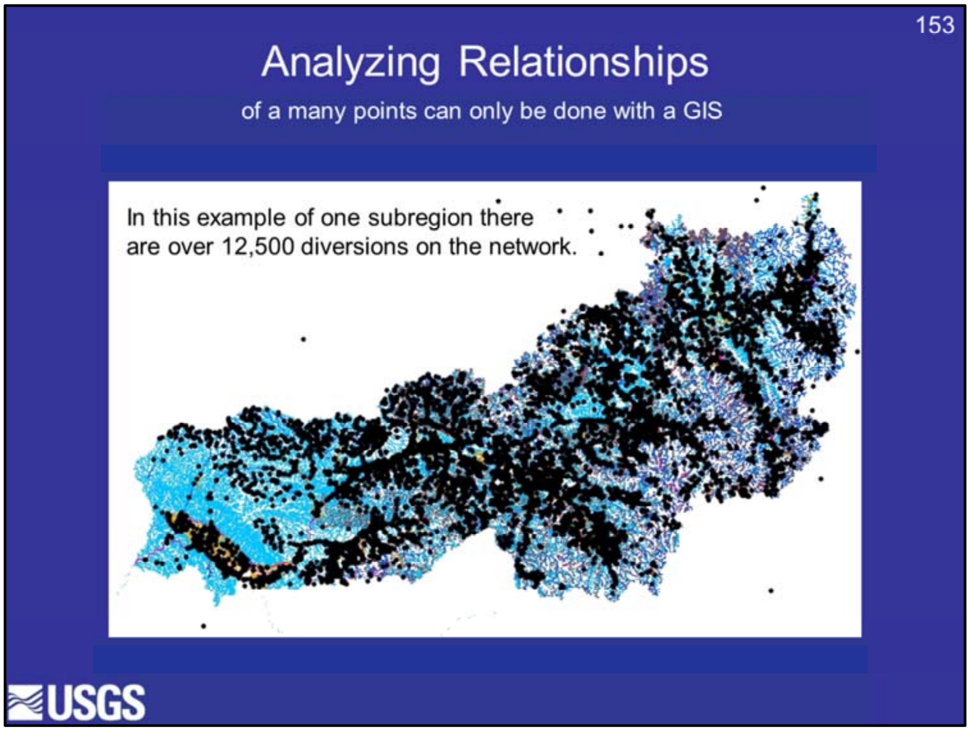



To better understand events, let's look at a stream network. Here we can see the stream network in spatial form. The part of the network being analyzed is shown in cyan. In this network we are looking for a dam [animate], which will stop the spread of invasive species upstream.

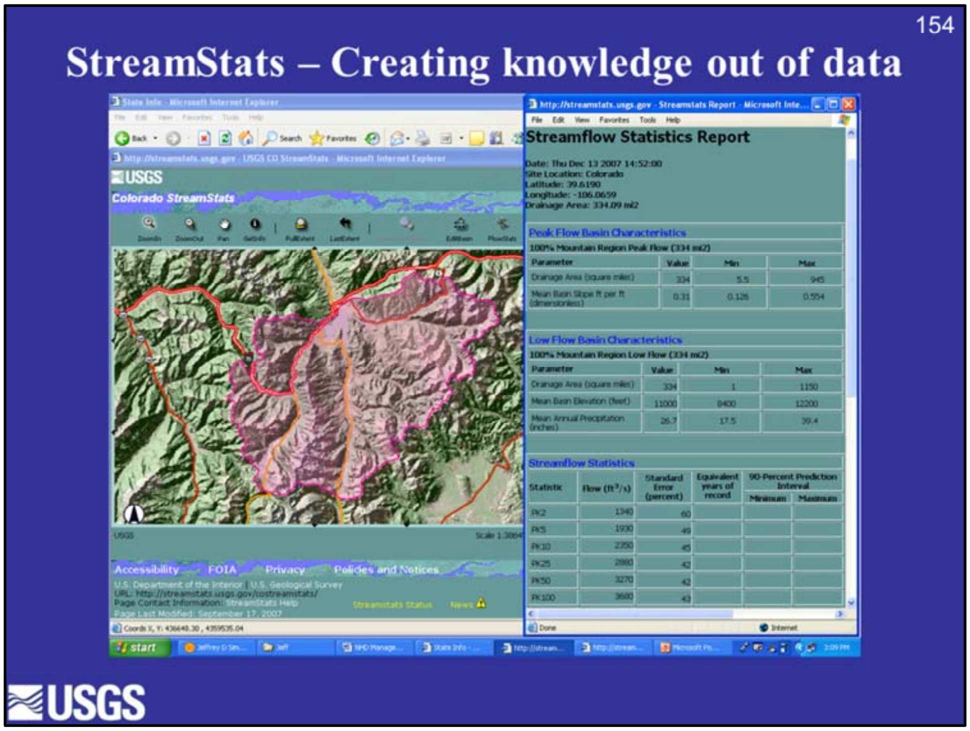



Here is the same river network shown as a schematic to illustrate how the rivers and streams can be viewed in the “network domain” as a computer navigation system would view the rivers and streams.

Here we see the dam [animate] located in the network domain.
Why do this? Because computer networking systems can much more efficiently analyze a network in the “network domain” than in the “spatial domain”. In a simple example like this it can easily be done manually.

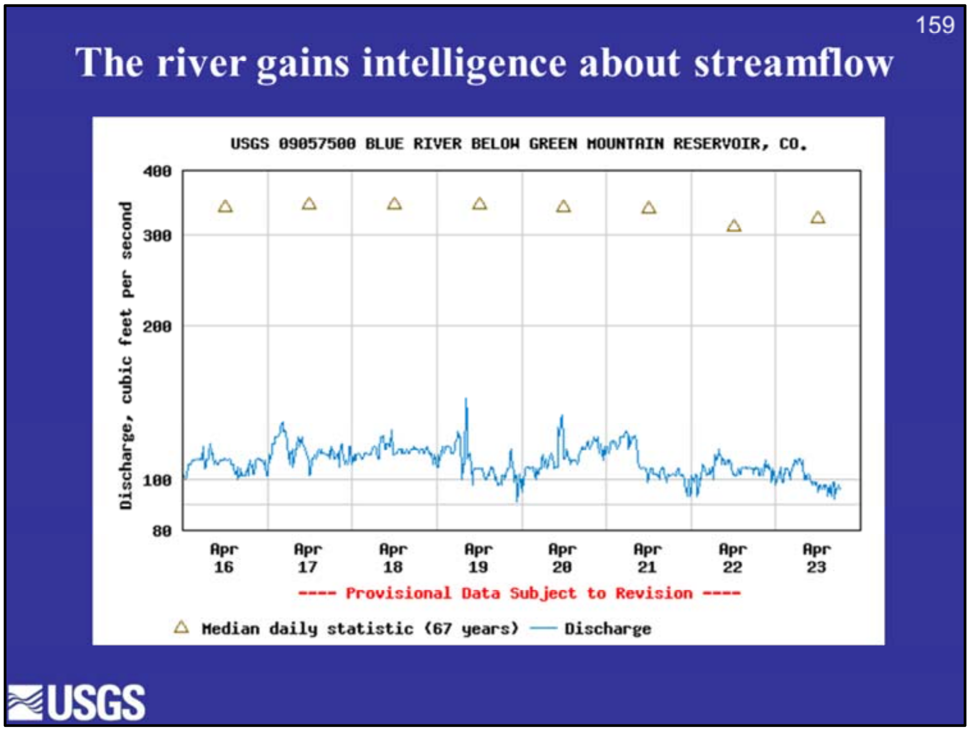



But in an example like this, where we are analyzing the relationship between 12,500 points, we really need a powerful network analysis system.

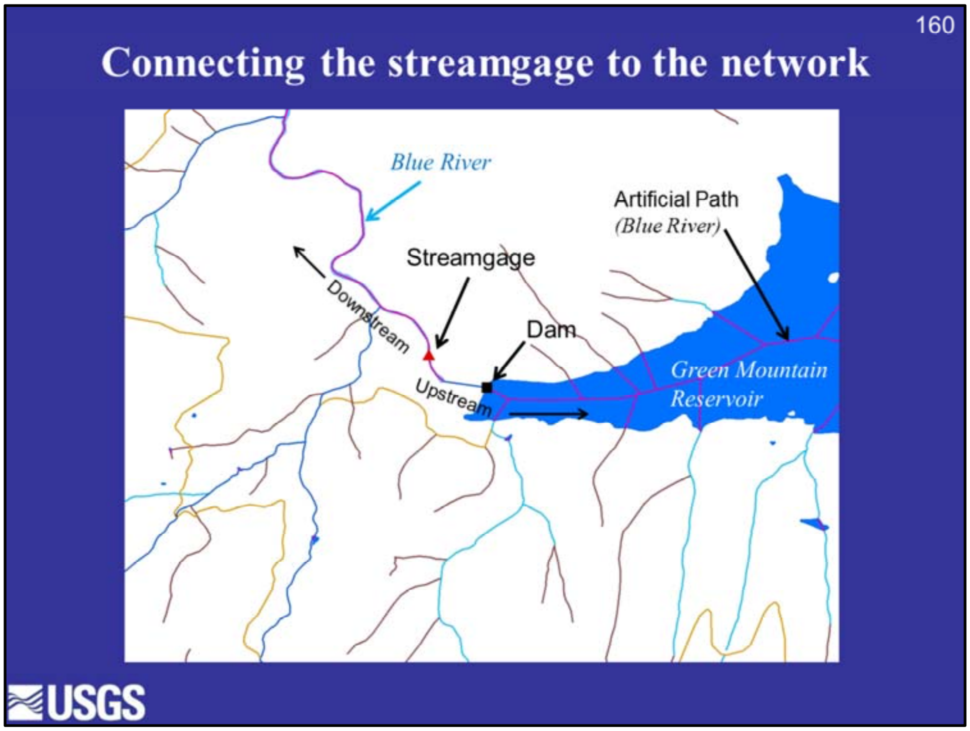



This is how a powerful analytical system like StreamStats is able to navigate a basin and find relevant streamgages for problem solving.

StreamStats is an example of how geospatial data like the NHD, NED, and WBD can be transformed into information, and how that information can be transformed into knowledge, such as the estimated flow of water at a give location in the drainage network.




This is a hydrograph of the gage over a one-week time-span in mid-April. It's measuring just over 100 cubic feet per second.




By linking this streamgage to the NHD, we make the NHD more intelligent. Now instead of just a river, we have a river characterized by flow-volume. We know that in April, this river had just over 100 cubic-feet-per-second flowing through it. We can also find out the flow for June, or any other month, or for a mean annual flow.

[Animate] We know that the streamgage is on a NHD feature named the Blue River.

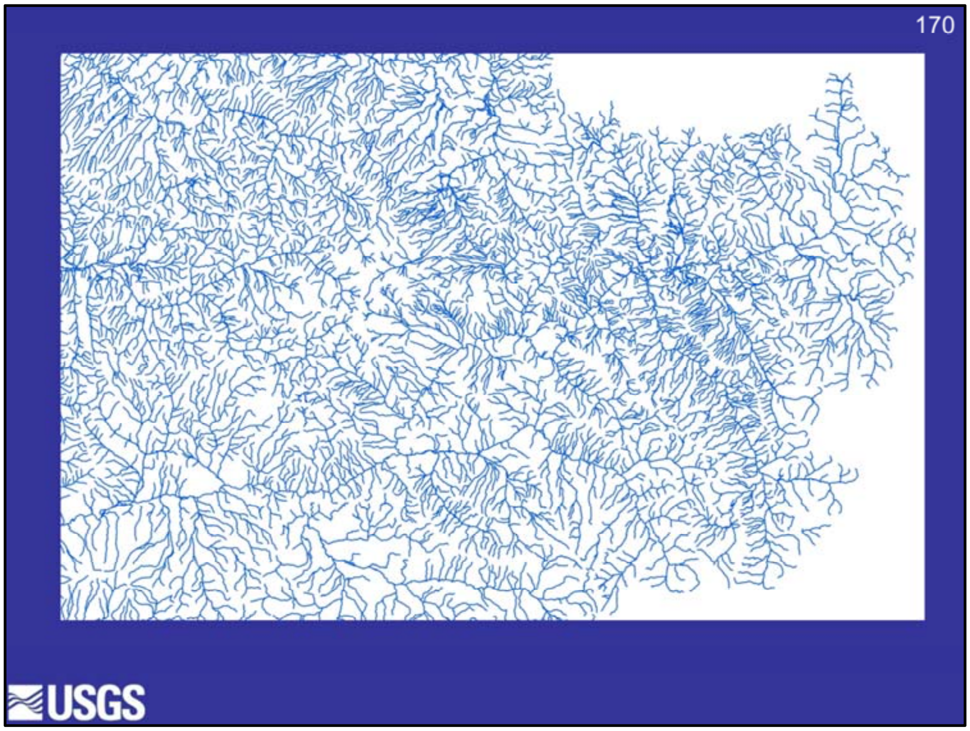
[Animate] We know what's downstream of the gage by following the network. For example we can find the next downstream gage, which is at Kremling, Colorado, on the Colorado River.

[Animate] We know what's upstream of the gage. For example we know there is a dam upstream [animate] which can determine how much water will flow through the gage by the regulated discharge of the dam. We know the dam's identification number and can use this to get more information about the dam.

[Animate] We know that upstream of the dam, and impounded by the dam, is a lake named Green Mountain Reservoir. We can use this to determine how many acre-feet of water are stored in Green Mountain Reservoir.

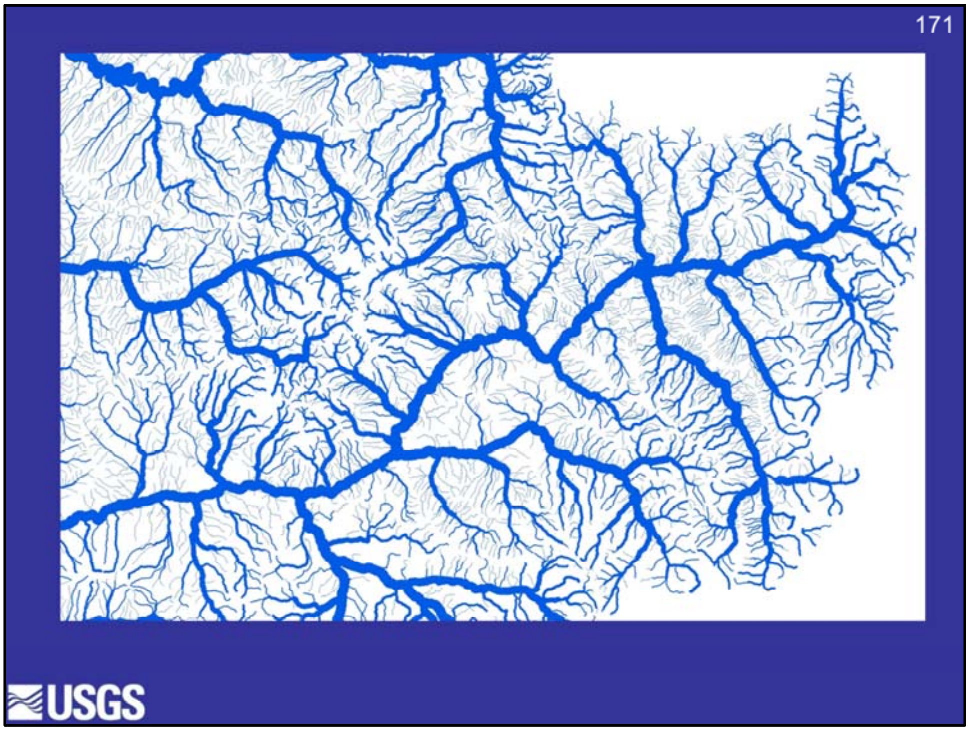
[Animate] We can continue to follow the network upstream and find out how many miles of stream drain into Green Mountain Reservoir and the Streamgage. We can determine how many miles of perennial, intermittent, and ephemeral steam are upstream. We know that there is a diversion upstream at another reservoir that is diverting 300 cubic-feet-per-second out of the Blue River system. And we know that there is a large heavy metals mining operation upstream that in the past has contributed heavy metals to the Blue River. Plus much, much more can be learned from the network.

The gage makes the network more intelligent and the network makes the gage much more intelligent. This is how the NHD works.

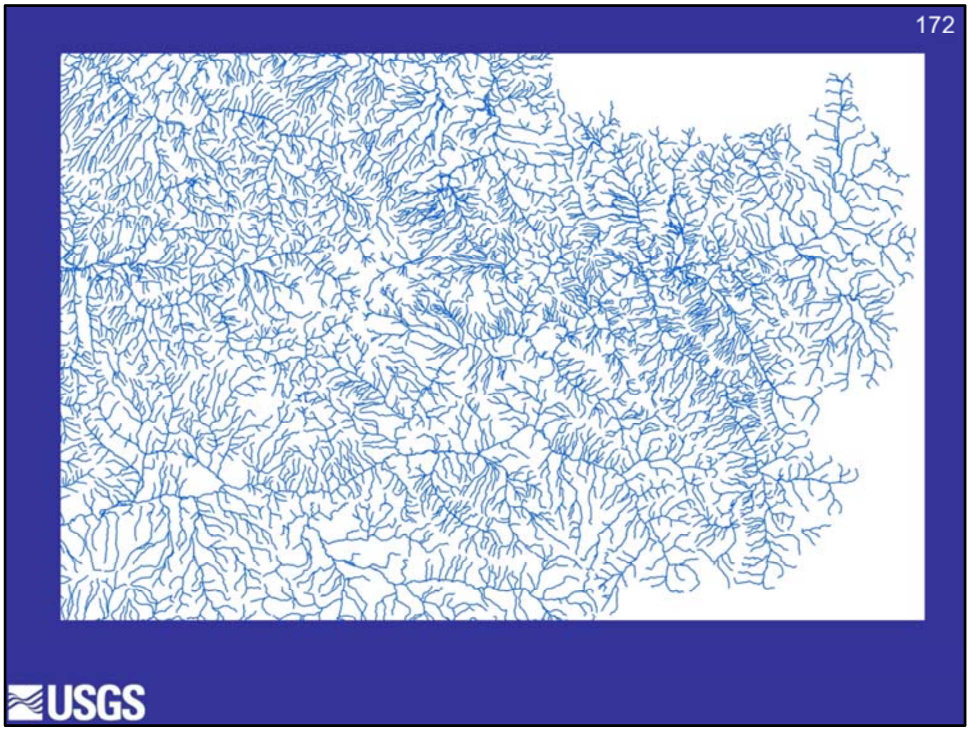



There are really two aspects to mapping streams. One is to know where the water is, such as this map showing the stream network in central Colorado. The other important aspect is knowing how much water is in the streams. As we mentioned earlier, all streams are different, characterized by how much water flows through them. There are only so many streamgages to help us, but there are hundreds more streams not gaged.

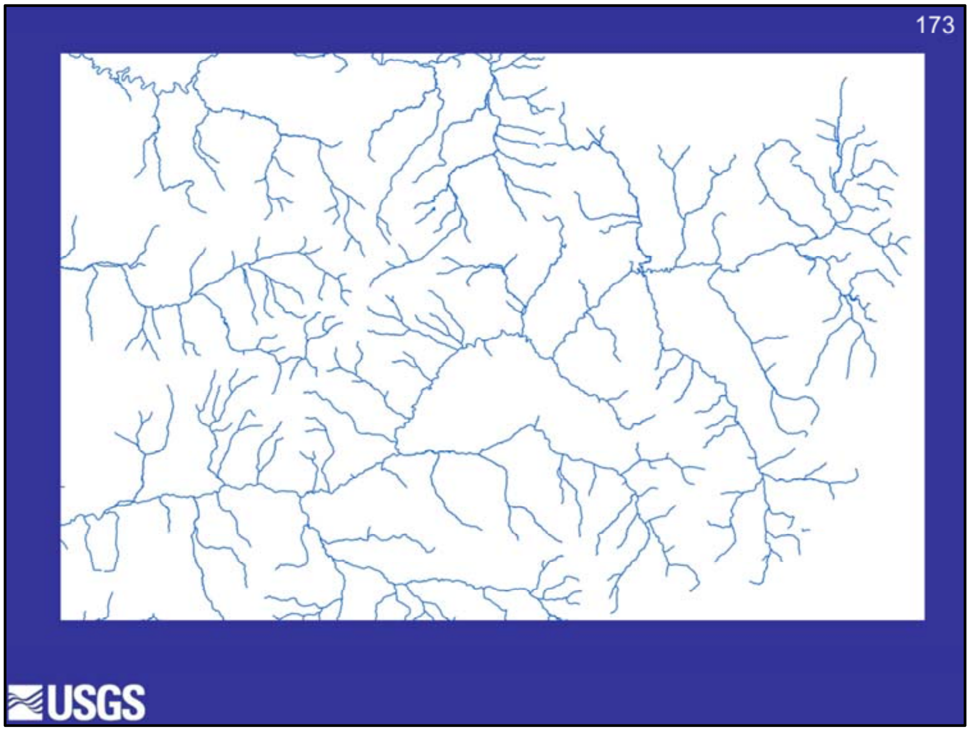
To help make this second aspect of mapping and analyzing streams possible, a companion dataset to the NHD called the NHDPlus has been developed.



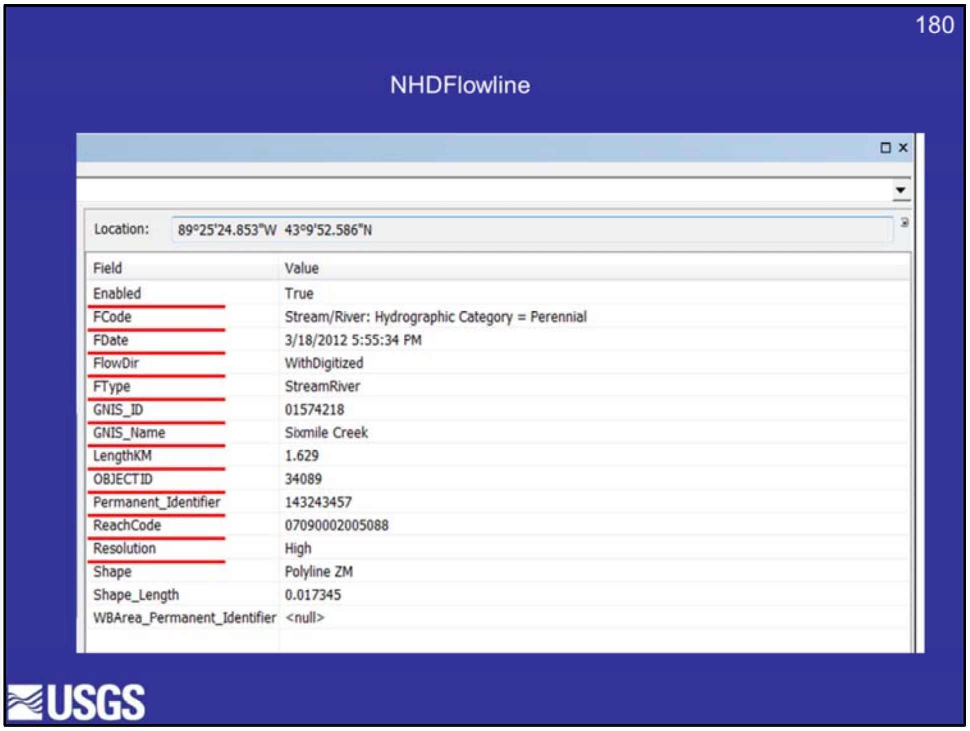

It gives us this view of the stream network. Now the streams are characterized by flow volume and we have a vastly improved understanding of water on the landscape.




This characterization has many purposes.  One major purpose is that it can take a network like this one, designed for a 1:100,000-scale level of content…




…and generalize it to a level of content suitable for 1:500,000-scale.




Now, let's go back to the data and examine it in additional detail. Here is where we could find potential keys for linking your wetlands data to the NHD. First we'll look at the attributes that make up NHDFlowline.

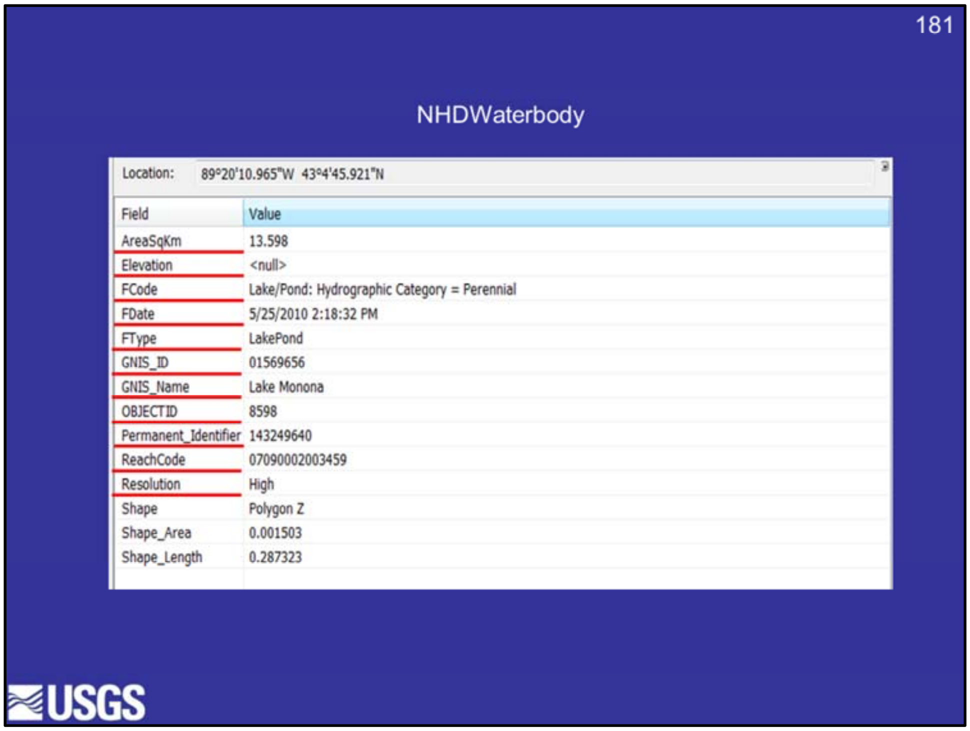
Permanent_Identifier provides an ID for each element, or feature, in the dataset. This is primarily used for managing the data.
ReachCode is also an ID, but used in the addressing system to link scientific data to the NHD.
ObjectID is also an ID, but used only internally by ArcGIS. The NHD user does not need to be concerned about this ID.
The FType tell us what this feature is. In this case a Stream/River.
The FCode provides more specific information about the feature. In this case it is a Stream/River, but specifically a Perennial Stream/River.
GNIS_Name tells us the name of the feature according to the Geographic Names Information System
GNIS_ID is the ID for that name.
Length Kilometer tells us how long the NHDFlowline feature is.
FlowDir is the direction of flow. With Digitized means that the water flows in the same order as the NHDFlowline verticies, which is normally set a downstream order.
Enabled is a flag telling the geometric network whether to include this feature in the network.

FDate tells us the date and time the feature was created.  This is for change management purposes.

Resolution tells us that this feature belongs in the high resolution dataset.

A few words about reach codes:

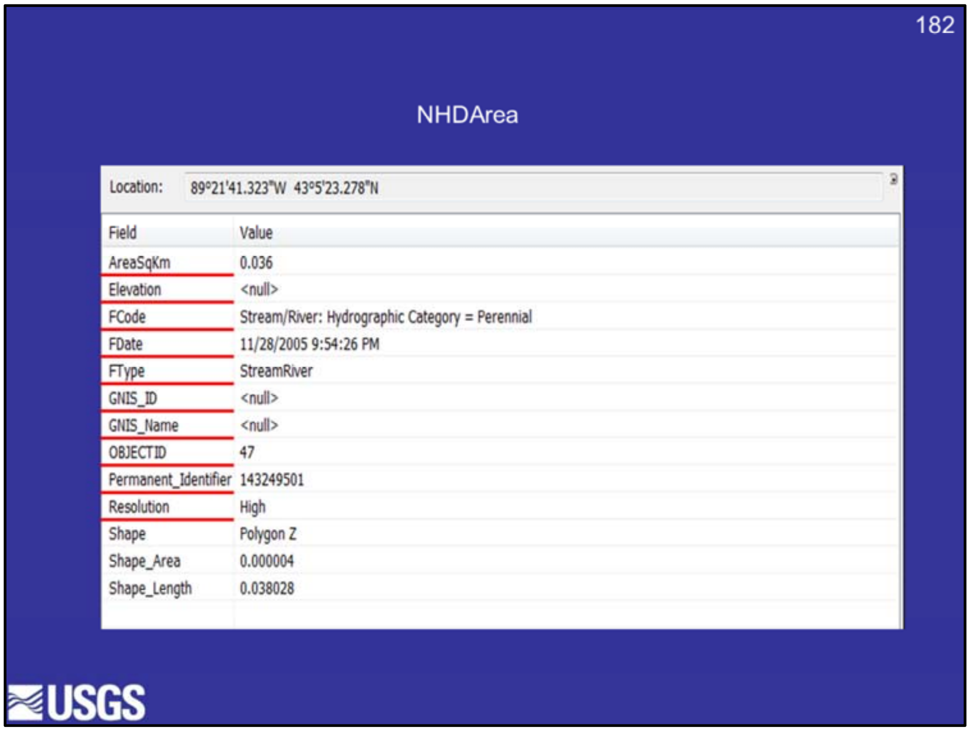
A reach is a continuous piece of surface water with similar hydrologic characteristics. Some unconnected (isolated) features are also reaches, for example, isolated lakes or streams. In the NHD, each reach is assigned a reach code upon being incorporated into the production data. A reach may be composed of a single feature, like a lake or isolated stream, but reaches are composed of a number of contiguous features due to the preservation of reach codes that occurred when the 1:24,000-scale NHD was created from the 1:100,000-scale NHD. A reach code is a 14-digit code comprised of two parts. The first eight digits represent the 8-digit HUC in which the reach exists, and the last six digits are a sequential numbers that are randomly assigned to the feature when reach codes are allocated during maintenance editing. Each reach code occurs only once throughout the nation, but a reach code may be on a number of contiguous features, if they all belong to the same reach. Once assigned, a reach code is permanently associated with its reach. If the reach is deleted, its reach code is retired.




| Field | Value |
|---|---|
| AreaSqKm | 13.598 |
| Elevation | <null> |
| FCode | Lake/Pond: Hydrographic Category = Perennial |
| FDate | 5/25/2010 2:18:32 PM |
| FType | LakePond |
| GNIS_ID | 01569656 |
| GNIS_Name | Lake Monona |
| OBJECTID | 8598 |
| Permanent_Identifier | 143249640 |
| ReachCode | 07090002003459 |
| Resolution | High |
| Shape | Polygon Z |
| Shape_Area | 0.001503 |
| Shape_Length | 0.287323 |

Next, let's look at the attributes that make up NHDWaterbody.

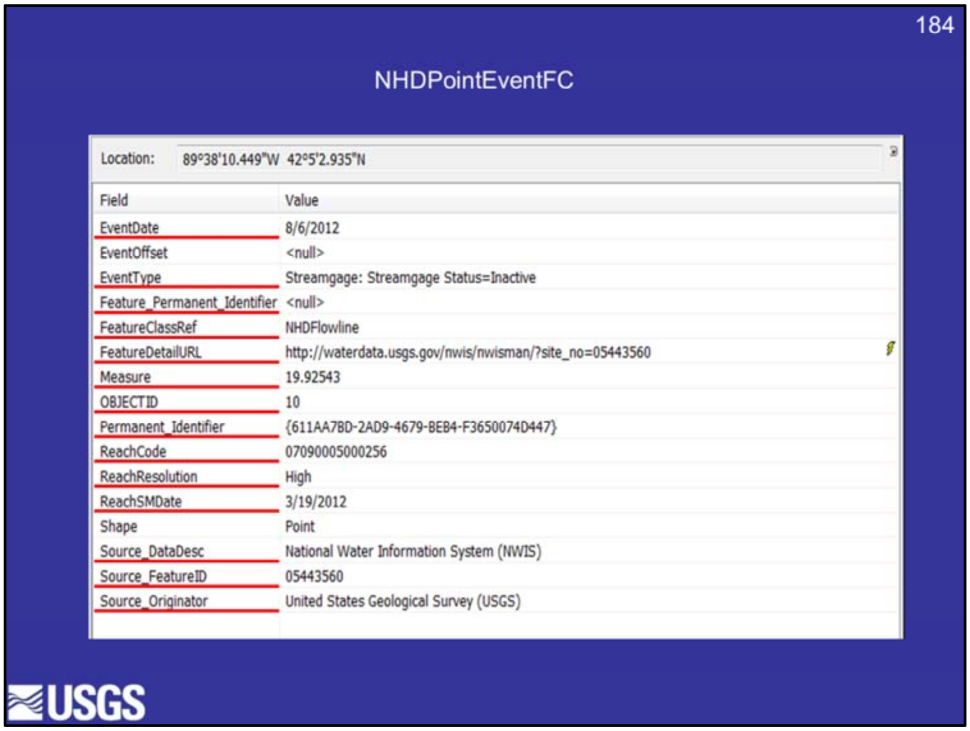
Permanent_Identifier provides an ID for the feature.
ReachCode is the ID used in the addressing system to link scientific data to the NHD.
ObjectID is the ID used internally by ArcGIS.
The FType tell us what this feature is. In this case a Lake/Pond.
The FCode provides more specific information about the feature. In this case it is a Lake/Pond, but specifically a Perennial Lake/Pond.
GNIS_Name tells us the name of the feature. In this case, Lake Monona.
GNIS_ID is the ID for that name.
Area Square Kilometer tells us the area of the NHDWaterbody.
Elevation is the altitude of the lake at normal pool elevation.
FDate tells us the date and time the feature was created.
Resolution tells us that this feature belongs in the high resolution dataset.




| Field | Value |
| --- | --- |
| AreaSqKm | 0.036 |
| Elevation | <null> |
| FCode | Stream/River: Hydrographic Category = Perennial |
| FDate | 11/28/2005 9:54:26 PM |
| FType | StreamRiver |
| GNIS_ID | <null> |
| GNIS_Name | <null> |
| OBJECTID | 47 |
| Permanent_Identifier | 143249501 |
| Resolution | High |
| Shape | Polygon Z |
| Shape_Area | 0.000004 |
| Shape_Length | 0.038028 |

Next, let's look at the attributes that make up NHDWaterbody.

[animate 1] Permanent_Identifier provides an ID for the feature.
[animate 2] ReachCode is the ID used in the addressing system to link scientific data to the NHD.
[animate 3] ObjectID is the ID used internally by ArcGIS.
[animate 4] The FType tell us what this feature is. In this case a Lake/Pond.
[animate 5] The FCode provides more specific information about the feature. In this case it is a Lake/Pond, but specifically a Perennial Lake/Pond.
[animate 6] GNIS_Name tells us the name of the feature. In this case, Lake Monona.
[animate 7] GNIS_ID is the ID for that name.
[animate 8] Area Square Kilometer tells us the area of the NHDWaterbody.
[animate 9] Elevation is the altitude of the lake at normal pool elevation.
[animate 10] FDate tells us the date and time the feature was created.
[animate 11] Resolution tells us that this feature belongs in the high resolution dataset.




| Field | Value |
|---|---|
| EventDate | 8/6/2012 |
| EventOffset | <null> |
| EventType | Streamgage: Streamgage Status=Inactive |
| Feature_Permanent_Identifier | <null> |
| FeatureClassRef | NHDFlowline |
| FeatureDetailURL | http://waterdata.usgs.gov/nwis/nwisman/?site_no=05443560 |
| Measure | 19.92543 |
| OBJECTID | 10 |
| Permanent_Identifier | {611AA7BD-2AD9-4679-BEB4-F3650074D447} |
| ReachCode | 07090005000256 |
| ReachResolution | High |
| ReachSMDate | 3/19/2012 |
| Shape | Point |
| Source_DataDesc | National Water Information System (NWIS) |
| Source_FeatureID | 05443560 |
| Source_Originator | United States Geological Survey (USGS) |

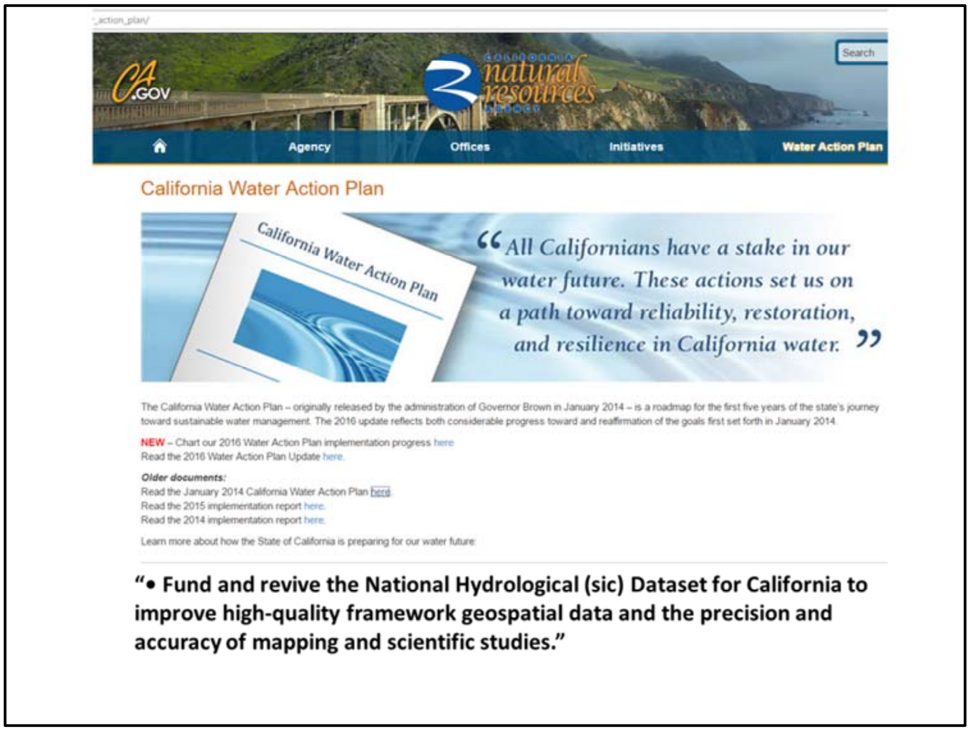
Next, let's look at the attributes that make up NHDPointEventFC. These are a special case of a feature called an Event. Events are data tied to the network, such as a streamgage, a water quality monitoring station, a dam, an outflow point, or a diversion.

Permanent_Identifier provides an ID for the Event.
ObjectID is the ID used internally by ArcGIS.
The EventType tells us what this event is, in this case a streamgage that is inactive.
Feature Detail URL is the URL link for the feature. In the case of a streamgage it is the URL for the gage in the National Water Information Stystem.
Feature Permanent Identifier is the Permanent ID of any features that are associated with the event.
Feature Class Reference is the feature class the event is associated with. In this case, as in most cases, the NHDFlowline.
ReachCode is the first of two values giving us the network address for the event. It is the 14-digit identifier designating the Reach.
Measure is the second of the two values giving us the network address. In this case, the distance upstream on the Reach.
Reach SM Date is the date that the ReachCode was created. This is useful for telling us if the underlying reach geometry many have changed since the

event was last linked to the network.
Reach Resolution is the dataset of the reach.
Source Data Description tells us the native data system the event was derived from.
Source Feature ID is the identifier for the event in its native data system.
Source Originator tells us the owner of the native data system.
Event Date is the date the event was created in the NHD.

So that’s about all I going to present today on the dataset; next I’ll talk about the stewardship program. Questions?

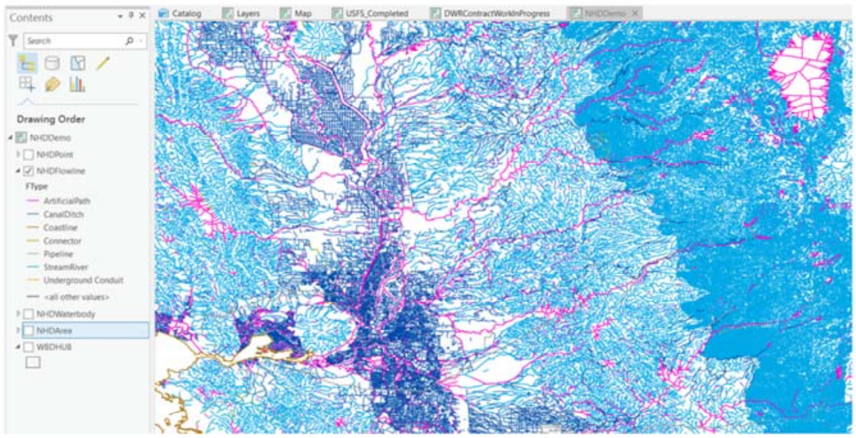

While the USGS Geospatioal Liaisons for our area - namely Carol Ostergren and Drew Decker – worked tirelessly to promote the idea NHD stewardship in California, some NHD editing work was begun by the Center for Geographical Studies at California State University Northridge, and the Geographical Information Center at California State University Chico. Some funding came from the Department of Fish and Wildlife, and some came from USGS as a pilot project. This allowed California to get started with learning the process and technical details involved with updating the NHD.




The DWR part of this story begins with program manager, Greg Smith, who managed DWR's water data library. With the encouragement and guidance of Carol Ostergren and Drew Decker of USGS as well as others, he began submitting budget proposals for NHD stewardship back in 2009. Year after year, the proposals were rejected. Then drought happened in California. The Governor Jerry Brown administration saw a heightened need to take action to help the State become more resilient. In January 2104, the first iteration of the California Water Acton Plan was released, and there, under Action #9: Increase Operational and Regulatory Efficiency – is this bulleted item at the bottom of the slide. The credit for this goes to Tom Lupo, the Deputy Director for Data and Technology in our sister Department of Fish & Wildlife. Now we had the solid justification we needed, and the seventh time the budet change proposal was submitted was the charm. The Governor's 2016-17 fiscal year budget included a general fund line item for the stewardship of the NHD. So we got 1.1 million in the General Fund for the program, but sadly we did not get the personnel positions we requested, which is an administrative problem for us in DWR. So we are getting creative.

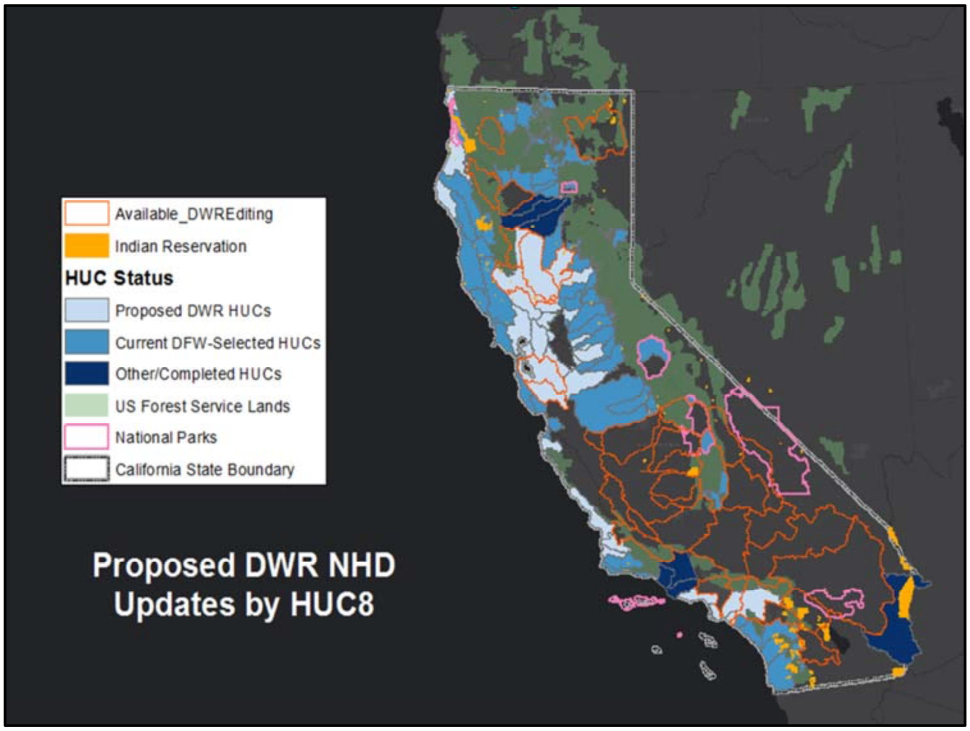

We are training several DWR GIS analysts around the department to work as part-time NHD editors. It may not be the most efficient way to get the work done, but we are making some progress. We have contracts in place with the CSU Chico Geographical Information Center and the CSU Northridge Center for Geographical Studies to update all of the subbasins in California at the 1:24,000 scale. This work will be done over the next three years. Under a separate contract that was executed between DWR and CSU Chico the area within the Legal Delta is being updated at the 1:4,000 scale; it will be densified to include all water features that can be detected from available imagery at that map scale. This effort was initiated prior to the beginning of our stewardship program by the former FloodSAFE Environmental Stewardship and Statewide Resources Office and funded under the Delta Knowledge Improvement Program, and is now managed by the Division of Flood Management's Delta Levees Program. That contract work will be completed in 2019. DWR's editors will focus this year on doing error correction and QC work with USGS as preparation for the NHDPlus being upgraded from the 1:100,000 scale to the 1:24,000 scale. The U.S. Forest Service has been involved with updating the NHD for many years and is now incorporating the appropriate features of the Sierra Nevada Meadows dataset into the NHD within and adjacent to US Forest Service lands.

## USFS Updates at Higher Resolution and Density in USFS Lands (and some adjacent areas.)




USGS Visibility Filter Attribute coming soon:
https://nhd.usgs.gov/VisibilityFilter.html

USFS forest management plans are based on WBD watersheds and they have a business need for a higher resolution NHD. They have trained many of their hydrologists and GIS staff yo edit the NHD according to their needs. The result is inconsistent density of features as you can see in this screenshot The light blue StreamRiver flowlines are much more numerous in the USFS lands. This can create a problem for analysis work and for cartography, so the USGS is working on adding a visibility filter attribute to NHDPlus that allows for filtering of vector data features at eight different scales.




To sum up: The 140 HUCs are being and will be edited collaboratively by some GIS folks around the DWR organization, by the California State University Geographical Centers, and anyone else we can get interested in participating. US Forest Service, is actively editing the portions of the subbasins within their administrative boundaries, and we have reached out to Indian tribes to participate whether by becoming editors or by providing local data for our editors. The CSUs are under contract with DWR for technical assistance, and one of their major deliverables so far has been helping with the training the DWR editors and the California Business Rules document.

http://www.water.ca.gov/waterdatalibrary/NHD/index.cfm

**Download the California Business Rules**

**Interactive status map:**

http://www.tinyurl.com/calnhd


The first url on this slide is the link to the NHD Stewardship for California page on the DWR website. That page has a link to download the California Business Rules. This document was created to guide the work of the CSUs and the DWR editors. It is a living document and will be updated as needed to cover the situations we discover as we examine the NHD. There is a link to the interactive Status map which I update as the subbasins are checked out and checked back in by the editors.

# Hydrography/NHD Workgroup of the California GIS Council

http://cgia.org/cagiscouncil/workgroups/hydrography/

# More Links

- https://nhd.usgs.gov/ USGS home page for NHD
- https://hydro.nationalmap.gov/arcgis/rest/services
- https://www.youtube.com/results?search_query=national+hydrography+dataset

Jane.Schafer-Kramer@water.ca.gov
916.653.4441

Here are additional links about the NHD; the home page on the USGS website, the link for the web map and feature services for the NHD and WBD, and some helpful videos on YouTube.
Feel free to contact me with questions, errors that you find in the NHD, and any ideas you may have for linking your work to the NHD.