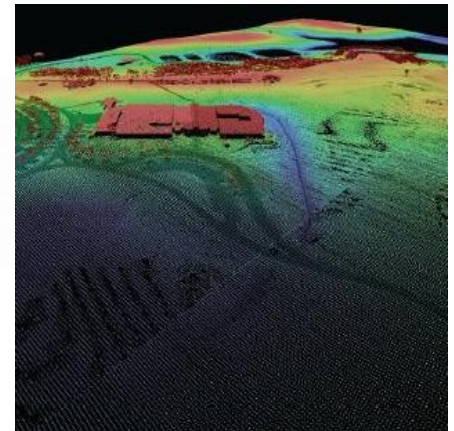
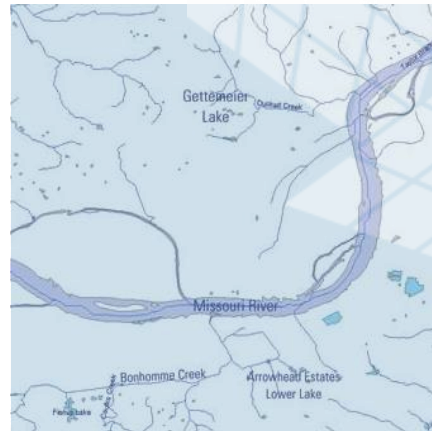
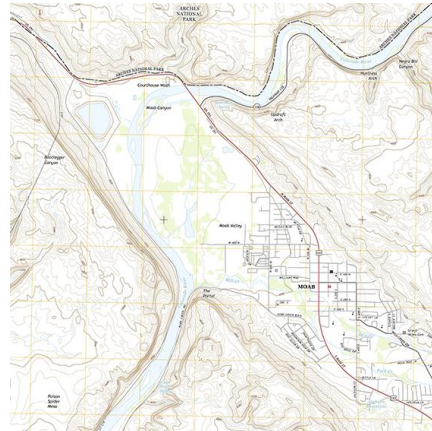




Referencing Data to the NHD and the Power of an Intelligent Stream Network



**WIMS Workshop Presentation
January 17, 2018**

**Drew Decker
USGS National Map Liaison**

**Al Rea
USGS National Hydrography Co-Lead**



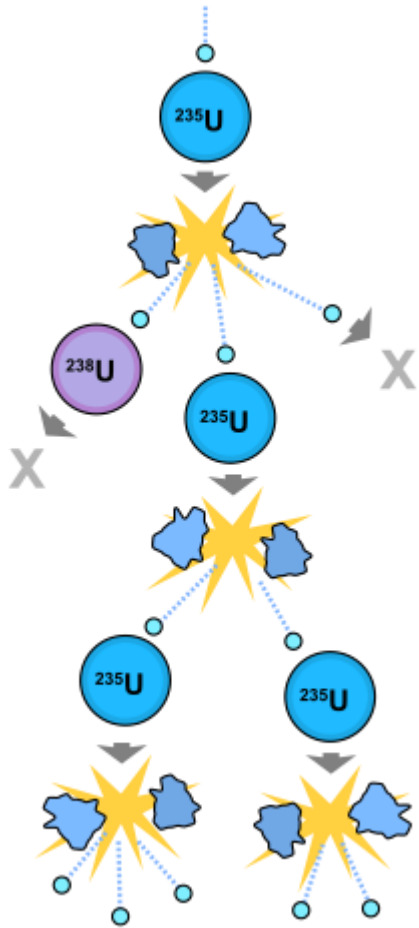
+ The Value of Water Information Sharing

Potential Value = (data x quality) ^{sharing}

- From blog post by Stu Hamilton, Aquatic Informatics:

<http://aquaticinformatics.com/blog/hydrology/unbounded-data-value/>

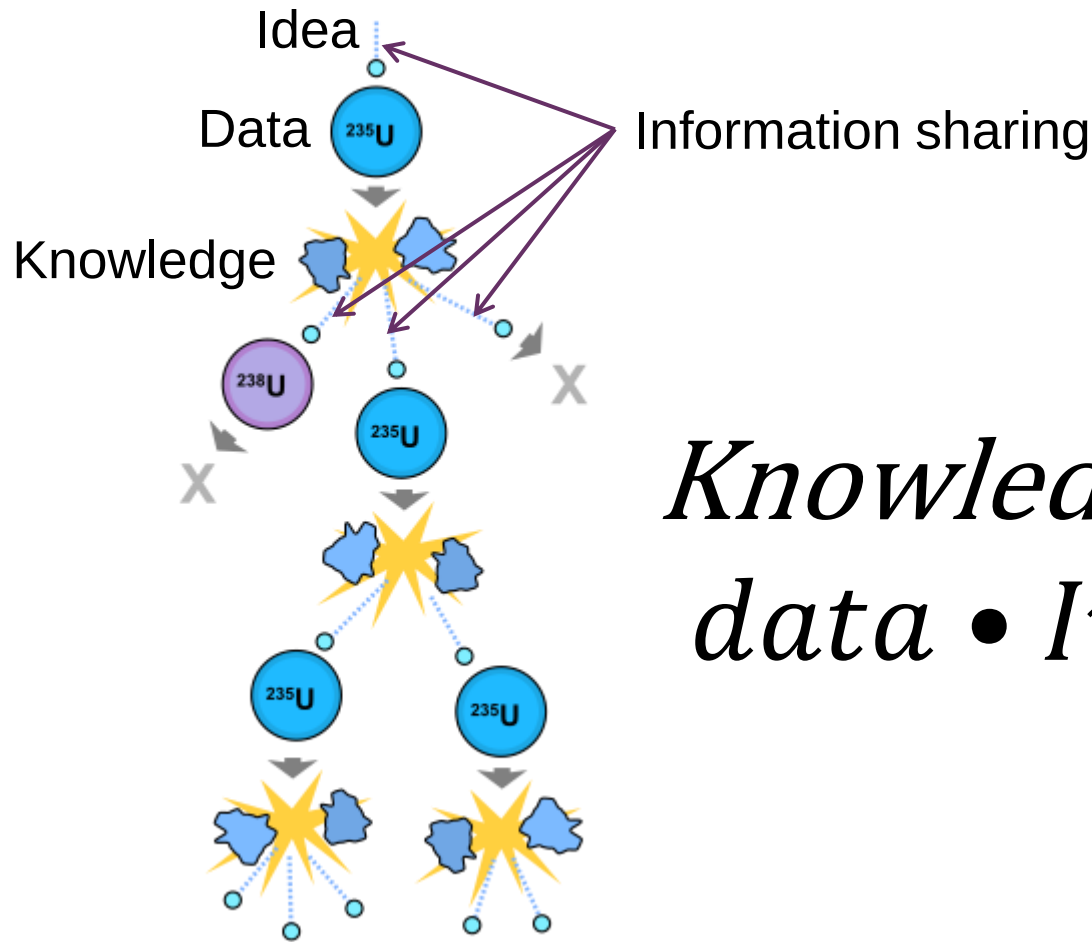
Chain Reaction



$$E = mc^2$$



Information Sharing Chain Reaction



$$\textit{Knowledge} = \textit{data} \bullet \textit{InfoSharing}^2$$

+ How can we facilitate water information sharing?

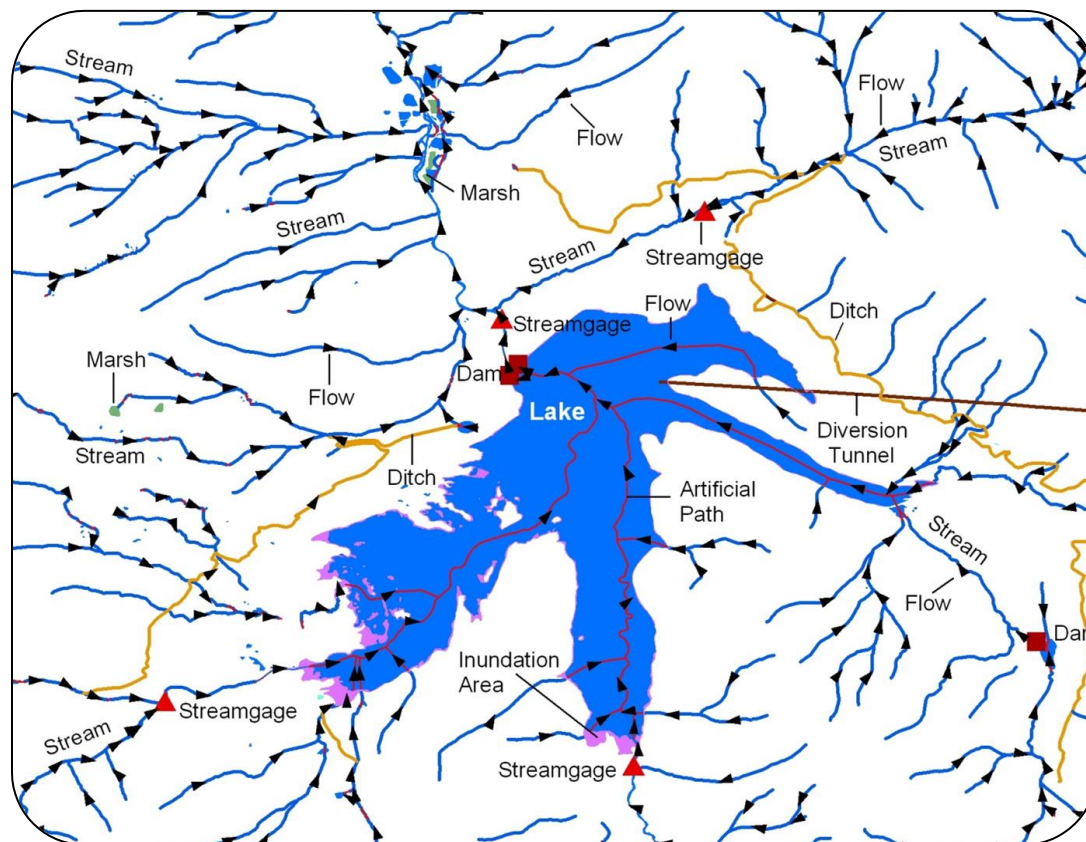
- Discoverability
 - Standard frame of reference – NHDPlus HR
 - Search engine for water data – NLDI
- Interoperability
 - Network navigation functionality
 - Data exchange via web services

+ National Hydrography Dataset

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Water network for mapping and modeling

- National drainage network of streams and lakes, plus other hydro info, in a GIS format
- Currently 1:24K or better (1:63K – 1:24K in AK)
- Shapefile and GDB downloads, plus web-based map services



+

Flow Direction

A key piece of intelligence

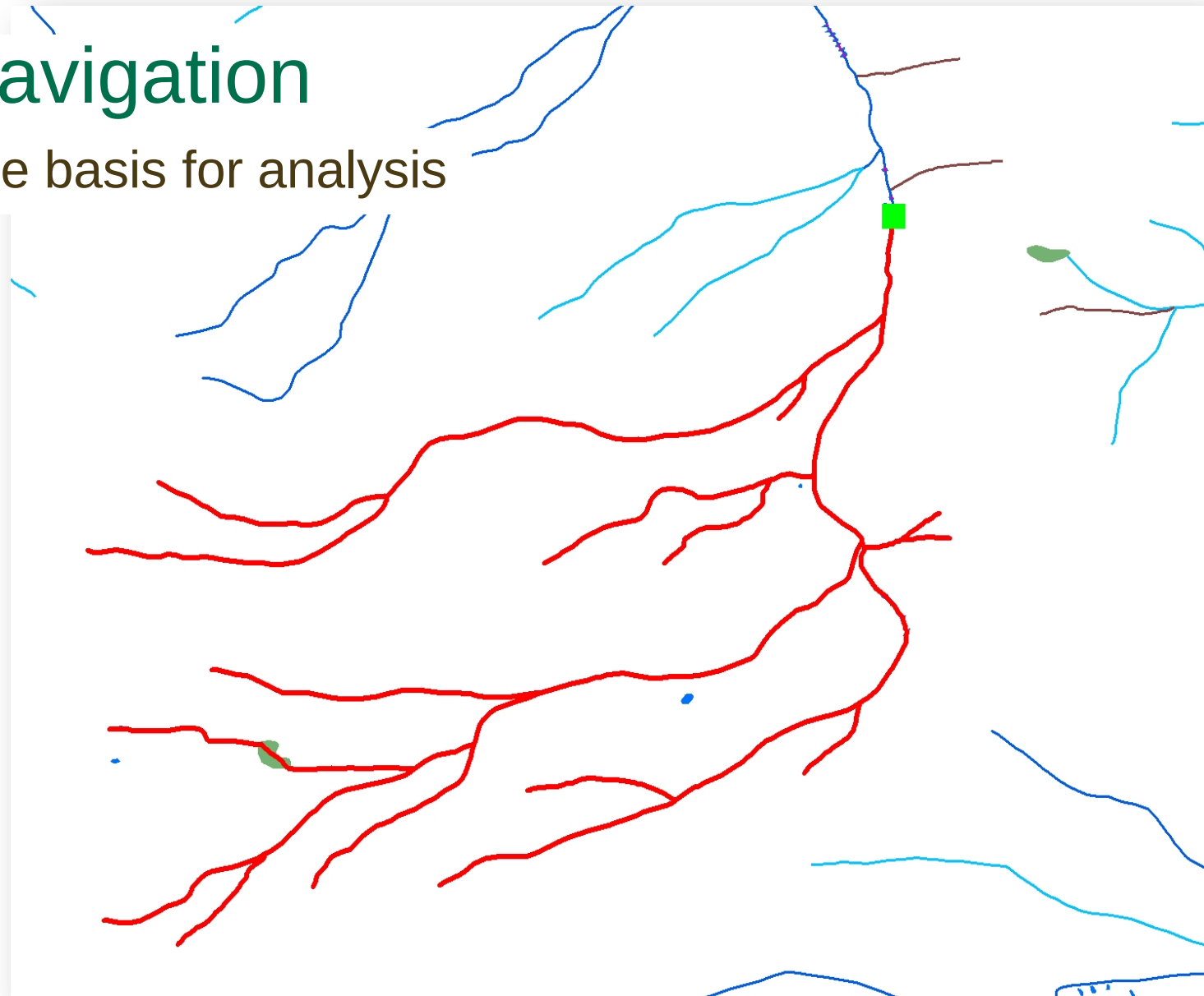


7

+

Navigation

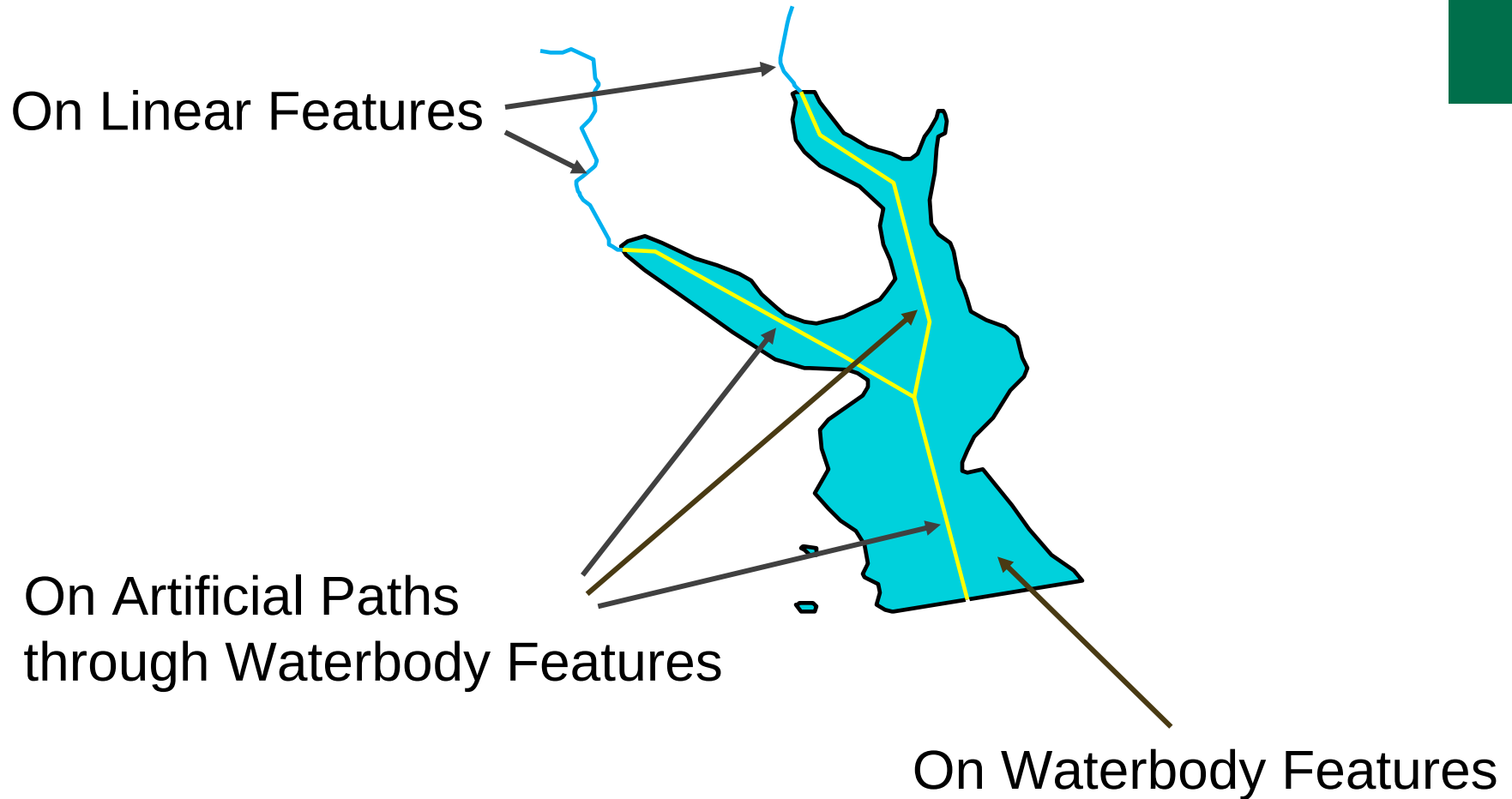
The basis for analysis



+ Referencing Data to the NHD: Reaches and Reach Codes

- Linear Referencing (Esri Routes and Measures)
- Avoids breaking up the national network with every user's observation sites, etc.
- Route system = “**Reaches**”
 - A linear group of surface water network features that have a unique reach code identifier
 - A waterbody that has a unique reach code identifier
- **Reach Code:** A 14-character stable identifier that changes rarely and when it does change, the change is tracked.

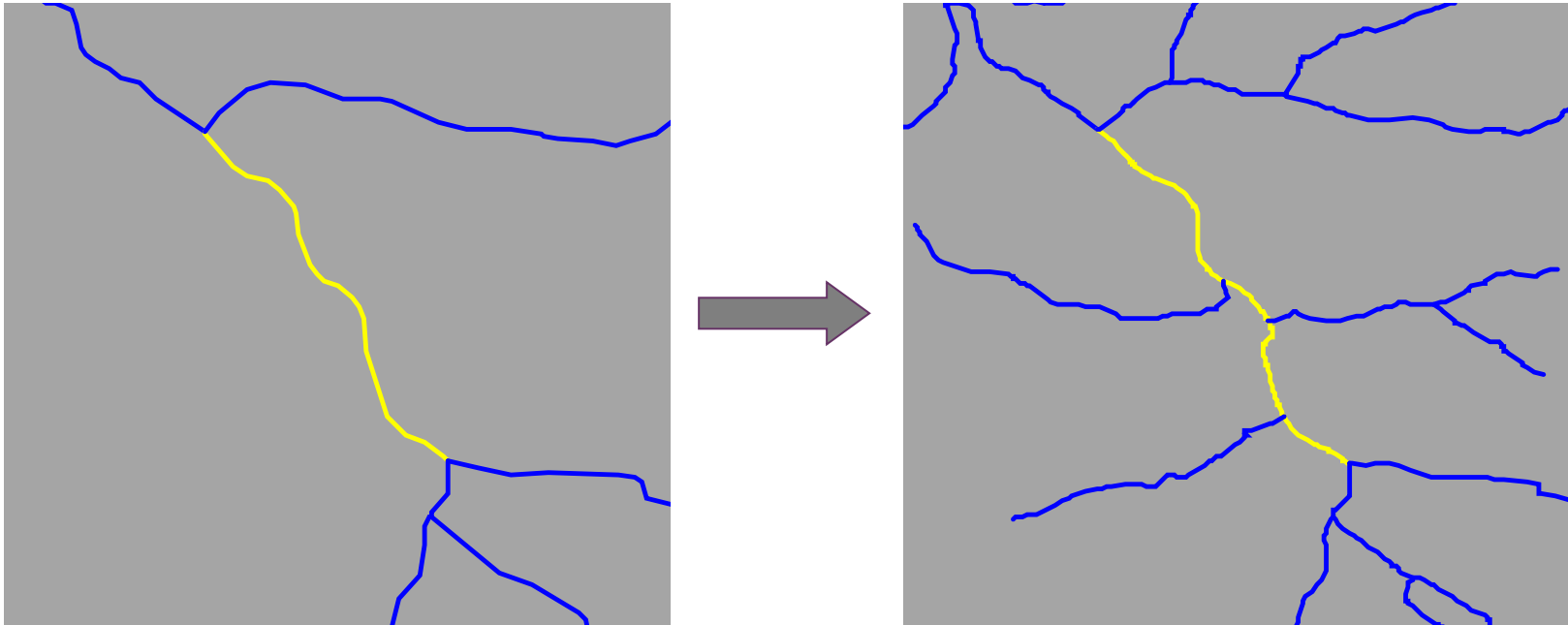
+ Referencing to the NHD: Reaches and Reach Codes



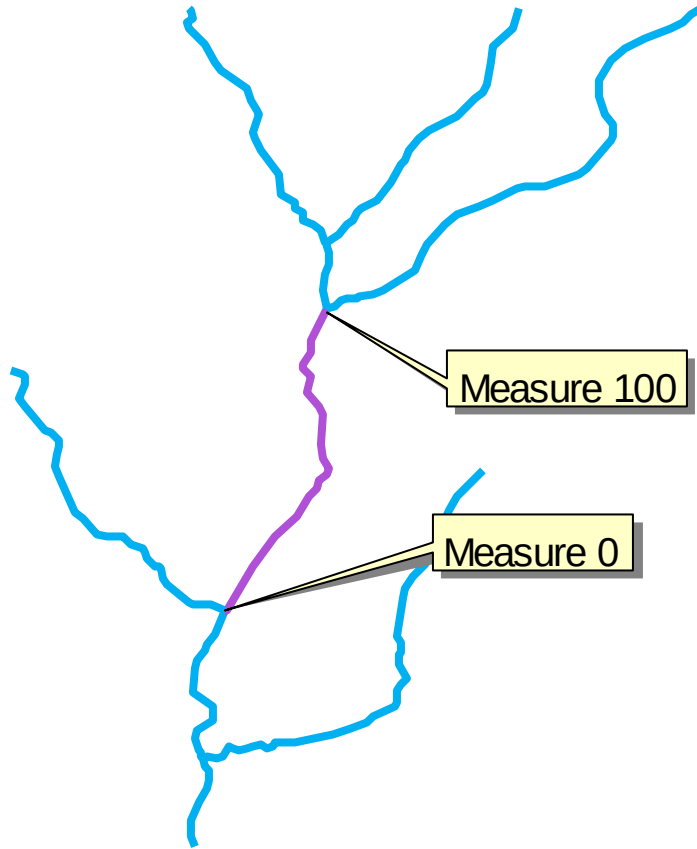
+ Linking Data to the NHD: Reaches and Reach Codes

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Reaches are designed to be relatively permanent/stable



+ Linking Data to the NHD: Reaches and Reach Codes



Each linear reach is one addressable unit - a 'street'

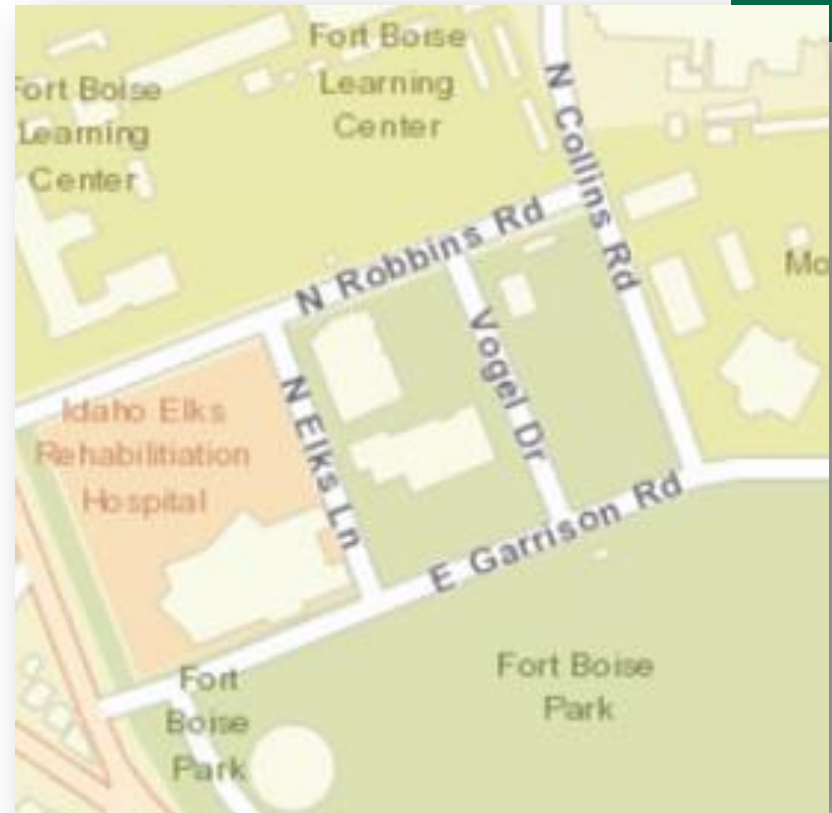
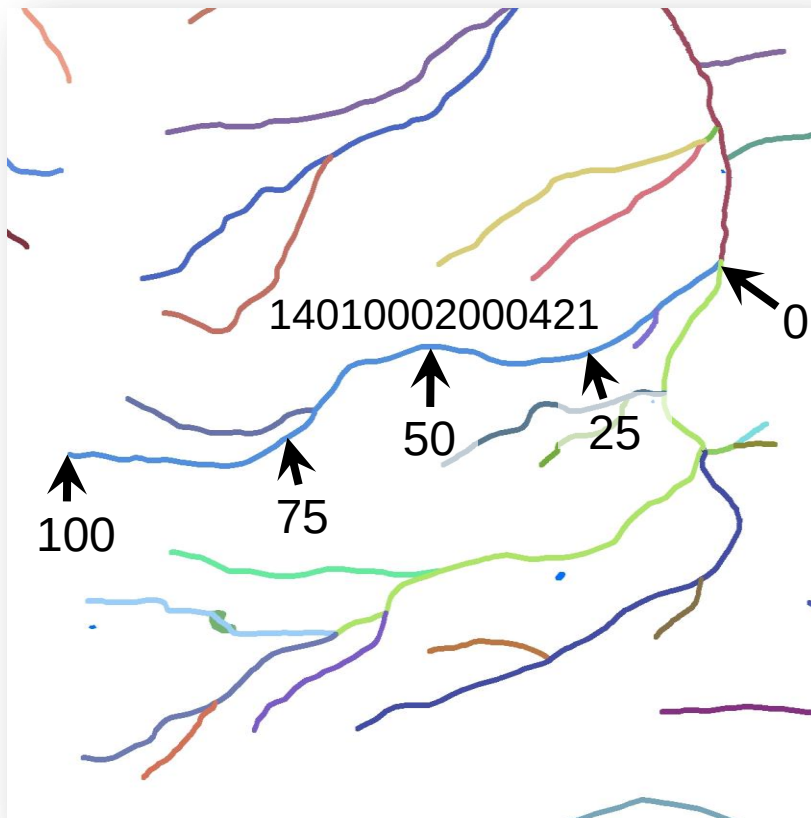
Addresses are proportional 'street' numbers 0-100 from downstream to upstream

Addresses are stored as coordinate M-values (x, y, z, m)



Linear Referencing

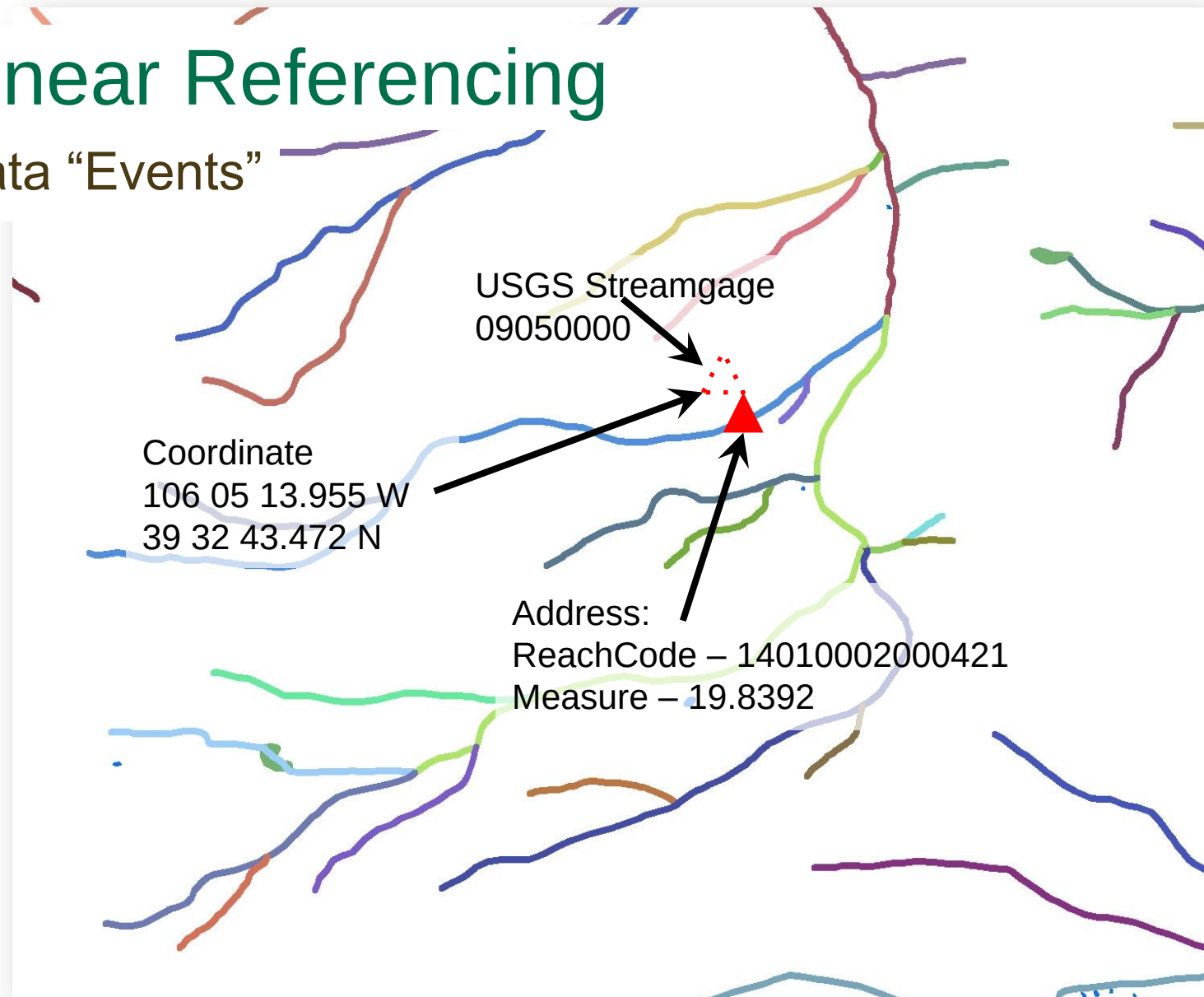
Stream addresses



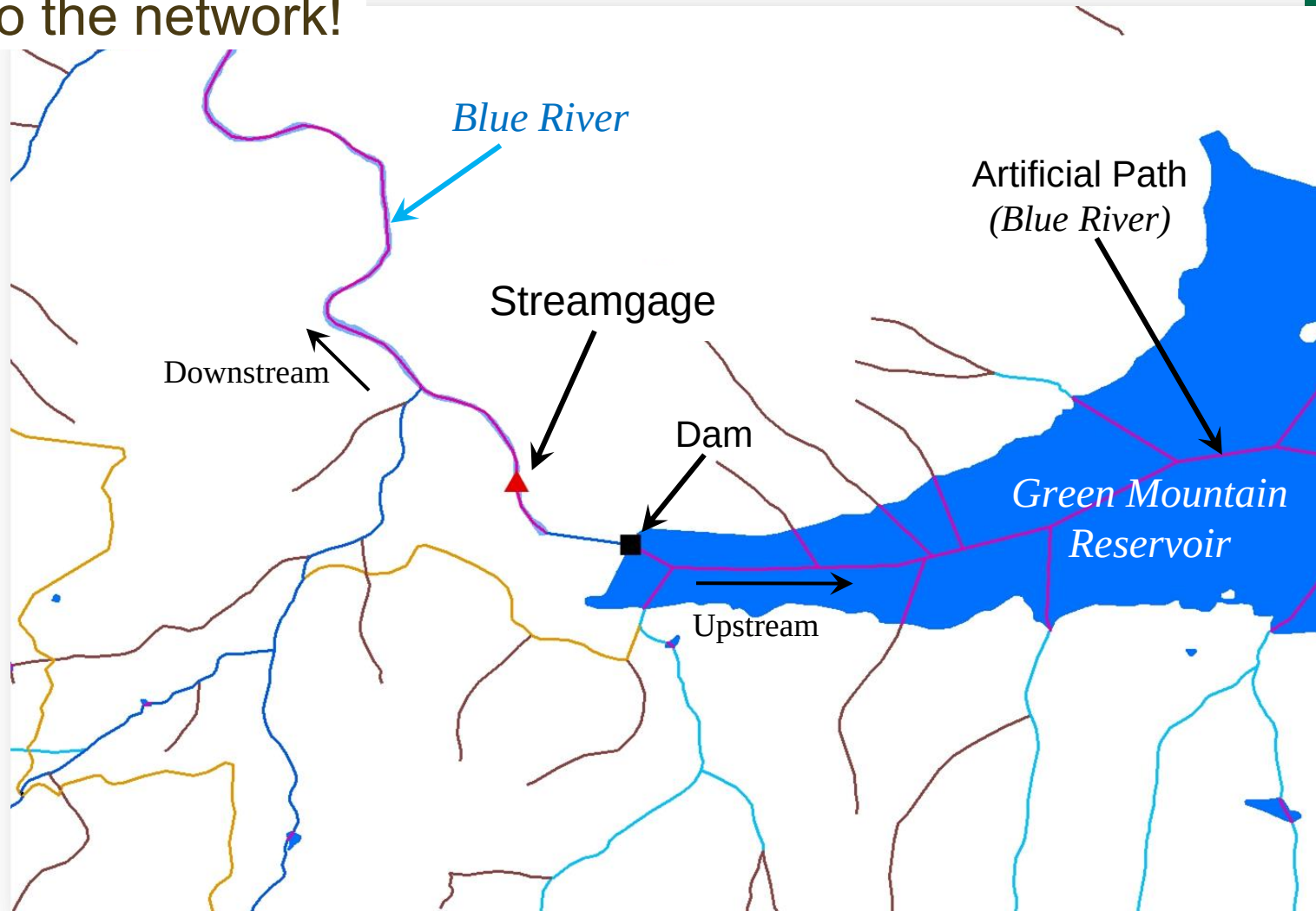


Linear Referencing

Data “Events”

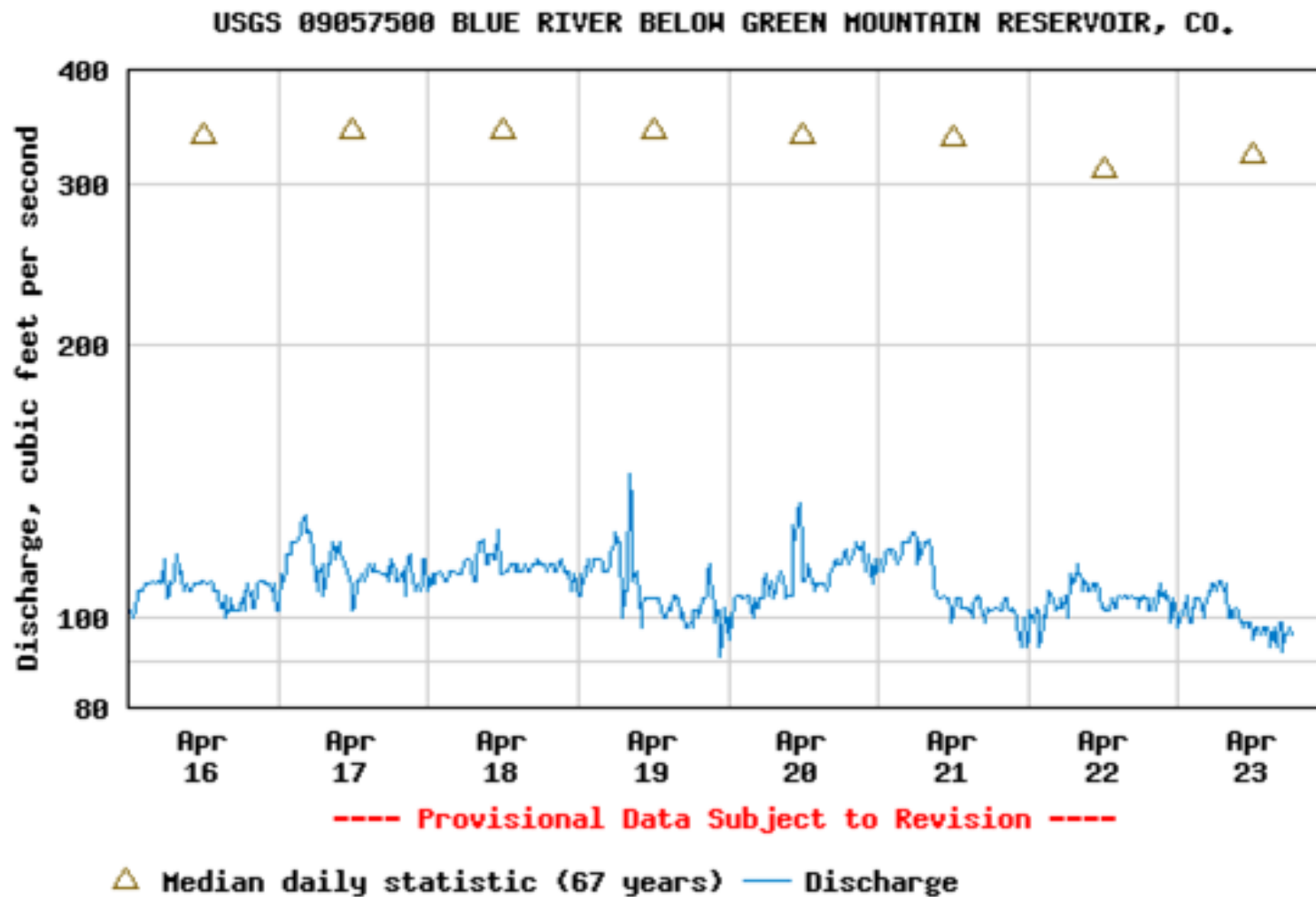


+ Connecting the streamgage... ...to the network!





Adds geospatial context to streamflow data



+ Network Linked Data Index (NLDI)

- Linked data, e.g. flow observations
- Search engine for Hydro Linked Data
 - “crawls” and indexes sources for fast access
 - Enables upstream/downstream queries using NHDPlus stream network
- **Web-based extensible design**—any surface-water data can be linked and shared via web services
- Currently implemented as pre-filter in Water Quality Portal

+ How NLDI Navigates

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Hydrologic Unit Code

030801011008

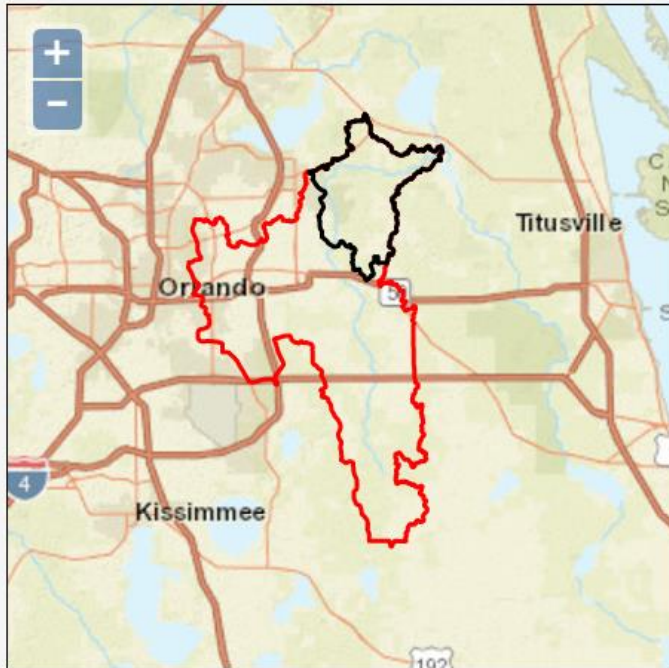
Watershed Name

Lower Econolockhatchee River

HUC Watershed Drainage Area (km²)

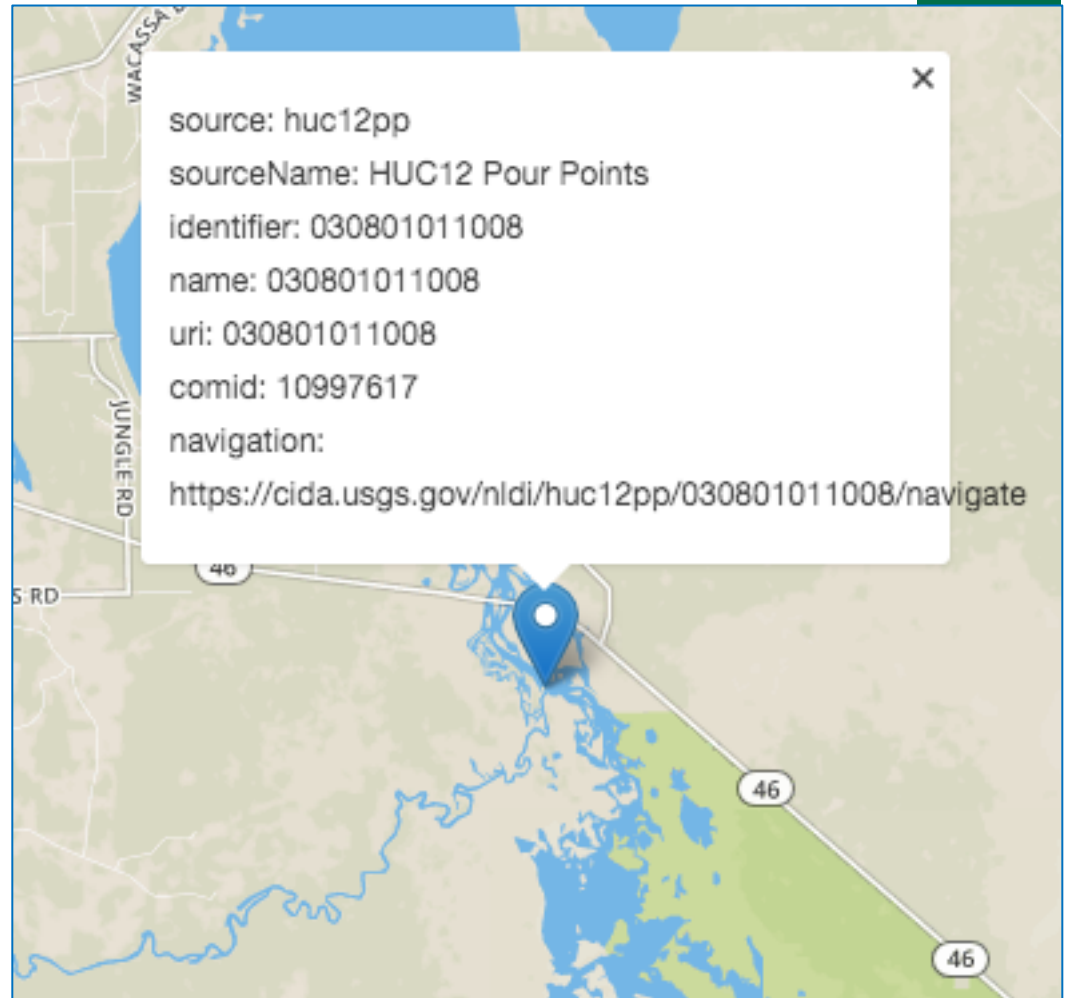
Local Incremental: 138.05

Total Upstream: 691.64



Local Incremental Watershed: —

Total Upstream Watershed: —

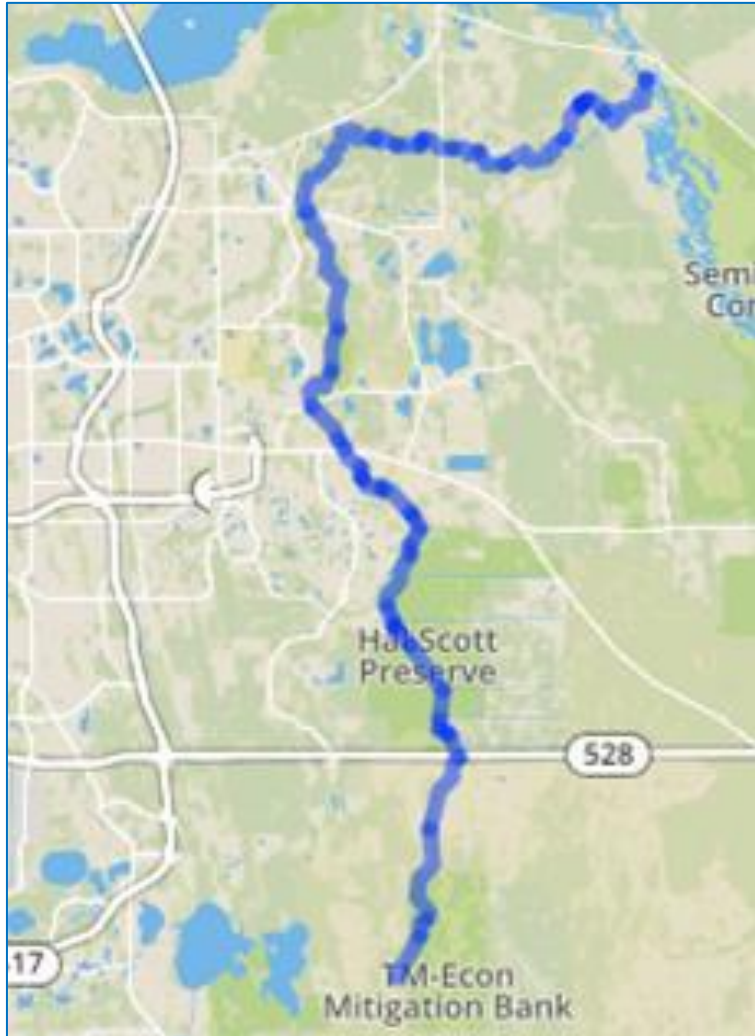


<https://cida.usgs.gov/nldi/huc12pp/030801011008>

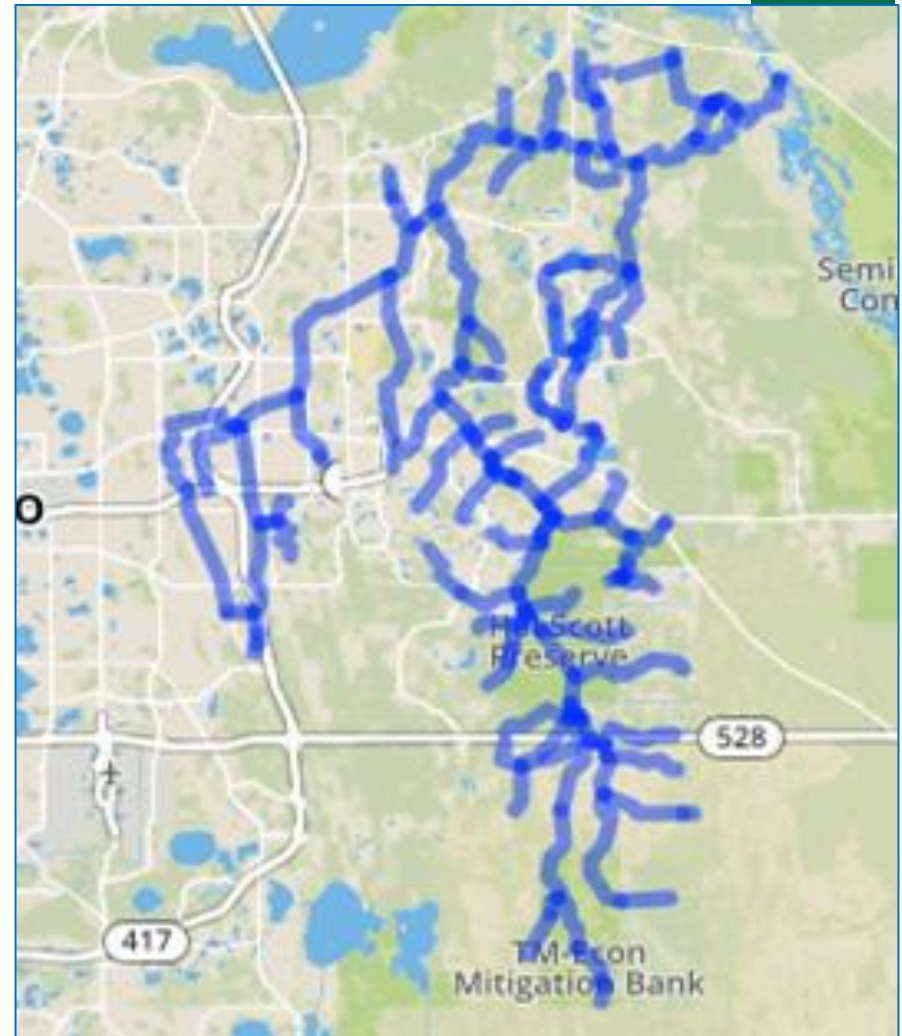
+ NLDI Navigation

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... /navigate/UM



... /navigate/UT

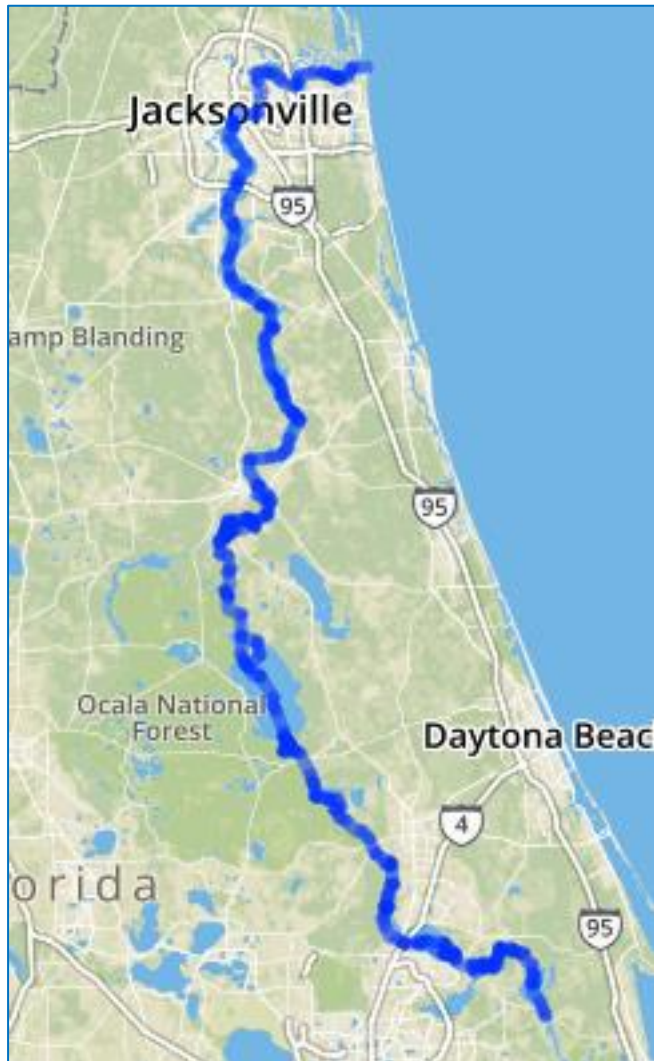


<https://cida.usgs.gov/nldi/huc12pp/030801011008>

+

... /navigate/DD

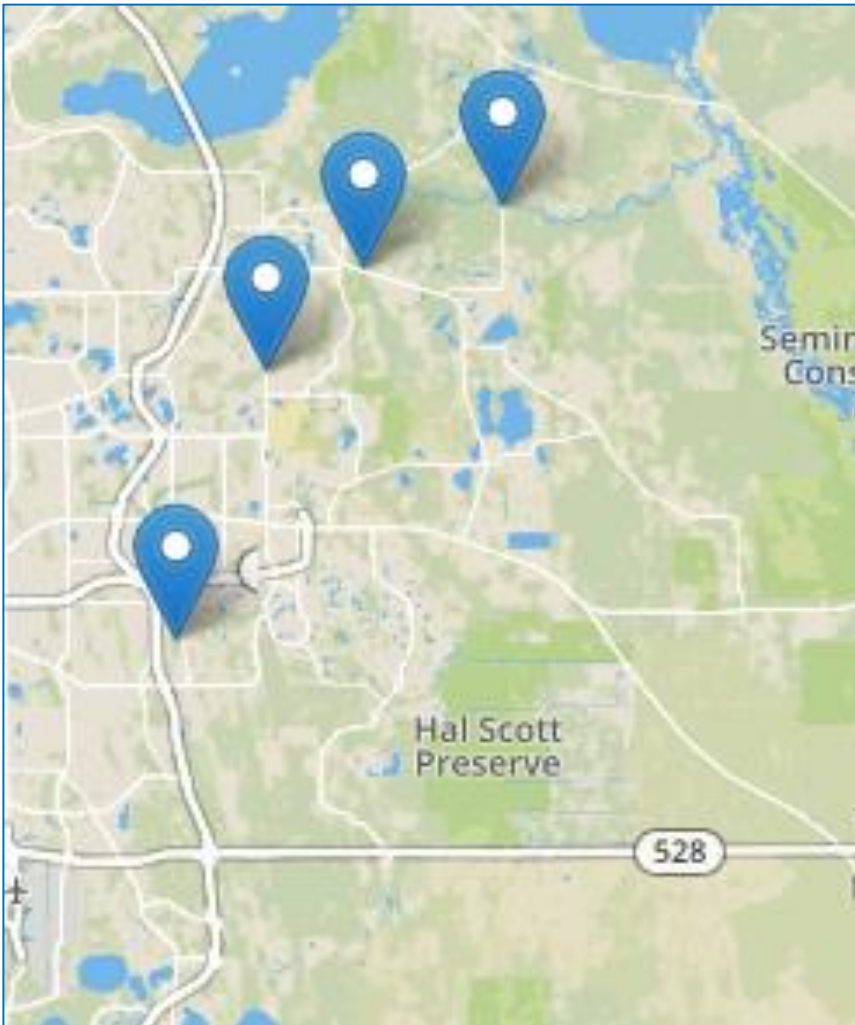
Zoomed In



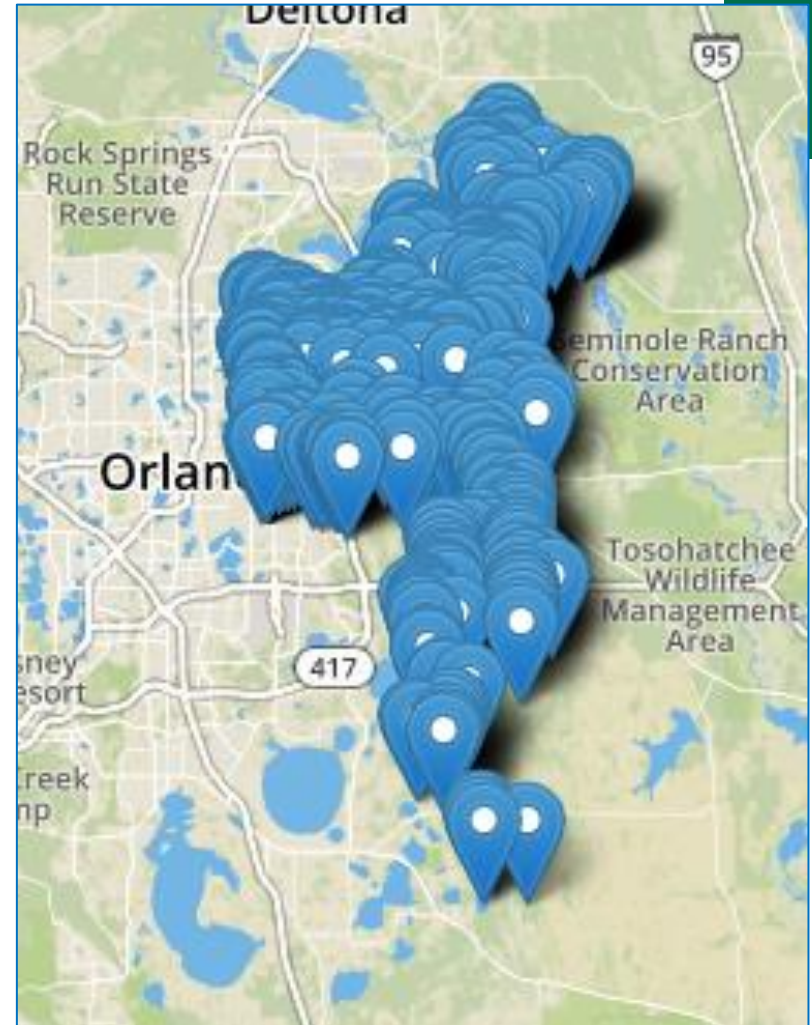
<https://cida.usgs.gov/nldi/huc12pp/030801011008>

+

... /navigate/UT/nwissite



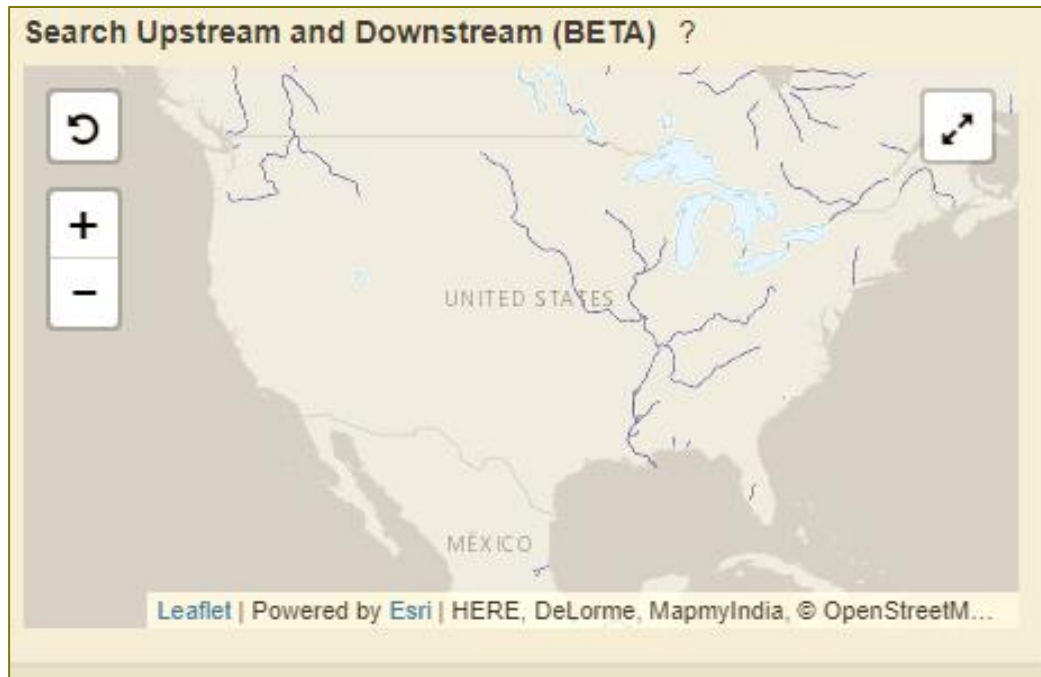
... /navigate/UT/wqp



<https://cida.usgs.gov/nldi/huc12pp/030801011008>

+ NLDI is embedded in the Water Quality Portal

- <https://www.waterqualitydata.us/>



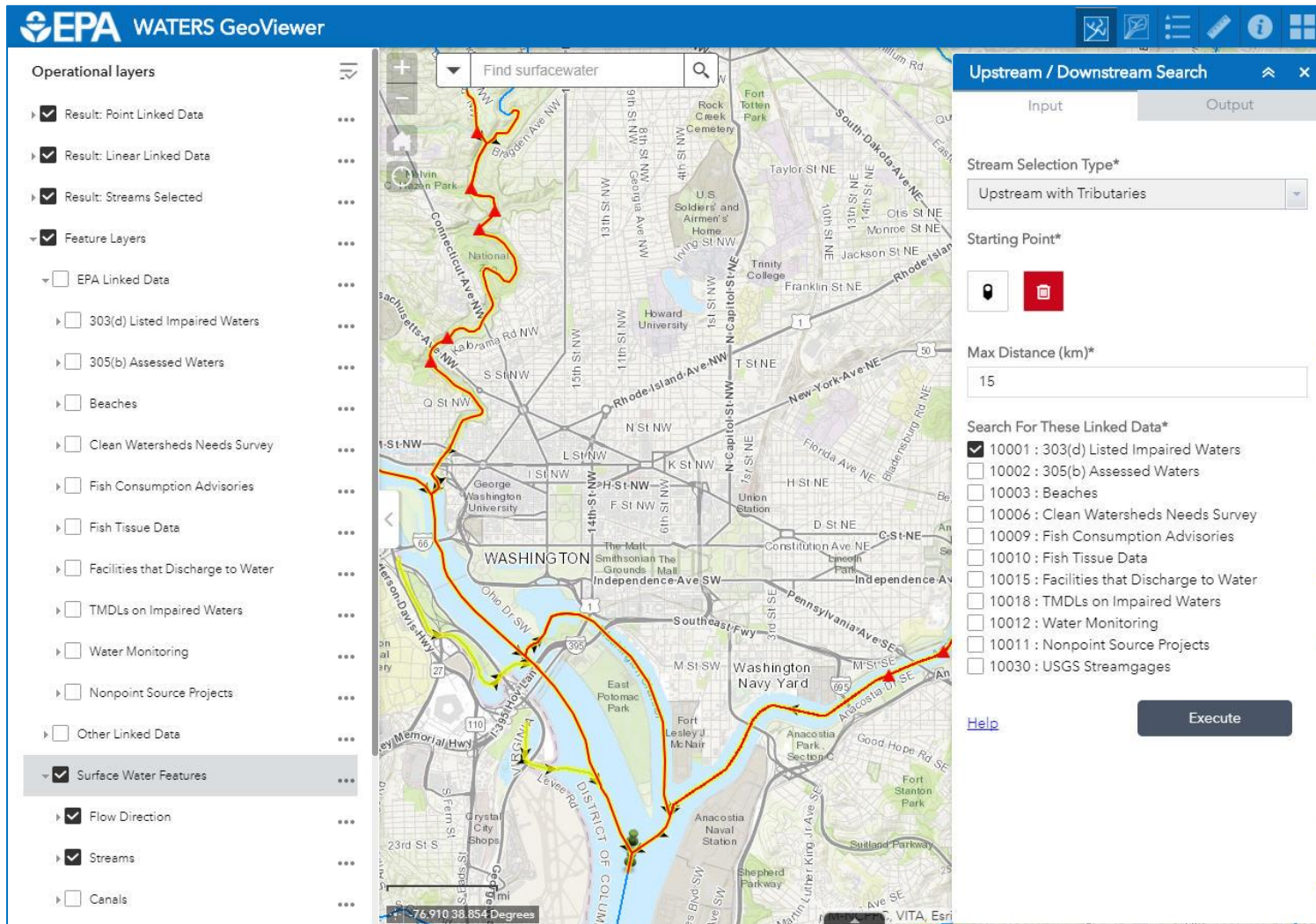
- Enables entirely new queries, e.g. “All metals analyses downstream of X,Y for 500 km”

+ NLDI Additional Information

- <https://owi.usgs.gov/blog/nldi-intro/>
- <https://cida.usgs.gov/nldi/about>
- jkreft@usgs.gov
- dblodgett@usgs.gov

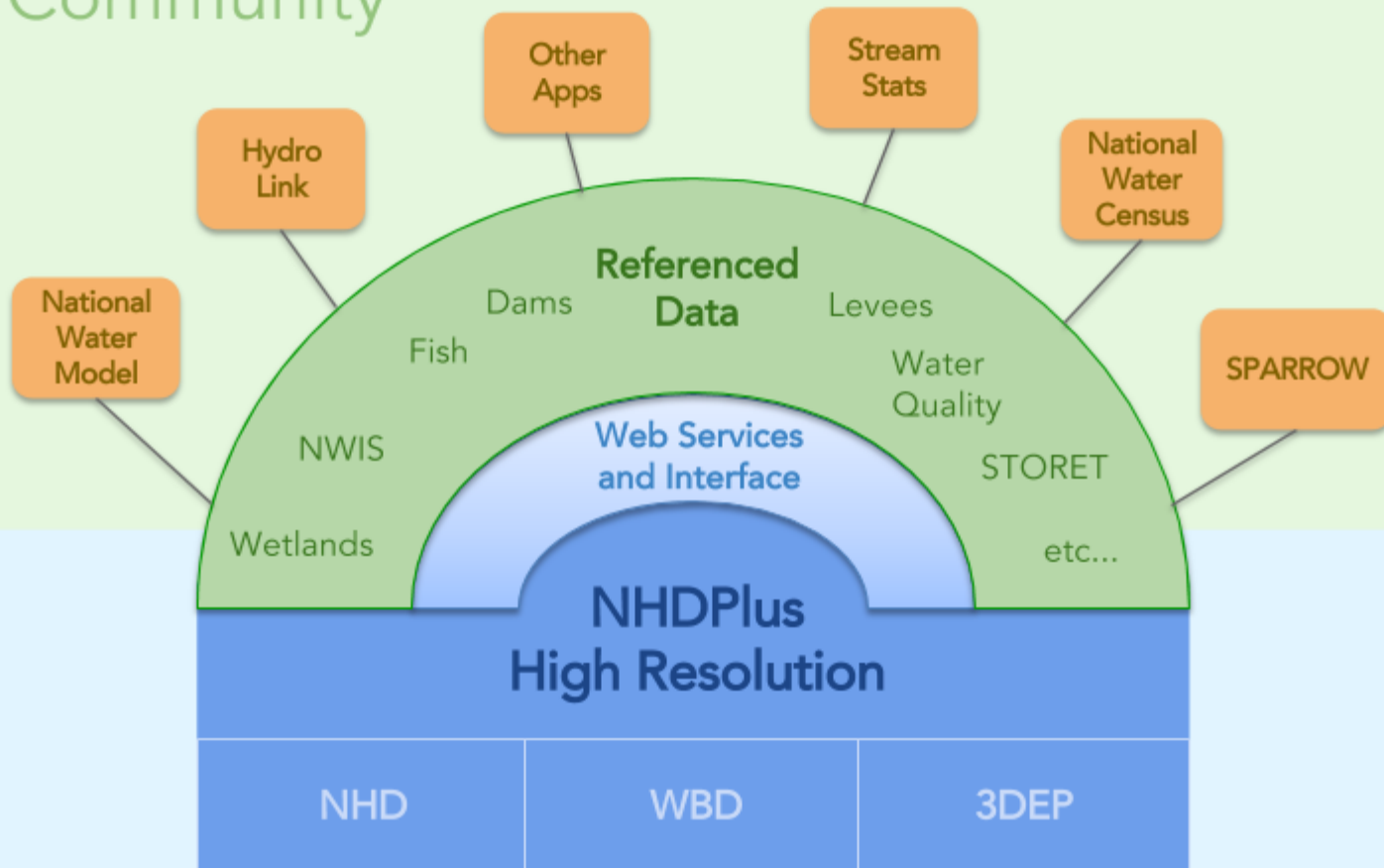
+ A similar application: EPA's WATERS GeoViewer

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<https://www.epa.gov/waterdata/waters-geoviewer>

Community



Infrastructure

+ Current status

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- What can you do with this now?
 - Water Quality Portal is initial application
 - EPA's WATERS GeoViewer is a general browse and query app for NHDPlus Medium Resolution (1:100,000)
 - NLDI for NHDPlus HR is being researched
- Reference your data to NHD (MR or HR)
 - Linked data (e.g. water withdrawals, permits, water rights)
 - Hydro Event Management (HEM) desktop application
 - Web-based tools in development <https://maps.usgs.gov/hydrolink/>

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National Map Liaison

ddecker@usgs.gov

619-225-6430

+ Demo site

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- https://codepen.io/WATERS_SUPPORT/pen/jEKaEx
- Point(-116.96388244628908 32.73877198768004)
- Snap – raindrop flow with value of 5
- Nav type – downstream main path only
- Max distance – 50
- Facilities that discharge to water