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Linking Data to the National Hydrography Datasets (NHD)

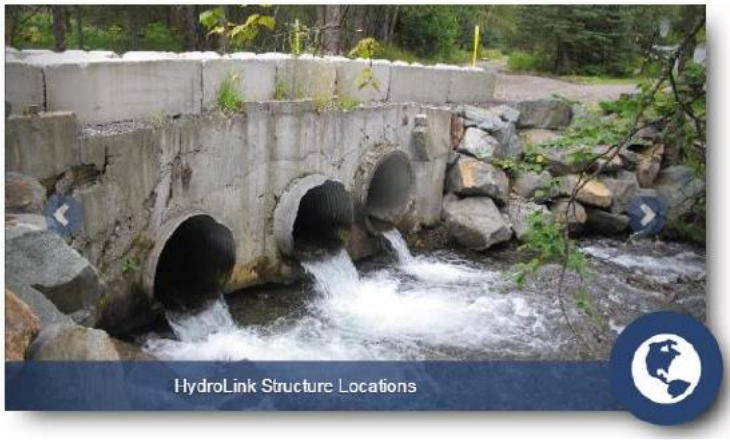
Daniel Wieferich

U.S. Geological Survey

April 24th, 2018

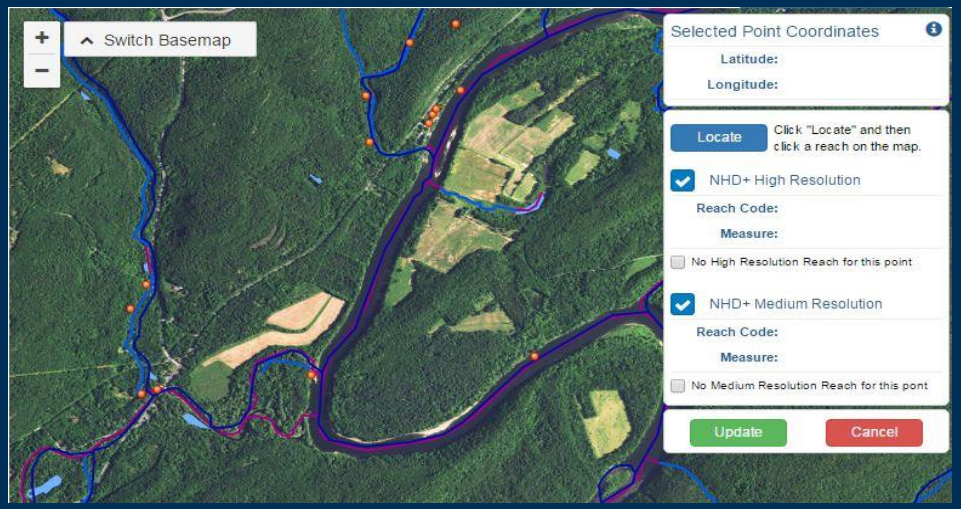
Instream Flow Council 2018

U.S. Department of the Interior
U.S. Geological Survey



Linking Data to the National Hydrography Datasets (NHD)

- Linking Data: Defined
- NHD Data Recap
- Linking Observation / Feature Data
- Methods for Summarizing Landscape Characteristics (NHDPlus)



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Linking Data: Defined

Assigning a spatial relationship between information and the hydrographic network.

Examples of information include field observations (water sample location), features (location of a gage station), landscape characteristics (percent of catchment containing agriculture) or….

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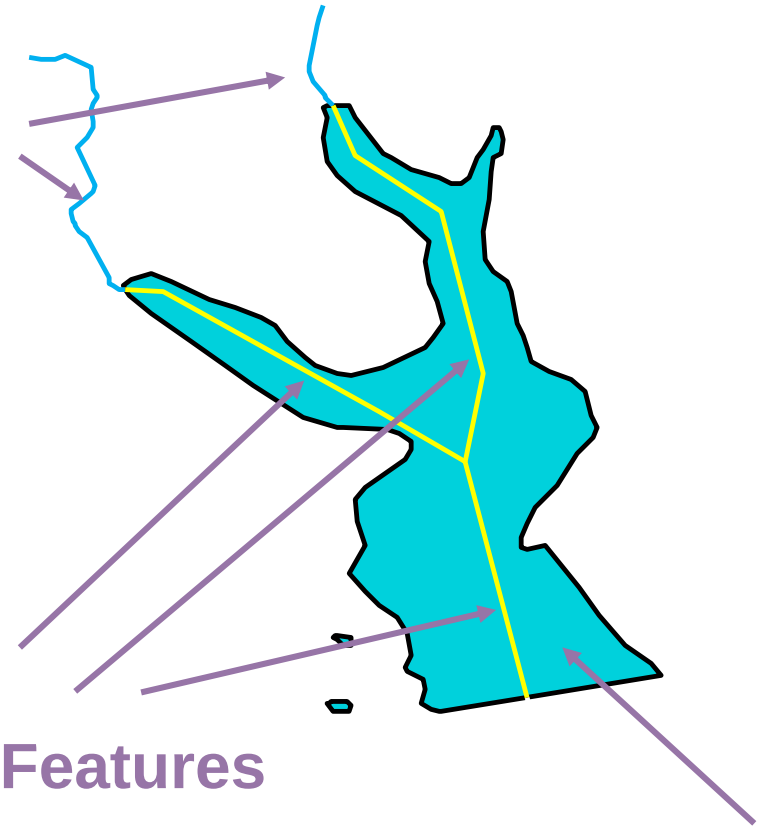
Linking Data to the NHD: Reaches & Reachcodes

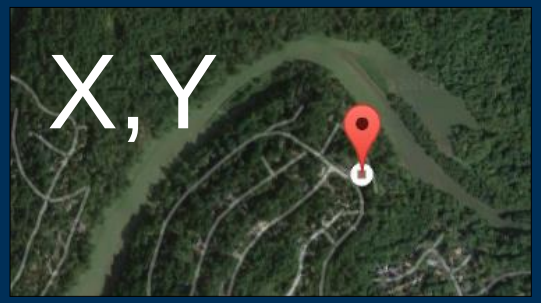


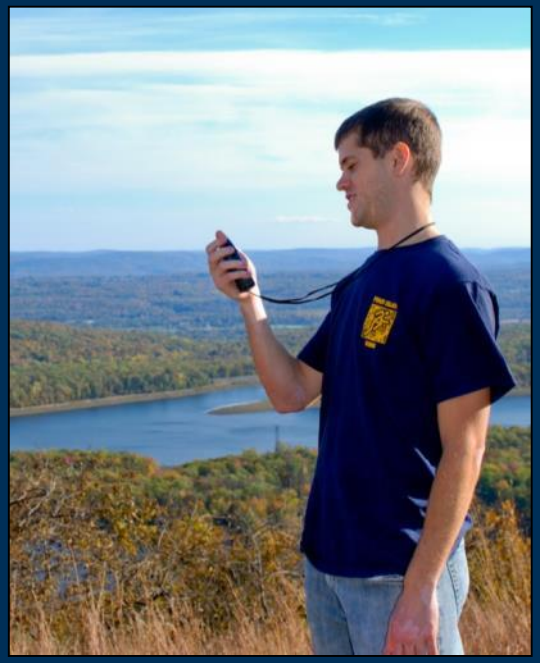
Important NHD Variables When Linking

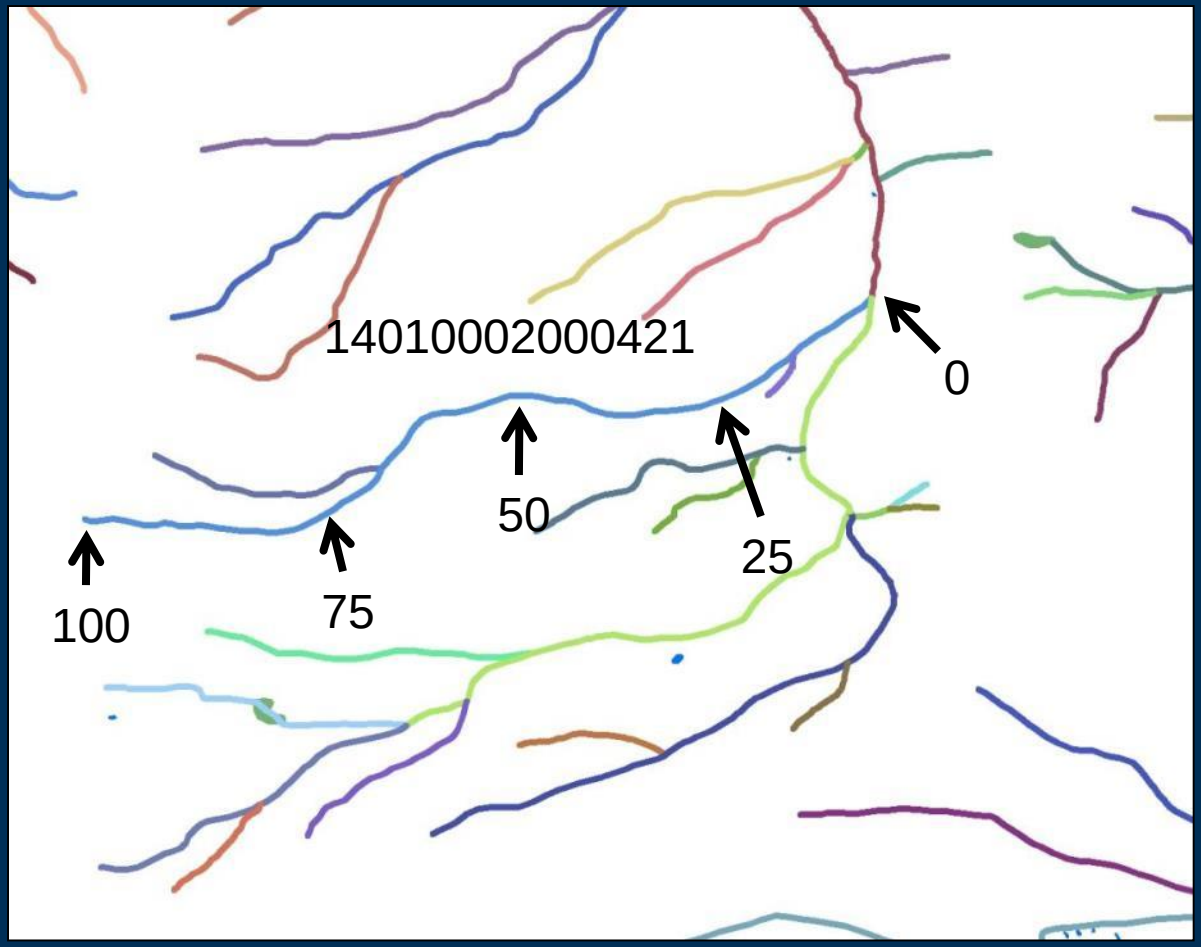
All NHD: ReachCode, Measure

NHD 1:24k : Permanent_Identifier

NHDPlus 1:100k: COMID







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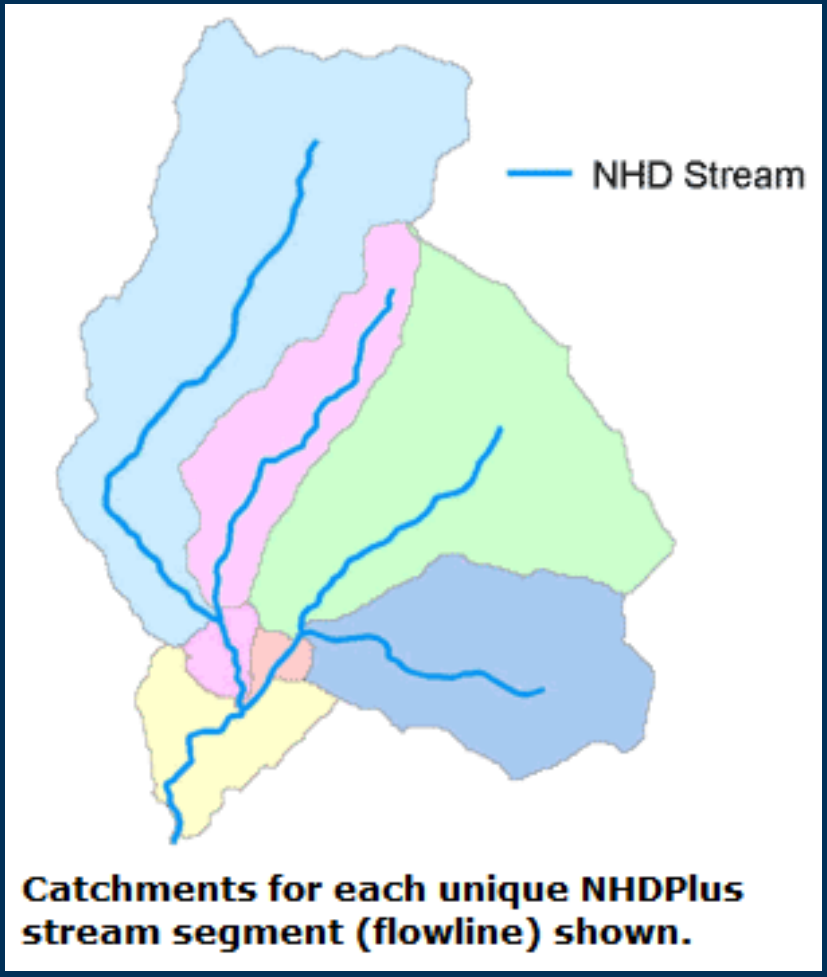
NHDPlus Identifiers

Line and Associated Catchment Same Identifier

- Medium Res: COMID
- High Res: Permanent ID



Catchments for each unique NHDPlus stream segment (flowline) shown.

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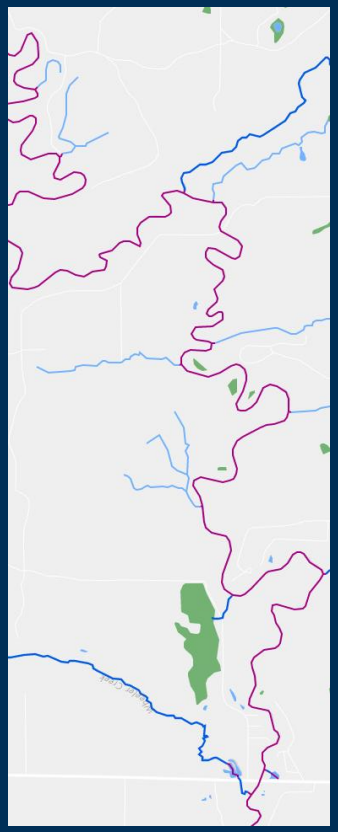
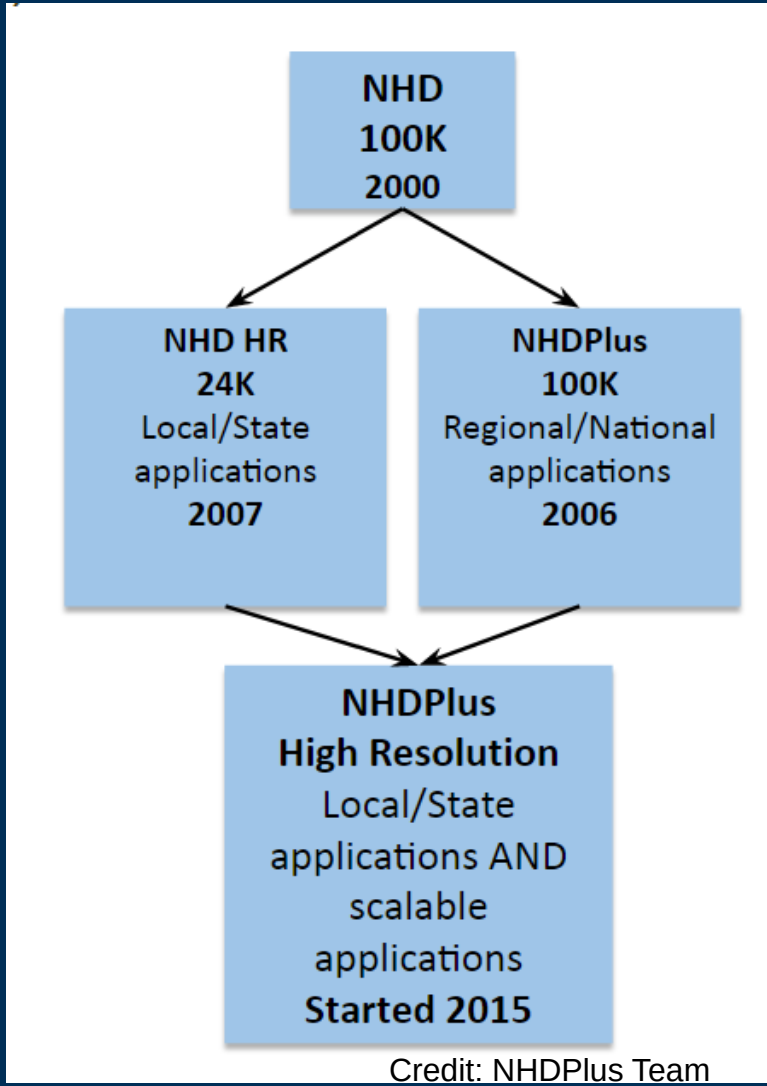
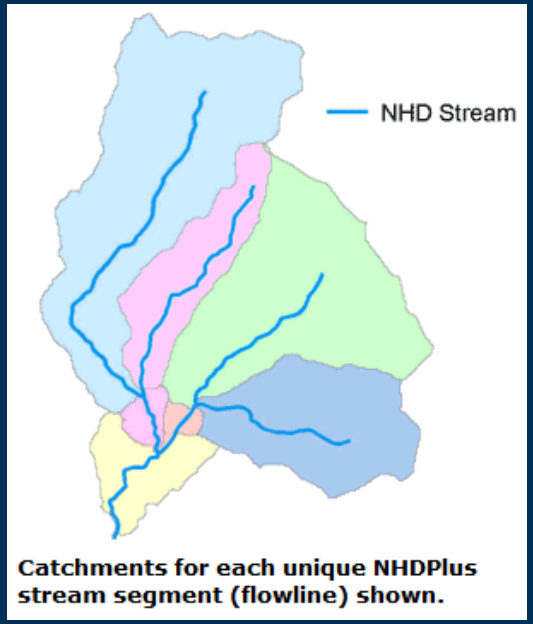
National Hydrography Datasets





Credit: NHDPlus Team



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Linking Different Types of Observational and Feature Data

Blue = input Red = linked

Point

Examples: dam, gage station, fish sample
Output: ReachCode, Measure

Line

Example: sampled stream segment
Output: ReachCode(s), From Measure(s), To Measure(s)

Polygon

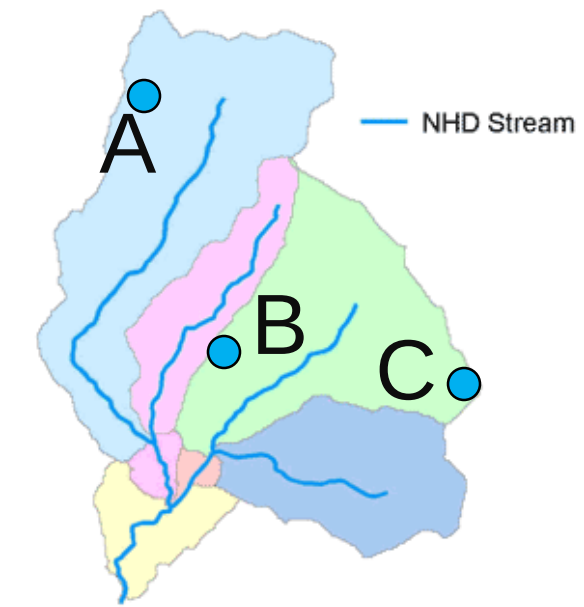
Example: delineated floodplain
Output: ReachCode(s), From Measure(s), To Measure(s)

Linking Data to NHD: Common Methods For Observation Data

Catchment – NHDPlus Only

What catchment(s) do the point/line/polygon fall in?

Point	Polygon	COMID
A	Light Blue	123532
B	Green	213888
C	Green	213888



Catchments for each unique NHDPlus stream segment (flowline) shown.

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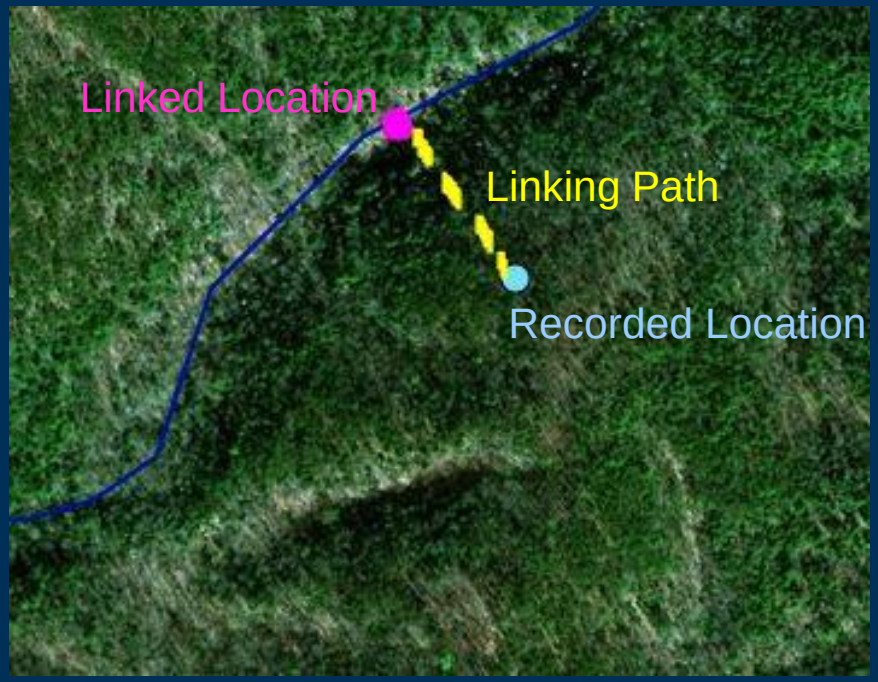
Linking Data to NHD: Common Methods For Observation Data

Raindrop

Follows elevation downhill to NHD waterbody

"Snap"

Straight line path to NHD waterbody



Considerations When Linking Observation Data

- Straight line “snap” of point data often fails when:
  - Point near confluence
  - Point > 50 meters from stream segment
  - Point represents location at edge of a wide river
- Use aerial imagery and attributes to minimize issues
- Using existing tools and services ensure consistency

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Hydrography Event Management (HEM) Tool

Desktop HEM

https://nhd.usgs.gov/tools.html#hem

- Desktop tool requiring ESRI
- Works against local copy of NHD
- Allows linking of points, line, polygon events, using a different methods

HEM Web Services

https://edits.nationalmap.gov/hem-soe-docs/

- Services for tool development
- Developed for High Resolution data, no download of data or ESRI license needed
- Allows linking of points, line, polygon events, using a few different methods

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The HydroLink Tool

For Validation of Sample Locations and Linking Data to the National Hydrography Datasets (High Resolution and Medium Resolution)

URL - https://maps.usgs.gov/hydrolink/

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U.S. Geological Survey - Core Science Analytics, Synthesis, and Libraries - HydroLink Tool

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HydroLink Tool

Generate a hydrologic linear reference for point data representing locations of geographic features or field samples using the HydroLink Tool. This web-based GIS application allows for upload of a shapefile for easy linkage of spatial data records to the National Hydrography Dataset (NHD) Plus Medium Resolution and NHD High Resolution hydrology layers. The outputted value-added dataset can be associated with NHD parameters and other data linked to the NHD.

The application accesses, and modifies feature services stored in your USGS ArcGIS Online account. Use the "Login" button below to sign into the HydroLink Tool using your ArcGIS Online credentials or "Request a ArcGIS Online Account" if one is needed.

Login | Request a USGS ArcGIS Online Account | Service Desk

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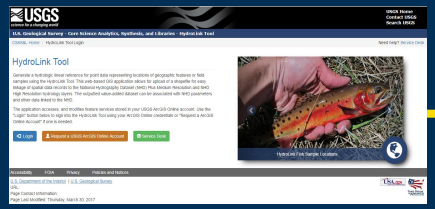
Geoprocessing Tool to Aid Researchers Verifying Sample Locations while Linking Data to NHD and NHDPlus

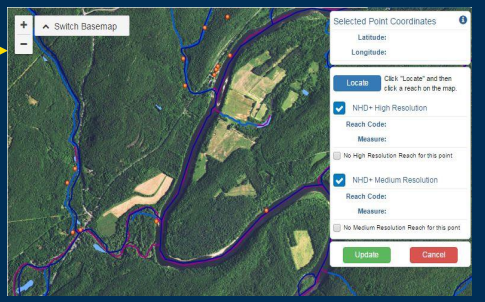
Field Sampling

spatial data upload

HydroLink Tool



Validate Spatial Data from Field and Link to NHD



Give me a map and I will show you right where I sampled

Researcher

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Geoprocessing Tool to Aid Researchers Linking Data to NHD and NHDPlus

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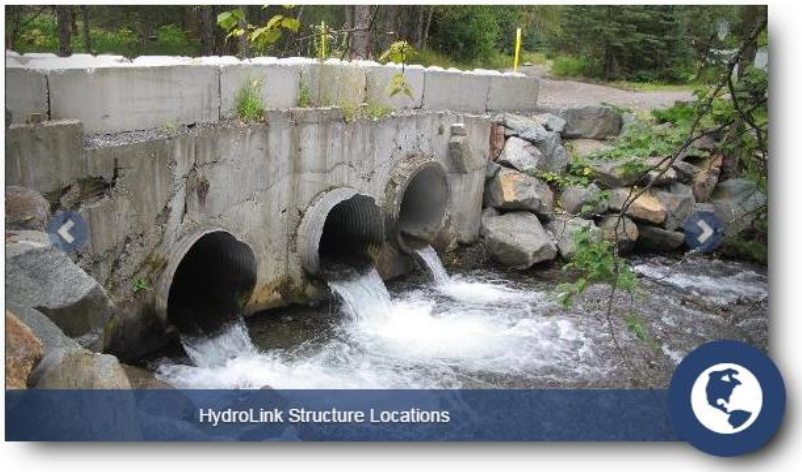

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If Time DEMO!!!

HydroLink Tool Planned Development

- "Ease of Use" Enhancements – e.g. Upload CSV vs. current need of shapefile
- Add Hydrographic Event Manager (HEM) Functionality (e.g. Link Line or Polygons)

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Batch Upload

- **Draft Python Code:**

https://github.com/dwief-usgs/batch-hydrolink

- **Accepts CSV or Shapefile**

- **Uses similar methods as HydroLink Tool but instead of user validation this code assigns levels of confidence based on attributes**

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Summarizing Landscape Info to NHDPlus

1. Summarize Local Catchment
2. Summarize Upstream Local Catchment Information

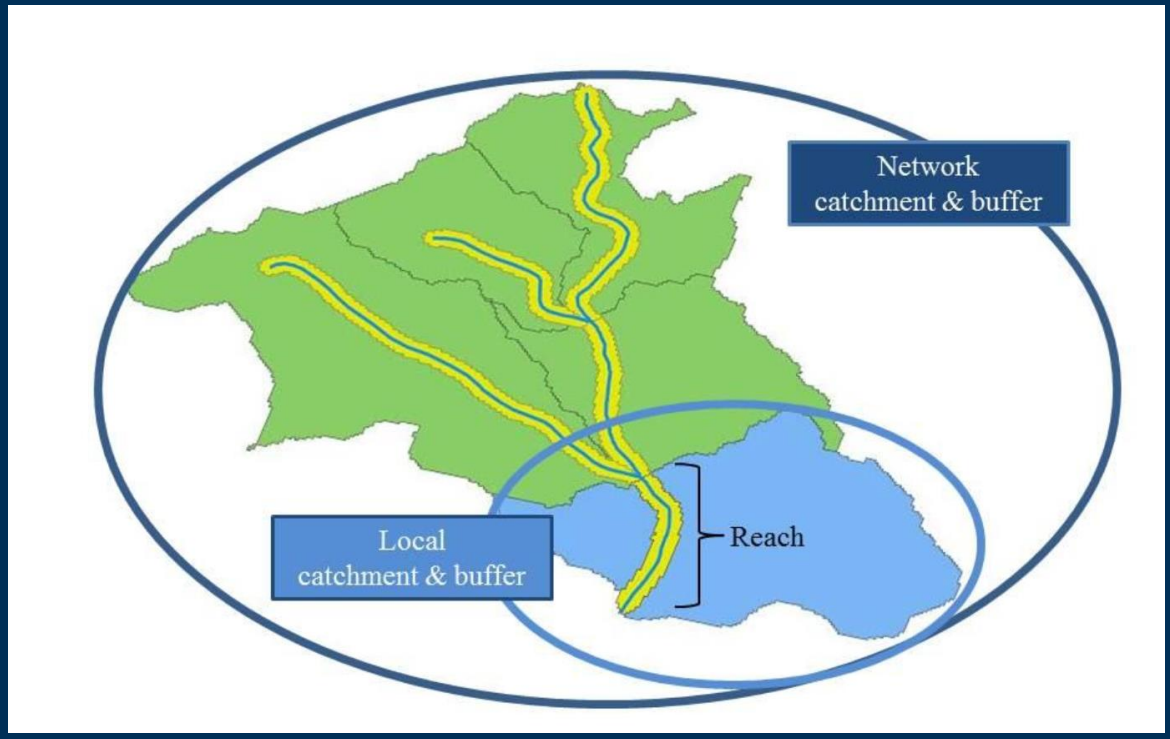


Figure Credit: http://assessment.fishhabitat.org/

Summarizing Landscape Info to NHDPlus

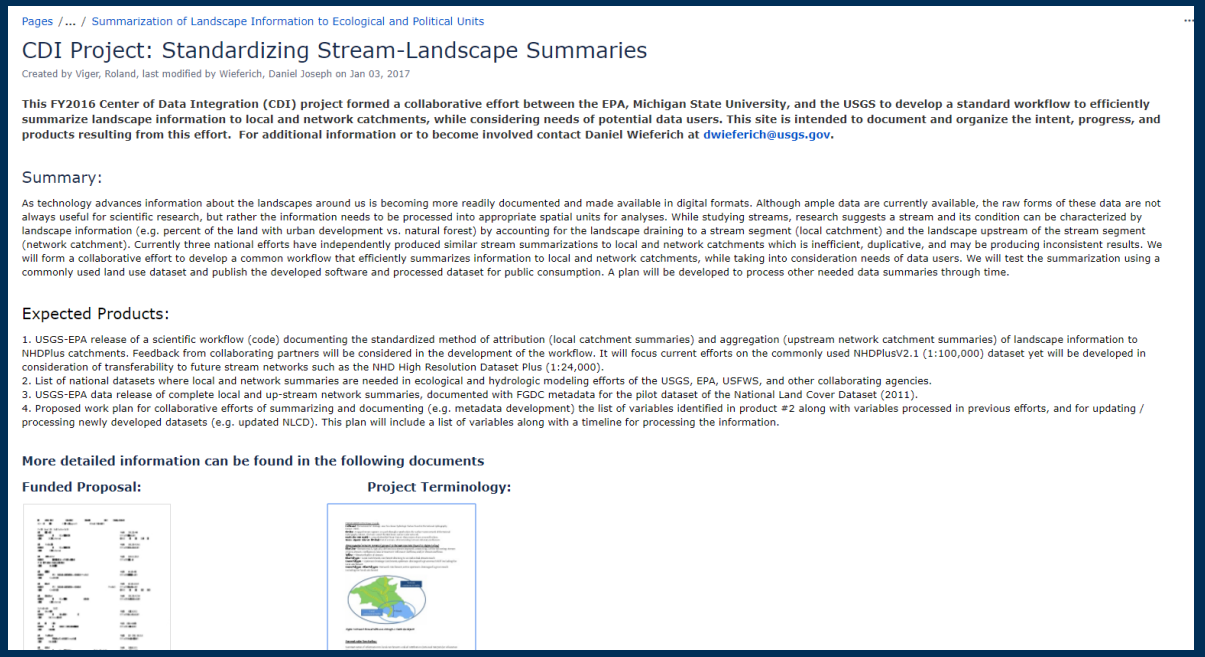
Tsang *et al. SpringerPlus* 2014, **3**:589
http://www.springerplus.com/content/3/1/589

SpringerPlus
a SpringerOpen Journal

METHODOLOGY Open Access

An approach for aggregating upstream catchment information to support research and management of fluvial systems across large landscapes

Yin-Phan Tsang[1*], Daniel Wieferich[1], Kuolin Fung[2], Dana M Infante[1] and Arthur R Cooper[1,3]



Pages / ... / Summarization of Landscape Information to Ecological and Political Units

CDI Project: Standardizing Stream-Landscape Summaries

Created by Viger, Roland, last modified by Wieferich, Daniel Joseph on Jan 03, 2017

This FY2016 Center of Data Integration (CDI) project formed a collaborative effort between the EPA, Michigan State University, and the USGS to develop a standard workflow to efficiently summarize landscape information to local and network catchments, while considering needs of potential data users. This site is intended to document and organize the intent, progress, and products resulting from this effort. For additional information or to become involved contact Daniel Wieferich at dwieferich@usgs.gov.

Summary:

As technology advances information about the landscapes around us is becoming more readily documented and made available in digital formats. Although ample data are currently available, the raw forms of these data are not always useful for scientific research, but rather the information needs to be processed into appropriate spatial units for analyses. While studying streams, research suggests a stream and its condition can be characterized by landscape information (e.g. percent of the land with urban development vs. natural forest) by accounting for the landscape draining to a stream segment (local catchment) and the landscape upstream of the stream segment (network catchment). Currently three national efforts have independently produced similar stream summarizations to local and network catchments which is inefficient, duplicative, and may be producing inconsistent results. We will form a collaborative effort to develop a common workflow that efficiently summarizes information to local and network catchments, while taking into consideration needs of data users. We will test the summarization using a commonly used land use dataset and publish the developed software and processed dataset for public consumption. A plan will be developed to process other needed data summaries through time.

Expected Products:

1. USGS-EPA release of a scientific workflow (code) documenting the standardized method of attribution (local catchment summaries) and aggregation (upstream network catchment summaries) of landscape information to NHDPlus catchments. Feedback from collaborating partners will be considered in the development of the workflow. It will focus current efforts on the commonly used NHDPlusV2.1 (1:100,000) dataset yet will be developed in consideration of transferability to future stream networks such as the NHD High Resolution Dataset Plus (1:24,000).
2. List of national datasets where local and network summaries are needed in ecological and hydrologic modeling efforts of the USGS, EPA, USFWS, and other collaborating agencies.
3. USGS-EPA data release of complete local and up-stream network summaries, documented with FGDC metadata for the pilot dataset of the National Land Cover Dataset (2011).
4. Proposed work plan for collaborative efforts of summarizing and documenting (e.g. metadata development) the list of variables identified in product #2 along with variables processed in previous efforts, and for updating / processing newly developed datasets (e.g. updated NLCD). This plan will include a list of variables along with a timeline for processing the information.

More detailed information can be found in the following documents

Funded Proposal: **Project Terminology:**

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https://my.usgs.gov/confluence/display/cdi/CDI+Project%3A+Standardizing+Stream-Landscape+Summaries