

AWRA 2022

Geospatial Water Technology Conference

March 21-23
Austin, TX
USA

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AMERICAN
WATER RESOURCES
ASSOCIATION



2022 Geospatial Water Technology Conference

Using the National Hydrography Dataset Plus High-Resolution (NHDPlus HR) Pre-Conference Workshop

PRESENTERS:

Karen Adkins: National Hydrography Dataset Plus High Resolution

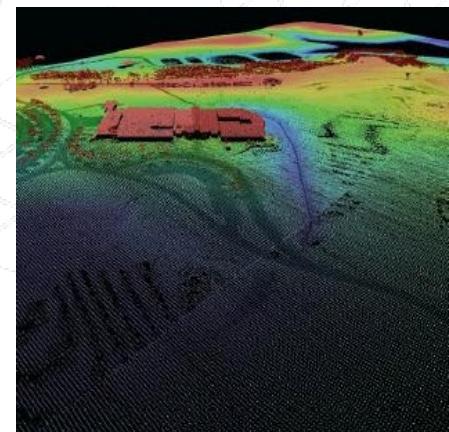
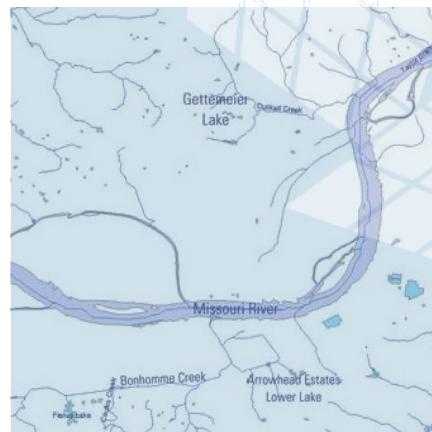
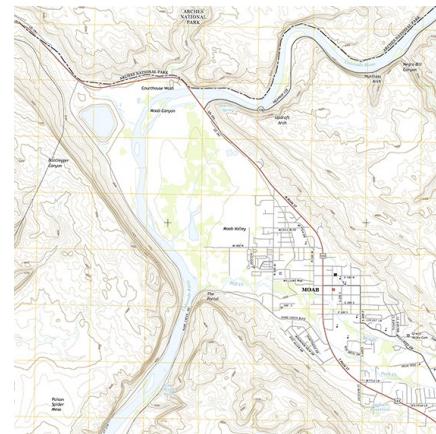
Annalisa Stasey: NHDPlus High Resolution R Value-Added Attributes

Karen Adkins: NHDPlus High Resolution VAA Navigator

Will Sjulstad: Using NHDPlus High Resolution Demonstration



NHDPlus High Resolution



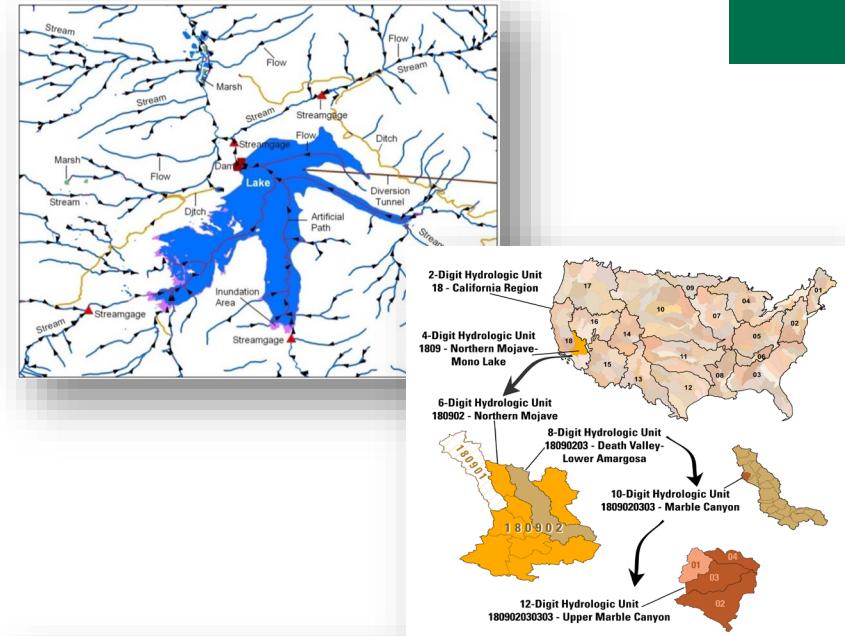
Karen Adkins
National Geospatial Technical Operations Center
May 8, 2022

USGS National Hydrography Datasets

Hydrologic networks, units, catchments, and more...

National Hydrography Dataset (NHD)

- The **drainage network** with features such as rivers, streams, canals, lakes, ponds, and stream gages

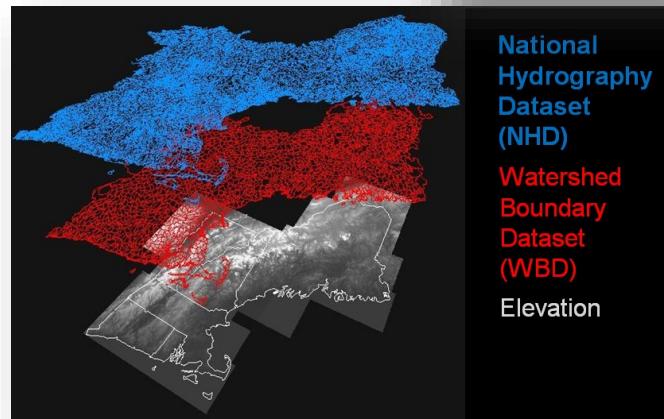


Watershed Boundary Dataset (WBD)

- Hydrologic units** at 8 scales of a nested hierarchy; defines all or part of the areal **extent of surface water drainage** to a point

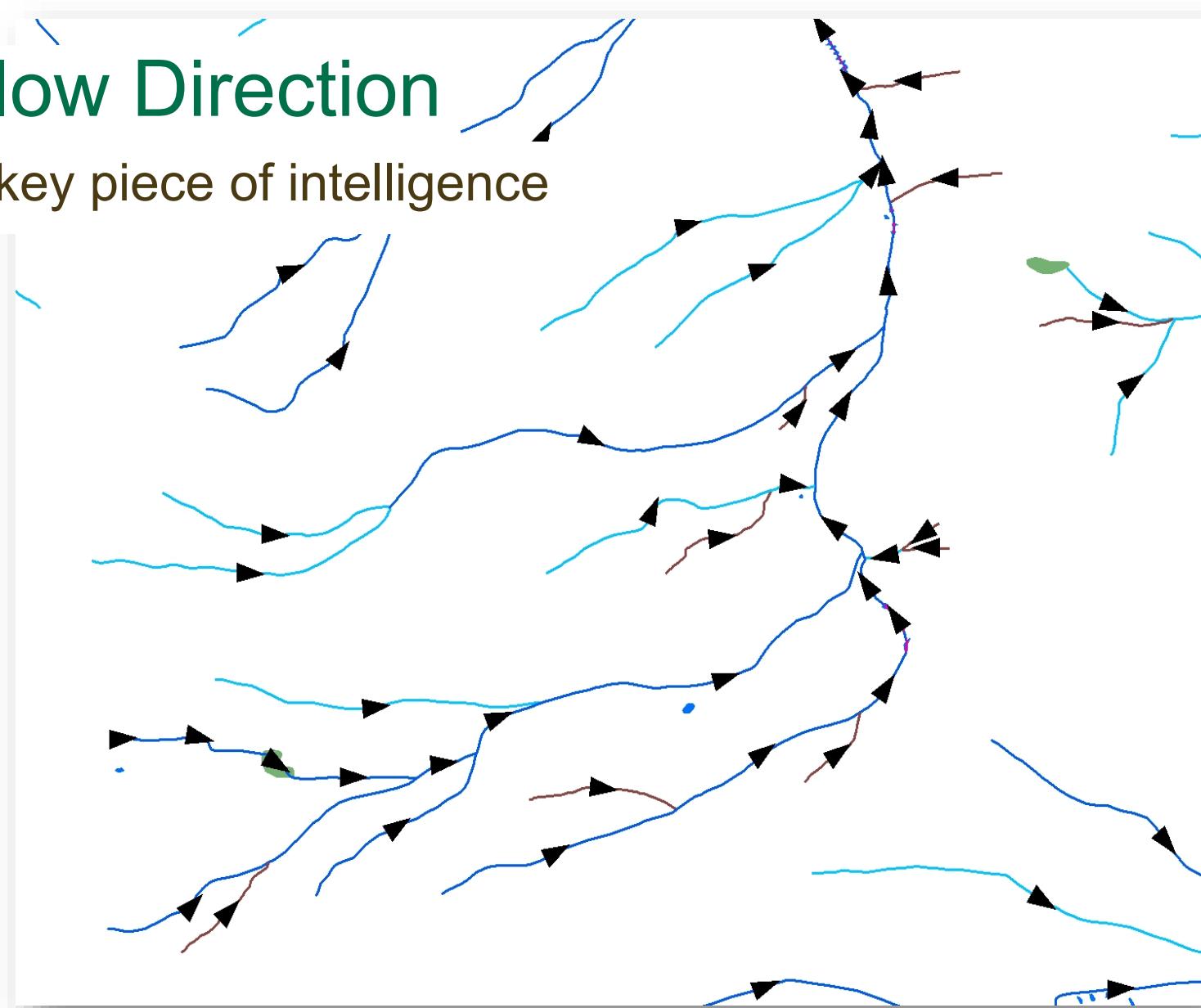
NHDPlus High Resolution

- Incorporates features of the NHD, WBD and 3DEP elevation data to create a **networked hydrography framework** that **incorporates the entire landscape**



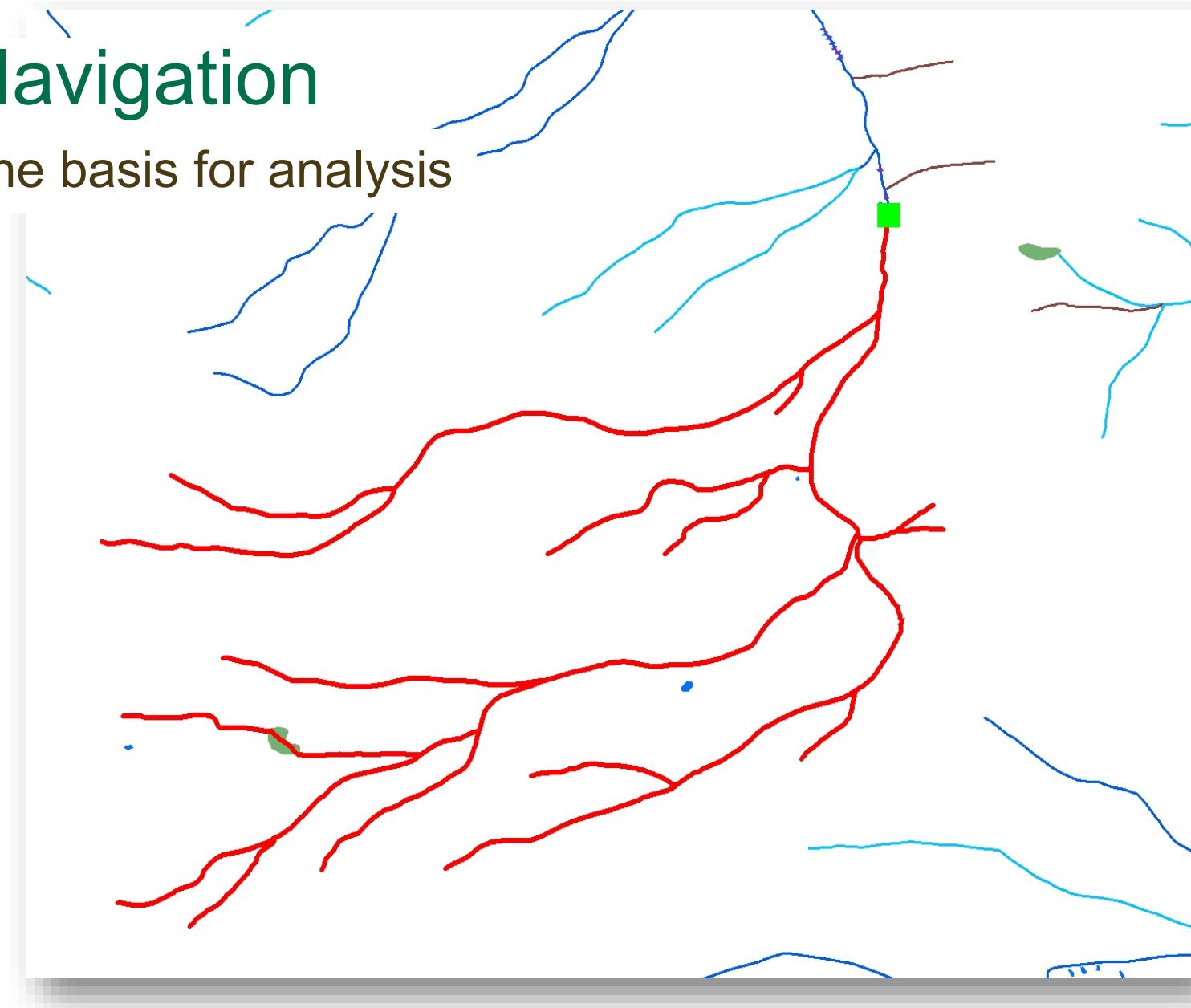
Flow Direction

A key piece of intelligence



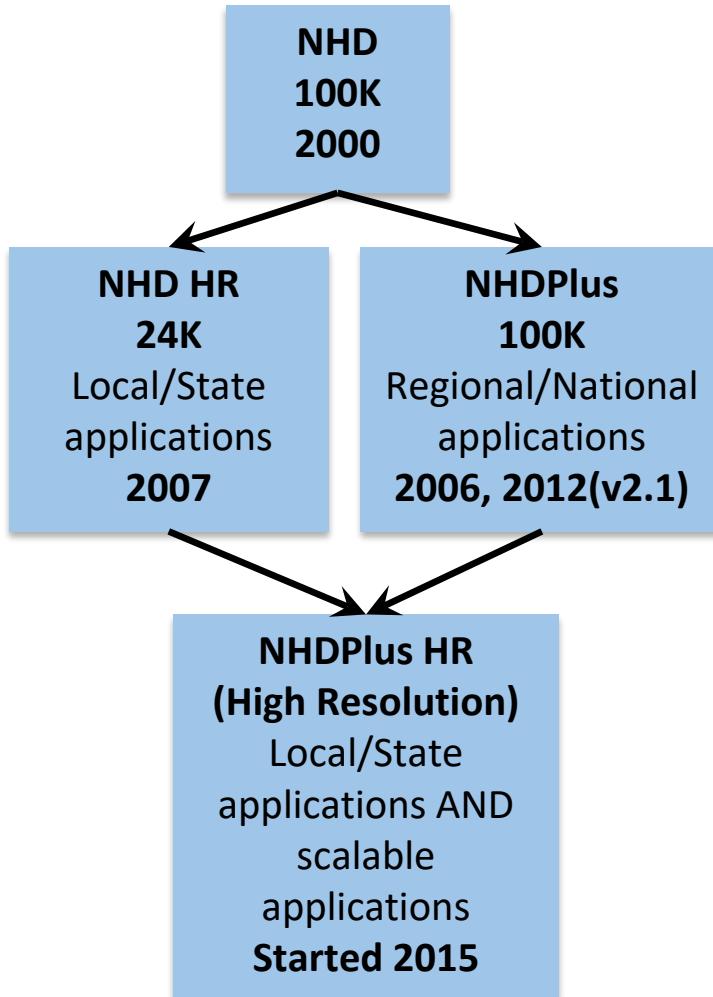
Navigation

The basis for analysis



+ Evolution of NHDPlus HR

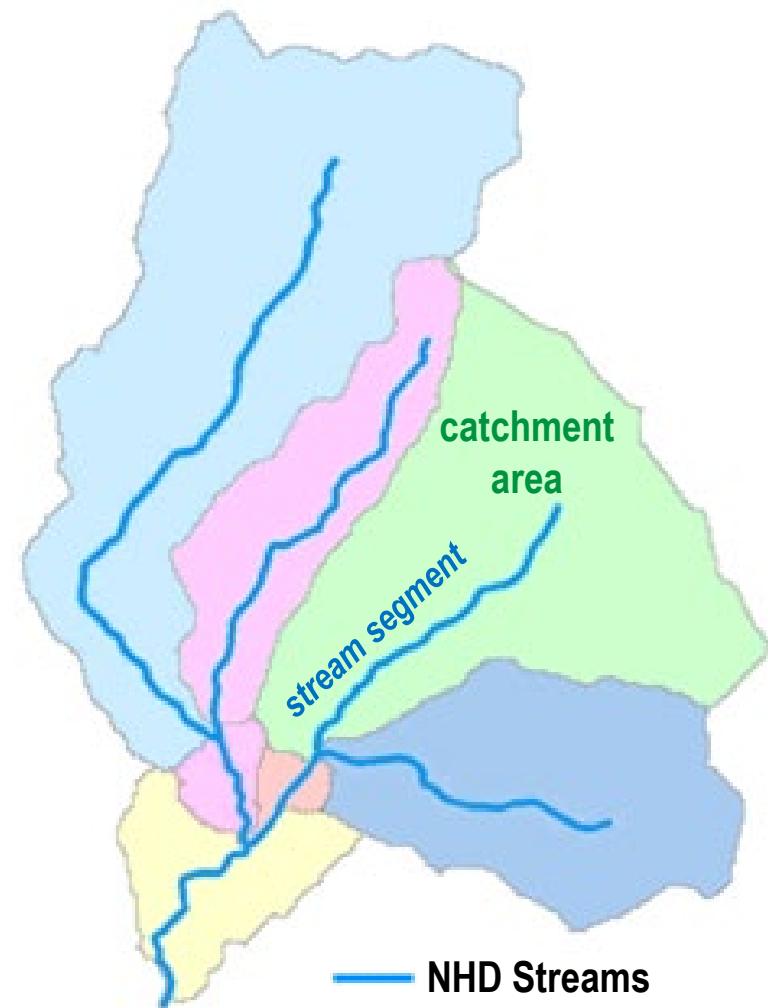
Taking NHDPlus v2 (Med Res) to a new level



- The best of NHDPlus and NHD HR (1:24,000 or better) data
- Addresses the need for a single hydrographic frame of reference
- Link data to one network and generalize to many different scales

NHDPlus includes...

- A nationally seamless network of stream reaches
- Value-added attributes for stream network navigation and analysis
- Flow surfaces in raster format
- Elevation-based catchment areas for each stream segment that
 - Create a seamless, scalable hydrologic framework
 - Enable modeling of water flow across the landscape, linking terrestrial characteristics to the stream network



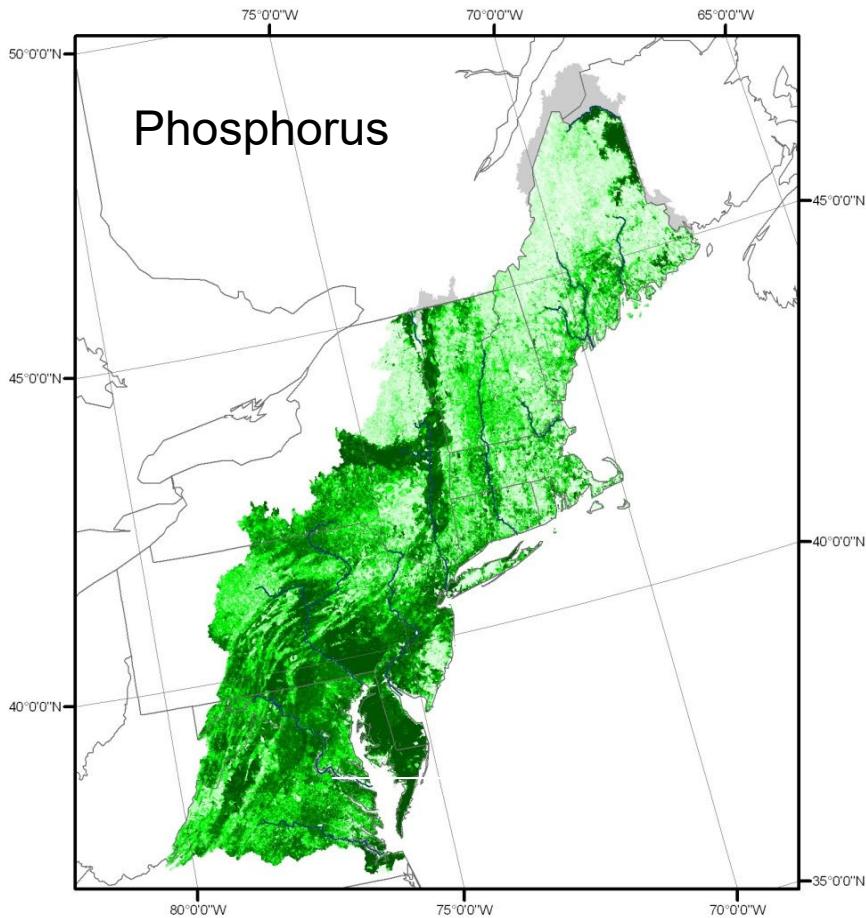
NHDPlus Medium Resolution Applications Sampler

A few examples to inspire ideas...

For a listing of ~150 more applications, see

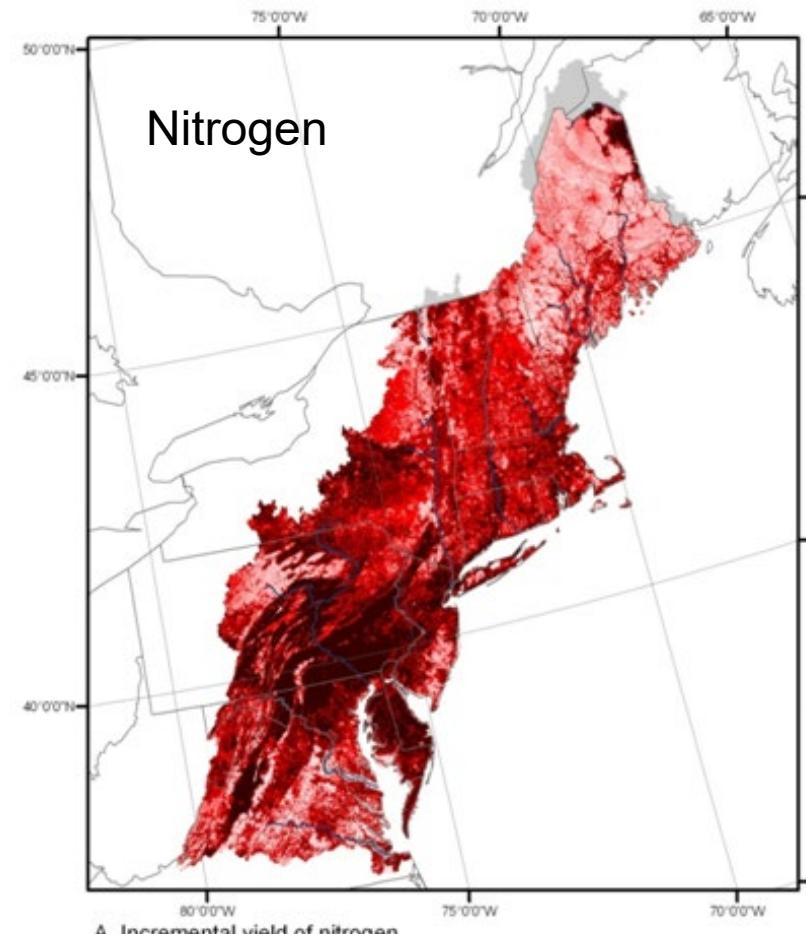
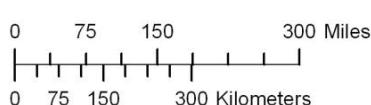
<https://www.epa.gov/waterdata/nhdplus-applications>

+ Phosphorus and Nitrogen yields predicted by the Northeastern and Mid-Atlantic regions SPARROW model.



Explanation

0 to 0.10	0.25 to 0.32	Greater than 0.93
0.10 to 0.16	0.32 to 0.42	Insufficient data (Canada)
0.16 to 0.21	0.42 to 0.58	
0.21 to 0.25	0.58 to 0.93	

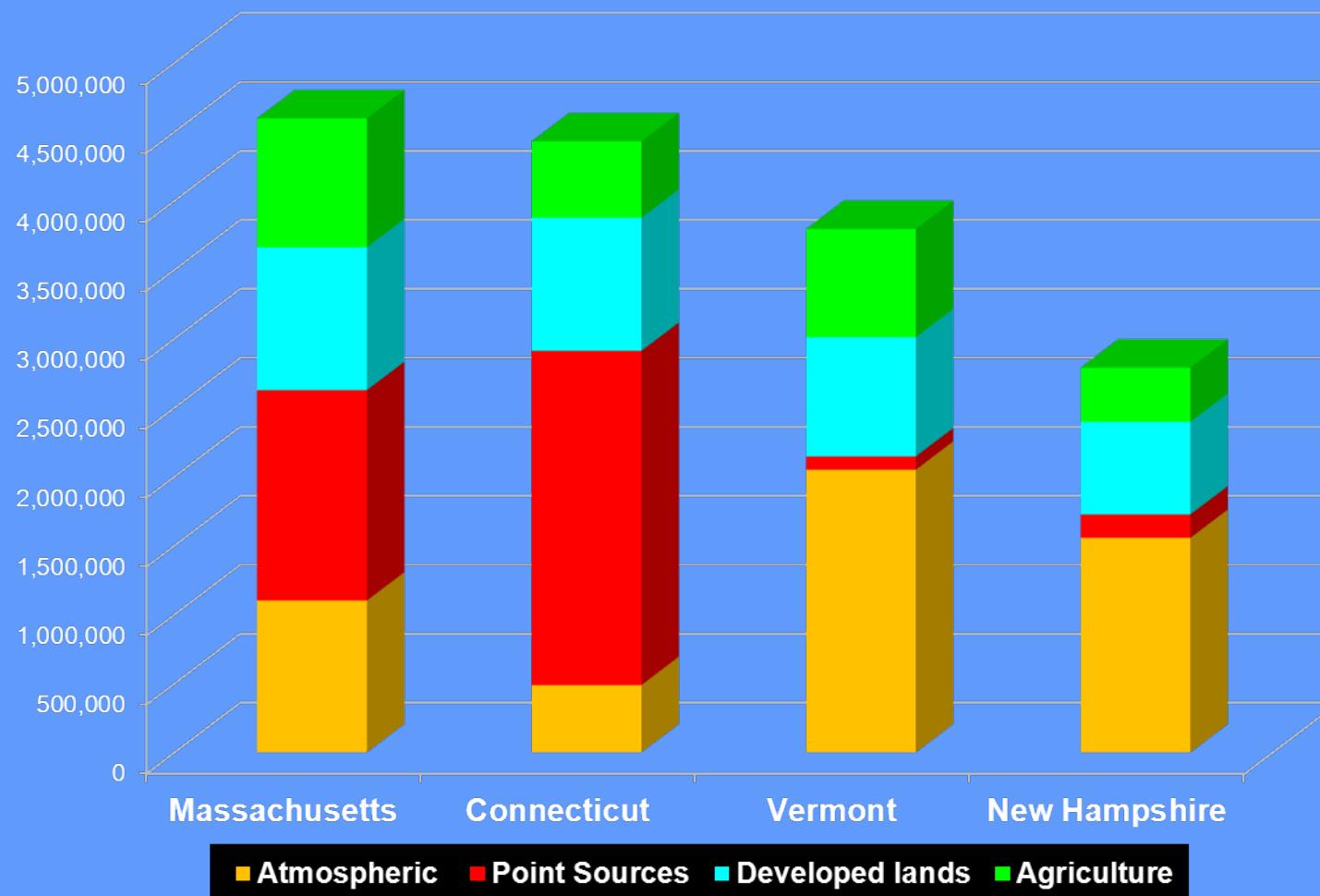


A. Incremental yield of nitrogen

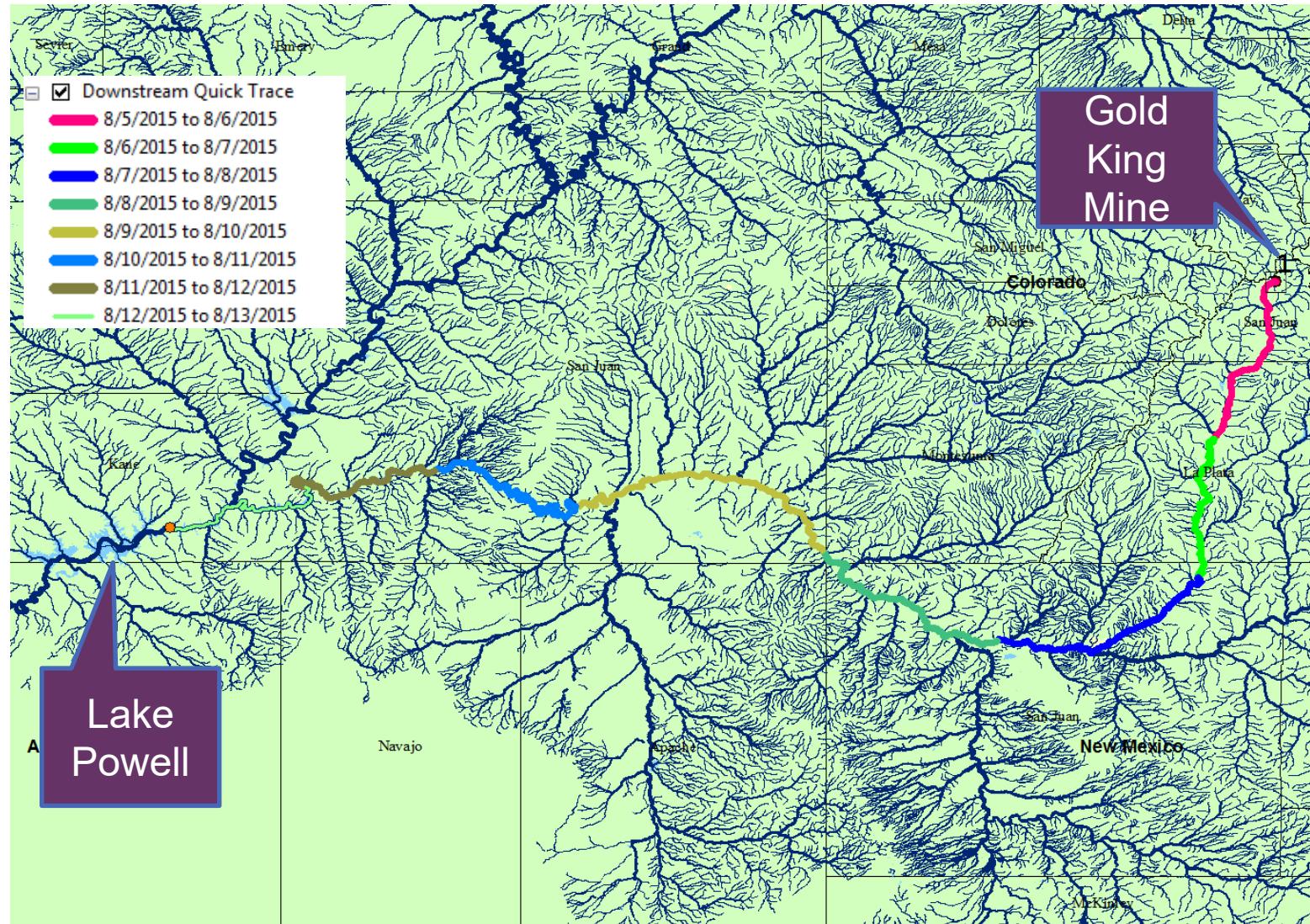
Explanation
Less than 1.5
1.5 to 2
2 to 2.5
2.5 to 3.2
3.2 to 4.2
4.2 to 5.8
5.8 to 8.2
8.2 to 12.7
Greater than 12.7
Insufficient data (Canada)

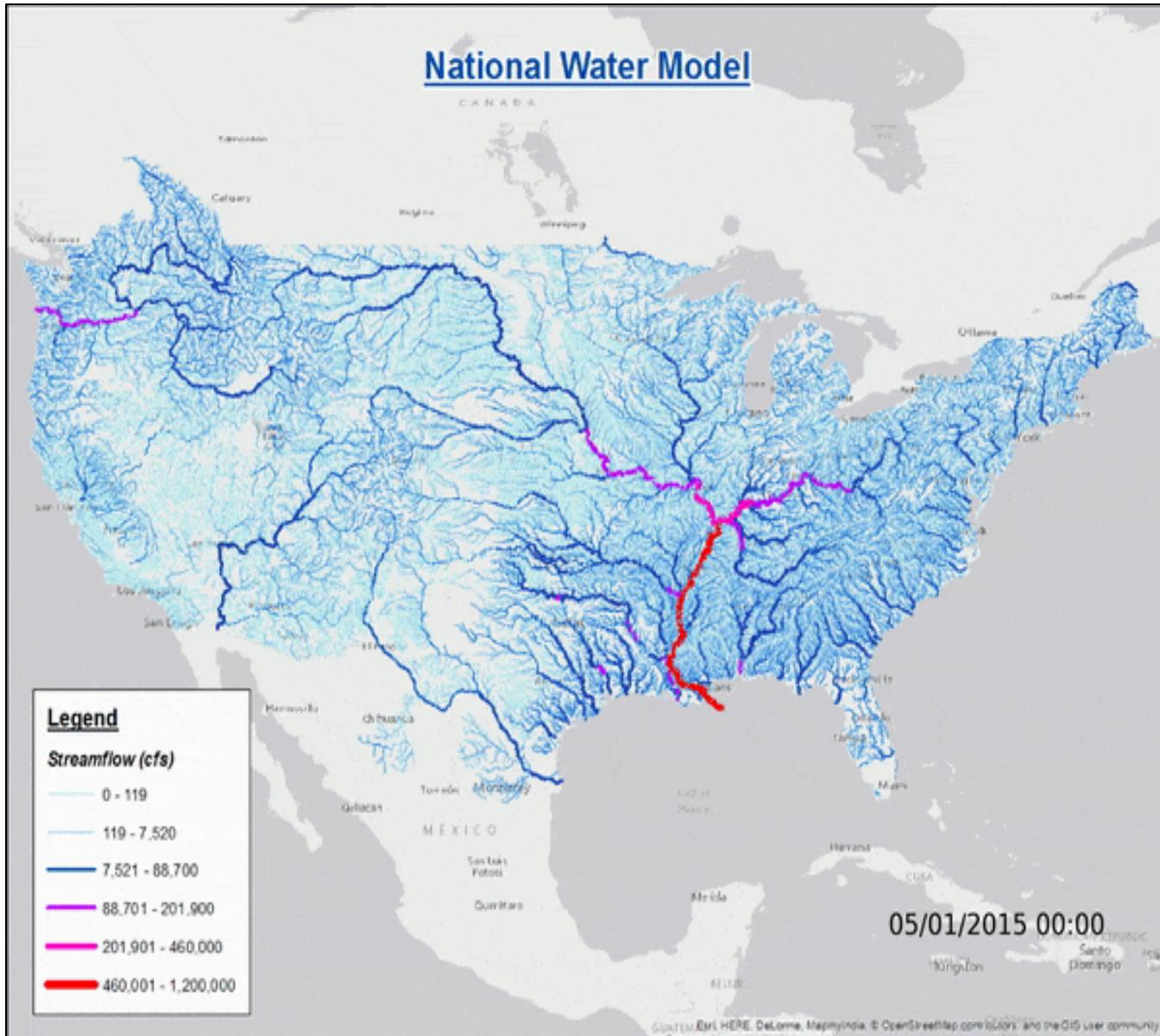
Kg / ha / year

Predicted Nitrogen Load (kg/year) Delivered to Long Island Sound from States within the Connecticut River Watershed



ICWater QuickTrace – 8 day travel time





National Water Model simulation: Fernando Salas, NOAA-NWS

Catalog, Search, and Discover

The Hydro Network Linked Data Index (NLDI)

- Allows network search of addressed data
- Upstream and downstream
- With or without tributaries or divergences
- Built into the Water Quality Portal

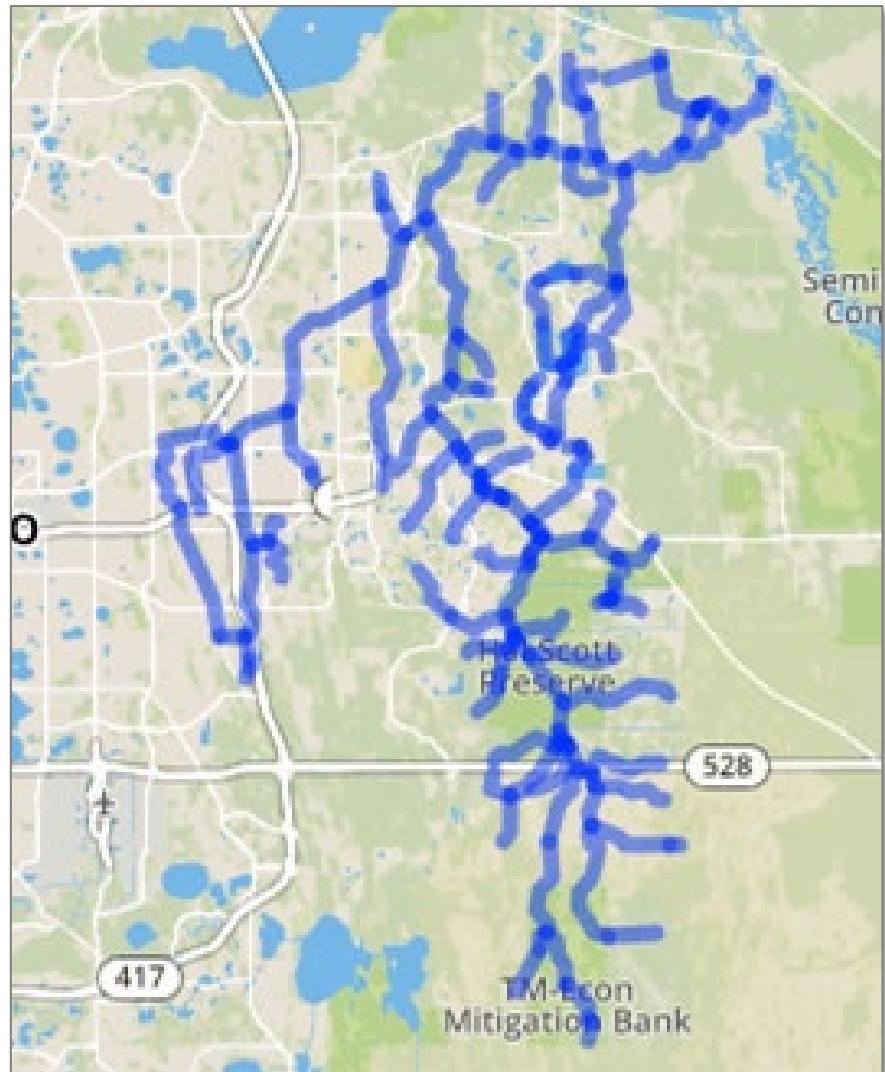
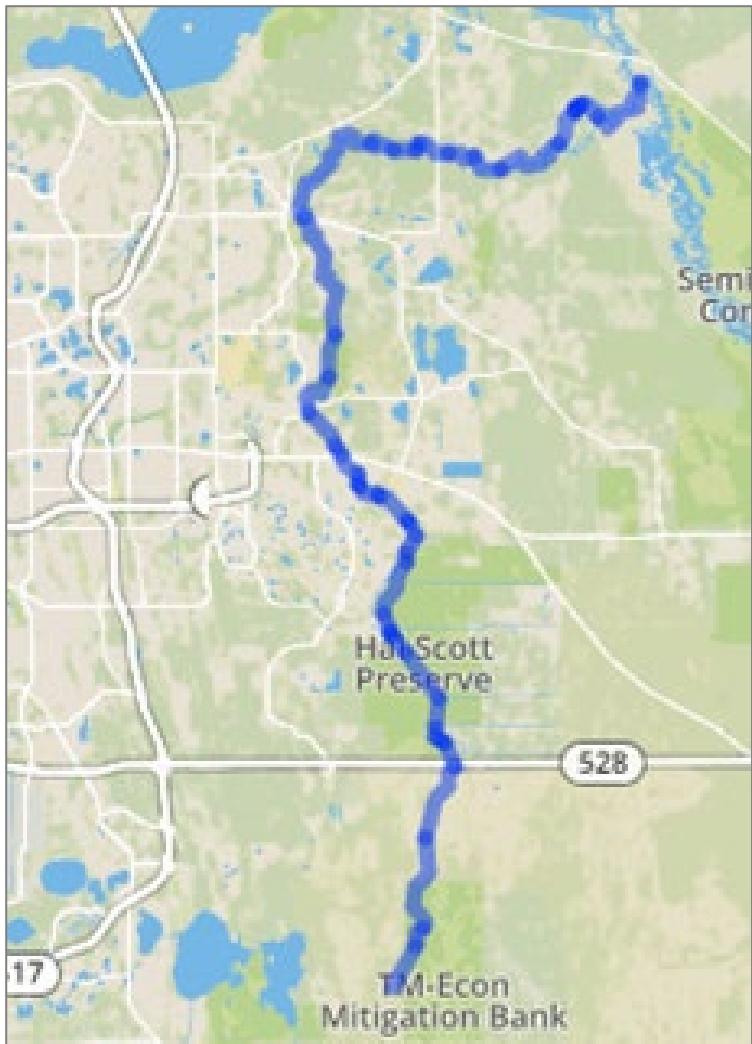
<https://www.waterqualitydata.us/>



<https://labs.waterdata.usgs.gov/api/nldi/linked-data/nwissite/USGS-05429700/>

... /navigate/UM?f=json

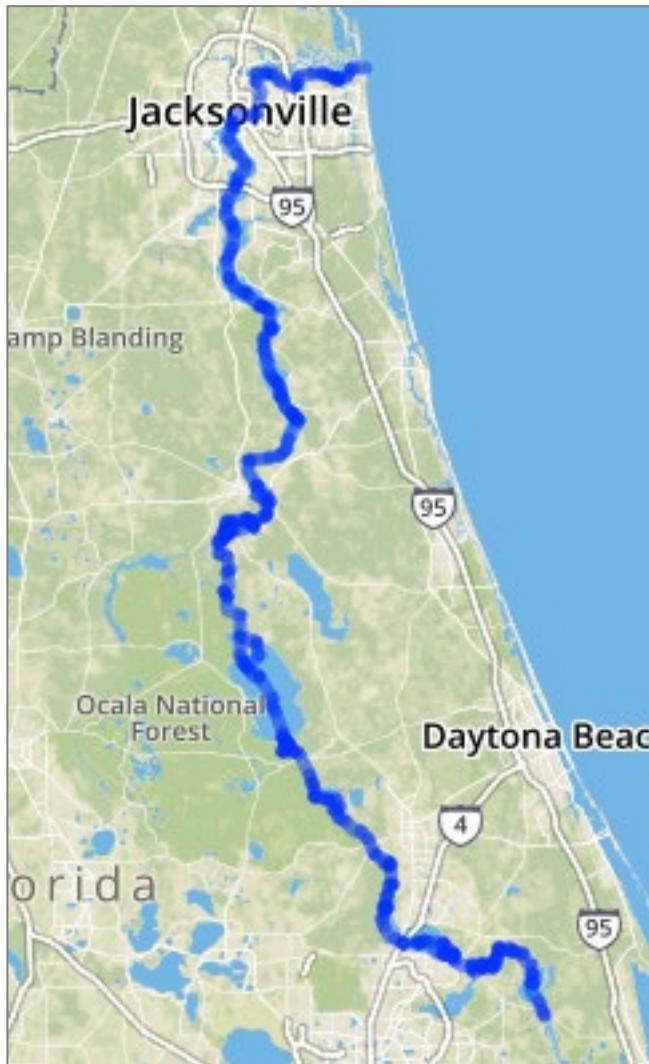
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<https://labs.waterdata.usgs.gov/api/nldi/linked-data/nwissite/USGS-05429700/>

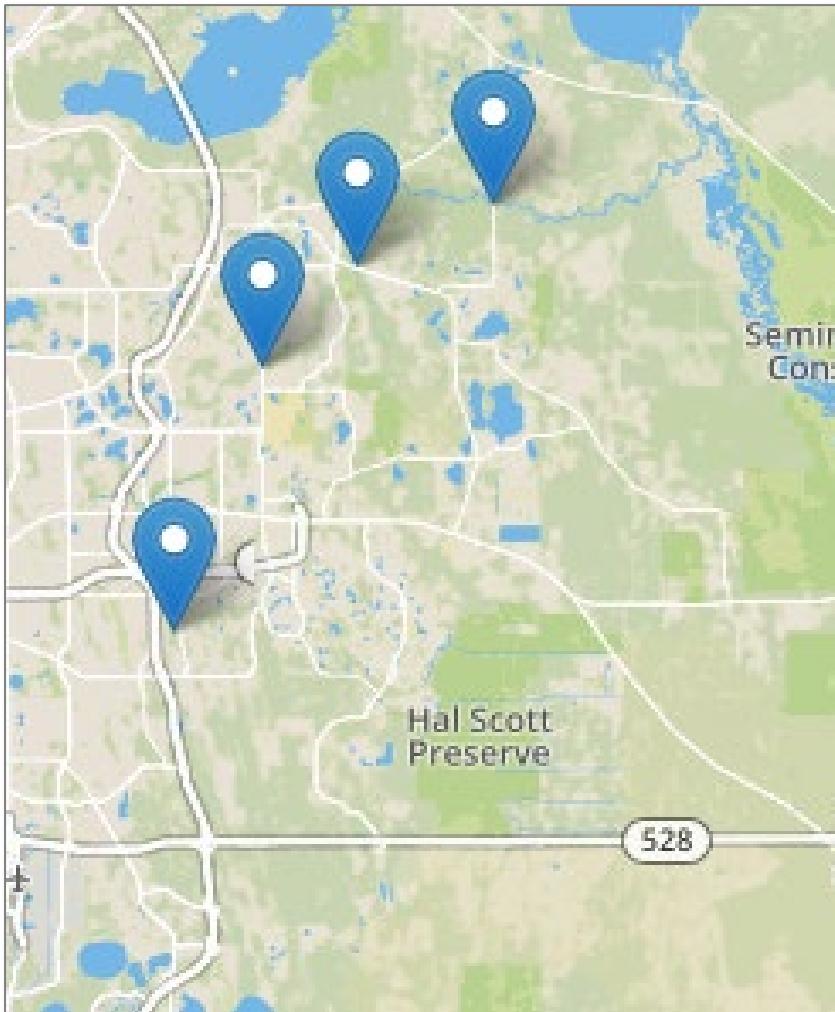
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Zoomed In

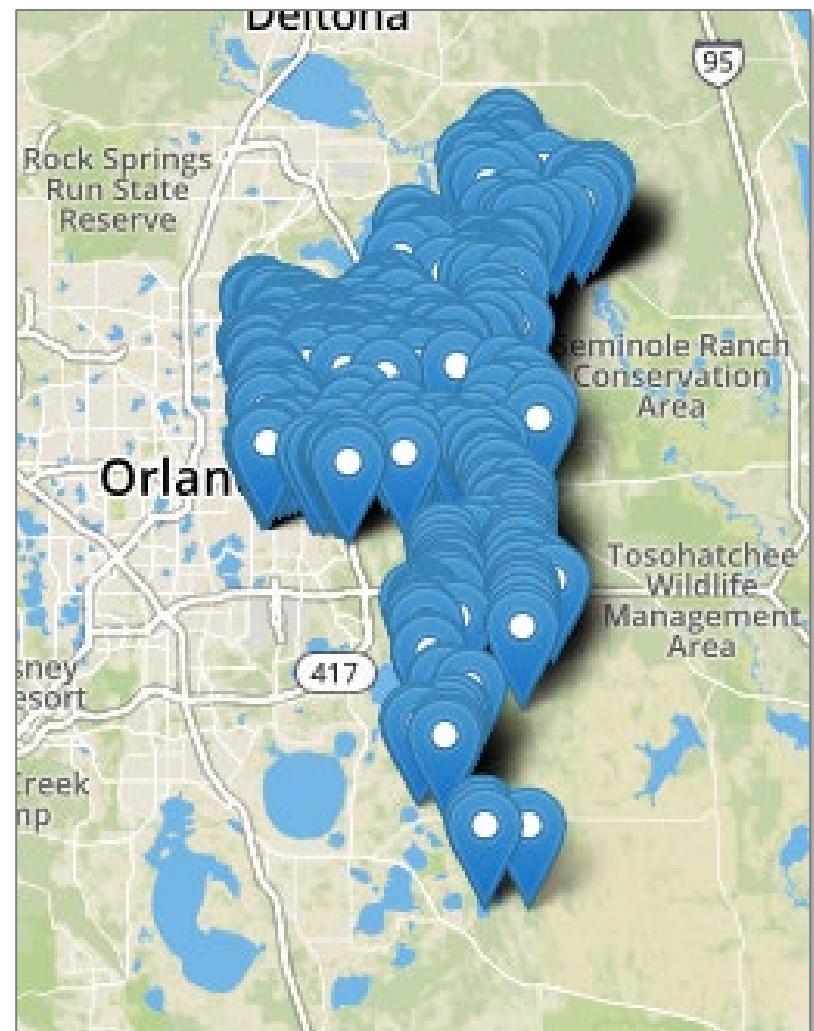


<https://labs.waterdata.usgs.gov/api/nldi/linked-data/huc12pp/030801011008>

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... /navigate/UT/wqp/nwissite?f=json



+ NLDI Additional Information

- <https://owi.usgs.gov/blog/nldi-intro/>
- <https://labs.waterdata.usgs.gov/about-nldi/index.html>

Contacts:

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Dave Blodgett dblodgett@usgs.gov

+ National Hydrography Dataset Plus High Resolution (NHDPlus HR)

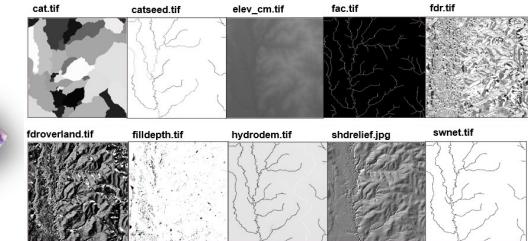
- High resolution (1:24,000 or better), NHD, WBD, and 3DEP elevation data (10-meter in CONUS, 5-meter in Alaska).
- Value-added attribution (VAA) for network navigation and analysis
- Catchments for every stream segment
- Rasters, including flow direction grids and flow accumulation rasters

Analysis NHDPlus VAAs

- StreamOrder
- StreamCalculator
- ArboluteSum
- ReturnDivergence
- PathLength

Navigation NHDPlus VAAs

- | | | |
|-------------------|-----------------|-------------------|
| ▪ FromNode/ToNode | ▪ Divergence | ▪ UpHydroSeq |
| ▪ Hydroseq | ▪ StartFlag | ▪ DnStreamLevel |
| ▪ LevelPathID | ▪ TerminalFlag | ▪ DnLevelPathID |
| ▪ TerminalPathID | ▪ VPUIIn/VPUOut | ▪ DnMinorHydroseq |
| ▪ StreamLevel | ▪ UpLevelPathID | ▪ DnDrainCount |



NHDPlus HR Status



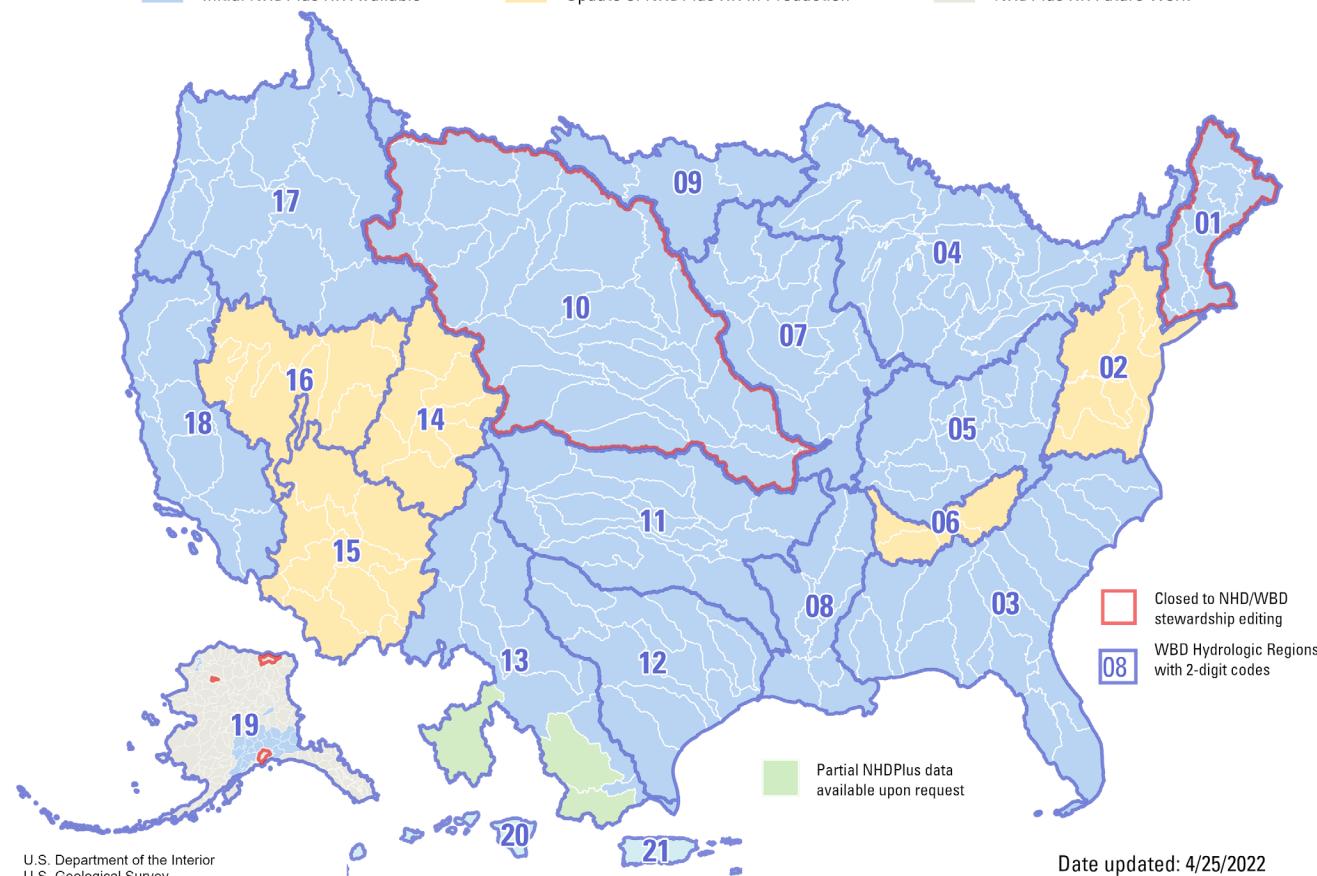
NHDPlus High Resolution Availability

Initial NHDPlus HR Available

Update of NHDPlus HR In Production

NHDPlus HR Future Work

- NHDPlus HR is available for the conterminous U.S., HI and the territories.
- Portions of AK are available, and AK will be completed in future years.



Products and Web Services

NHDPlus HR
available at the HU4
for CONUS and HU8
for Alaska

- File Geodatabase
- Rasters in GeoTIFF
- Coming soon:
GeoPackage,
National

NHDPlus HR
National available as
web service

- Quickly explore
VAAs

An official website of the United States government [Here's how you know](#)



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[NATIONAL HYDROGRAPHY](#)

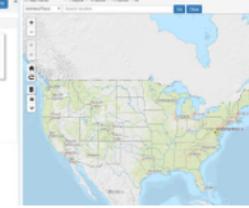
Access National Hydrography Products

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- [PUBLICATIONS](#)

The NHDPlus High Resolution (NHDPlus HR), National Hydrography Dataset (NHD), and Watershed Boundary Dataset (WBD) are available for download and as web-based map services.

The National Map Downloader



The National Map Download viewer provides an online mapping tool for downloading the NHDPlus HR, NHD and WBD as a shapefile or file geodatabase by Hydrologic Unit (HU), including 4-digit (HU4) or 8-digit (HU8), by state, or nationally.

[Go there](#)

The National Map Web-based Map Services List



National Map publishes 44 services including: Base Maps (Cached), Availability/Index Overlays (US Topo, 3DEP), Theme Overlays (NHD, Names, Elevation, Transportation), Small-scale, Natural Hazards, Web Feature Services (WFS), WCS Services and more.

[Learn More](#)

Markup Application

<https://edits.nationalmap.gov/markup-app>

Suggest edits to NHD, WBD

Access using Gmail, ArcGIS Online, or Microsoft Office account
in Google Chrome or Microsoft Edge browser

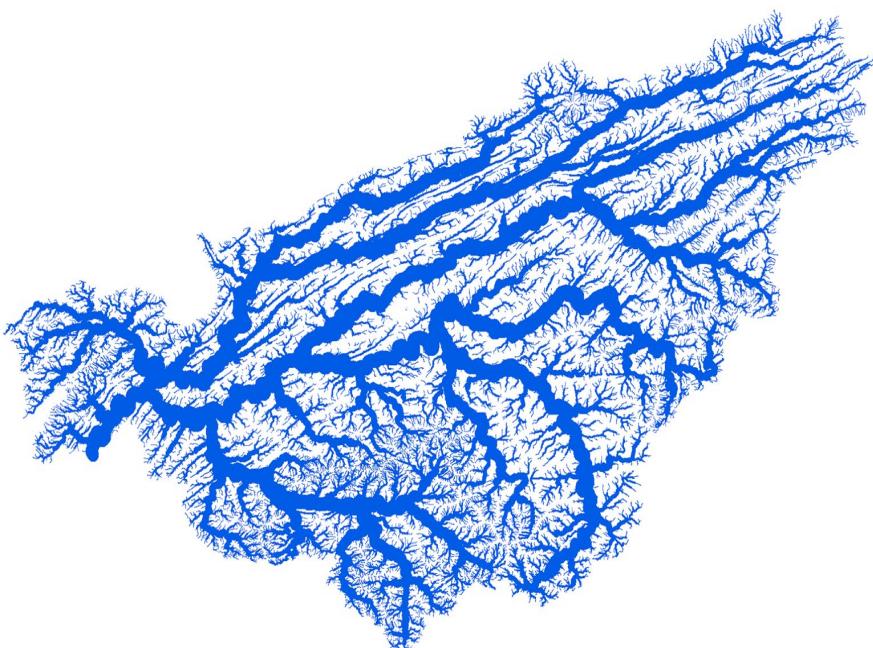
The screenshot shows the USGS Markup Application interface. On the left, a dark sidebar titled "Markup App" contains icons for user profile, search, edit, undo, redo, and help, along with a "Logout" button. The main area displays a map of North America with state boundaries and major cities labeled. A dashed rectangular selection box highlights a region in the western United States, specifically the Colorado Plateau area. A hand cursor is visible over the map. At the bottom of the map, coordinates "Lat: 34.7416 Lng: -93.4277" and a zoom level "Zoom: 4" are shown. The bottom right corner of the map area includes the text "Leaflet | Powered by Esri | USGS Topo Basemap Tile". The top of the page features the USGS logo and the tagline "science for a changing world".

Vector Data

- NHD features
- NHDPlus features
- WBD features
- Value Added Attribute (VAA) tables

□	■	NHDPlus_H_0903_GDB.gdb	■	NHDPlusDivFracMP
□	□	Hydrography	■	NHDPlusEROMMA
	□	HYDRO_NET	■	NHDPlusEROMQAMA
	□	HYDRO_NET_Junctions	■	NHDPlusEROMQARPT
	□	NHDArea	■	NHDPlusFlow
	□	NHDFlowline	■	NHDPlusFlowlineVAA
	□	NHDLine	■	NHDPlusIncrLat
	□	NHDPoint	■	NHDPlusIncrPrecipMA
	□	NHDWaterbody	■	NHDPlusIncrPrecipMM01
□	□	NHDPlus	■	NHDPlusIncrPrecipMM02
	□	NHDPlusBurnLineEvent	■	NHDPlusIncrPrecipMM03
	□	NHDPlusBurnWaterbody	■	NHDPlusIncrPrecipMM04
	□	NHDPlusCatchment	■	NHDPlusIncrPrecipMM05
	□	NHDPlusLandSea	■	NHDPlusIncrPrecipMM06
	□	NHDPlusSink	■	NHDPlusIncrPrecipMM07
	□	NHDPlusWall	■	NHDPlusIncrPrecipMM08
□	□	WBD	■	NHDPlusIncrPrecipMM09
	□	NonContributingDrainageArea	■	NHDPlusIncrPrecipMM10
	□	NonContributingDrainageLine	■	NHDPlusIncrPrecipMM11
	□	NWISDrainageArea	■	NHDPlusIncrPrecipMM12
	□	NWISDrainageLine	■	NHDPlusIncrROMA
	□	WBDHU10	■	NHDPlusIncrTempMA
	□	WBDHU12	■	NHDPlusIncrTempMM01
	□	WBDHU14	■	NHDPlusIncrTempMM02
	□	WBDHU16	■	NHDPlusIncrTempMM03
	□	WBDHU2	■	NHDPlusIncrTempMM04
	□	WBDHU4	■	NHDPlusIncrTempMM05
	□	WBDHU6	■	NHDPlusIncrTempMM06
	□	WBDHU8	■	NHDPlusIncrTempMM07
	□	WBDLine	■	NHDPlusIncrTempMM08
			■	NHDPlusIncrTempMM09
			■	NHDPlusIncrTempMM10
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			■	NHDPlusMegaDiv
			■	NHDPlusNHDPlusIDGridCode

Vector Data

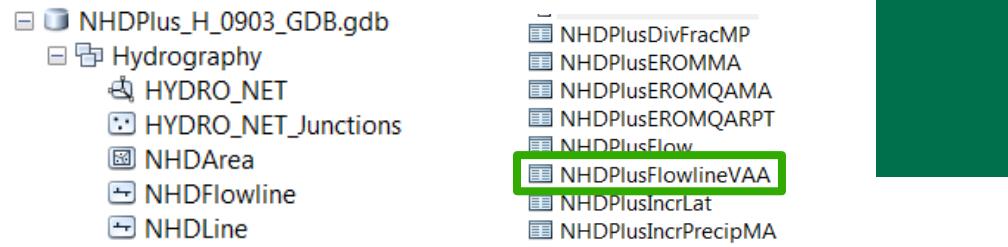


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	■	HYDRO_NET_Junctions
	■	NHDArea
	■	NHDFlowline
	■	NHDLIne
	■	NHDPoint
	■	NHDWaterbody
□	□	NHDPlus
	■	NHDPlusBurnLineEvent
	■	NHDPlusBurnWaterbody
	■	NHDPlusCatchment
	■	NHDPlusLandSea
	■	NHDPlusSink
	■	NHDPlusWall
□	□	WBD
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	■	NonContributingDrainageLine
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	■	WBDHU12
	■	WBDHU14
	■	WBDHU16
	■	WBDHU2
	■	WBDHU4
	■	WBDHU6
	■	WBDHU8
	■	WBDLine
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	■	NHDPlusEROMMA
	■	NHDPlusEROMQAMA
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	■	NHDPlusIncrPrecipMA
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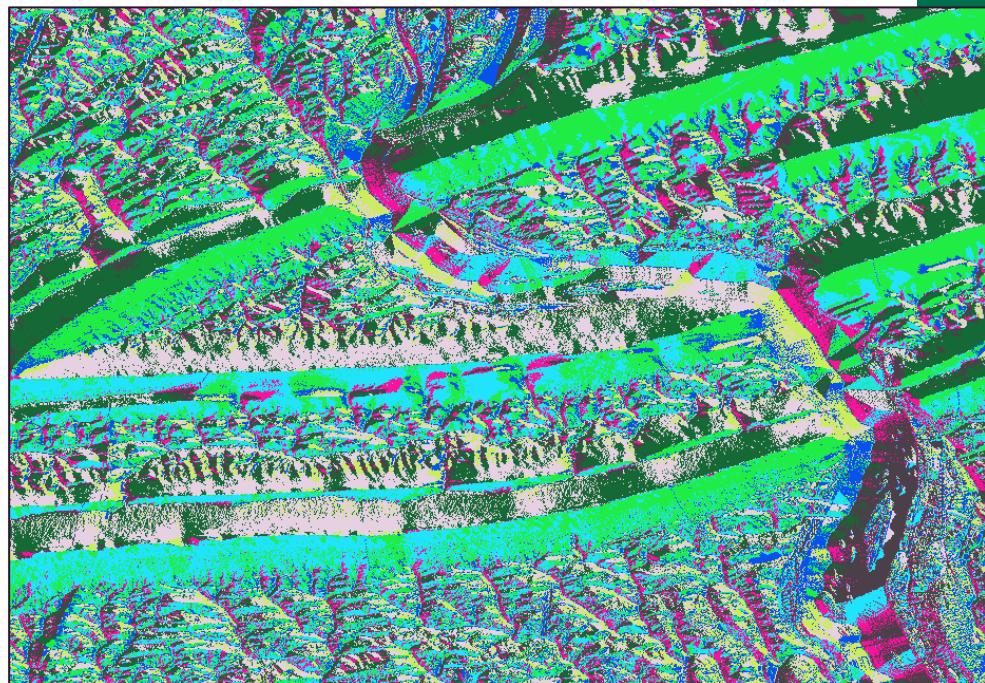
Vector Data

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65000300052711	8	1	1
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65000300106445	6	4	4
65000300096895	7	TotDASqKm	
65000300035863	8	0.6497	0.6497
65000300065594	10	0.88560002	0.88560002
65000300105411	6	47.51939998	23.90860021
65000300041488	8	215.67509921	215.67509921
65000300085887	7	17.77670014	17.77670014
65000300098802	7	0.70980006	0.70980006
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65000300104158	9	2003.84179784	2003.45979789
6500030009816	9	0.78219994	0.78219994
65000300016216	7	33.79639983	33.79639983
65000300090069	8	1.30610012	1.30610012
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65000300020007	7	4.53500008	4.53500008
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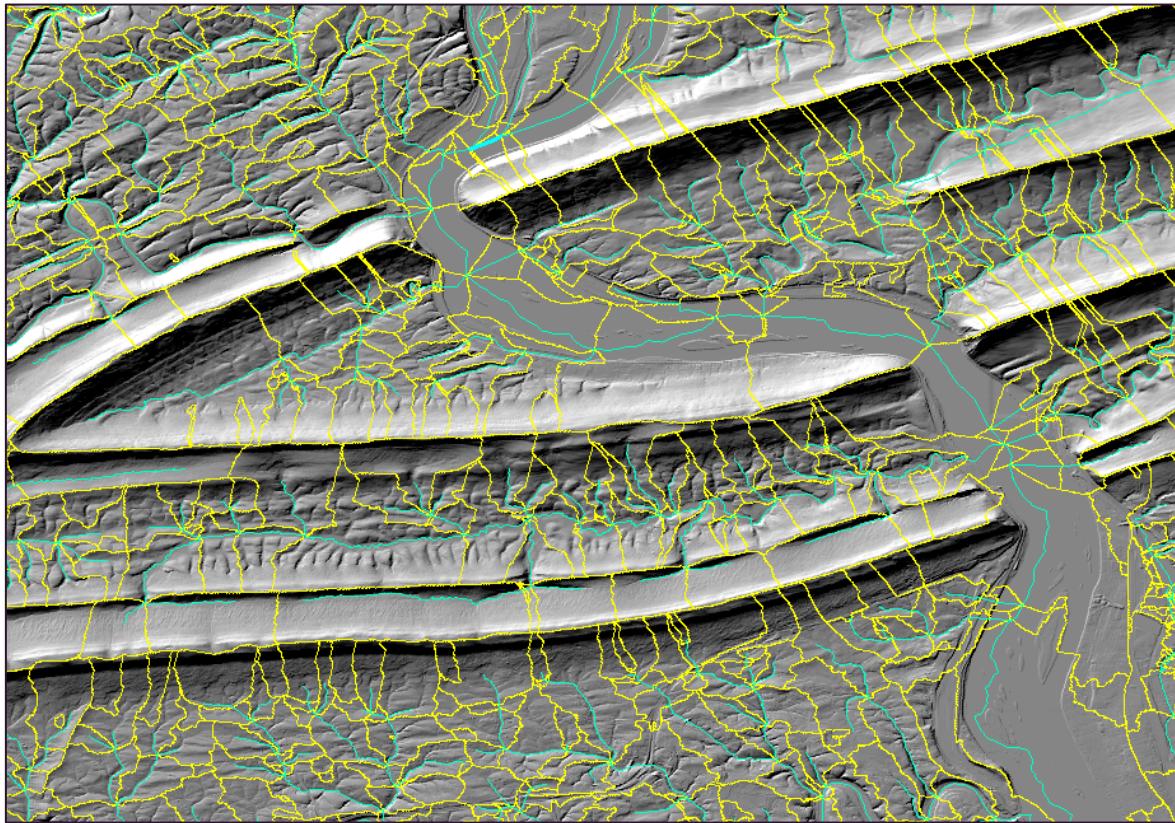


Raster Data

- 📁 HRNHDPlusRasters0601
 - ⊕ elev_source.gdb
 - ⊕ cat.tif
 - ⊕ catseed.tif
 - ⊕ elev_cm.tif
 - ⊕ fac.tif
 - ⊕ facmask.tif
 - ⊕ fdr.tif
 - ⊕ fdroverland.tif
 - ⊕ filldepth.tif
 - ⊕ hydrodem.tif
 - ⊕ shdrelief.jp2
 - ☒ swnet.tif.xml



Raster and Vector Data



Resources

- See VAA web page
<https://usgs.gov/NHDPlusHR/VAAAs>
- User Guide for NHDPlus HR
<https://doi.org/10.3133/ofr20191096>
- GitHub Repository: https://github.com/ACWI-SSWD/nhdplushr_tools
- NHDPlus HR web page:
<https://usgs.gov/NHDPlusHR>

Thank you for participating!

Contact us with questions:

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