

Improving Surface Water Datasets for California

Benefits for Water Resource Management

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Resilience Panel

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CENTER FOR GEOSPATIAL
SCIENCE & TECHNOLOGY
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What is NHD?

Overview

- National Hydrography Dataset
- Nation-Wide GIS Dataset
 - What is GIS Data?
- Provided and Hosted by USGS
- Hydrography/Surface Water
 - Rivers
 - Lakes
 - Swamps
 - Canals
 - Springs
 - Etc.
- Available Publically
- Authoritative to Many Agencies

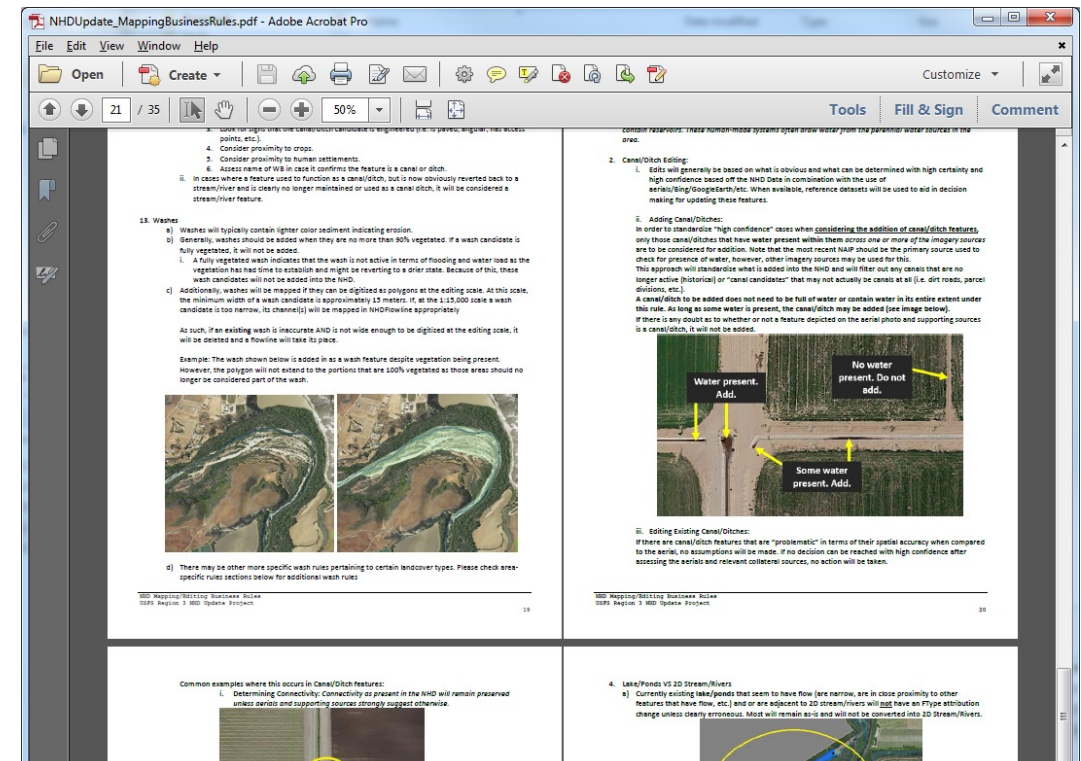


CGST's History With NHD

- 10+ Years Working with NHD
- 8+ Years as CA Substewards of NHD
- Multiple Collaborations/Projects
- Stewardship and Going Beyond Data Deliverables:

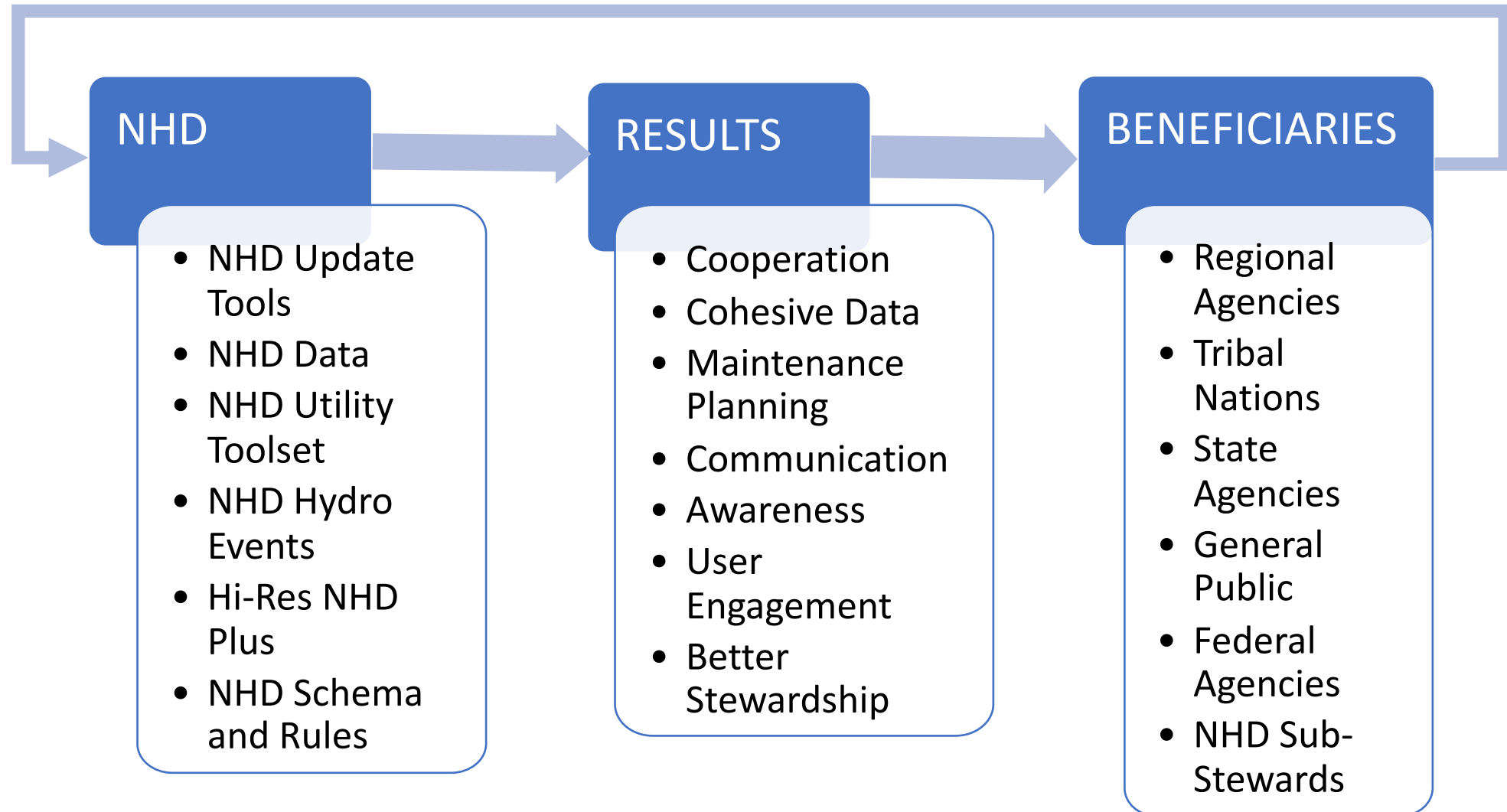


- Working with stakeholders
- Increased awareness of and user engagement with NHD
- Development of mapping standards for CA



CGST's History With NHD

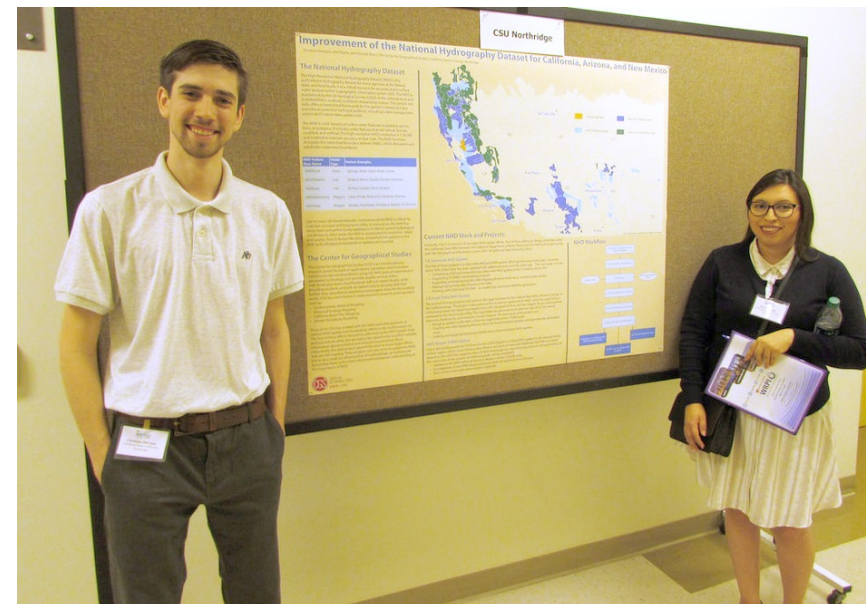
Data Stewardship, User Engagement, and Benefits for All



CA DWR and CSU Collaboration

Background

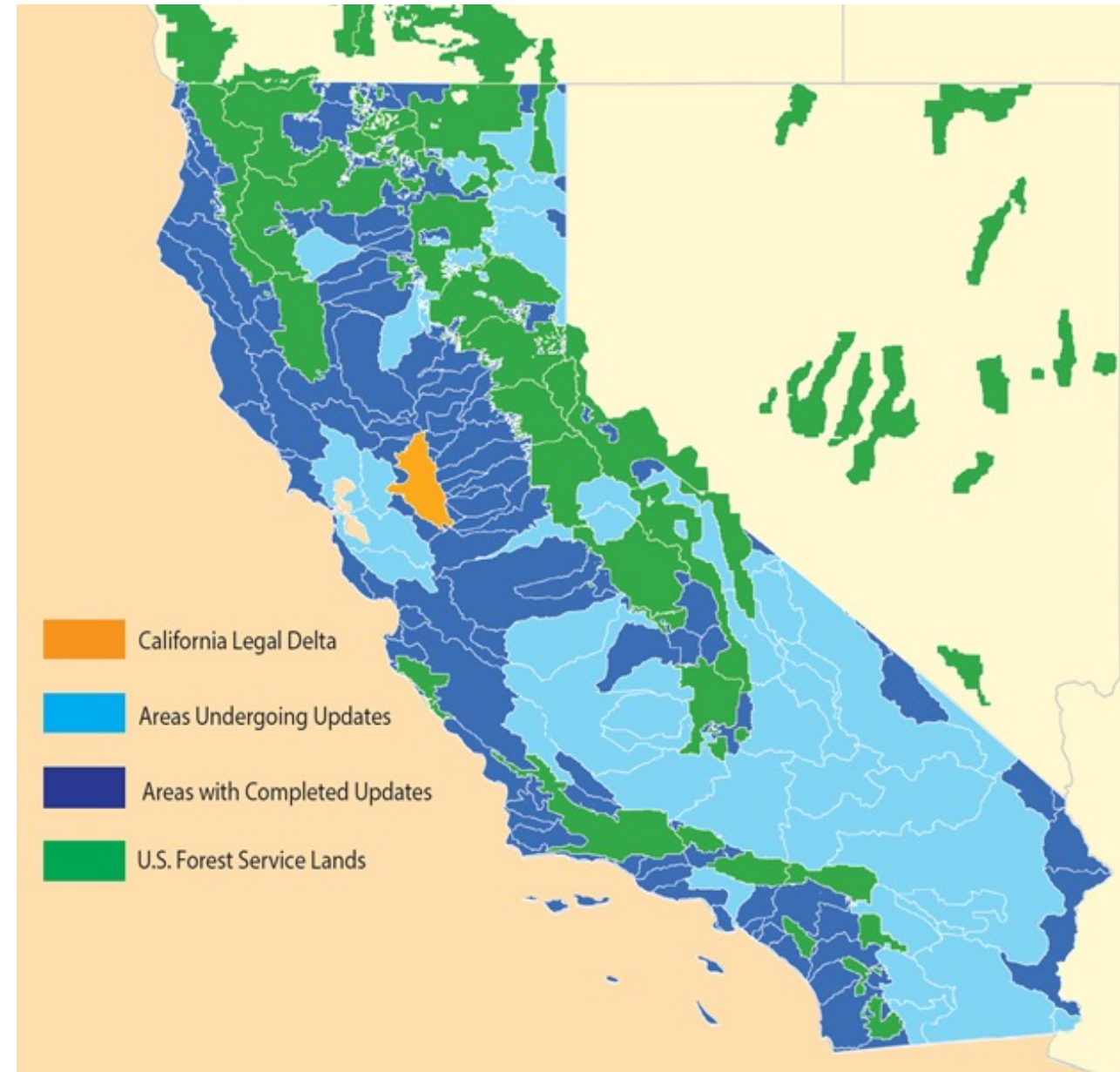
- CA Drought Funding Origin
- Official State Stewardship in 2016
- Leveraging established NHD expertise and workflow at CSUs
 - Northridge: CGST
 - Chico: GIC
- Opportunities for students and young professionals



CA DWR and CSU Collaboration

Current Work

- Slated for next 4 years
- Realizing a fully updated NHD for all of CA
 - Including US Forest Service (USFS) Lands
 - ~80% of CA area completed or nearly completed by CSUs
 - ~20% of CA area remains in USFS Lands
- Pilot testing new methodologies
 - Higher resolution updates
 - Deriving local res NHD from LiDAR
 - Other focused feature improvements and representation

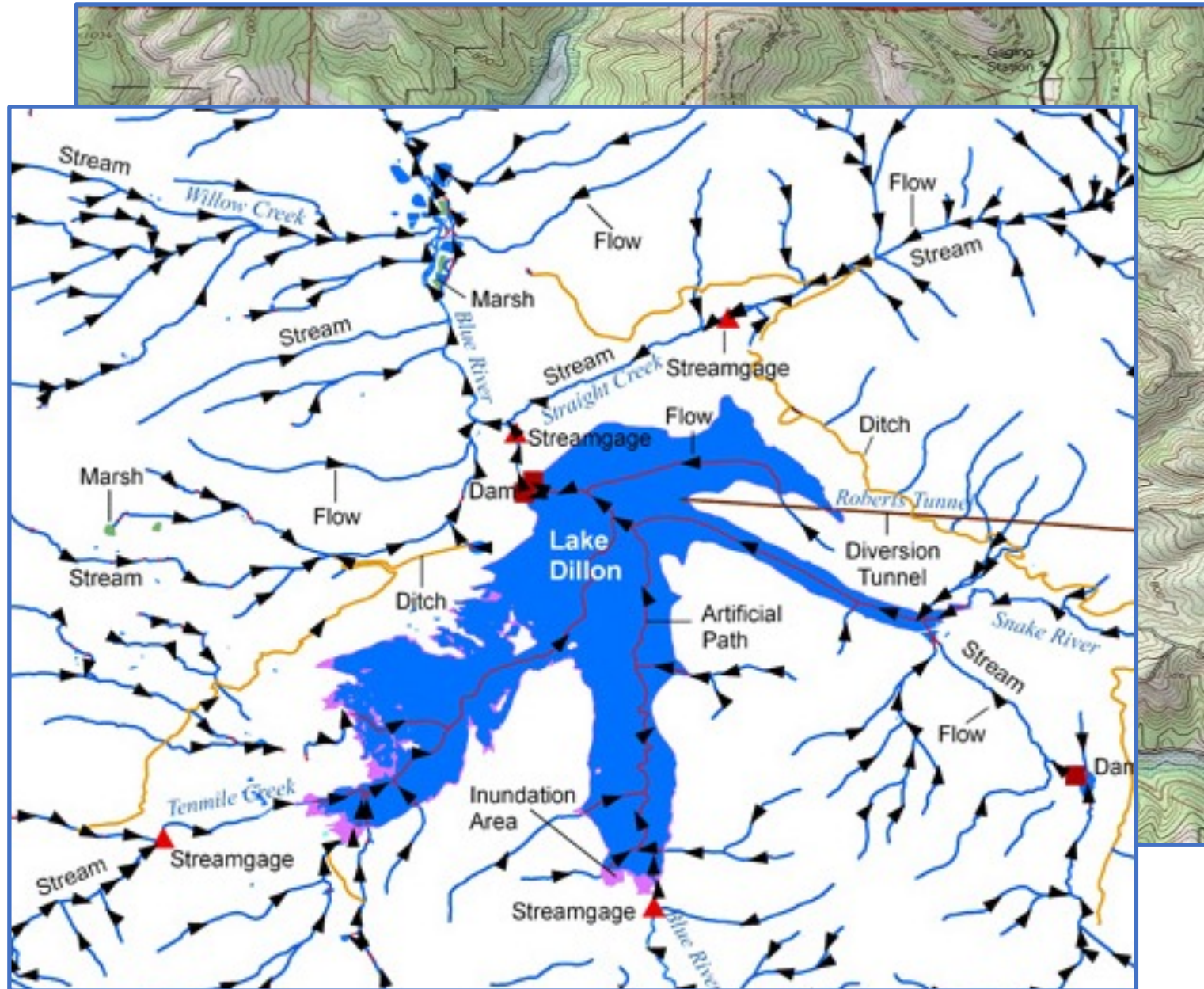


NHD Beyond Map Making

NHD as a Cartographic Product

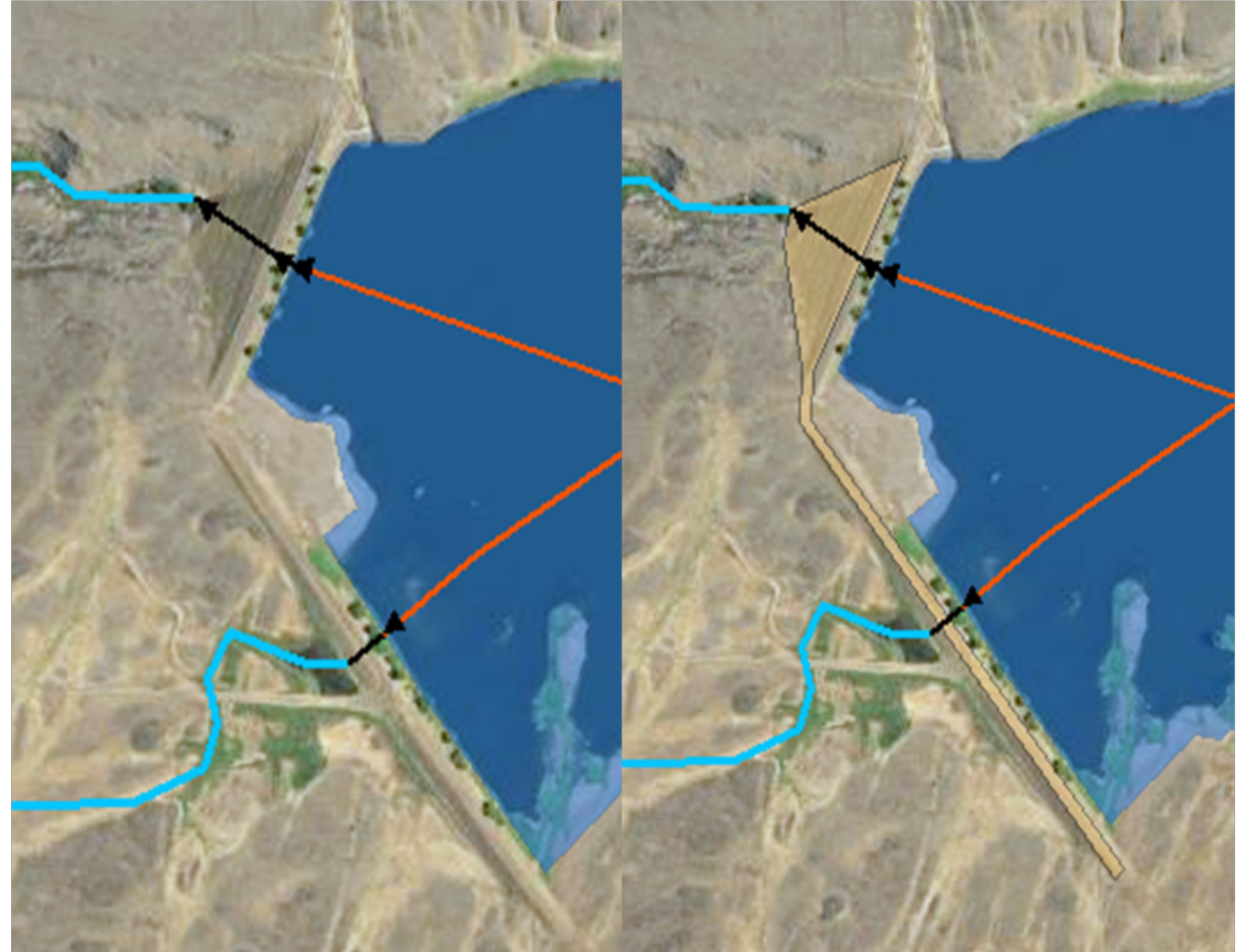
- Staple/most common use case
- Topographic maps/basemaps
- Reference layer for hydrography
- Water feature type labels and water feature names

But... NHD has many more uses beyond map making!



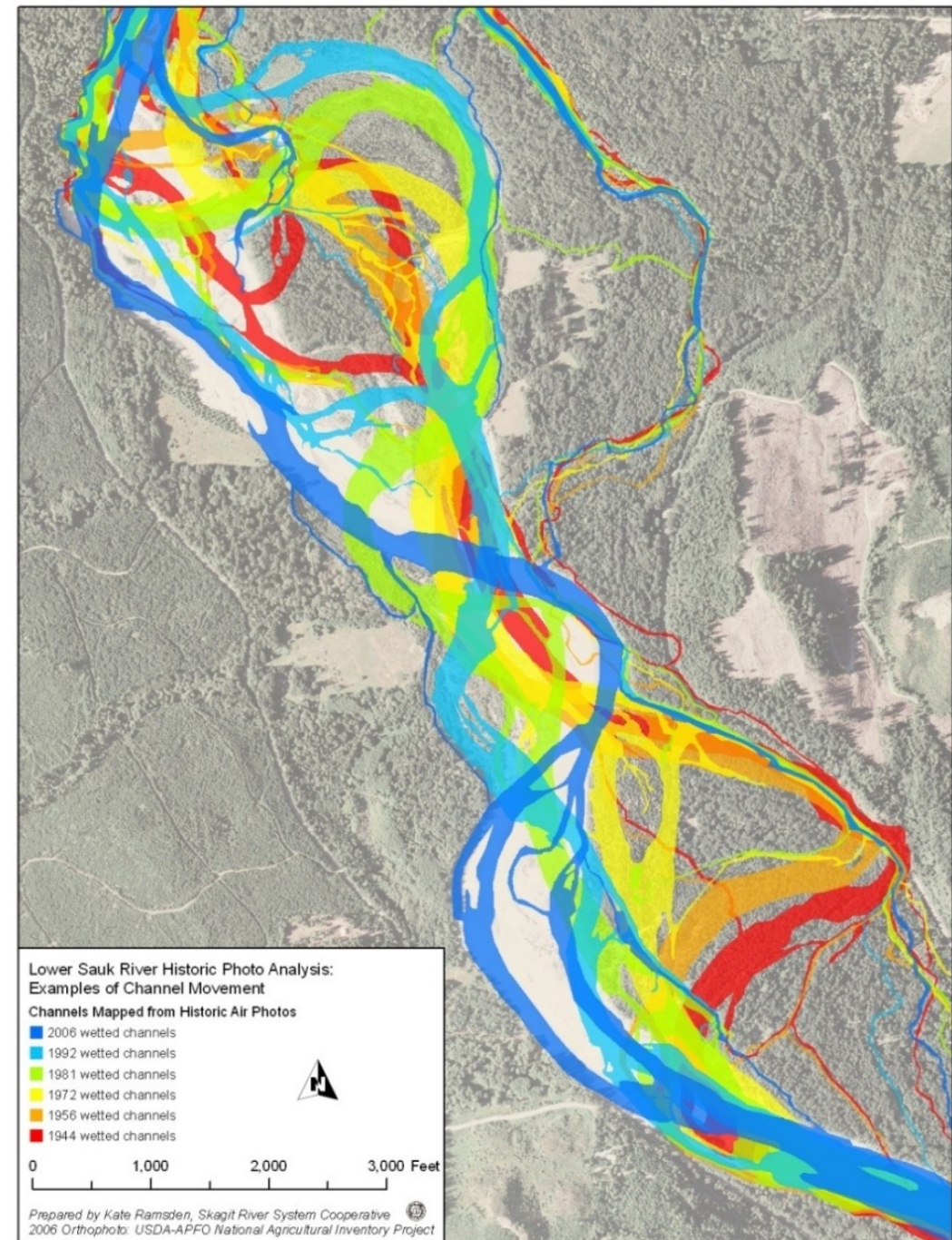
Surface Water Resource Inventory

- Current and Up-To-Date
- Reflecting Real-World Conditions
 - Through wealth of NHD data components
- Consistent
- Robust
- Helps Support:
 - ✓ Water Resource Management
 - ✓ Watershed Health Assessments



Change Analysis

- Date Stamps
- Metadata
- Visualize and Analyze Change Over Time
- Directly Supports Work In:
 - ✓ Climate change analysis
 - ✓ Predictive modeling
 - ✓ Emergency response
 - ✓ Urbanization/development and human use impacts

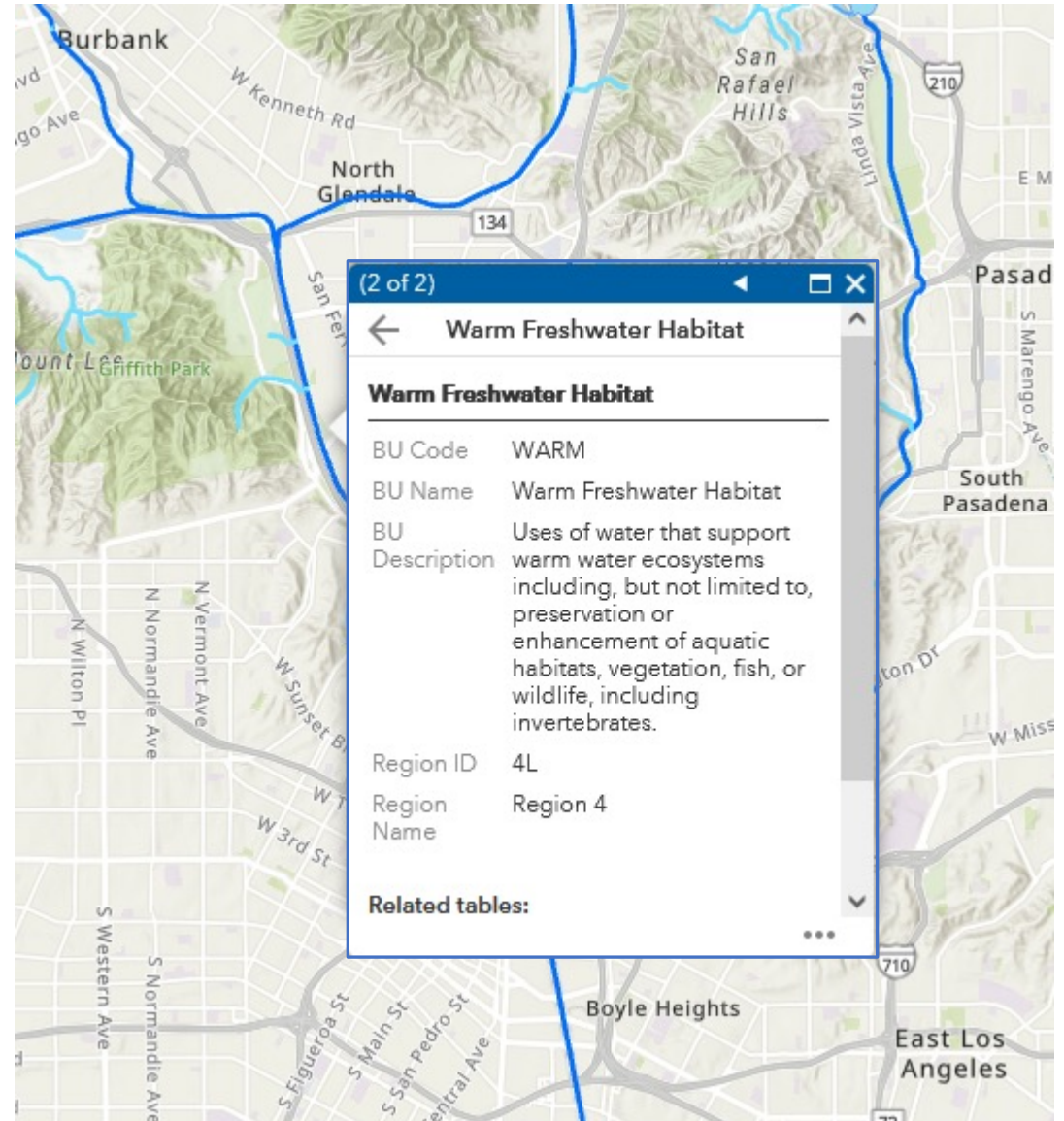


NHD as a Base Hydrographic Dataset

- CA Water Board's Basin Plan Mapping Project
 - Used NHD as Base Dataset
 - Statewide
 - Associated Regional and State Basin Plan Information to the NHD:
 - Water Quality Objectives
 - Beneficial Uses
 - Total Maximum Daily Load Thresholds
 - Other Descriptive Attributes

CA Basin Plan Beneficial Use Viewer:

<https://gispublic.waterboards.ca.gov/portal/apps/webappviewer/index.html?id=116f7daa9c4d4103afda1257be82eb16>

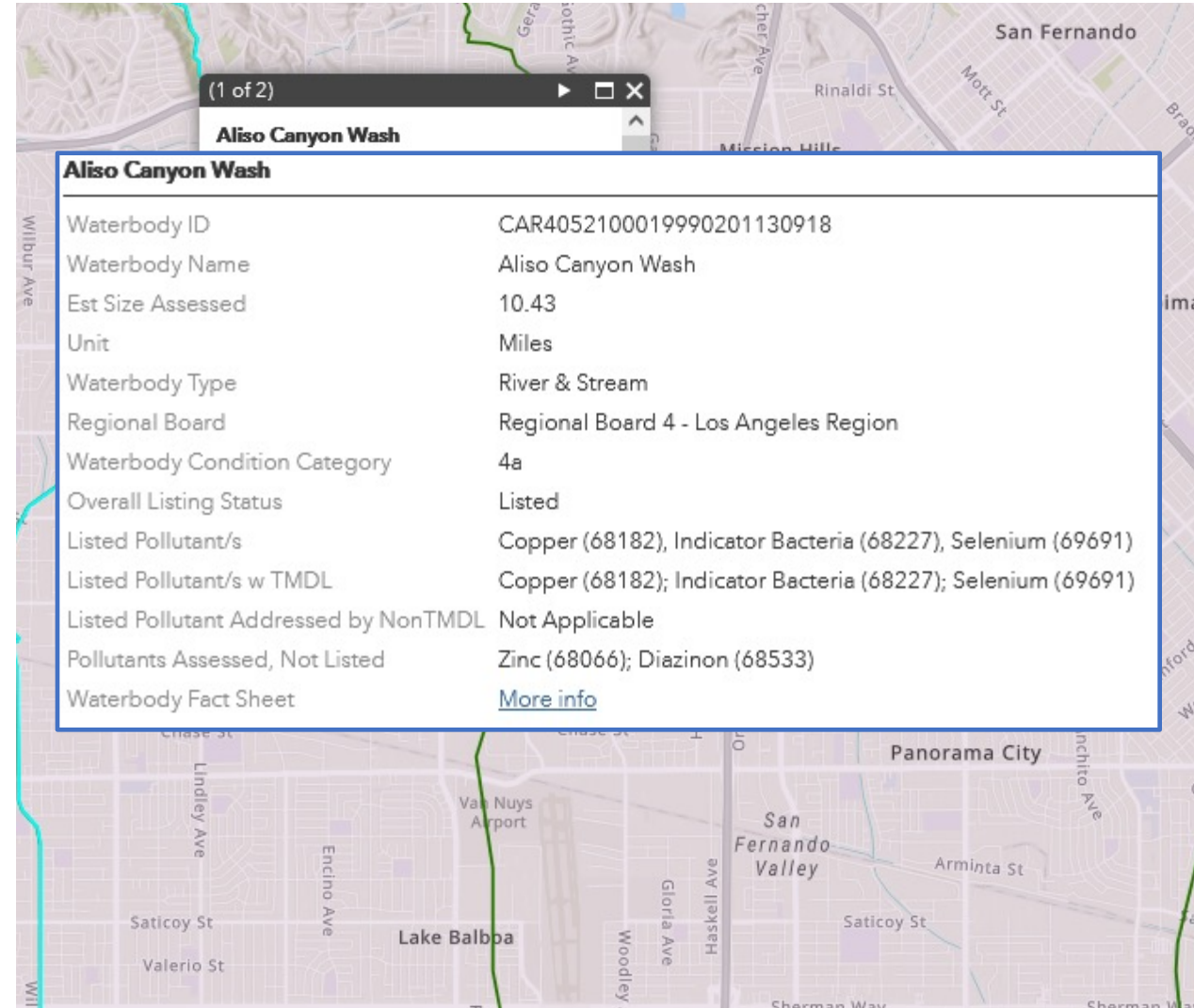


NHD as a Base Hydrographic Dataset

- CA Water Boards WQ Integrated Report
 - Federal Clean Water Act (CWA)
 - Quality of Surface Waters
 - Assessment of Pollutant Levels
 - 305(b) Reporting: Sets Condition Categories for Assessment
 - 305(d) Reporting: Lists Impaired Waters
 - Uses NHD as base dataset for map viewer with TMDL data

CA WQ Integrated Report Map:

<https://waterboards.maps.arcgis.com/apps/webappviewer/index.html?id=e2def63ccef54eedbee4ad726ab1552c>



Hydro Addressing/Linking User Data to NHD

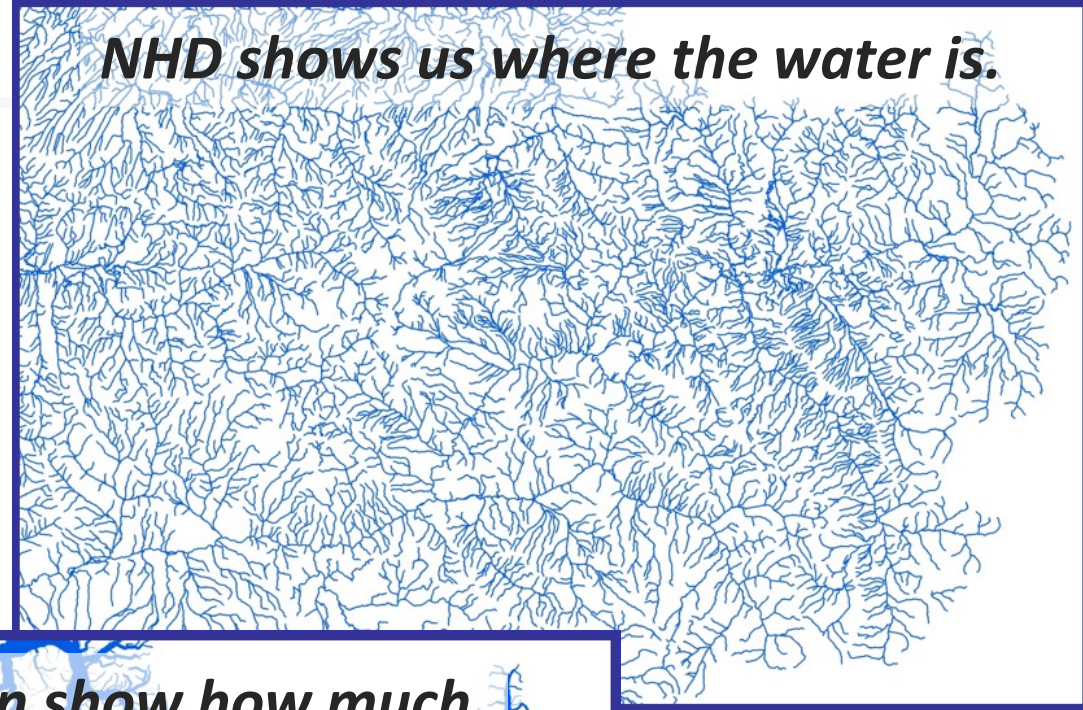
- Associating User Data to NHD
- Examples:
 - Biological Data
 - ✓ Fish spawning sites
 - ✓ Rare species locations
 - Infrastructure Data
 - ✓ Monitoring stations
 - ✓ Gates
 - ✓ Fish screens
 - Environmental Impact Data
 - ✓ Hazardous events
 - ✓ Pollution site



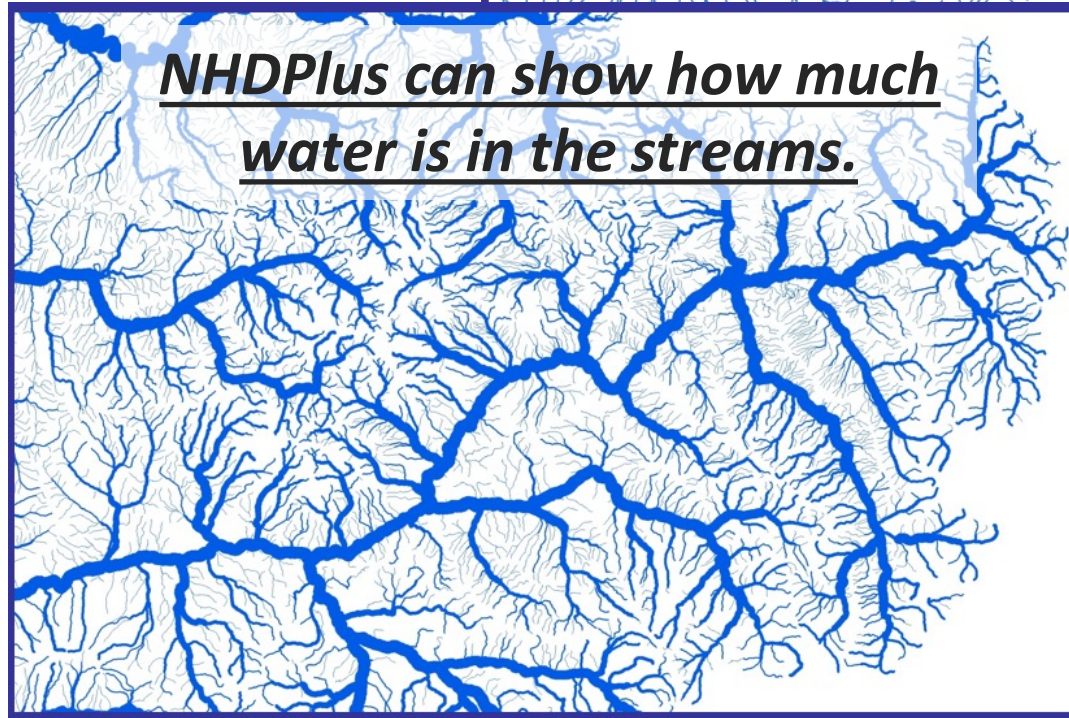
High Resolution NHDPlus

- Derived from NHD
- Value Added Attributes:
 - Stream Order
 - Mean Annual Flow
 - Average Flow Velocity
 - Precipitation
 - Temperature
 - ...and more!

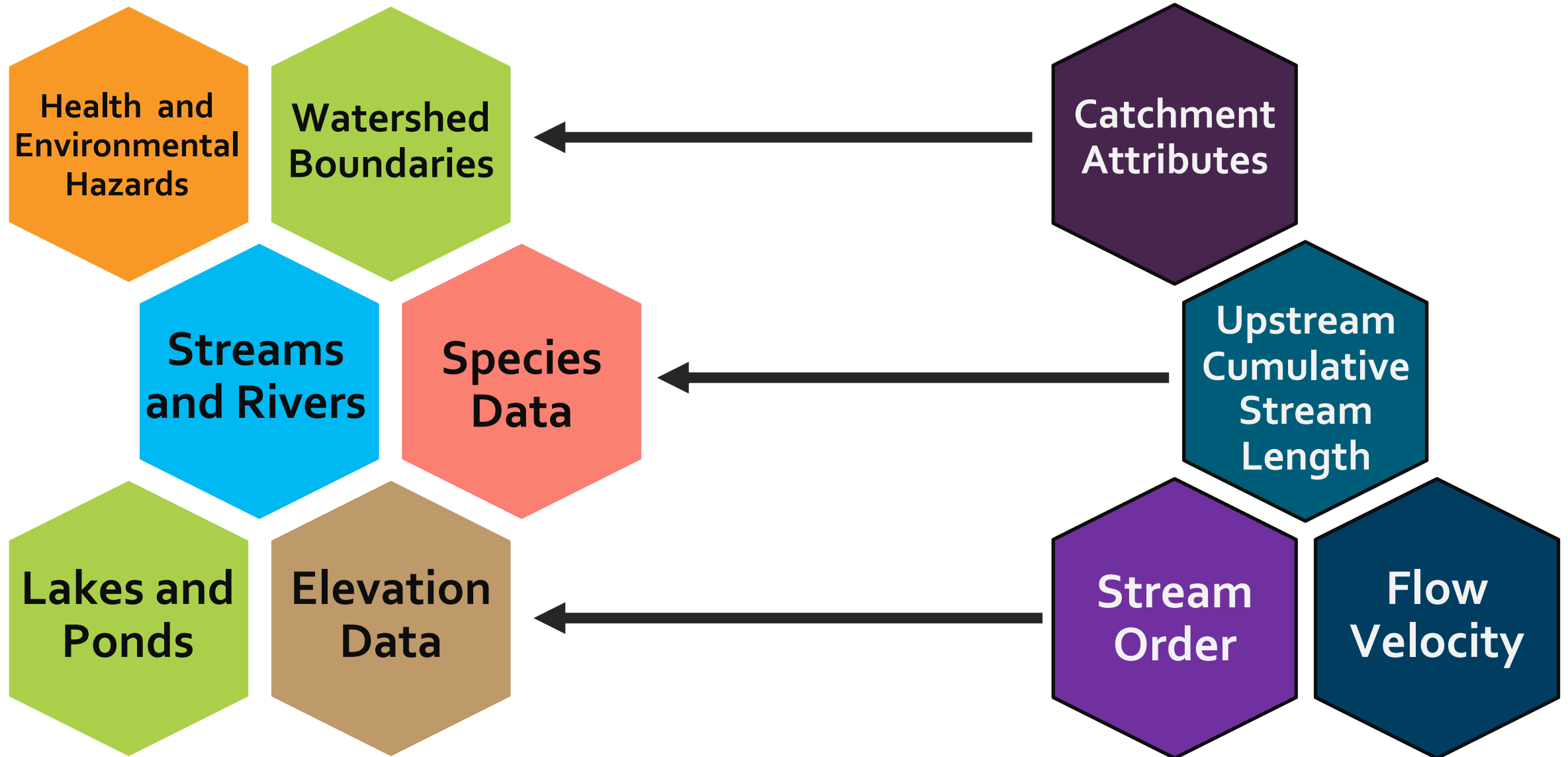
NHD shows us where the water is.



NHDPlus can show how much water is in the streams.



High Resolution NHDPlus



High Resolution NHDPlus

Health and Environmental Hazards

Watershed Boundaries

Catchment Attributes

Streams and Rivers

Species Data

Upstream Cumulative Stream Length

Lakes and Ponds

Elevation Data

Stream Order

Flow Velocity

Temporal/ Historical Studies

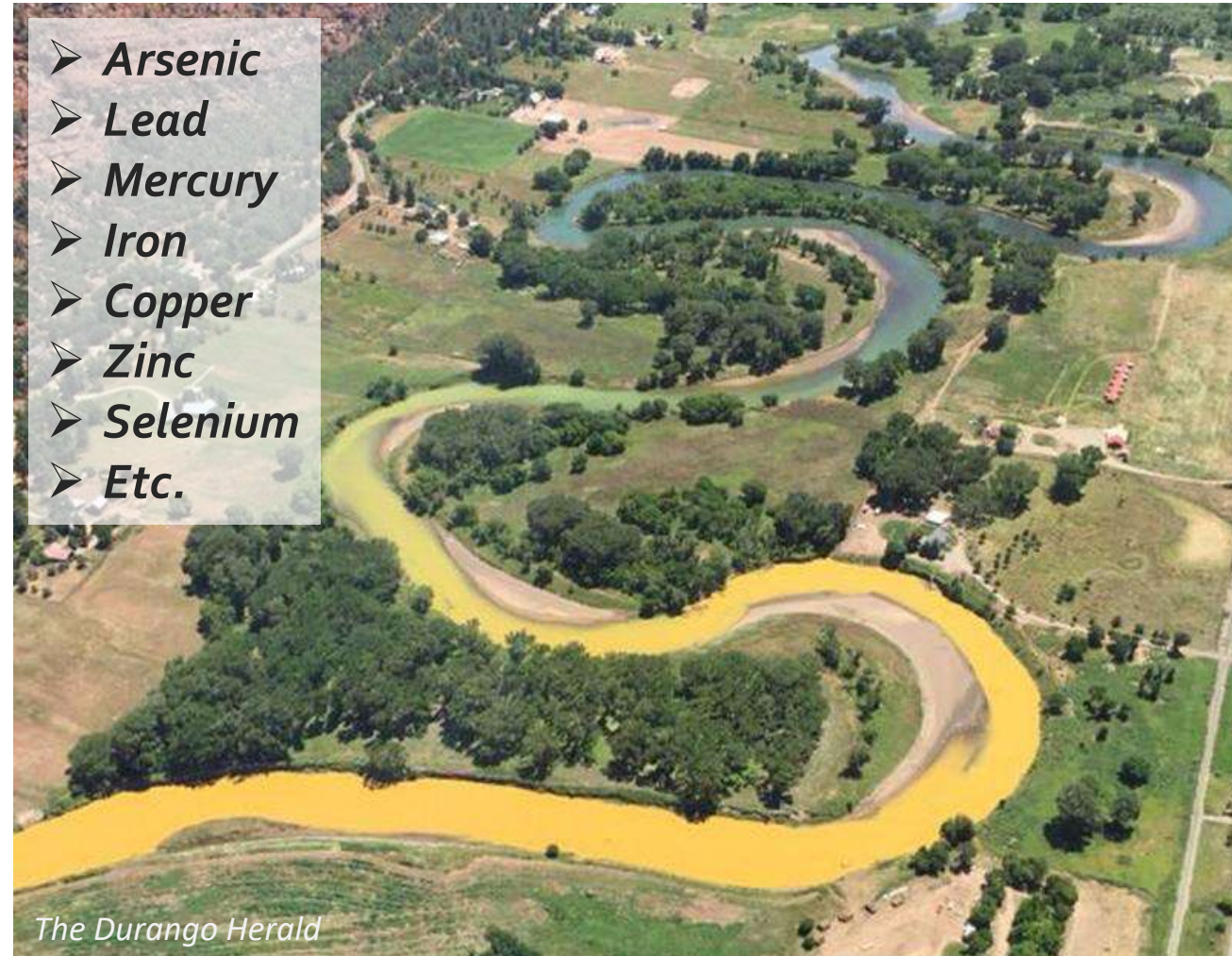
Comprehensive Analysis Using Contemporary Conditions

Predictive Analysis/ Modeling

High Resolution NHDPlus

Gold Kings Mine Case, 2015

- Southwestern Colorado
- US EPA mine inspection
- Accidental release of **3 million gallons** of **acidic, metal-rich mine wastewater** to Cement Creek and Animas River
- Toxic spill modeling tool by Center for Water Science and Engineering (Virginia)
 - NHD
 - NHDPlus
 - Forecasting downstream transport of contaminated water
 - **Real-time** emergency planning and response potential



High Resolution NHDPlus

Gold Kings Mine Case, 2015

- Modeling Components
 - Time of Arrival Analysis:
 - ✓ 48 hours
 - ✓ 8 day
 - Validation Using Stream Gauges
- Appropriate and timely response to impacts:
 - ✓ Drinking Water
 - ✓ Recreation
 - ✓ Irrigation



Future of NHD

- Higher Resolution Data
 - LiDAR
 - Elevation
 - Modeling
 - Automation/Machine Learning
- Shift to 3D Modeling
- Seasonality and Periodicity Modeling
 - Addressing regional impacts of drought and climate change
- Benefits to Water Resources:
 - ✓ More Detail
 - ✓ More Accuracy
 - ✓ More Data Compatibility

INTRODUCING THE 3D HYDROGRAPHY PROGRAM

A New Approach to Water Data

Building on the decades of experience developing and managing the National Hydrography Datasets, the USGS is establishing the **3D Hydrography Program (3DHP)** initiative to completely refresh the Nation's hydrography data and improve discovery and sharing of water-related data.

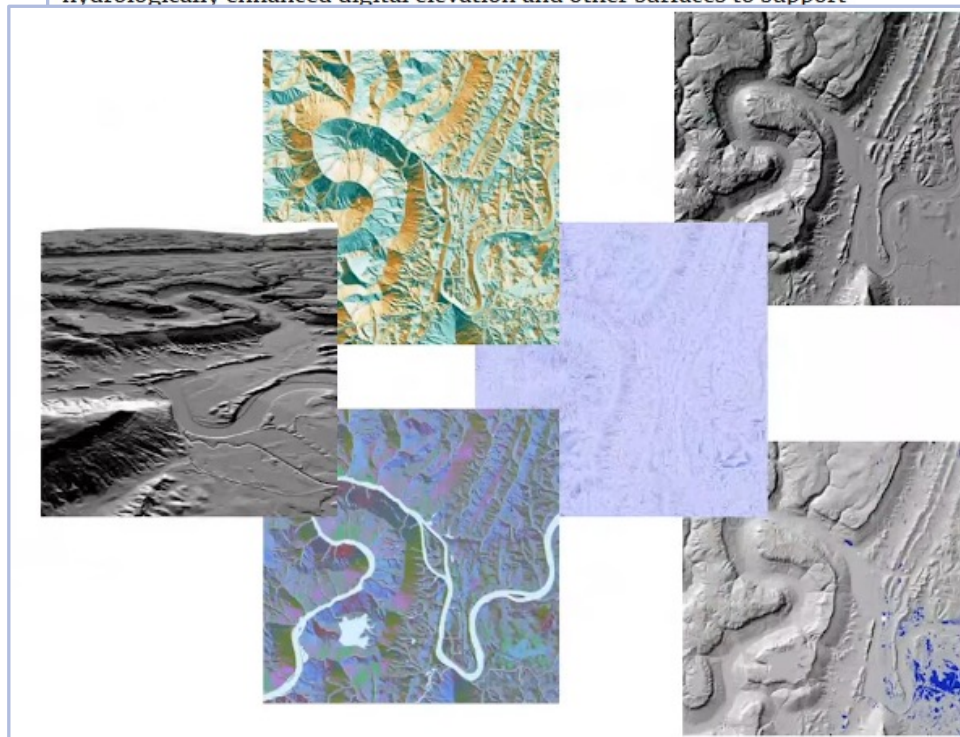
When fully implemented, 3DHP is estimated to provide more than **\$1 billion in benefits every year**, in addition to myriad societal benefits. Additionally, decisions that directly affect water would be better informed. The next generation of surface water mapping under the new 3DHP will incorporate the most relevant and impactful components of the existing hydrography data and accomplish major spatial accuracy improvements. The resulting products and services will be freely available and openly accessible.

The 3DHP will significantly improve the level of detail, currency, and inclusion of hydrography data by deriving a 3D stream network and hydrologic units from accurate, high-quality 3D Elevation Program (3DEP) data, as well as hydrologically enhanced digital elevation and other surfaces to support



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Figure 2: The 3D Hydrography Program aims to align hydrography and elevation data.



Thank you!



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