

1.5.1.502 – HydroSource



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HydroSource

A comprehensive and unique National Energy-Water digital platform designed to help the hydropower community make data driven decisions

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National Laboratory

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Presentation Date: 07/27/2022

Project Overview

Project Summary

- HydroSource is the most comprehensive and unique National Energy-Water digital platform designed to help hydropower stakeholders make data-driven decisions with diverse datasets.
- Addresses lack of access to information necessary to support hydropower related decision-making.
- Uses data science and data analytics to develop data collections and tools to effectively assemble, consolidate, and compare diverse datasets from a range of sources across the hydropower spectrum

Intended Outcomes

- HydroSource provides streamlined access to authoritative information about U.S. hydropower assets and hydropower development potential to serve the data needs of a diverse user-base
 - facilitate interdisciplinary investigations
 - use of new analytical capabilities and tools to weigh multi-objective tradeoffs and support stakeholder decision-making at basin scales
 - play a critical role in ‘water-data’ landscape

Project Information

Principal Investigator(s)

- Debjani Singh

Project Partners/Subs

- Internet of Water
- Hydro Research Institute (HRI)
- Kearns & West

Project Status

Ongoing

Project Duration

- Project Start Date: October 2010
- Project End Date: Ongoing

Total Costed (FY19–FY21)

\$3.184 Million

Project Objectives: Relevance to Program Goals

Challenge: Lack of access to information to support decision-making

Programmatic Activities:

- Support the development of systems and standards to improve access to integrated water data and information relevant to hydropower stakeholders.
- Improve capabilities to analyze multifaceted types of hydropower and water data to better identify opportunities and weigh potential trade-offs at basin-scales

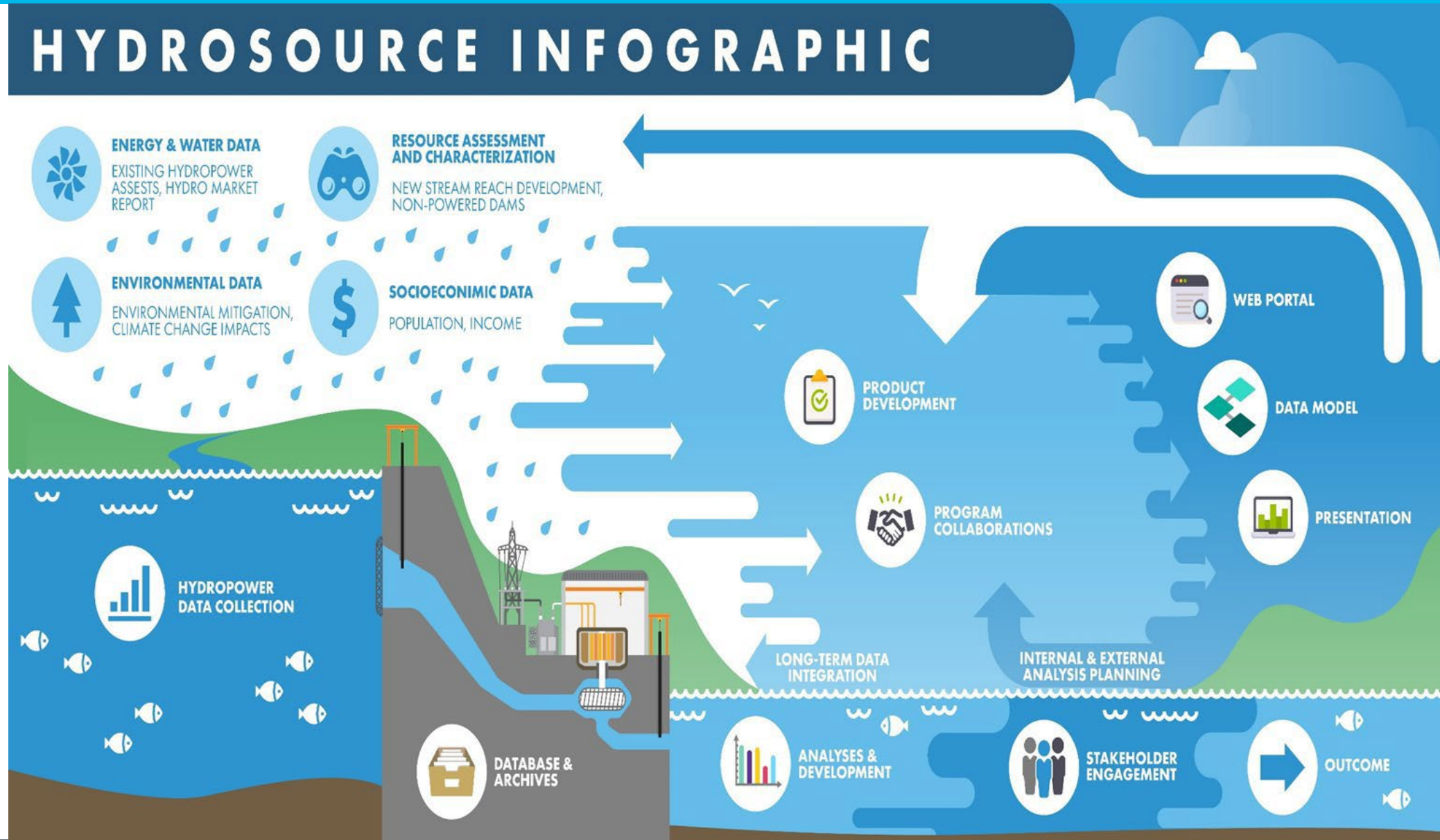
Intermediate Outcome

- Reduced cost/time and greater certainty in federal/state authorization processes for hydro development and relicensing
- Improvements in river/water data availability, accessibility, and management
- Commercialization and use of new analytical tools to weigh multi-objectives trade-offs at basin scales


Long Term Outcome

- Knowledge diffusion for improved decision making processes and basin-wide management of river resources for multiple objectives
- Contribute to clean, renewable future energy portfolio through sustainable development of hydropower
- Energy Security


Project Objectives: Approach



Project Objectives: Approach



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HydroSource


A comprehensive and unique National Energy-Water digital platform designed to help the hydropower community make data driven decisions


Hydropower Market
Information

Resource Assessment
and Characterization

Environmental
Research

Project Objectives: Approach


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Datasets

Keywords

Science Themes

Energy (59)

Environment (36)

Economics (27)

Resource Assessment (22)

Climate (2)

Regulatory (2)

Technology (2)

Hydrology (1)

Site Characterization (1)

Social Aspects (1)

US Hydropower Market Report Data (January 21 edition)

U.S. Hydropower Development Pipeline Data, 2020

Existing Hydropower Assets (EHA) Net Generation Plant Database, 2003-2019

Existing Hydropower Assets (EHA) Gross Generation Plant Database, 2003-2019

Existing Hydropower Assets (EHA) Capacity Factor Plant Database, 2005-2019

Existing Hydropower Assets (EHA) Capacity Plant Database, 2005-2019

Fish Injury and Mortality caused by Simulated Impacts from Turbine Blades

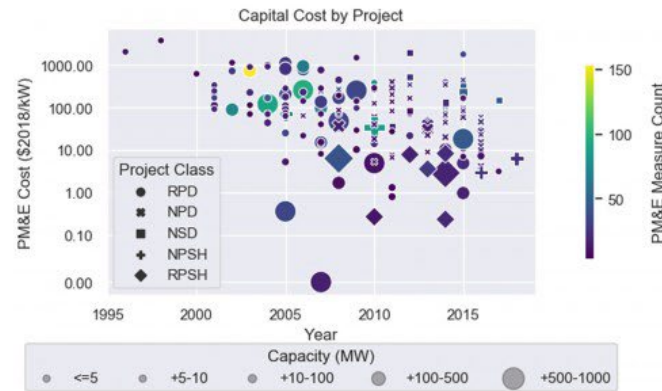
Fish Scale-Loss caused by Simulated Hydraulic Shear Stress

Cost of Mitigating the Environmental Impacts of Hydropower Projects

 **OAK RIDGE**
National Laboratory

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Cost of Mitigating the Environmental Impacts of Hydropower Projects



Dataset Overview

This dataset compiles data on environmental impacts mitigation costs for 182 hydropower projects based on documents obtained from the U.S. Federal Energy Regulatory Commission (FERC). Data for all measures (which are generally found in the “Developmental Analysis” section of the EA documents) as well as their associated economic information, FERC categorization, and final FERC decision were collected. Due to differences in file type (i.e. PDF, Microsoft Word document, or image) and structure (i.e. different table formats, page and section numbering styles, and section titles), each EA document was manually investigated and all relevant PM&E data were consolidated in a Microsoft Excel Workbook, referred to below as the EA Cost Database.

DOI

10.21951/1734879

Citation

Werble, J., Tingen, W., Oladosu, G. A., Witt, A., Mobley, M., & O'Connor, P. Database on Cost of Environmental Impacts Mitigation Requirements for Hydropower Projects 2021. HydroSource. Oak Ridge National Laboratory, Oak Ridge, TN.

Downloads

ORNL
CostofMitigatingEnvironmentalImpacts
FY2021 (xlsx)

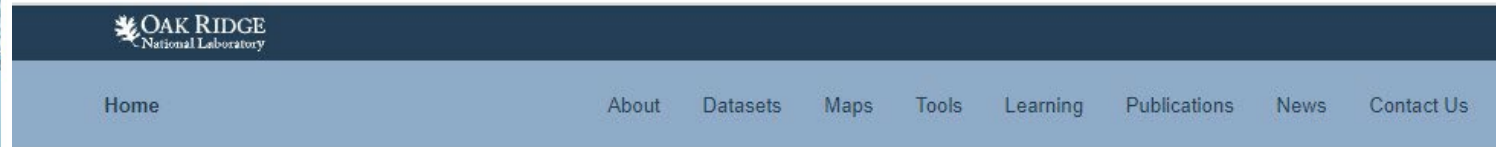
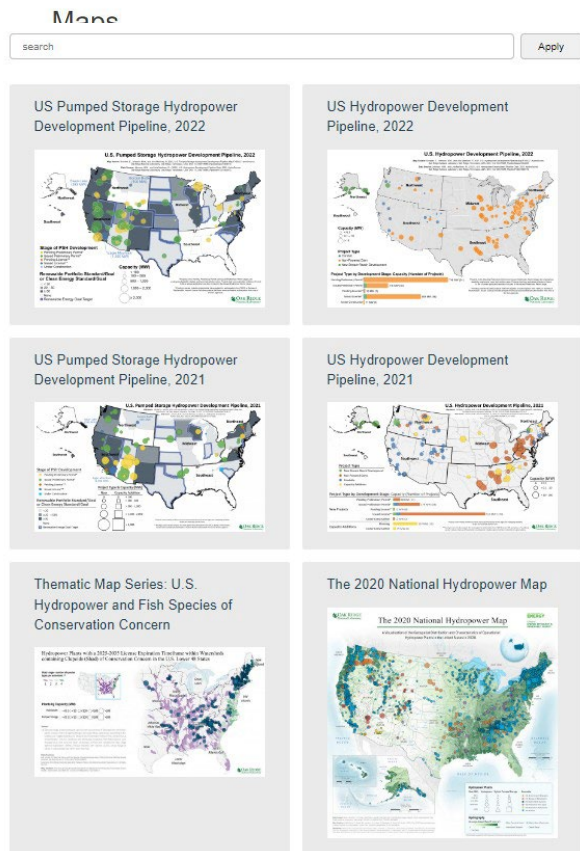
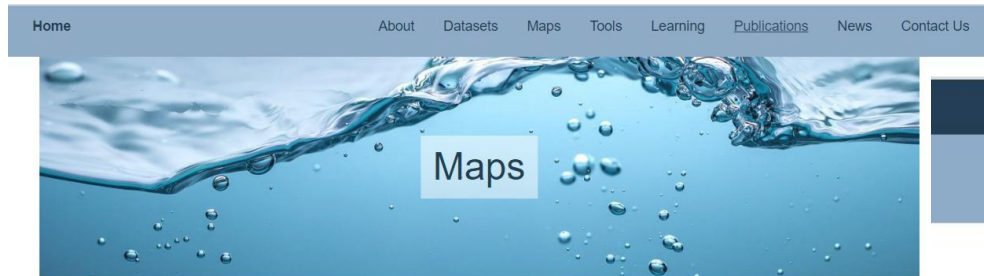
Science Theme

Energy
Economics

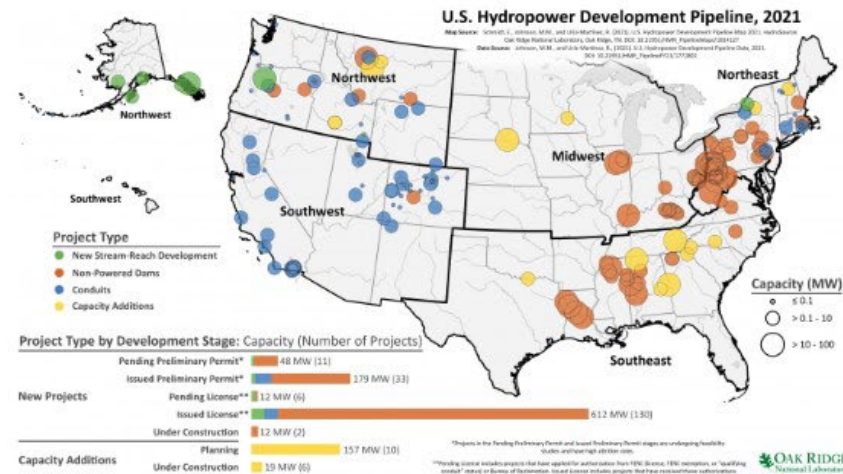
Related Publications

Costs of mitigating the environmental impacts of hydropower projects in the United

Project Objectives: Approach



US Hydropower Development Pipeline, 2021



[Download high-res image.](#)

Abstract

This map provides a snapshot of the composition of the U.S. hydropower development pipeline as of December 31, 2020. It displays the location of hydropower projects whose developers have formally registered interest in project development through documents submitted to FERC or Bureau of Reclamation. The map provides project-level information on size and type as well as a summary of the number and capacity of projects at each of stage of development.

Downloads

[hmr us hy 2021 \(pdf\)](#)

DOI

[10.21951/HMR_PipelineMaps/1814127](https://doi.org/10.21951/HMR_PipelineMaps/1814127)

Citation

Schmidt, E., Johnson, M.M., and Uriá-Martínez, R. (2021). U.S. Hydropower Development Pipeline Map 2021. HydroSource. Oak Ridge National Laboratory, Oak Ridge, TN. 10.21951/HMR_PipelineMaps/1814127

Keywords

Development Pipeline
Market Report
Hydropower Generation

Science Theme

Energy
Economics

Related Datasets

[U.S. Hydropower Development Pipeline Data, 2021](#)

Project Objectives: Expected Outputs and Intended Outcomes

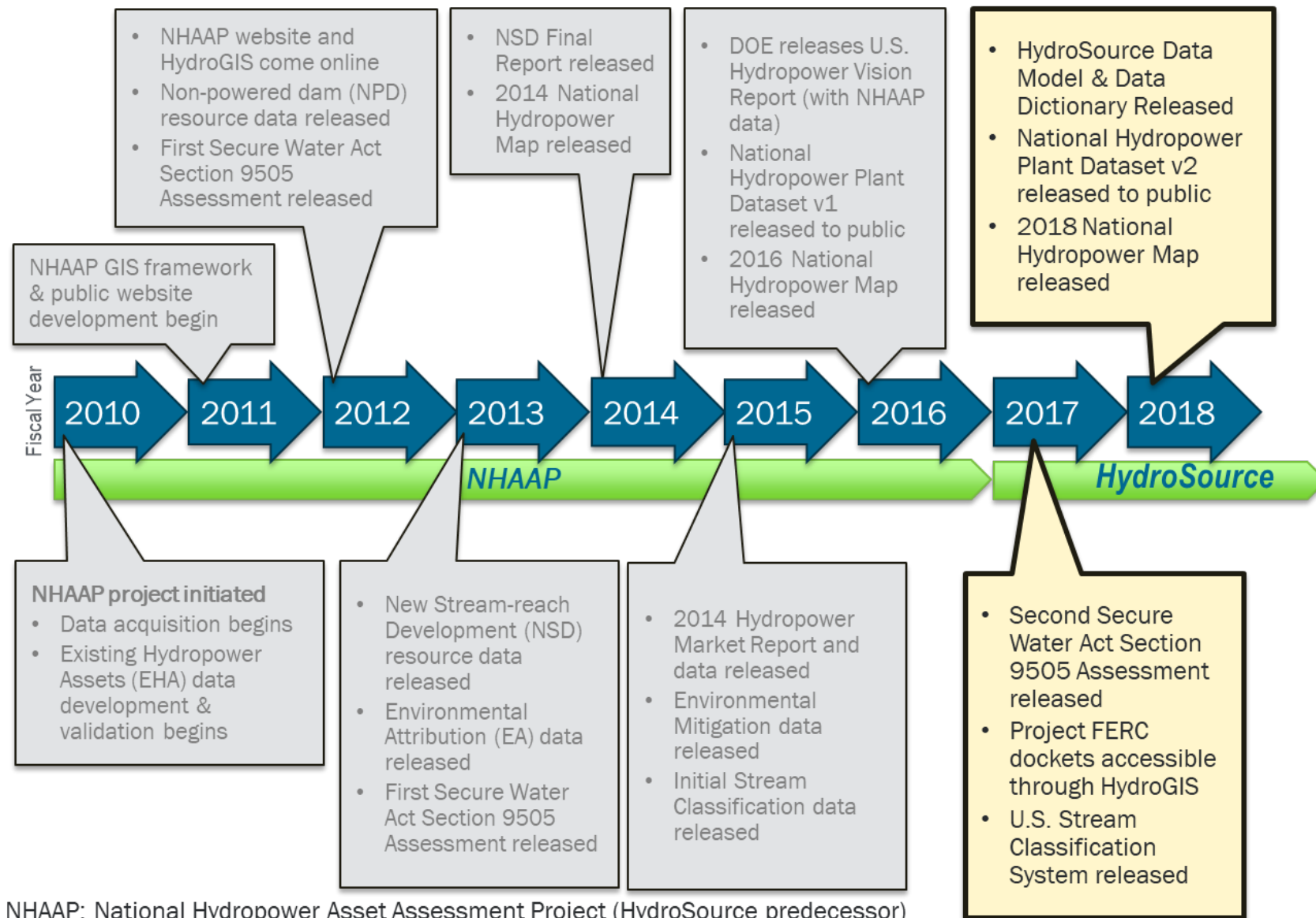
Outputs:

- A standalone data portal housing all publicly available hydropower related datasets at <https://hydrosource.ornl.gov>
- Multiple tools and applications with use-case capabilities that will improve the usage of the datasets (housed on HydroSource) in decision making
- A dedicated user base for hydropower data
- HydroSource as a water data hub in the Internet of Water

Outcomes:

- Enhance access to most up-to-date hydropower related information
- Efficient stewardship of science-quality data.
- Facilitate interdisciplinary investigations by providing efficient and harmonized data systems.
- Management and analysis of complex hydrology data.
- Develop and maintain partnerships to expand the use of open data, promote open science, and increase the use of data across multi-disciplinary, multi-agency organizations.
- Demonstrate leadership in Hydropower related data system technology and techniques.

Project Timeline



Project Timeline Cont. (Peer Review Period)

FY 2019

Initial scoping of potential thematic map series
Updated Existing Hydropower Asset (EHA) dataset
Initial scoping of HydroSource website redesign

FY 2020

Redesign of HydroSource Website
Started development of HydroSource Data Explorer
Published National Hydropower Map
Published 5 new datasets and updated the EHA dataset
License agreement with Hydropower Research Institute (HRI).
Initial analysis of the impact of expanding wild and scenic rivers on Hydropower
Developed 3 thematic map series

- Relicensing
- Fish Species of Concern
- Environmental Mitigations

FY 2021

Completed development and released the HydroSource Data Explorer to the public along with its API
HydroSource Data Story published at the Basin Scale Data Access workshop
Added new functionalities to the website
Published 20 new datasets and updated EHA dataset
Collaborated with Internet of Water to establish HydroSource as a Water Data Hub
Completed analysis of the impact of expanding wild and scenic rivers with most recent hydropower infrastructure data

Project Budget

Total Project Budget – Award Information		
DOE	Cost-share	Total
\$3.148 Million	None	\$3.148 Million

FY19	FY20	FY21	Total Actual Costs FY19–FY21
Costed	Costed	Costed	Total Costed
\$384,000	\$986,000	\$1,778,000	\$3,148,000

End-User Engagement and Dissemination

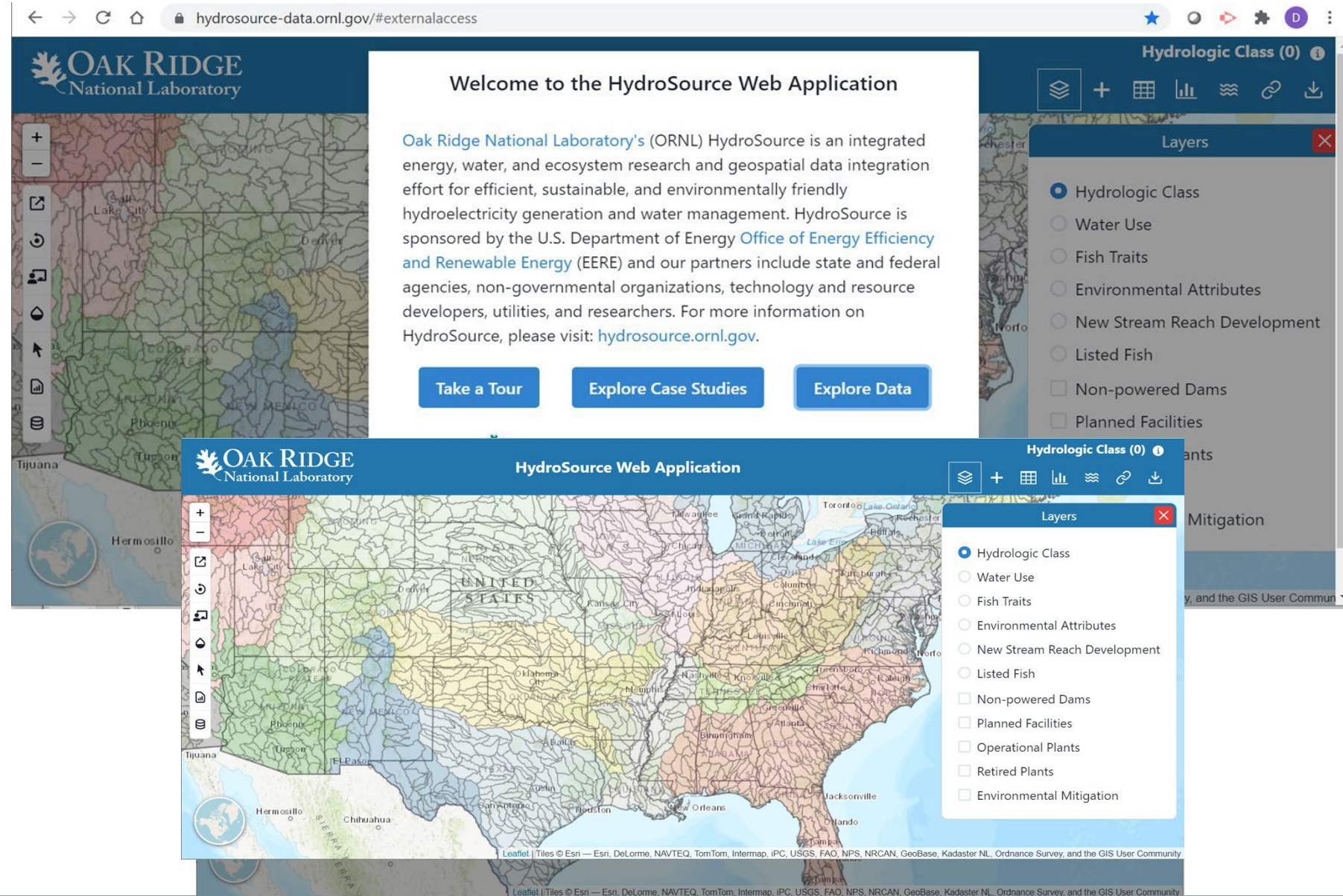
HydroSource strives to engage with end-users through

- Workshops
 - Basin scale data access workshop
- Webinars
 - Industry/commercial engagement through the NHA transparency series
 - Uncommon Dialogue working group meetings
 - Agency and institutional engagement through USFWS & USDOT sponsored “Turbine Talk”
- Web portal: <https://hydrosource.ornl.gov>
 - “Contact Us” form enables public to provide specific feedback on portal or data
- Conference Presentations

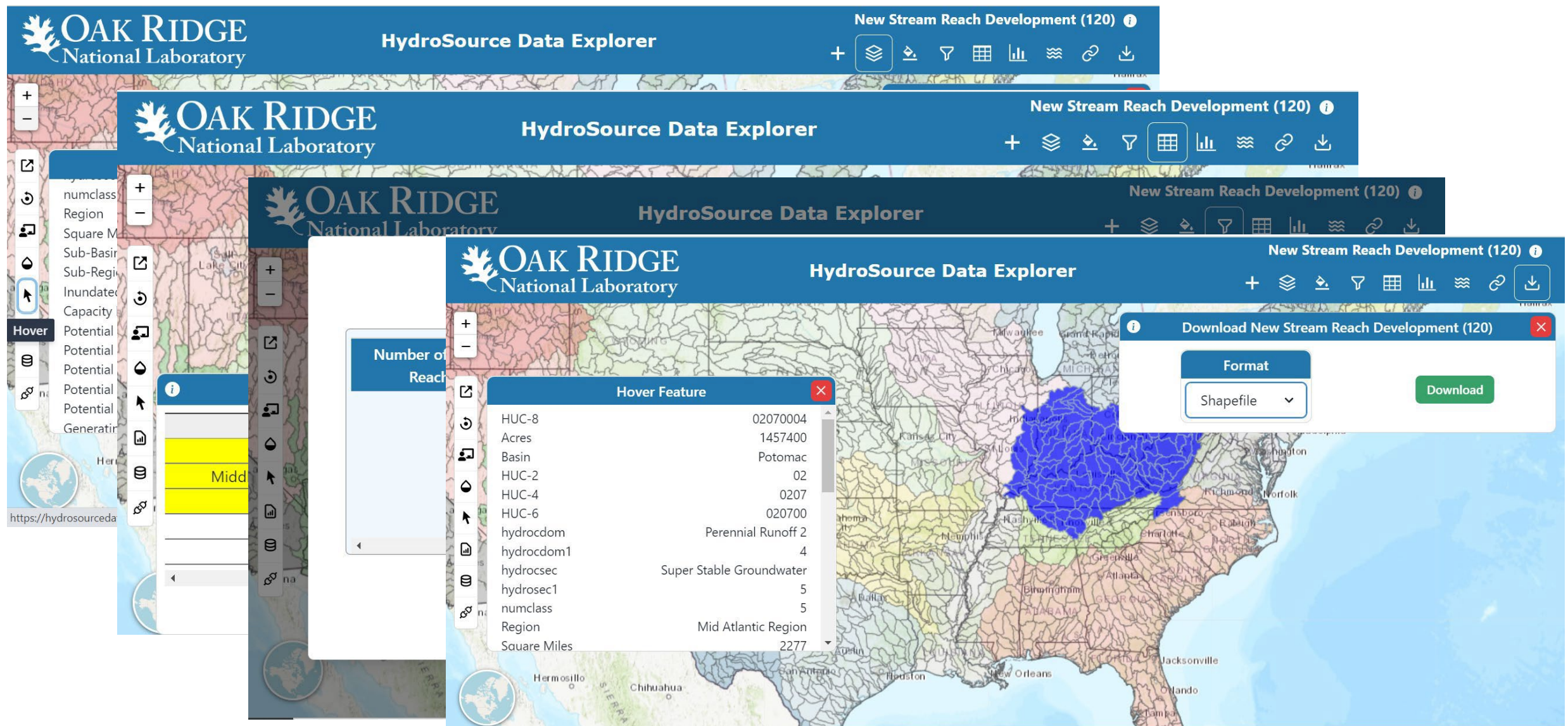
Performance: Accomplishments and Progress

HydroSource Data Explorer

- Estimating hydropower generation and capacity by administrative or hydrologic boundaries or other attributes
- Visualizing hydropower potential of a basin
- Analyzing existing facilities/hydrology around a new development site
- Identifying hydropower plants that are up relicensing in a basin or state
- Recognizing mitigations associated with the hydropower plants that are up for relicensing



Visualizing Future Hydropower Potential of a Basin



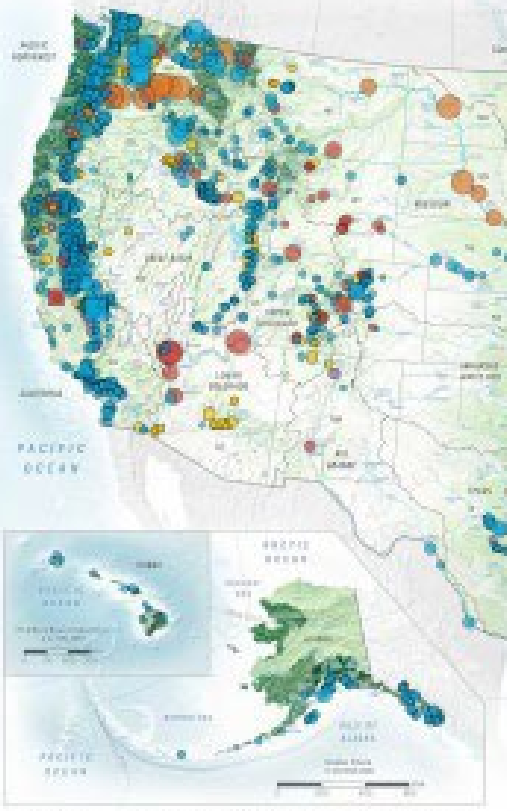
Performance: Accomplishments and Progress

The 2020 National Hydropower Map



The 2020 Nations'

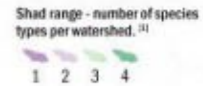
A Visualization of the Geospatial Distrib Hydropower Plants in U

[illegible]

DOI

Thematic Map Series: U.S. Hydropower and Fish Species of Conservation Concern

Hydropower Plants with a 2025-2035 License Expiration Timeframe within Watersheds containing Clupeids (Shad) of Conservation Concern in the U.S. Lower 48 States



Plants by Capacity (MW)

Hydropower ☐ ≤0.1 ☐ ≤10 ☐ ≤100 ☐ ≤500 ☒ >500

Pumped Storage ☐ ≤0.1 ☐ ≤10 ☐ ≤100 ☐ ≤500 ☐ >500

Notes:

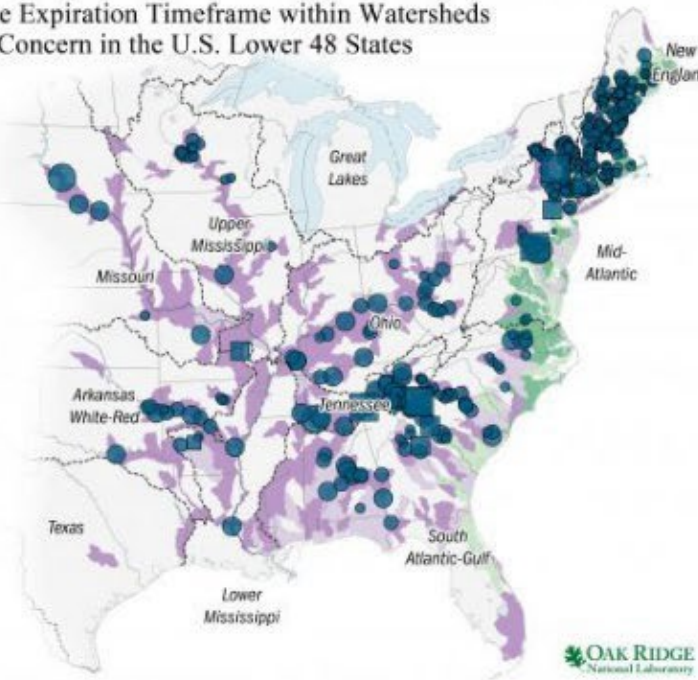
[3] Species range is distributed based upon current occurrences of Shad species of conservation concern within 8-digit hydrologic unit code (HUC) watersheds according to NatureServe's "Digital Distribution Maps of the Freshwater Fishes in the Conterminous United States" (2010). Locations and attributes of species from NatureServe were mapped as-is and have not been empirically verified and validated by Oak Ridge National Laboratory (ORNL). Please interpret with caution as the actual range of fishes in watersheds may differ from this map.

Data Sources:

H.M. Johnson, J.-C. Kuo, H.M. Sana, and R. J. de Wit: *Environ. Health Perspect.* 2003, 111(12):1688-1694.

Barry/Sears. 2010. Digital Distribution Maps of the Freshwater Fishes of the Conterminous United States. Version 3.0. Arlington, VA, U.S.A.

Map Citation: N.H. Sarno, T. Singh, B. Probst, and R. Smith. U.S. Hydropower and Fish Species of Conservation Concern. Version 1. United States: 2020. Web. USA: 10.21955/ThreatMapGen.1902.168673



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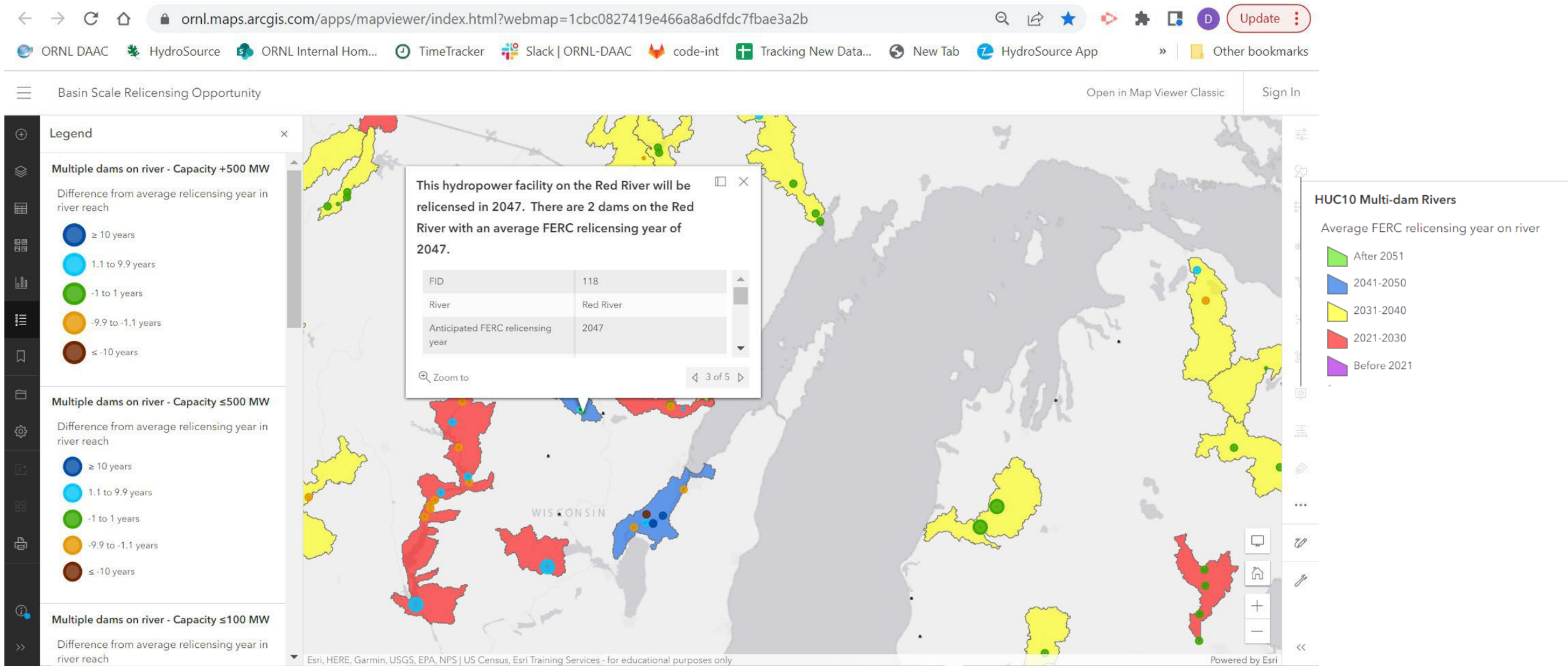
[ornl fish amshad eha \(pdf\)](#)

[Download high-res image.](#)



Performance: Accomplishments and Progress

Basin Scale Relicensing Opportunity



Performance: Accomplishments and Progress

Web Analytics



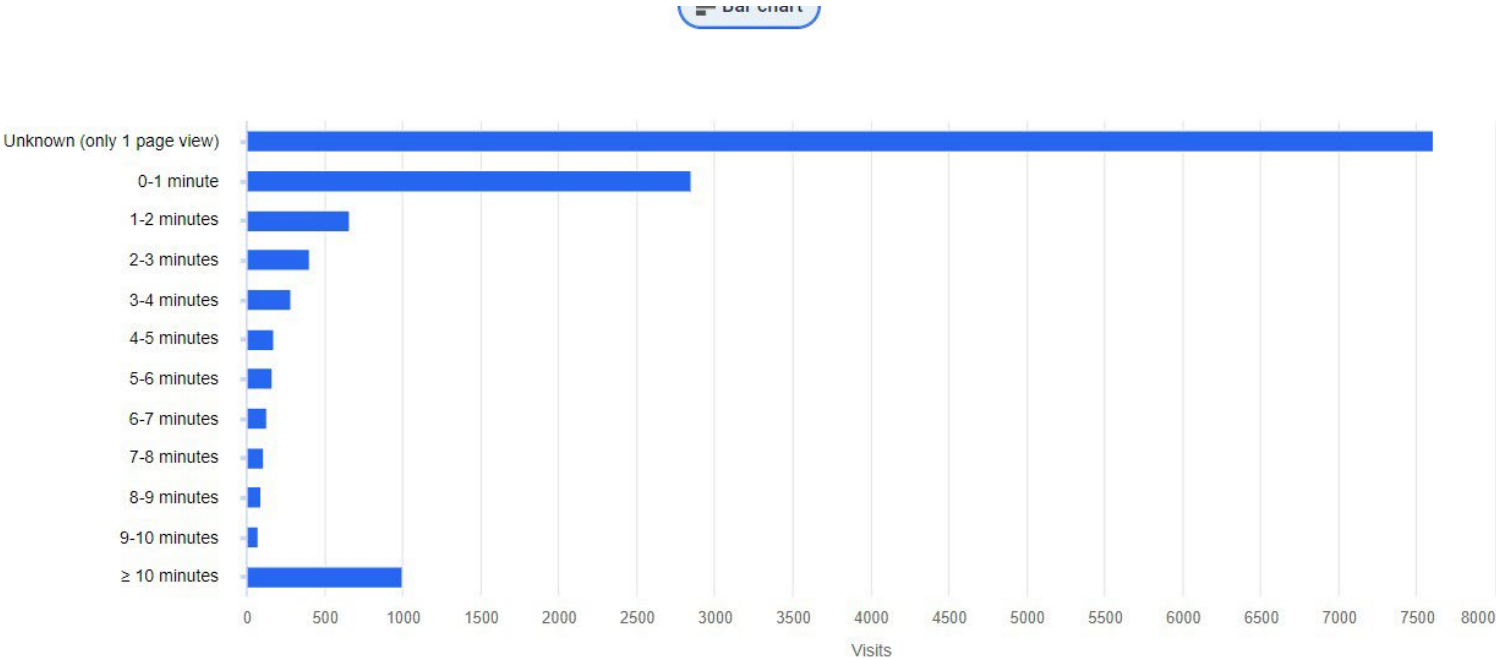
6/30/2022 4:03 AM
Period: 1/1/2021 - 6/28/2022

Site
Hydrosource

Period
1/1/2021 - 6/28/2022

Visit Length

typically



Performance: Accomplishments and Progress

Web Analytics

Most Popular Pages

Your most popular pages, based on the number of page views.

#	Title	URL	Page view
1	Home Hydrosource	https://hydrosource.ornl.gov	
2	Datasets Hydrosource	https://hydrosource.ornl.gov/datasets	
3	Maps Hydrosource	https://hydrosource.ornl.gov/maps	
4	Tools Hydrosource	https://hydrosource.ornl.gov/tools	
5	Existing Hydropower Assets (EHA), 2021 Hydrosource	https://hydrosource.ornl.gov/dataset/EHA2021	
6	US Hydropower Potential from Existing Non-powered Dams (greater than 1MW) Hydrosource	https://hydrosource.ornl.gov/dataset/us-hydropower-potential-existing-non-powered-dams-greater-1mw	
7	Recent Publications Hydrosource	https://hydrosource.ornl.gov/publications	
7	Recent Publications Hydrosource	https://hydrosource.ornl.gov/publications	878 1.9 %
8	Hydropower Potential from New Stream-Reach Development for the Conterminous United States. Hydrosource	https://hydrosource.ornl.gov/dataset/hydropower-potential-new-stream-reach-development-conterminous-united-states	812 1.8 %
9	The 2020 National Hydropower Map, Version 1 Hydrosource	https://hydrosource.ornl.gov/map/2020-national-hydropower-map-version-1	744 1.6 %
10	Existing Hydropower Assets Plant Dataset, 2020 Hydrosource	https://hydrosource.ornl.gov/dataset/existing-hydropower-assets-plant-dataset-2020	681 1.5 %
11	Hydropower Infrastructure - Lakes, Reservoirs, and Rivers (HILARRI) Hydrosource	https://hydrosource.ornl.gov/dataset/hydropower-infrastructure-lakes-reservoirs-and-rivers-hilarr	672 1.5 %

Performance: Accomplishments and Progress

- Redesigned and developed HydroSource Data Portal using the Findable, Accessible, Interoperable, and Resuable (FAIR) principles.
- Developed an Application Programming Interface (API) for the HydroSource Data Explorer.
- Published 30 datasets over the past 3 years.
- Prepare HydroSource Platform for “Big Data”
- Analyzed the potential impacts of expanding the existing 13000+ miles of wild and scenic rivers within US on new and existing hydropower assets.
- Collaborated with Internet of Water (IoW) to enable HydroSource as a water data hub.
- Collaborated with PNNL, Stanford University, U Maine and UNH to investigate water data access at the basin scale.

Performance: Accomplishments and Progress

- Peer Reviewed Journal Articles
 - Debjani Singh, Brennan Smith and Corey Vezina. 2022. HydroSource : A Data Discovery Platform for Hydropower Assets. Accepted in AGU EOS
- Conference Presentation
 - Singh, Debjani, Forest Carter, Nicole M. Samu, Megan Johnson, and Brennan Smith. "HydroSource: A National Water-Energy digital platform for Hydropower Data Accessibility and Use." In *AGU Fall Meeting Abstracts*, vol. 2020, pp. H145-0008. 2020.
 - Ruggles, Thomas Alan, Debjani Singh, and Brenda M. Pracheil. "Accessibility, Usability, and Visualization of HydroSource Data for River Basin-Scale Decision Making." In *AGU Fall Meeting 2021*. AGU, 2021.
 - Singh, Debjani. "Enhancing the FAIRness of Hydropower Data through the HydroSource Digital Platform." In *AGU Fall Meeting 2021*. AGU, 2021.

Future Work

- Improve metadata on the landing page to improve data access.
- Advanced search options that helps users filter down results (e.g. subject, keywords, science themes, map type, file type, year, region).
- Dynamic visualizations to help visualize and analyze complex datasets.
- Collect more user metrics to analyze the impact of HydroSource data across organizations, domains and demographics.
- Integrate and link new and updated datasets into HydroSource Data Explorer and HydroSource Data Model.
- Landing page for associated organizations so users could find related data (e.g. EPA, EIA).
- Form a dedicated user base or a user working group from diverse stakeholder groups who will help define the future direction of HydroSource

Q&A