The N-EWN Knowledge Series

A Continuing Education Series about Engineering with Nature

Dave Coffman, PG
Director, Northern California and Southern Oregon Operations | Sr. Fluvial Geomorphologist
Resource Environmental Solutions LLC

The Lower Klamath Project – The World's Largest Dam Removal and River Restoration Project

Removal of four hydropower dams (Iron Gate, Copco 1, Copco 2, and J.C. Boyle) on the Klamath River in northern California and southern Oregon represents the largest dam removal and river restoration project in the country. The project restores free-flowing conditions and volitional fish passage to more than 400 miles of historic anadromous fish habitat upstream of the former lower-most dam site, Iron Gate. RES was selected by the Klamath River Renewal Corporation to lead restoration for this ambitious effort, as well as accept liability associated with ensuring restoration meets ecological and biological performance standards and long-term goals/objectives. RES is leading design and implementation efforts for the restoration of nearly four miles of priority tributary streams and associated fish habitat, as well as vegetation restoration for approximately 2,200 acres of previously inundated lands. This presentation provides a look back at the past two years of dam removal and restoration actions accomplished, lessons learned along the way, and how RES has positioned restoration for the years ahead.

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Katherine Dafforn, PhD; Co-Director, Stone Living Lab & Distinguished Professor, University of Massachusetts Boston
Co-producing Coastal Resilience: The Stone Living Lab as a Collaborative Model for Testing Nature-Based Approaches

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1 Continuing Education Credit (CEC) is available to attendees

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Presented by:

NETWORK FOR ENGINEERING WITH NATURE
LimnoTech Water Environment Scientists Engineers
UNIVERSITY OF GEORGIA
ERDC

Questions? Please contact:
Sage Paris, LimnoTech
sparis@limno.com

From Reservoirs to Rivers: A Look at the Past Year of the Klamath River Renewal Project Restoration Journey

Network for Engineering With Nature

July 17, 2025

EWN Engineering With Nature®

res Restoring a resilient earth for a modern world

Presenter: Dave Coffman

Director, Northern California and Southern Oregon | Sr. Fluvial Geomorphologist

Overview

I. Background

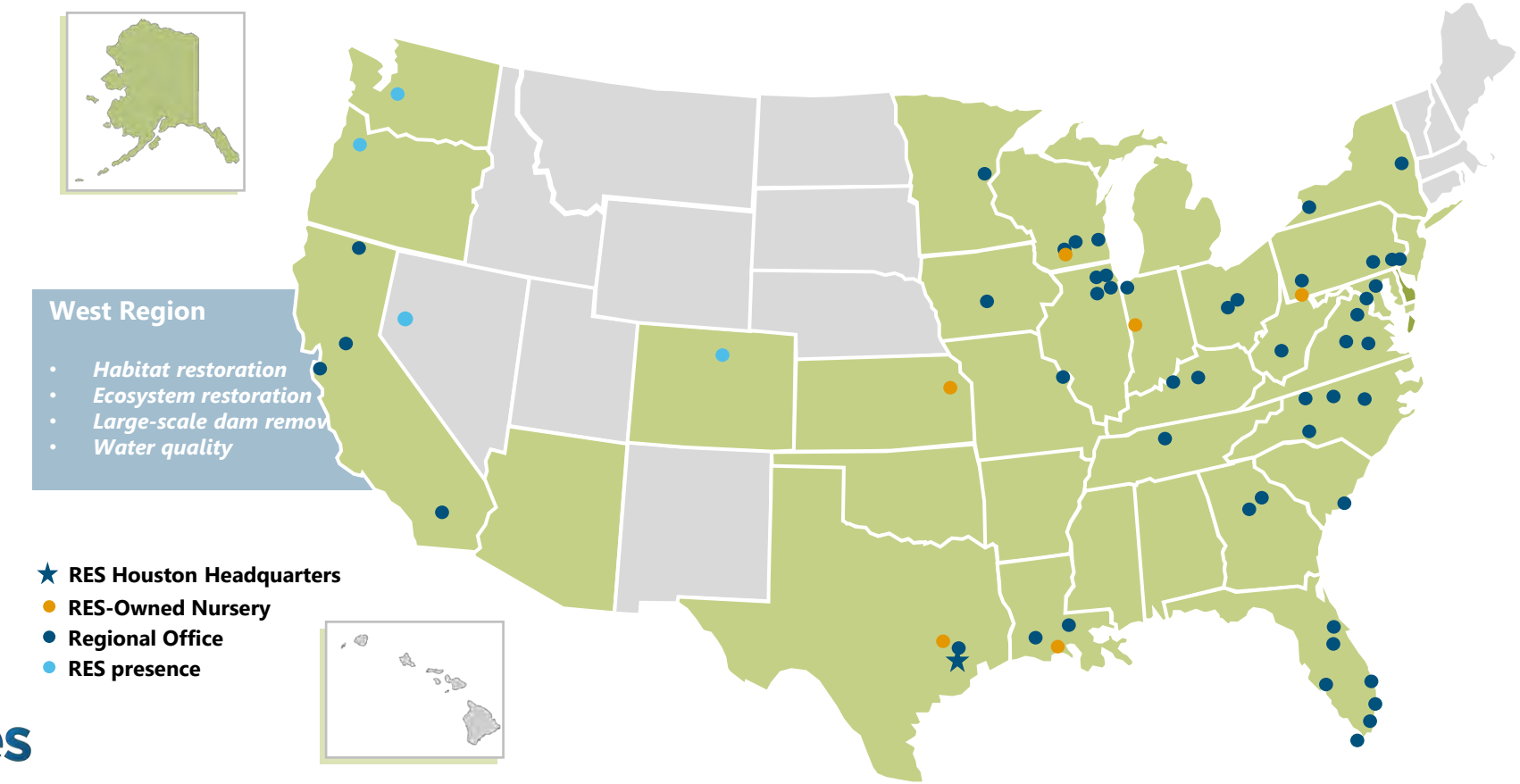
II. The year the dams came down

III. Restoration continues

RES Today

Understanding the needs of the resource, client, regulators, and stakeholders at the nation, regional, and local levels.

- In-state teams with locally experienced, industry-leading talent
- Backed by national experts across the ecological disciplines
- Over 900 dedicated staff in 40 operational hubs



Recognition

Fastest Growing

Inc. 5000

2010-2020

Project Merit Awards

Environmental Business Journal
Six-time Winner

Milestones

- **Founded 2007**
- **KKR investment, 2016**
- **Awarded largest PRM mitigation contract in U.S. history, 2018**
- **Onex/KKR investment, 2022**

Acquisitions

- **E Sciences, 2022**
- **Sandra Walters Consultants, 2022**
- **LECON, 2021**
- **Applied Ecological Services, 2021**
- **Blueway, 2020**
- **Redwing Ecological Services, 2020**
- **Carolina Environmental Contracting, 2020**
- **Apache Environmental, 2018**
- **Angler Environmental, 2016**
- **EBX, 2014**

RES' Role on the Project

- Restoration Designer & Contractor
- Supported the regulatory approvals process
- Implementation of biological resource protection measures
- Long-term monitoring and maintenance to meet performance criteria
- Performance Guarantee

Project Contributors

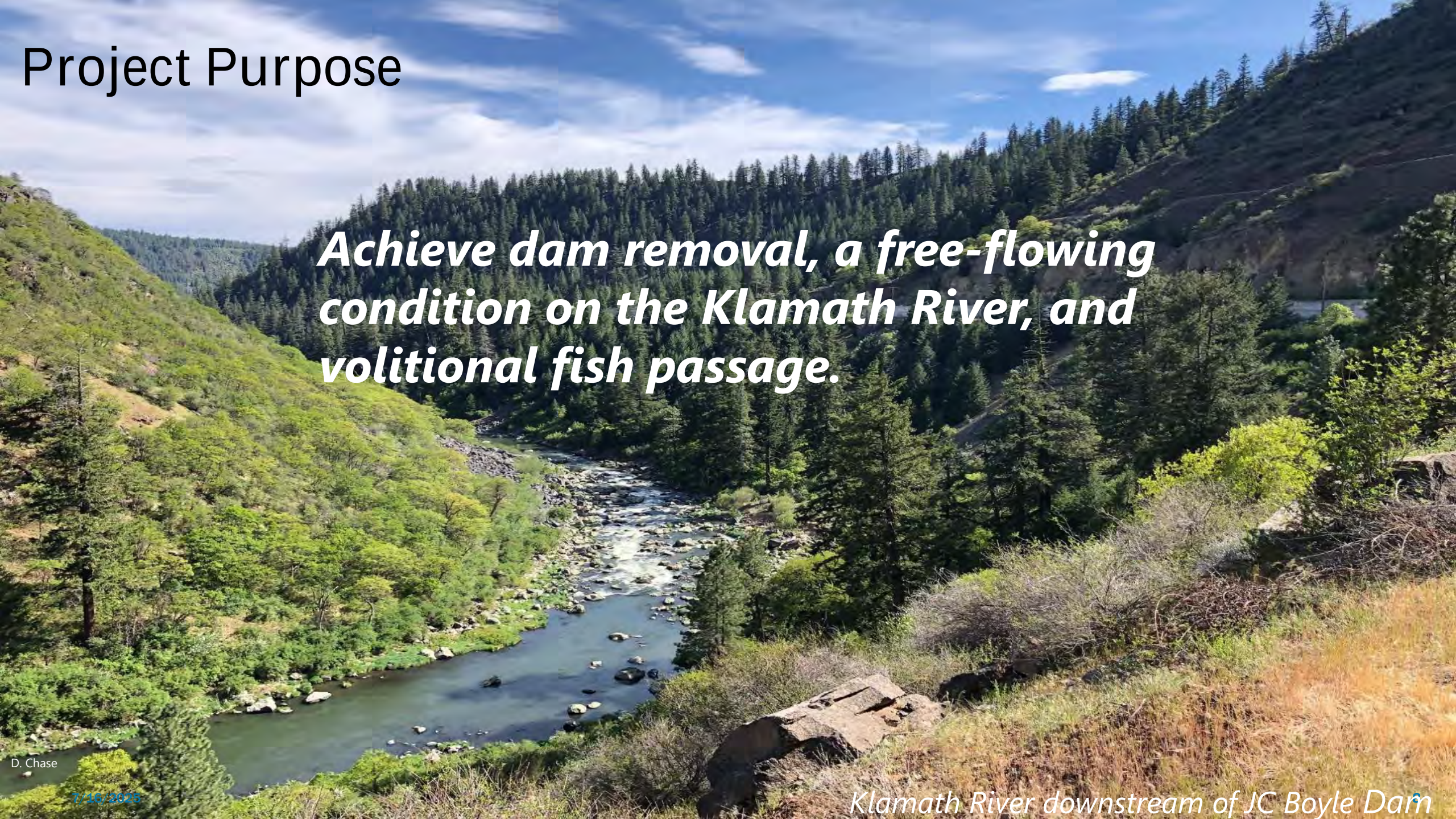
Advocating for Change

Dams impacted cultural ceremonies, practices, and culturally-significant resources

Photo: kqed.org/news/11622280/fish-blood-in-their-veins-but-few-salmon-in-their-river

Project Purpose

Achieve dam removal, a free-flowing condition on the Klamath River, and volitional fish passage.



D. Chase

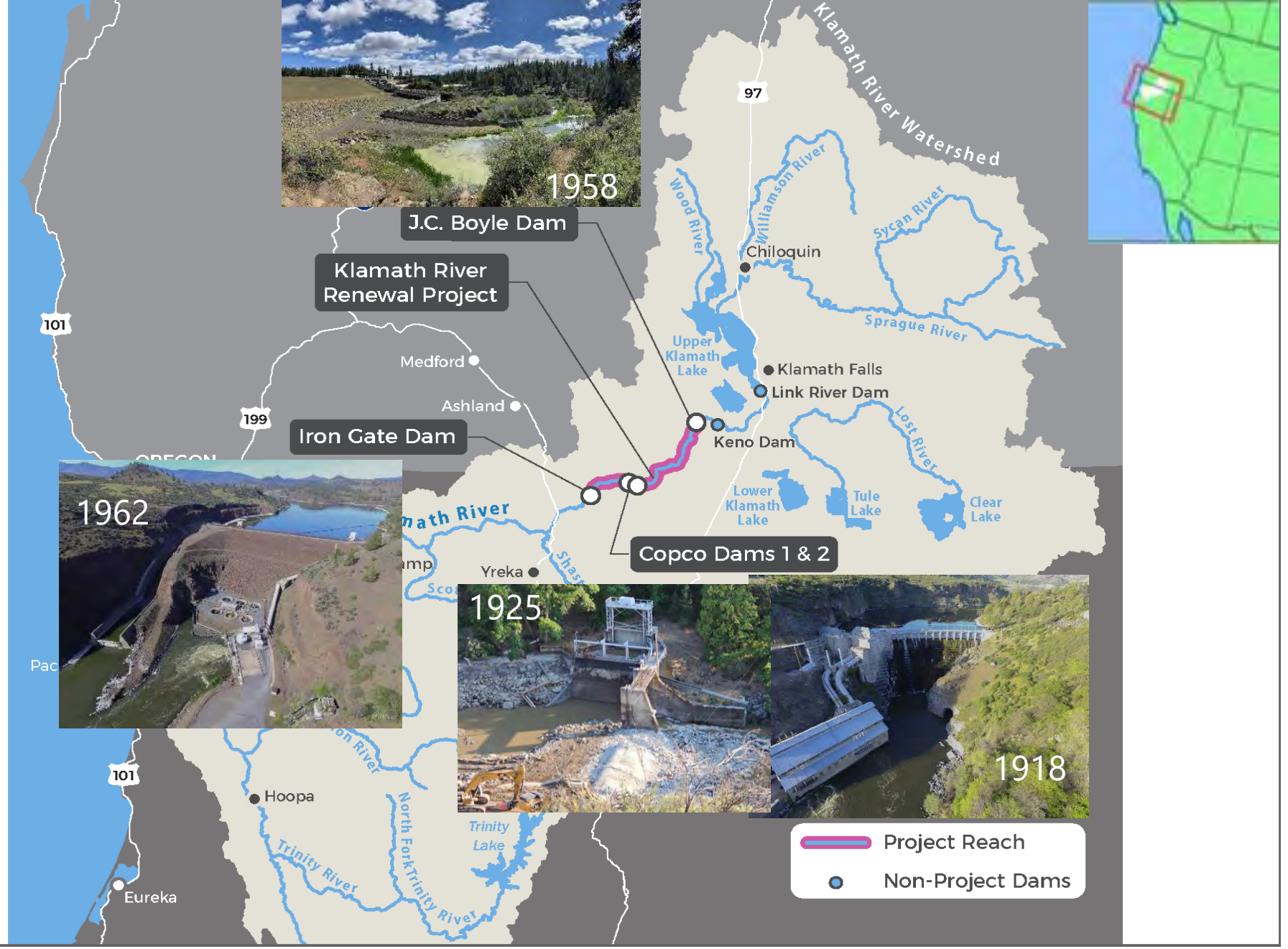
Klamath River downstream of JC Boyle Dam

Achieved Through

- Deconstruction of four hydroelectric dam facilities on the Klamath River:
  - J.C. Boyle Dam
  - Copco No. 1 Dam
  - Copco No. 2 Dam
  - Iron Gate Dam

These dams were not operated for flood control and did *not* provide water for agriculture or drinking water.

Photo: Dan Chase



Project Vicinity Map

Klamath River Renewal Project

Ecological Issues

- Reduced water quality
  - Toxic algae blooms in reservoirs
  - Below dams, increased temperature and decreased oxygen
  - Increased prevalence of fish health issues [e.g., *Ceratonova shasta, Ichthyopthirius multifiliis (*ICH*),* bacterial pathogen columnaris *(Flavobacter columnare)*]
- Imperiled Fish Populations
  - Threatened and endangered species
  - Tribal, commercial, and recreational fishing closures

Photo: Joe Cavaretta/ Associated Press in New York Times Aug 22, 2015

Algal bloom in Iron Gate Reservoir
Photo: EcoFlight; from: klamathrenewal.org

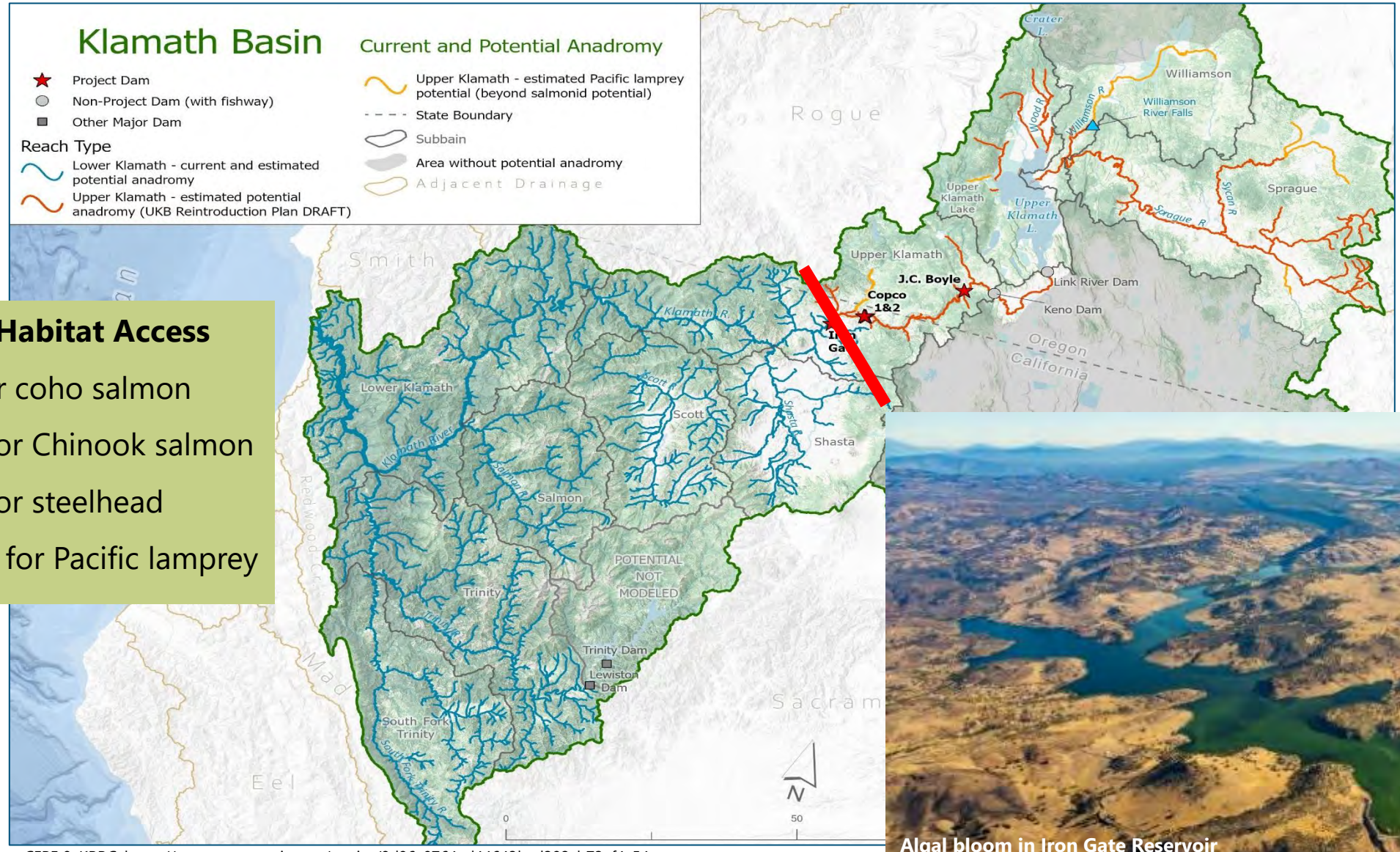
Algae sample.
Photo: Karuk Tribe; from: klamathrenewal.org

Ecological Benefits

- Improve water quality, water temperature, and flow
- Significantly reduce nuisance algae
- Sediment and debris transport
- Significantly reduce disease
- Restore access to historical habitat

Coho salmon
Photo: Karuk Tribe; from: klamathrenewal.org

Ecological Significance



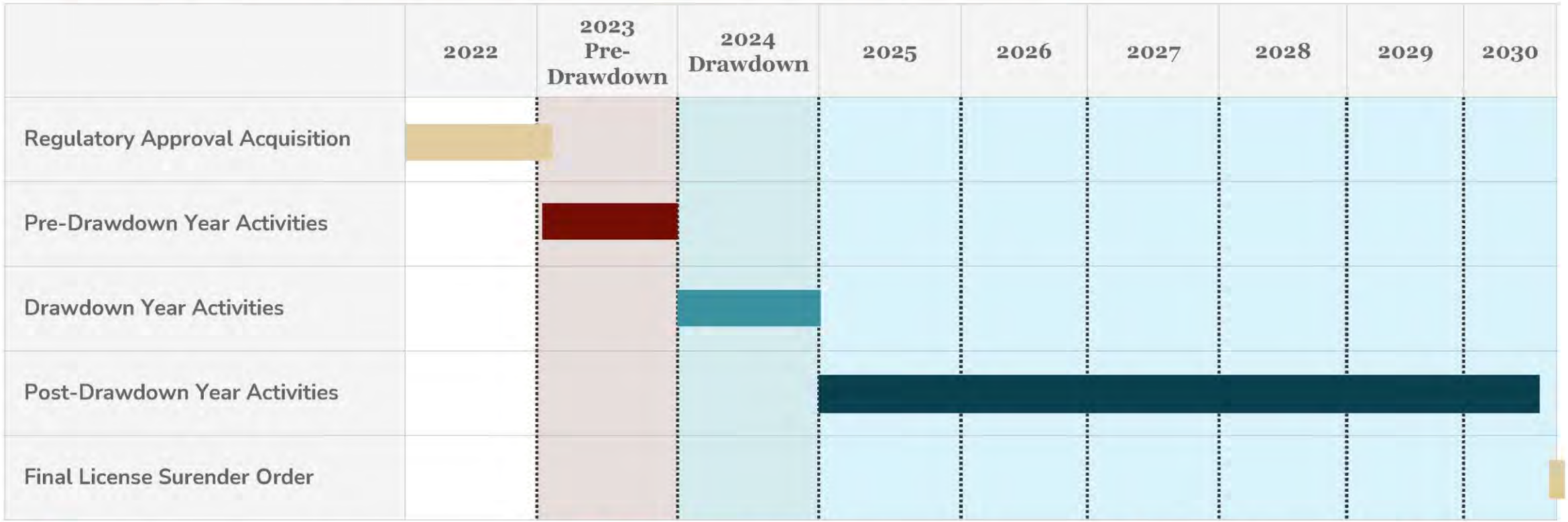
Restored Habitat Access

- 76 mi for coho salmon
- 300 mi for Chinook salmon
- 420 mi for steelhead
- >420 mi for Pacific lamprey

Algal bloom in Iron Gate Reservoir
Photo: EcoFlight; from: klamathrenewal.org

CFPF & KRRC: https://storymaps.arcgis.com/stories/8d96c0764ed44643bad392cb73ef4c54

Dam Removal Project Timeline



Pre-Drawdown Year:

- Dam/tunnel modifications
- Road/bridge improvements
- CoY Waterline Replacement
- Fall Creek Hatchery Construction
- Water Quality/Quantity Monitoring
- Copco No. 2 Dam Removal

Drawdown Year:

- Dam and infrastructure removal
- Initial reservoir restoration

Post-Drawdown Years:

- Site Restoration
- Monitoring/Adaptive Management

Regulatory: 70 + Approvals/Agreements

FEDERAL

15+

FERC, USACE, USFWS, NMFS, NEPA (3), NPS, BLM, EPA

STATE

30+

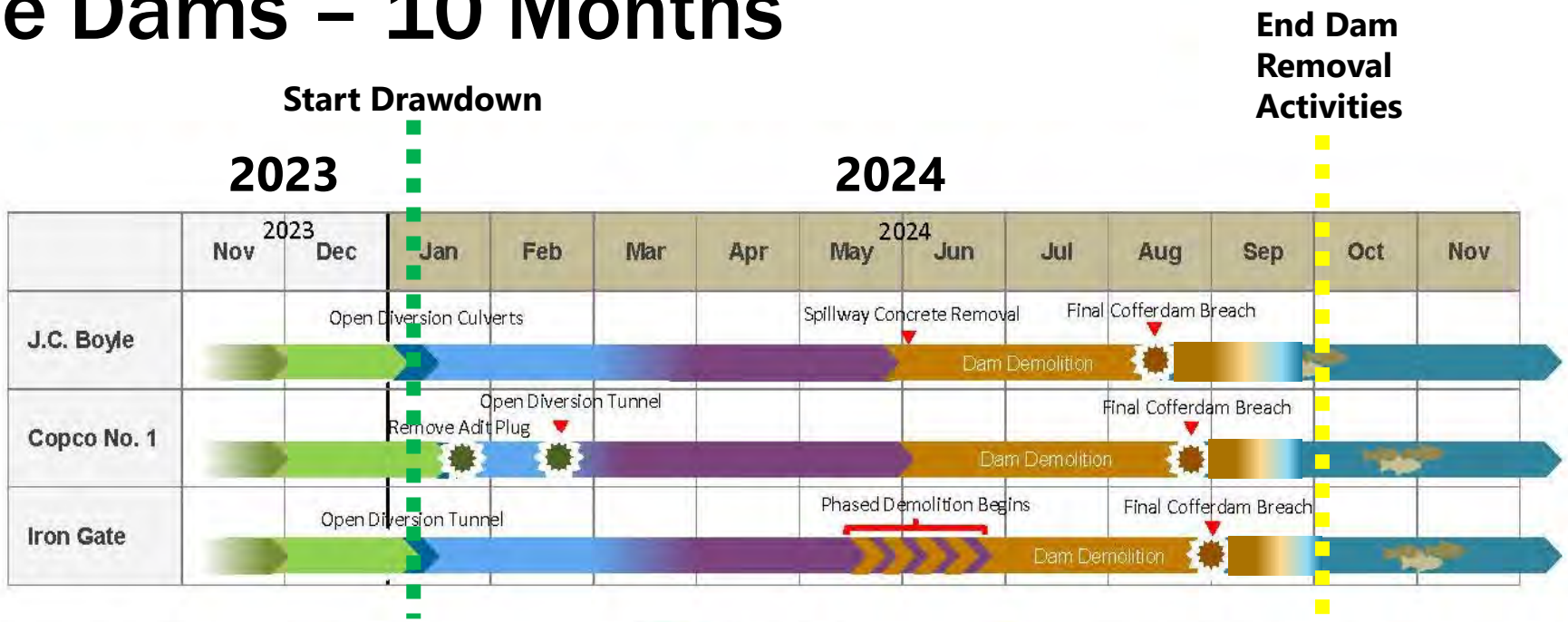
401s, DSOD, S106, NPDES, DSL, Clean Fill, Haz Waste, Coastal Comm, Fire, Dust, Air Quality, WQ Plans

COUNTY

25+

MOU's, Drilling, Haz Waste, Signs, Septic, Encroachments, Demo, Bridges, Wells, Waterlines

Three Dams – 10 Months



1. Operational Drawdown:
Lowering reservoir to its minimum operating level

2. Initial Drawdown:
Reservoir water evacuation below the Operational Drawdown limits

3. Reservoir Refilling and Releasing Period:
Inflows exceed outflow capacity periodically, causing reservoir levels to rise and fall

4. Dam Demolition:
Reservoir water elevation remains at the top of the historic cofferdam while dam concrete and embankments are removed

5. Klamath River Reconnection:
Breaching of the historic cofferdam, allowing the river to permanently flow in a riverine condition

Copco Dams 2 & 1 – Klamath River – June 2023

Copco Dam 1 – Klamath River – January 2024

Camp Creek - February 2024

Photo: Matt Mais, Yurok Tribe

Copco Dam 1 - March 2024

Photo: Swiftwater Films

Jenny Creek - April 2024

Iron Gate – Klamath River - May 2024

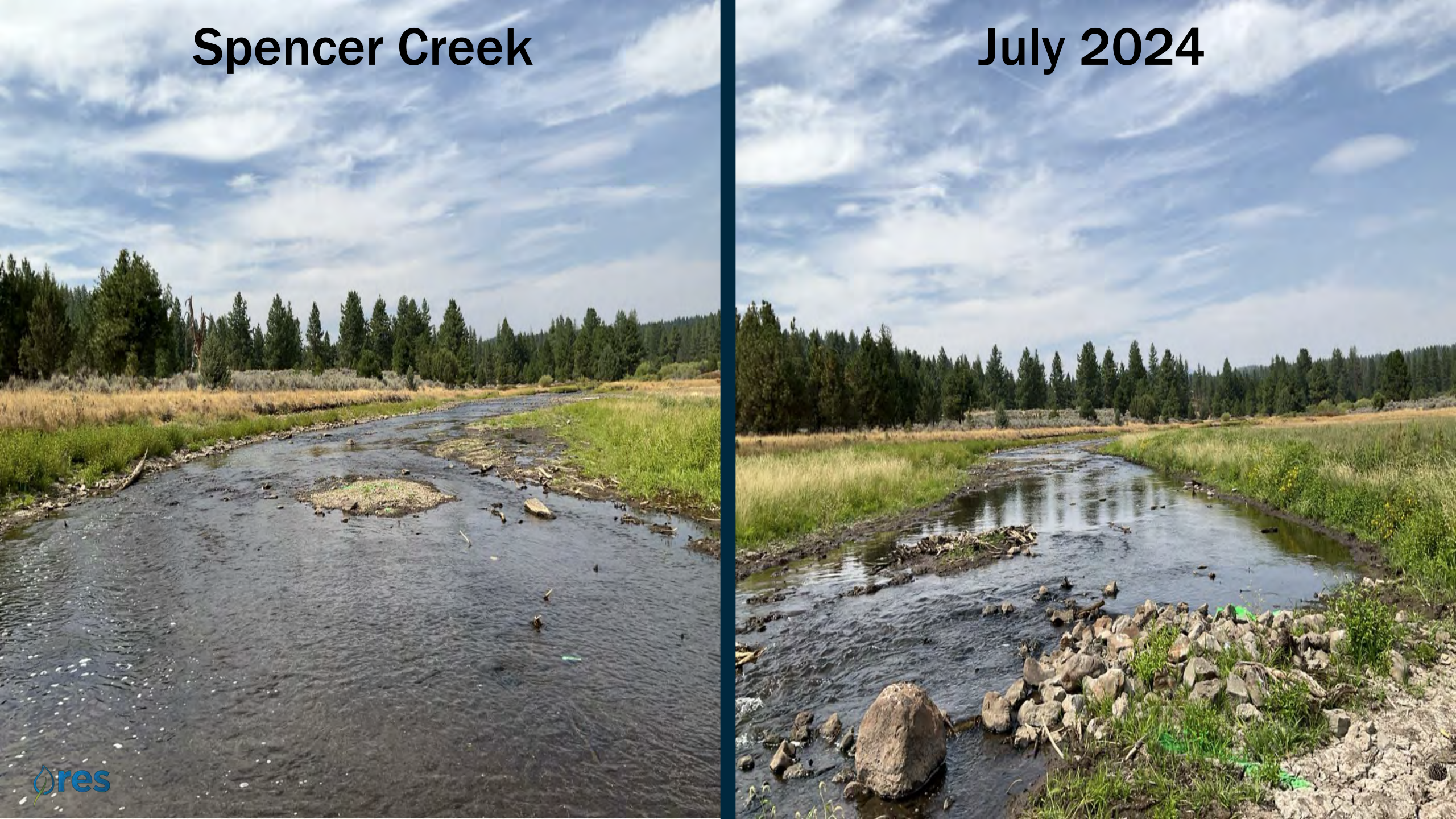
Iron Gate Dam - June 2024

JC Boyle Dam Breach - July 2024

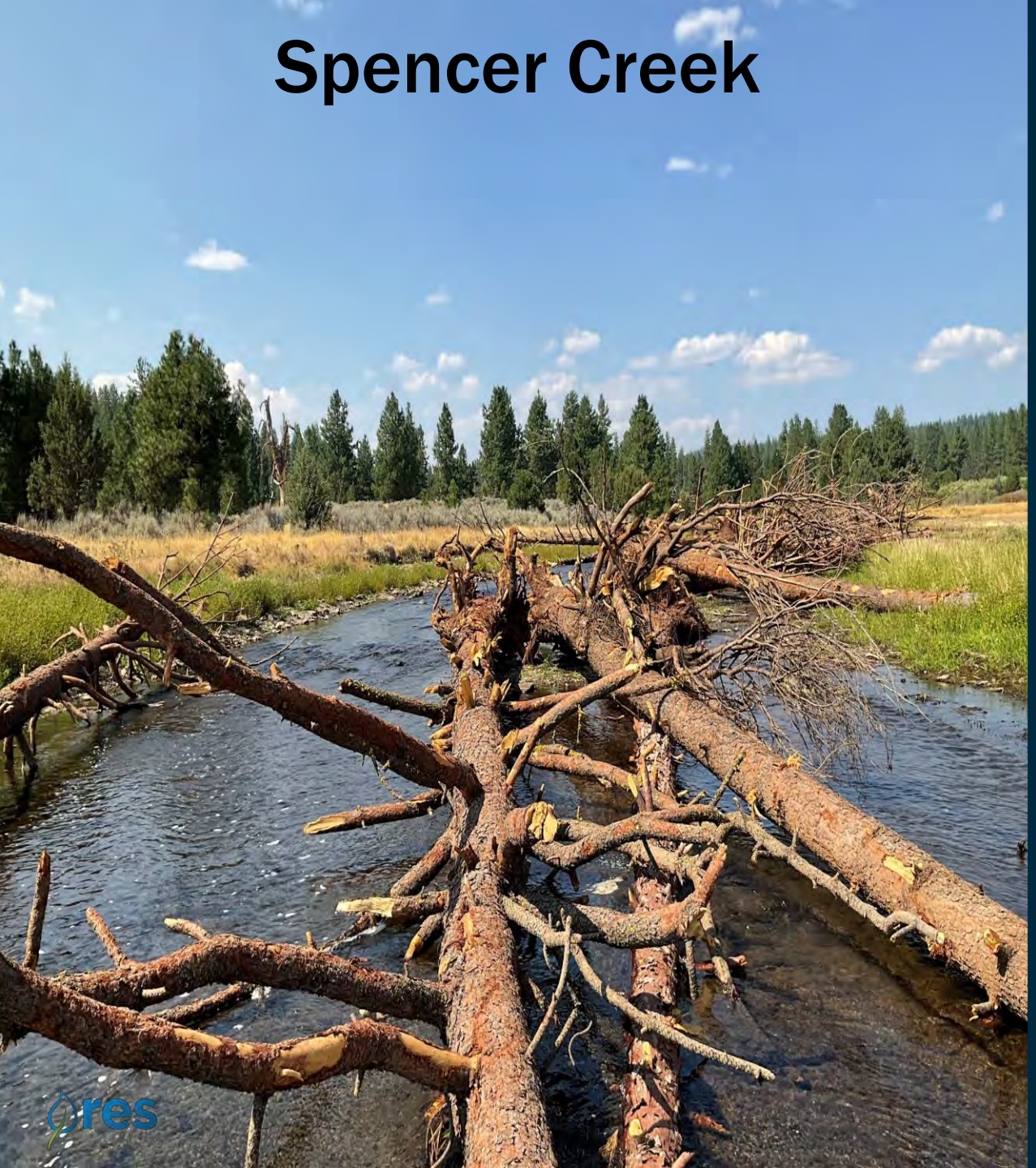
Photo: Swiftwater Films

Also July 2024… Iron Gate – Klamath River

Spencer Creek – Klamath River – August 2024


Spencer Creek
July 2024

Spencer Creek



August 2024


Copco 1 Dam - September 2024

JC Boyle – Klamath River - October 2024

JC Boyle – Klamath River - June 2023

JC Boyle – Klamath River - October 2024

Copco Valley – Klamath River - October 2024

Copco Dam 1 and Reservoir - September 2023

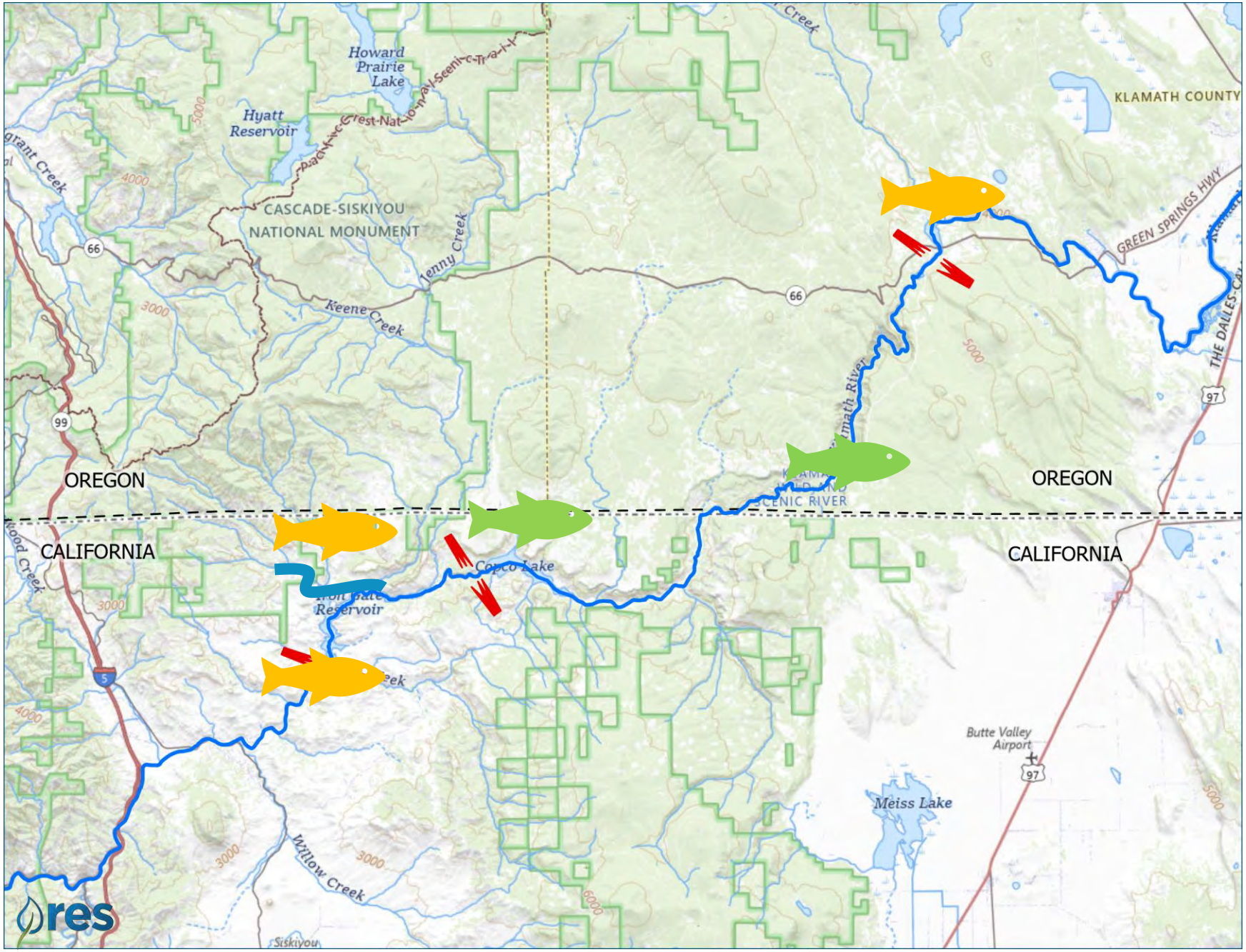
Copco Valley – Klamath River - October 2024

Iron Gate Dam Upstream View - January 2024

Former Iron Gate Dam Upstream View - October 2024

Jenny Creek – October 2024

Photo: Swiftwater Films



10/2 In-water work complete

10/1 Pacific lamprey detected in Jenny Creek

10/3 first Chinook passed Iron Gate

10/15 Chinook detected in Jenny Creek

10/16 Chinook detected in Spencer Creek, OR

12/5 Coho detected in Beaver Creek

12/19 Coho detected spawning in Oregon

Restoration Underway in Tributaries and Reservoir Footprints

Sediment Evacuation and Fish Passage Impediment Removal

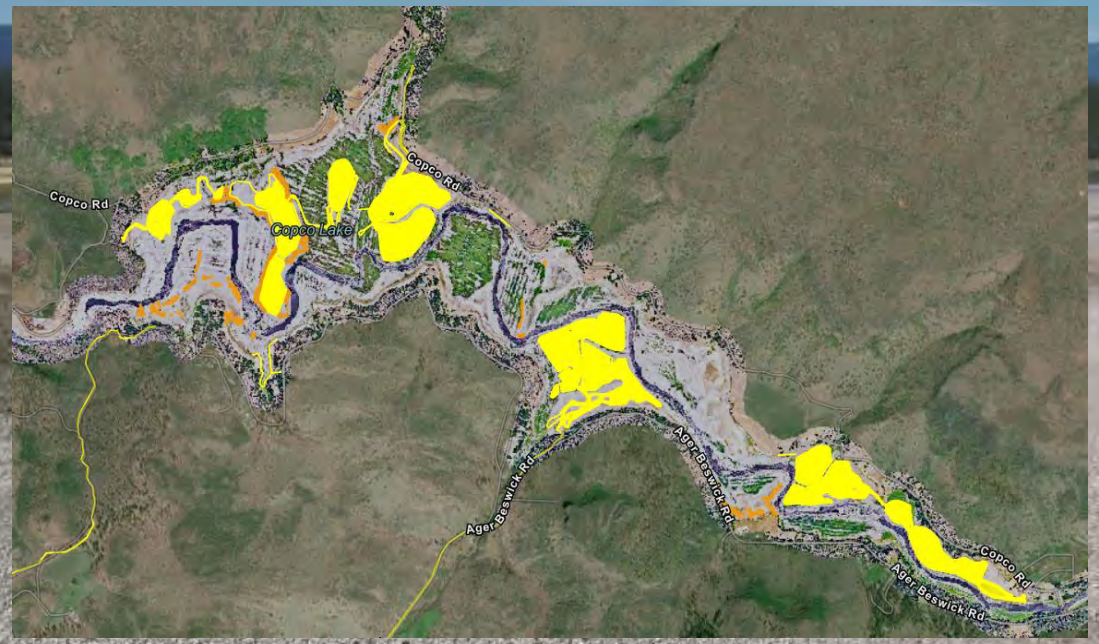
Revegetation Efforts

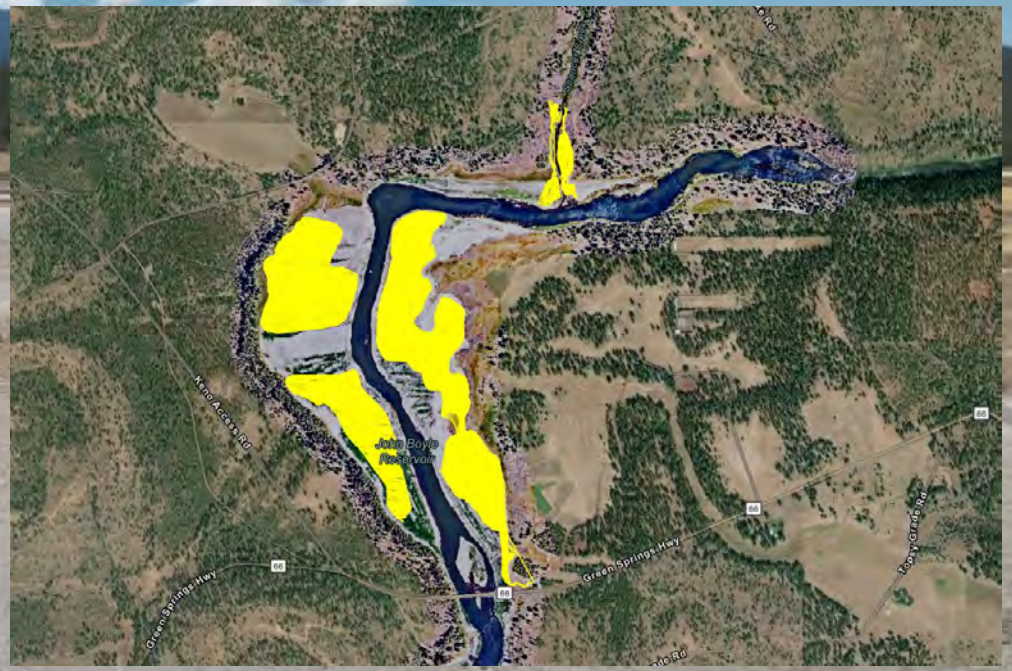
Large Wood Loading

Klamath River - Copco Valley – Copco Lake Footprint

Photo: Joel Ophoff

Seedbed Preparation





Seedbed Preparation at JCB, September 2024 Photo: Nathan McCanne

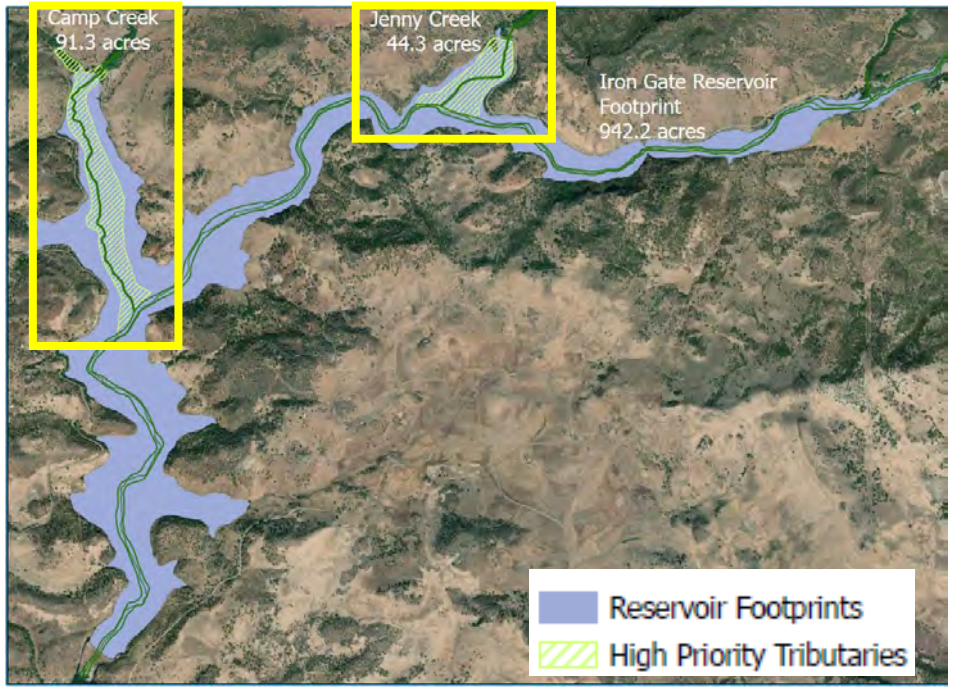
Former Copco Reservoir Footprint - March 2024

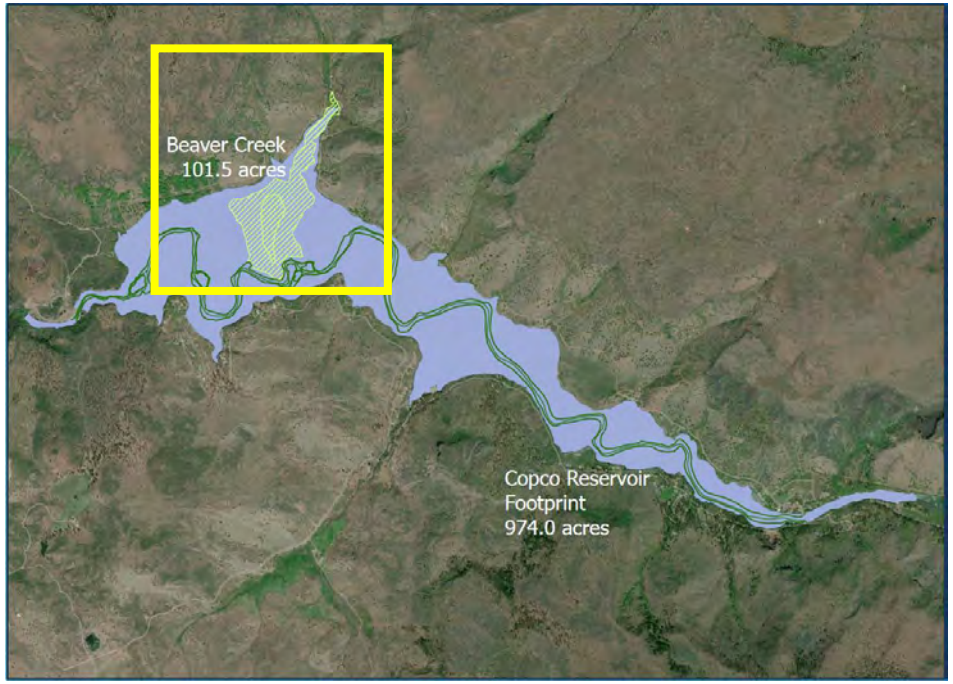
Former Copco Reservoir Footprint - March 2024

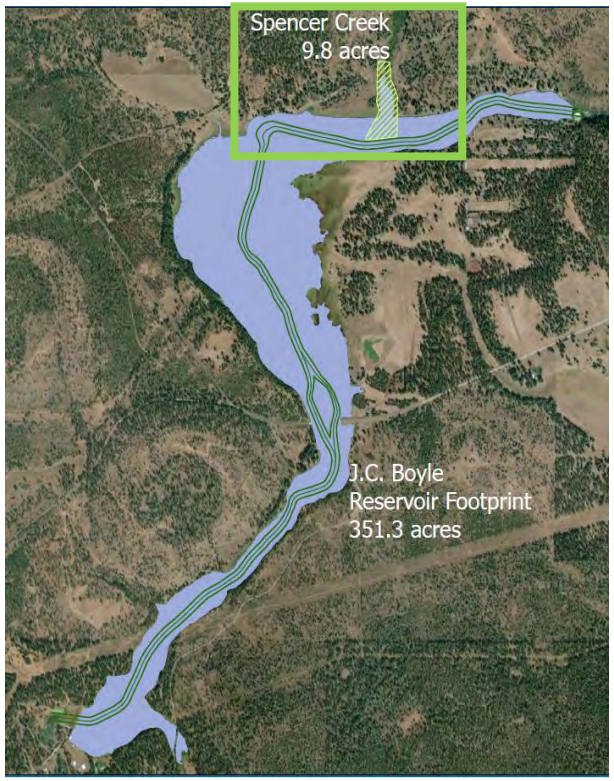
Former Iron Gate Reservoir Footprint - March 2024

Former Iron Gate Reservoir Footprint - March 2024

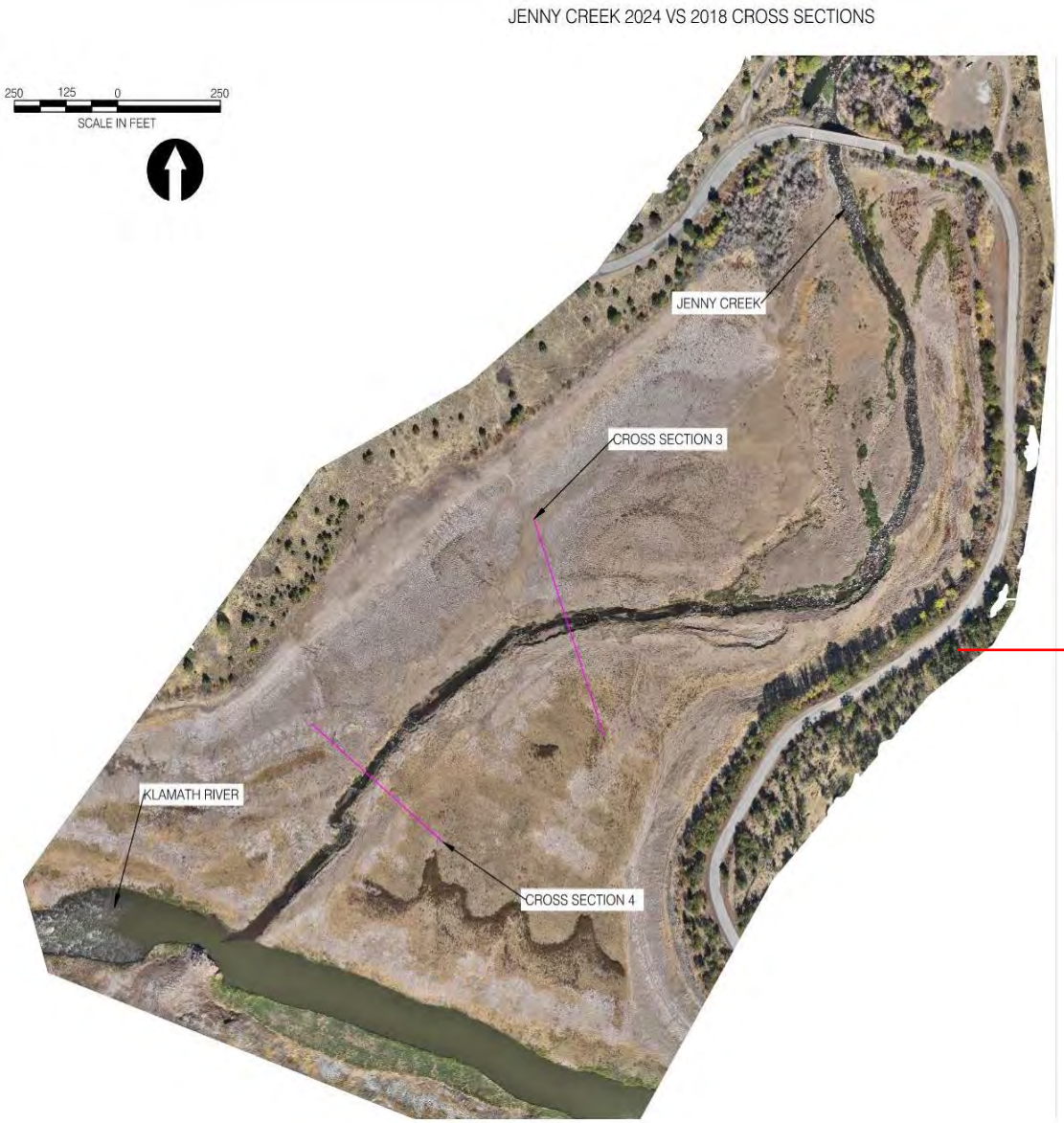
Tributaries and Reservoir Footprints







Jenny Creek Adaptive Design



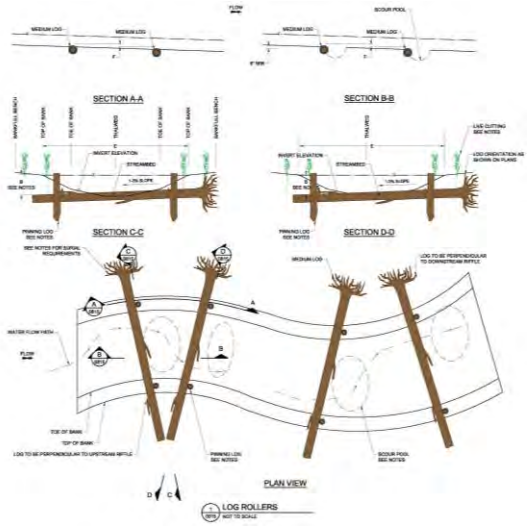
Adaptive Design Approach

By Improving and then Monitoring:

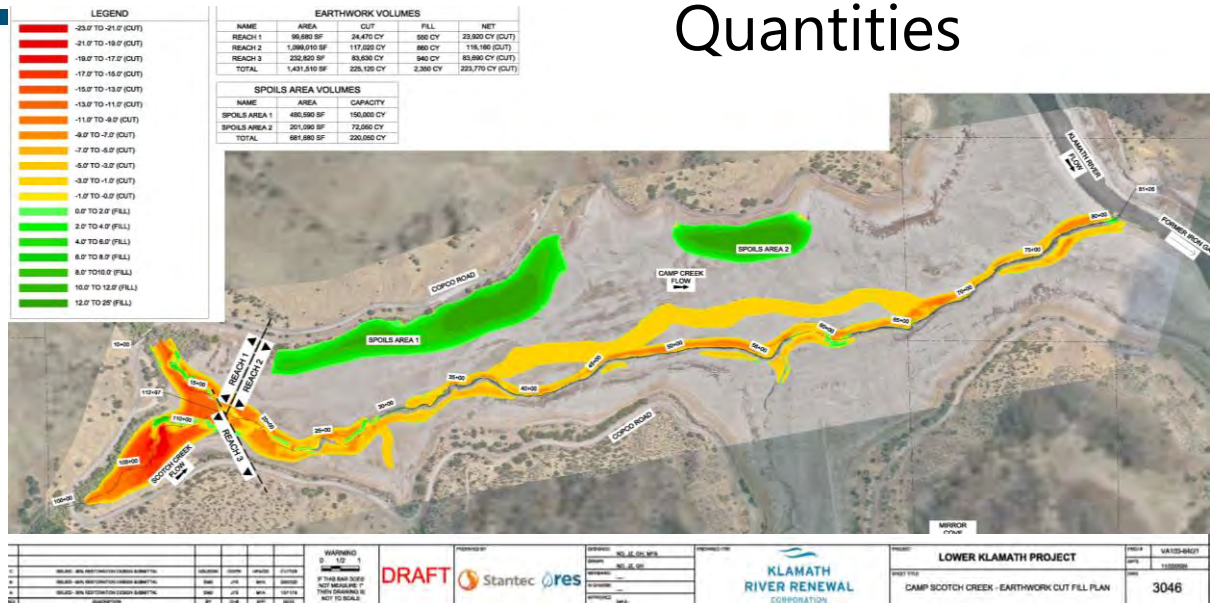
- Fish Passage
- Bank Stability
- Floodplain Connectivity
- Floodplain Roughness
- Channel Fringe Complexity

Design Progression

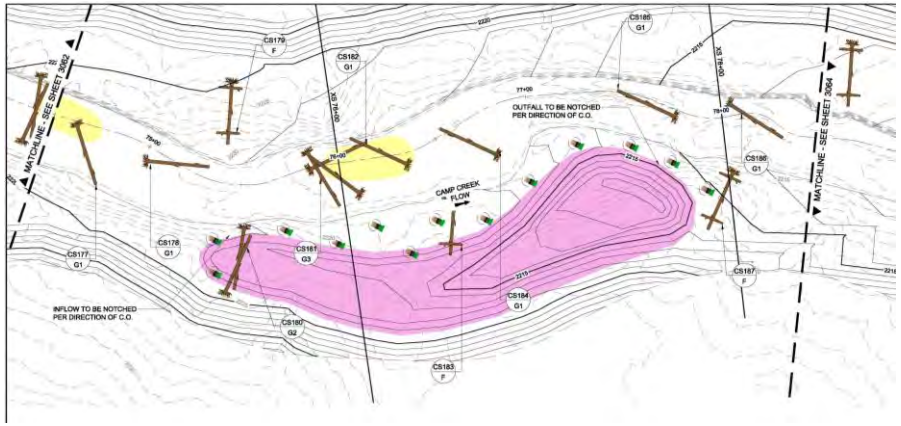
Features



Quantities



Placement



Sourcing

Verifcation

res

Tributary Restoration Construction Underway

Photo: Yurok Tribe Construction Company

Tributary Restoration Construction Underway

Photo: Yurok Tribe Construction Company

Tributary Restoration Construction Underway

Photo: RES

Ongoing Restoration Work

2025

- Data collection and field surveys
- Restoration work in priority tributaries
  - Floodplain grading
  - In-channel work
- Fall revegetation effort
- IEV management

RES Project Partners

KLAMATH RIVER RENEWAL CORPORATION

McMillen

Kiewit

SHASTA INDIAN NATION

CAMAS

Stantec

TROUT UNLIMITED

USGS

RDG RIVER DESIGN GROUP

Ross Taylor & Associates

CROMAN CORP

cbec eco-engineering

res

Molecular Time Capsule – eDNA Collection

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Article | Open access | Published: 01 July 2025

A molecular specimen bank for contemporary and future study captures landscape-scale biodiversity baselines before Klamath River dam removal

Dylan J. Keel ✉, Katie Karpenko, Scott M. Blankenship, Gregg Schumer, Oshun O'Rourke, Carl O. Ostberg, Daniel A. Chase ✉ & Jeffrey J. Duda

Scientific Reports **15**, Article number: 20679 (2025) | Cite this article

334 Accesses | **1** Altmetric | Metrics

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Dan Chase
Lead Fisheries Biologist
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Dave Meurer
Director of Community Affairs
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RES Klamath Story Map

Experience More

- Voice of America The Inside Story Video - Undamming the Klamath: https://www.voanews.com/a/7037728.html
- Social Impact Study – Stanford and Karuk Tribe: https://damremovalsocialimpact.com/
- Podcast: What it takes to take down a dam: https://podcasts.apple.com/us/podcast/what-it-takes-to-take-down-a-dam/id1712541201
- Amy Bowers Cordalis; Yurok Tribe - Bioneers Talk: The Water Remembers: Year Zero: https://bioneers.org/amy-bowers-cordalis-water-remembers-year-zero-zstf2504/

Klamath River – former Iron Gate Reservoir Footprint - May 2025

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