

Columbia River Zone 6 Delta Assessment

Columbia Gorge Fisheries & Watershed Science Conference
The Dalles, Oregon
April 16th, 2024

Technical Assistance Agreement
US Army Corps of Eng. – Portland District
Yakama Nation August 2022



Bill Sharp, Yakama Nation Fisheries Program



Ben O'Conner, USACE – Portland District



Charles Seaton, Columbia River Intertribal Fish Commission



Wind River Delta



White Salmon Delta



Klickitat River Delta

Columbia River Hydrosystem Sediment Impacts



Klickitat Delta.

- Prior to Bonneville Dam (1935) the Columbia River transported 16.4 million tons of sediment each year.
- Despite a significant increase in soil runoff from agriculture and other human development, only around 8 million tons of Columbia River sediment reaches the Pacific Ocean each year.
- These changes are particularly noticeable at the mouths of tributaries in the impounded pools.
- Where still water of a reservoir can no longer carry much sediment, which quickly settles, creating a sediment fan or delta.
- Significant deltas have formed at mouths of the Klickitat, Hood, White Salmon, Wind, and Deschutes Rivers.

Sediment Negatively Impacts Treaty Fishers

- Sediment can impede both scaffold-based and boat-based tribal fishers.
- Traditional fishing holes become filled in.
- Navigation hazards are created:
 - Sand bars appear in new locations.
 - Changes to the river flow create unpredictable currents, increasing risk for fishers.
- Build-up at in-lieu treaty sites restricts access to docks and boat launches.

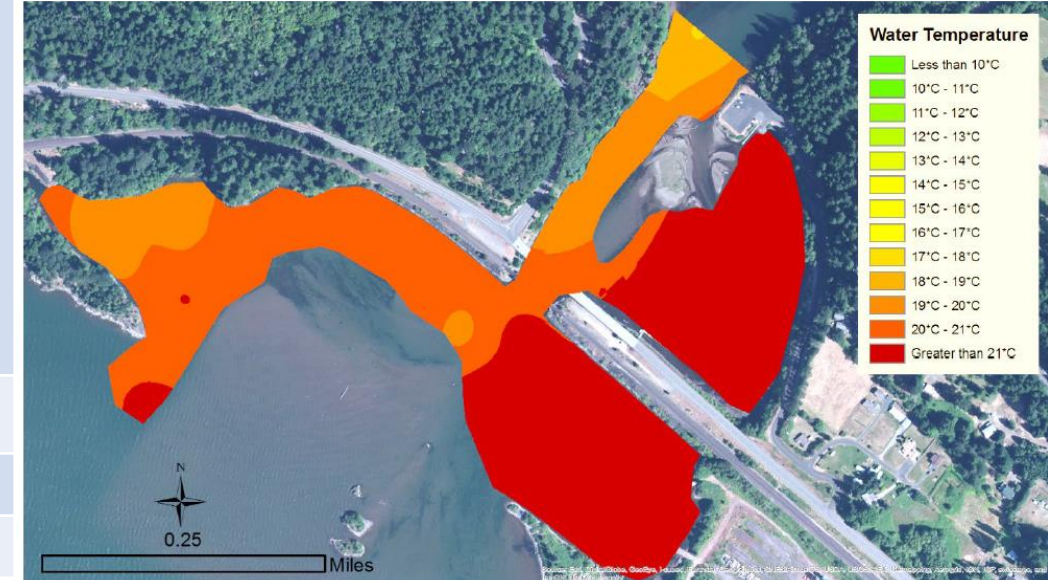


EPA's 2021 Columbia River Cold Water Refuges Plan

| Zone 6 Hydro Dams | River Mile | Dist. to upriver dam | EPA Priority CWR w/in Zone 6 Refuge Volume— ranking (1-13) |
|-------------------|------------|----------------------|---|
| Bonneville Dam | 146 | 46 | Little White Salmon River (2 nd) Klickitat River (5 th) Herman Creek (6 th) White Salmon River (7 th) Wind River (8 th) Hood River (11 th) |
| The Dallas Dam | 192 | 24 | Deschutes River (3 th) |
| John Day Dam | 216 | 76 | None |
| McNary Dam | 292 | | |

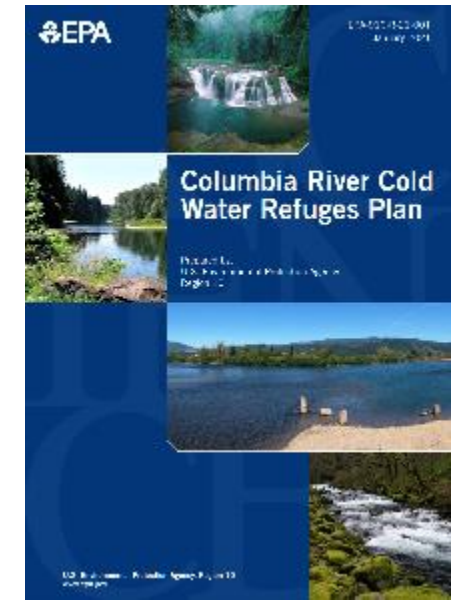
Figure 16. Wind River and Columbia River Confluence – Model Water Temperature at Various Depths for August, 15, 2016.

Depth - 0.5 m



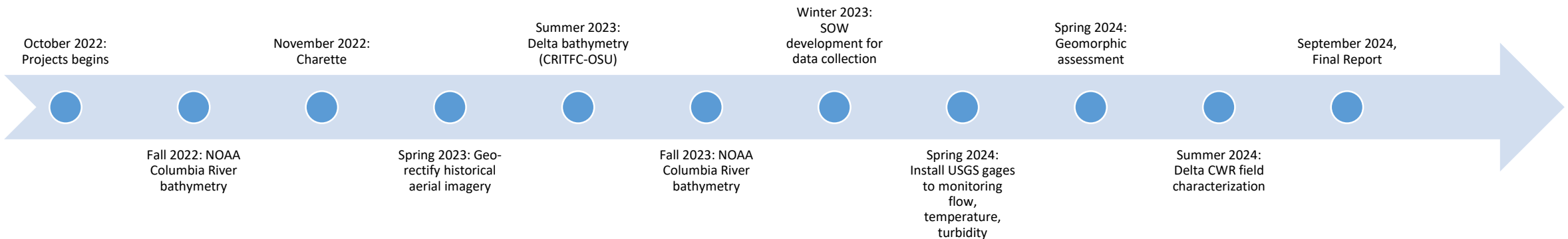
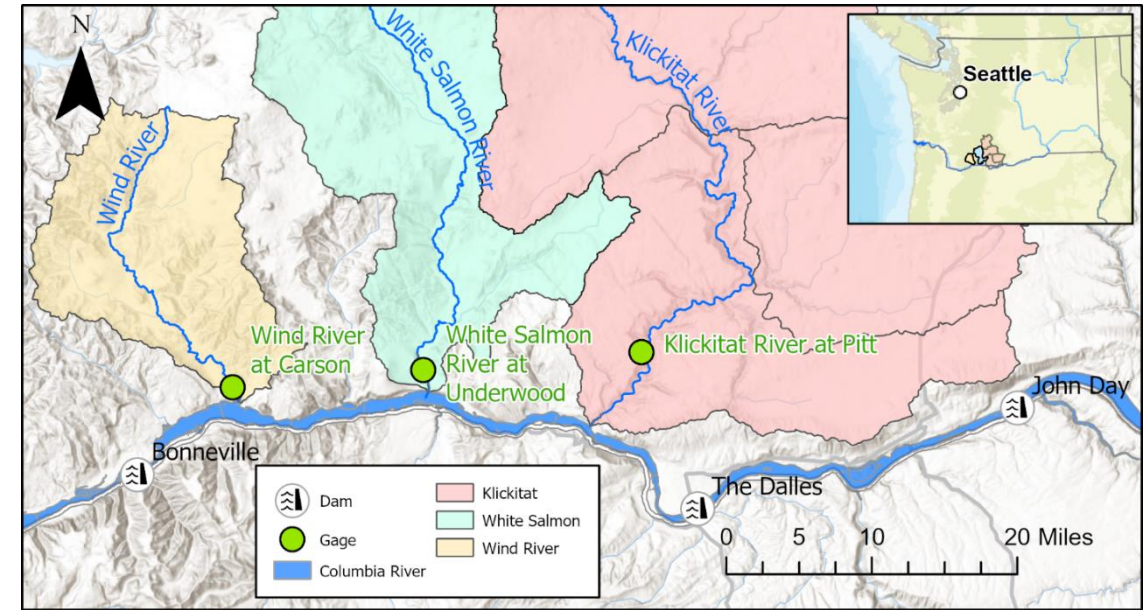
Zone 6 Col. River summer temps. are predicted to rise. August mean temps are predicted to be near **23°C by 2040 and ~24°C by 2080.**

- Optimal adult migration, 12-16°C. Adverse effects begin above 18°C and w/ exposure time.
- State water quality criteria, 20°C max. for Zone 6 of the Columbia River.



USACE delta assessment study

- Yakama Nation (YN), Columbia River Inter-Tribal Fish Commission (CRITFC), and U.S. Army Corps of Engineers (USACE) initiated planning study to assess sedimentation impacts to cold water refuges in the delta regions of Columbia River tributaries.
 - Planning charette
 - Geomorphic assessment
 - Data synthesis
 - Data collection
 - Establish background information that could be used to support future development of models, restoration designs, management strategies



Charette

- November 3-4, 2022, Bingen, WA
 - Approx. 50 attendees over two days
 - Tribal, Federal, State and Local agencies and stakeholder participation.
- Brainstorming activities on
 - Delta-specific problem statements and questions
 - Opportunities and constraints
 - Available resources (data, studies, plans)
 - Future goals and objectives
- Themes emerged along topics concerning
 - Watershed actions to limit upstream sediment loads
 - Modifications to delta regions
 - Dredge to make deeper CWR areas, reduce predation
 - Embayment features to retain cold tributary waters
 - Need for data collection, synthesis, and model generation to assess historical, current, and proposed conditions

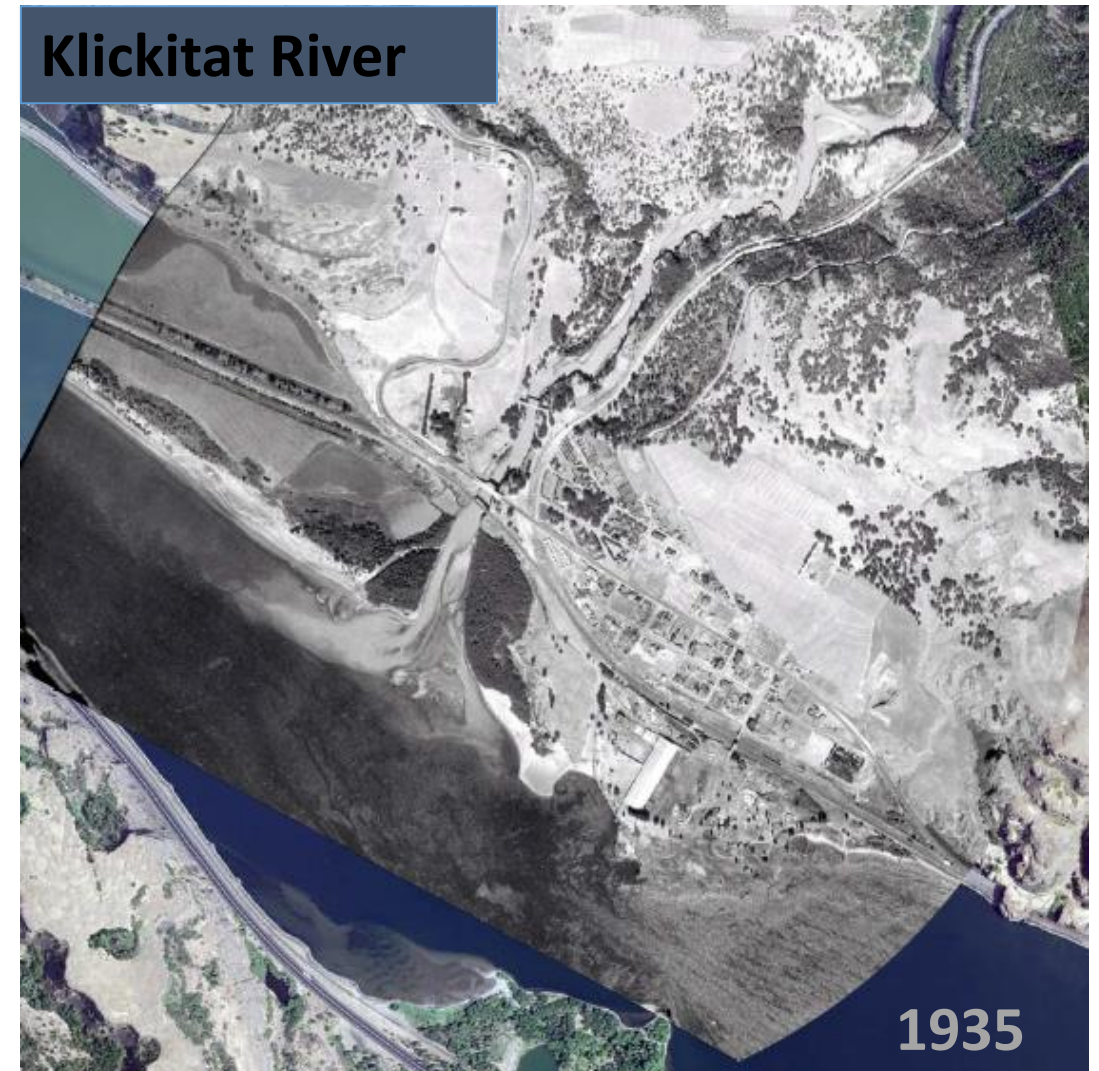
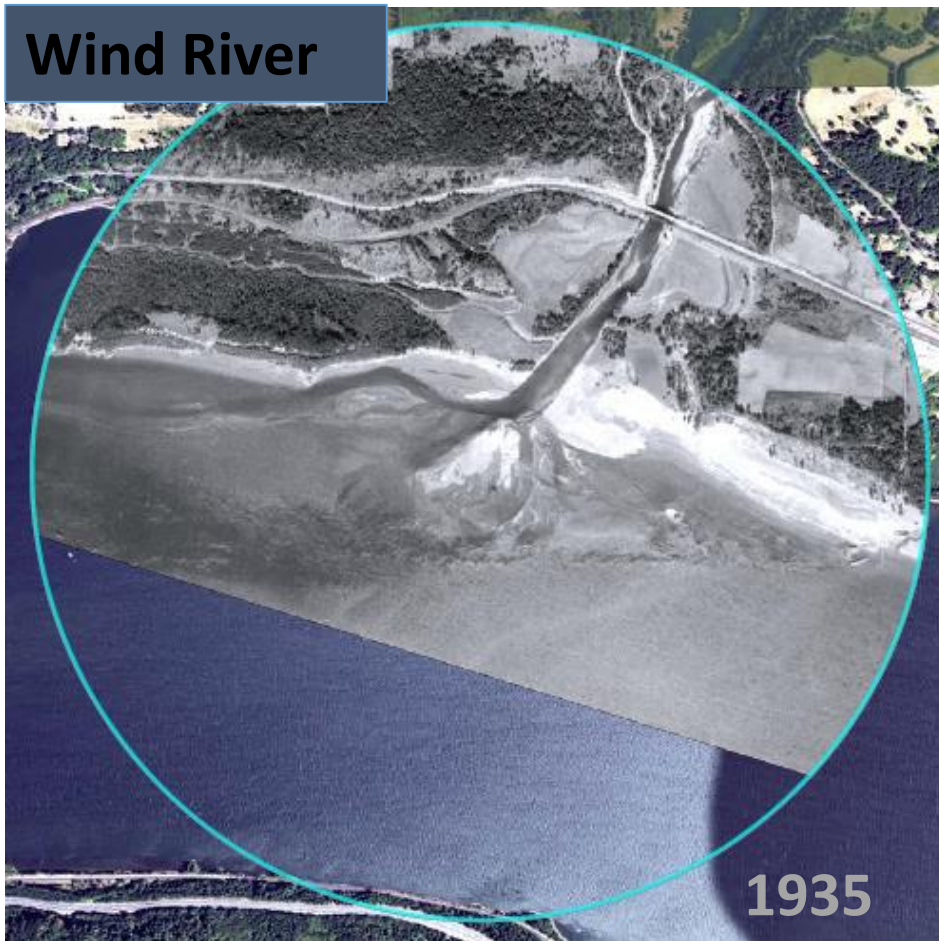
Group 3 - Klickitat Visioning



Geomorphologic Assessment

Qualitative assessment on the physical changes to tributary delta regions

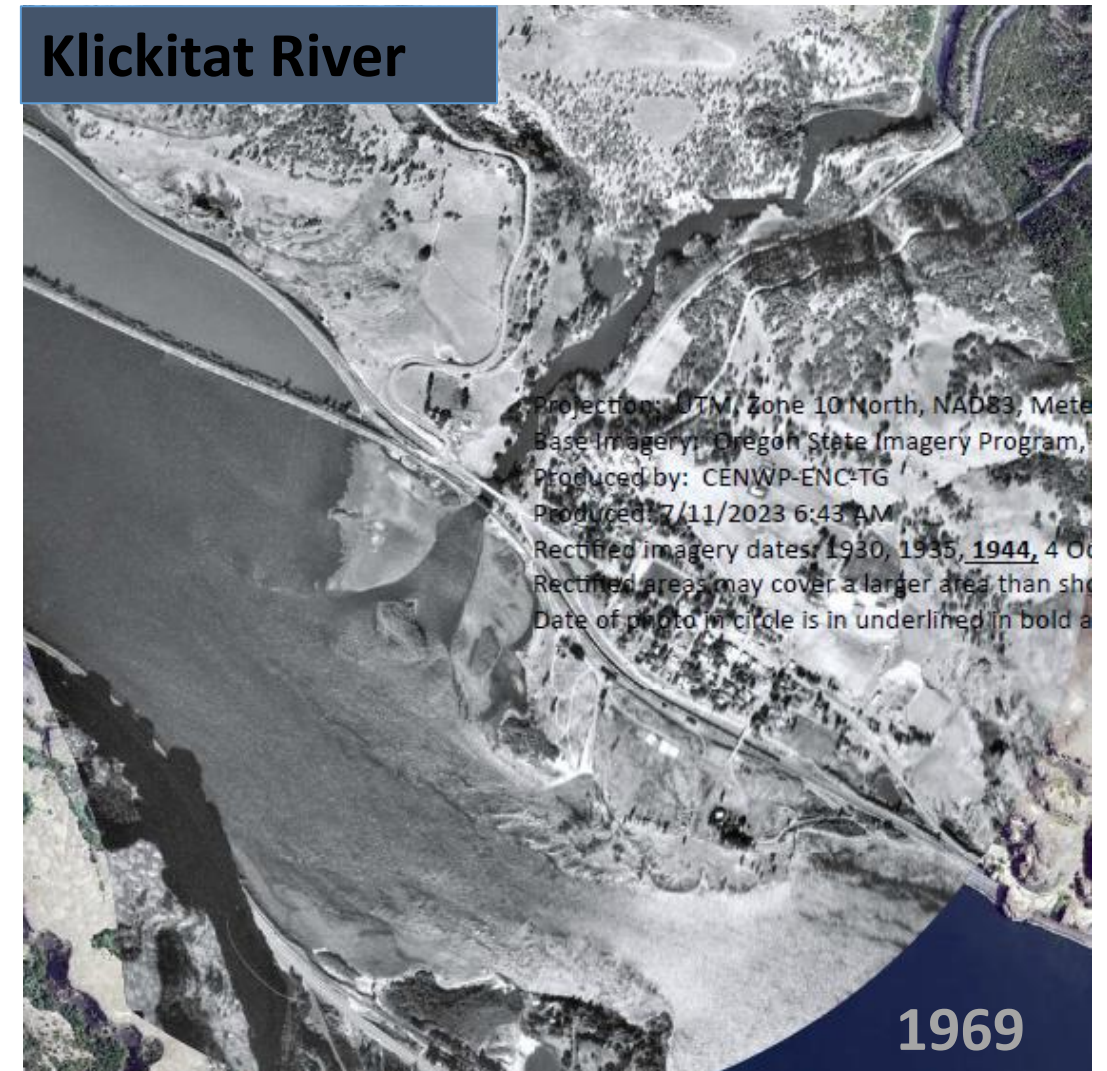
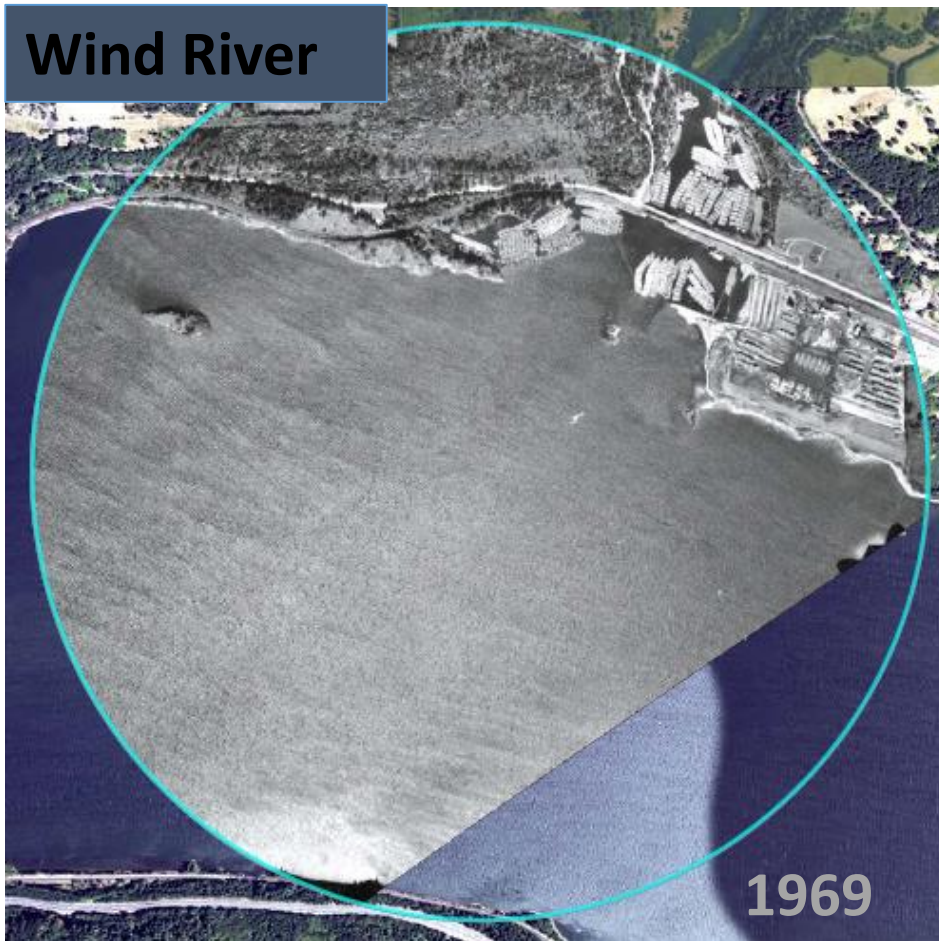
- Geo-rectify historical aerial imagery over time (Complete)
- Assess pre- and post-dam conditions (In Progress)



Geomorphic Assessment

Qualitative assessment on the physical changes to tributary delta regions

- Geo-rectify historical aerial imagery over time (Complete)
- Assess pre- and post-dam conditions (In Progress)



Data Synthesis and Collection

- Data Synthesis

- Sources include USGS, USEPA, USACE, CRITFC, YN, NOAA, WA Dept. Ecology, WA Dept. Fish and Wildlife, Columbia River DART, NMFS, USFS NorWeST, OSU, UCD

- Water temperature, flow, depth, suspended sediment, turbidity, fish metrics, bathymetry, topography, imagery, habitat characterization

- Data types include gage timeseries, synoptic sampling, research studies, planning reports, surveys, remote sensing

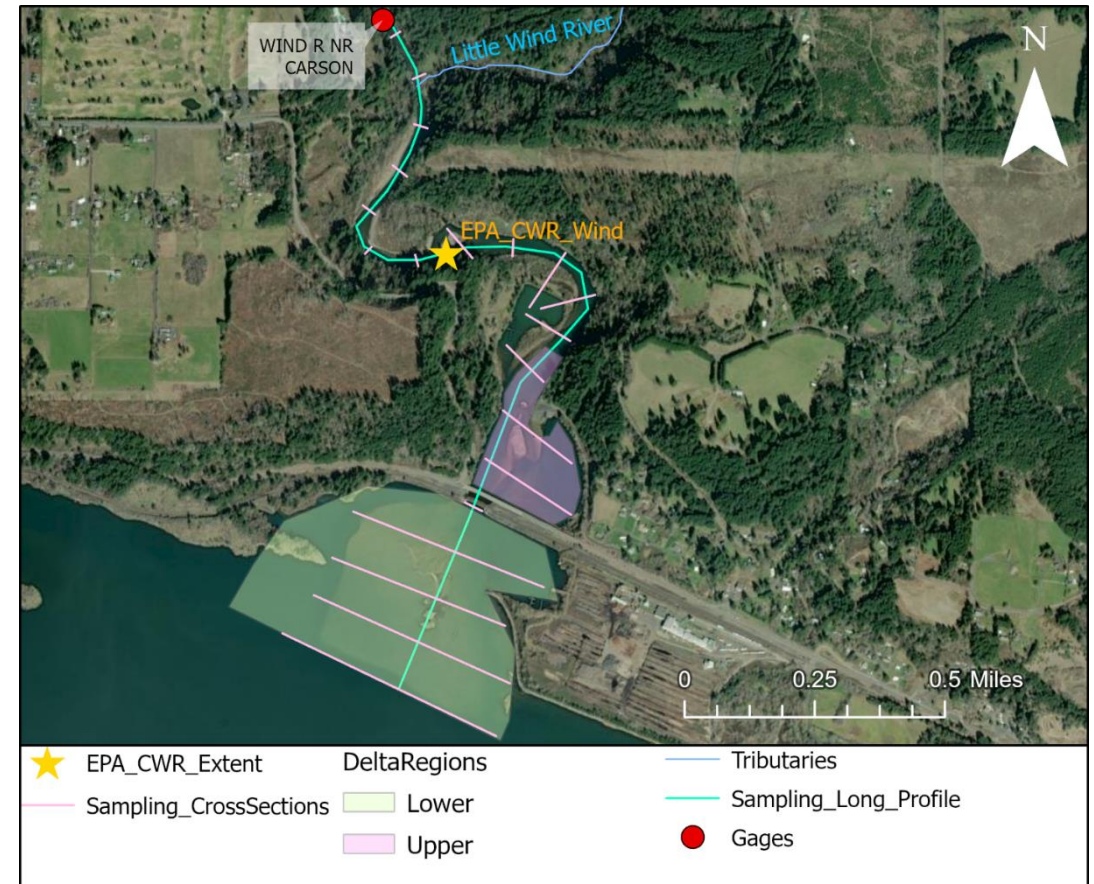
- Data Collection

- Scope and funding set for USGS to install turbidity and temperature sensors in May 2024 at

- Wind River near Carson (14128500)
- White Salmon near Underwood (14123500)
- Klickitat River near Pitt (14113000)

- Scope development for August 2024 synoptic sampling

- Temperature depth and cross sections
- Water depths
- Sediment characterization



Outcomes, Key questions & next steps

- Main outputs from Delta Assessment Study
 - Historical context on how Bonneville Pool and previous flood events have affected sedimentation in the CWR habitats
 - Characterize current physical conditions of CWR habitats
 - Establish continuous monitoring of tributary flows, water temperature, and turbidity
 - Set up for future projects to establish suspended sediments-turbidity correlation
 - Establish data sets needed for modeling efforts to guide management and restoration

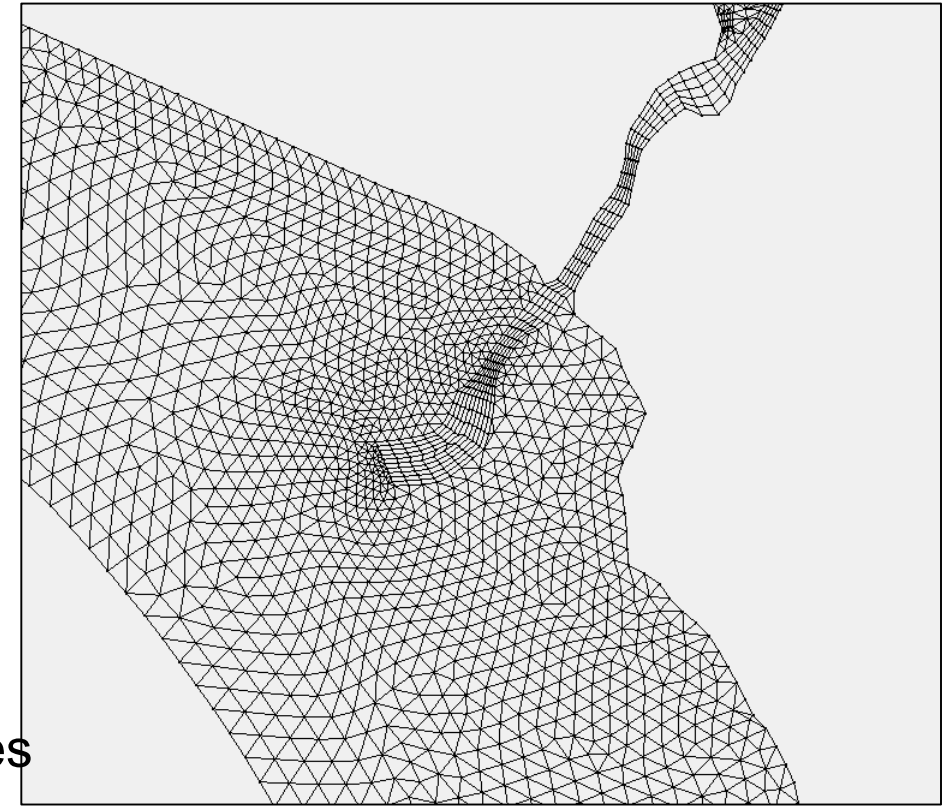
Future uses of the Delta Assessment Study information and key questions that can be addressed

- What are the opportunities for restoration or modification of the delta areas?
- Define the types of modifications that need to be considered to provide ecological benefit
- How does sedimentation interact with/impact the federal navigation channel?
- Understand potential upstream modifications that reduce sediment load.
- Further refine mapping of the cold-water plume.

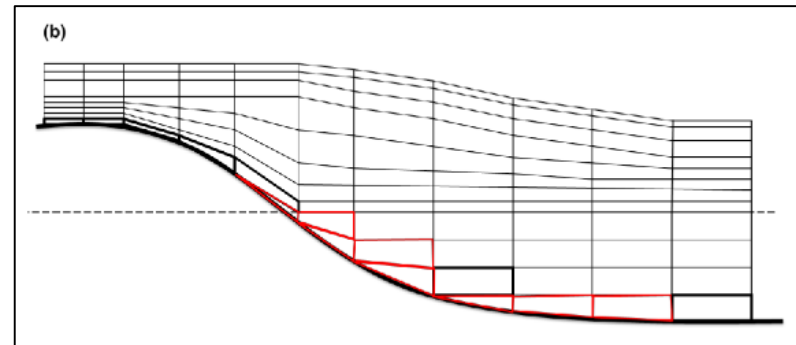
CRITFC-CMOP modeling of the deltas

- CRITFC's Coastal Margin Observation and Prediction program (CMOP) has extensive experience with 3-D hydrodynamic modeling below Bonneville dam
- The same modeling methods (SCHISM) can be applied in Zone 6 to evaluate potential modifications to the deltas
- 3-D modeling requires detailed bathymetry

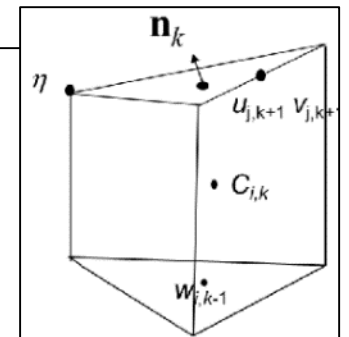
We model:
Using triangles
and quadrangles



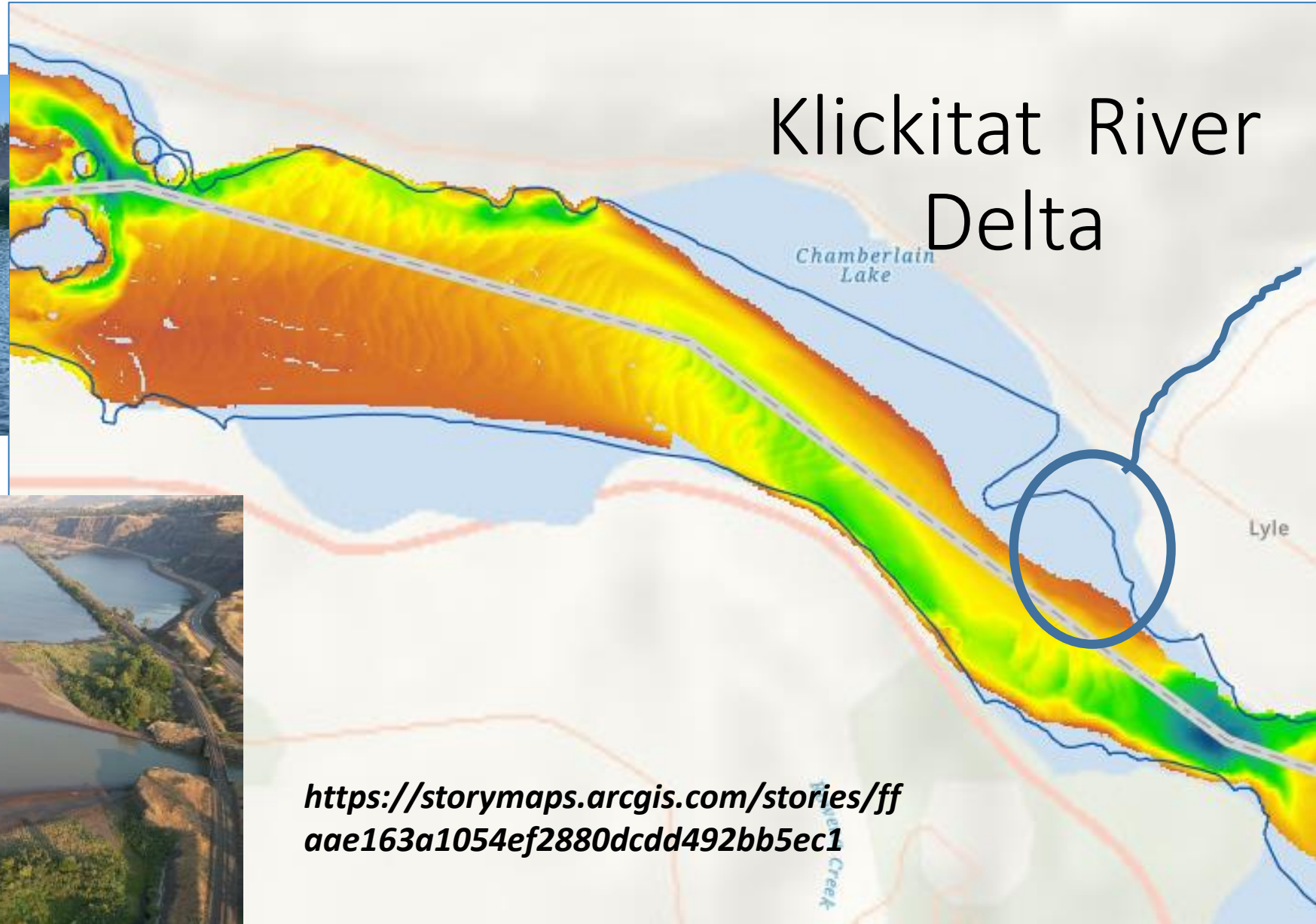
In vertical stacks



... the world as prisms



NOAA-Office of Coast Survey. 2022 bathymetry coverage.



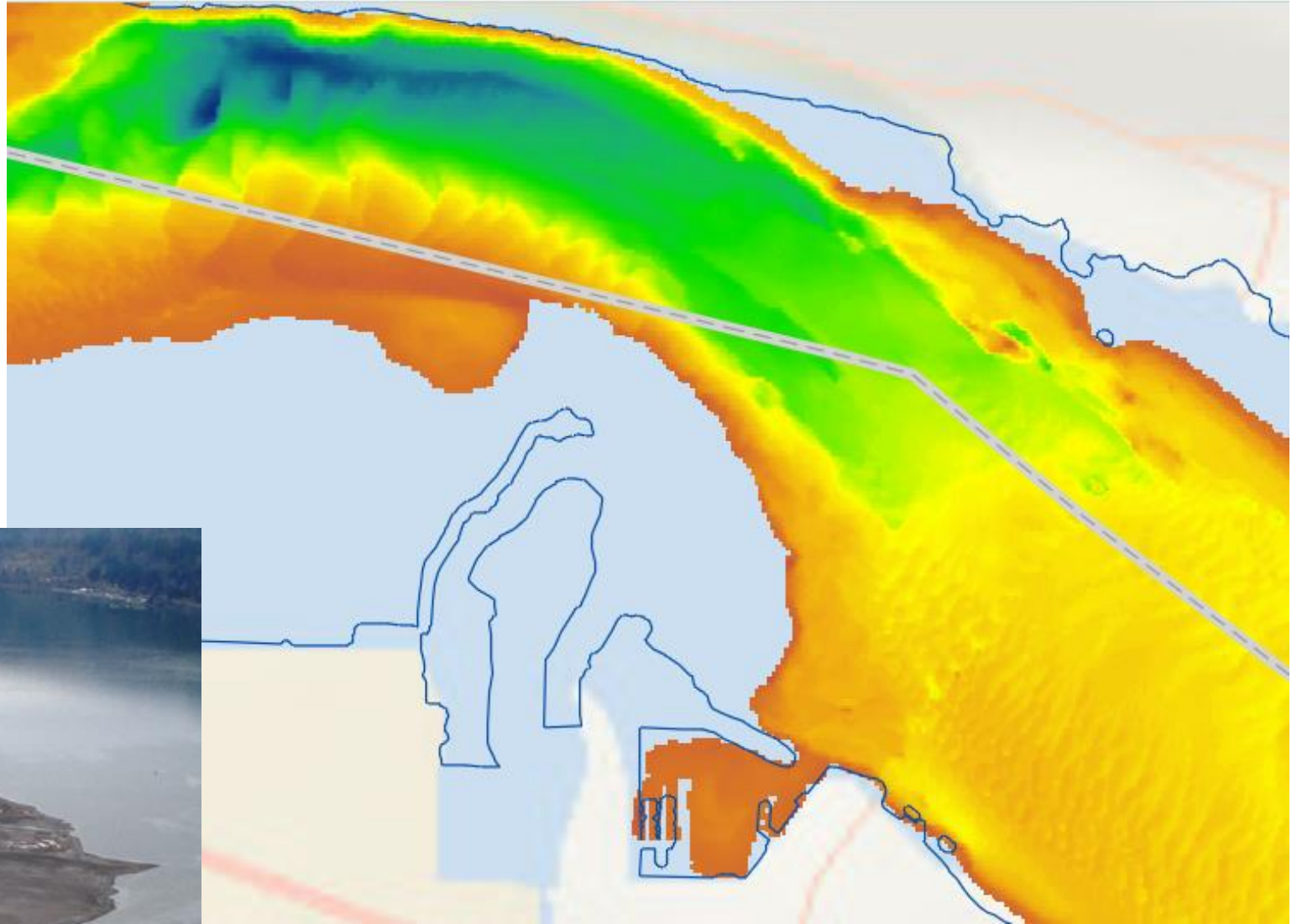
Klickitat River Delta

<https://storymaps.arcgis.com/stories/ffaae163a1054ef2880dcdd492bb5ec1>



Hood River Delta

CTBWSR & COE-Portland
Juvenile Survival Study
Project Assistance Agreement



... OCS survey limited to minimum depth of 4 meters

Composite Bathymetry

- Bathymetry from NOAA-OCS surveys is not available yet
- Composite topo-bathy DEM generated from:
 - LiDAR survey conducted by Cayuse Native Solutions
 - Sonar bathymetry survey conducted by CRITFC and Dr. Chris Parish (OSU)
- Additional sonar surveys of Klickitat delta and other deltas will be conducted as part of GCAP this year

Development of initial version of Zone 6 hydrodynamic model planned for Fall 2024





Empowering CRTFC with Satellite data-driven tools for better decision-making in fisheries resource management

PROJECT SPONSORED BY
WATER RESOURCES APPLIED SCIENCE PROGRAM

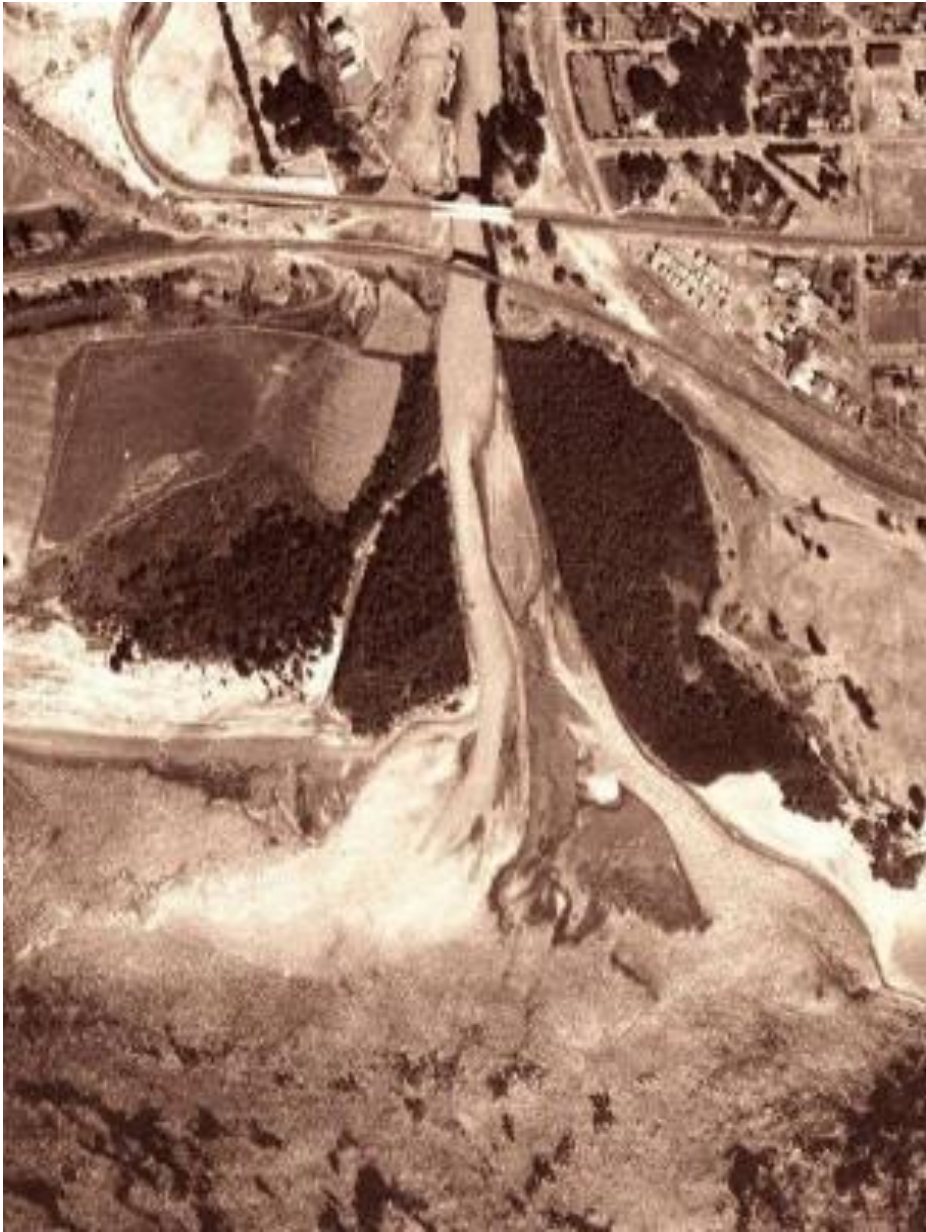
April 7 2023

THORR – Thermal History of Regulated Rivers

Key research Questions that THORR is currently being used to answer for CRITFC with UW collaboration:

- To what extent can temperature changes due to regulation be attributed to the changes in fish abundance?
- How does the historical trend of water temperature relate to fish processes such as migration, reproduction, and abundance?
- How can we optimize reservoir operation to protect the fish population?

Klickitat River – Delta



Klickitat River Delta Restoration Concept



Dredge material collected from Delta channel riverward of RR Br. (blue) and used to elevate and expand the two riparian forest islands (green). Dredge leading edge of the delta at Col. River "shelf" to encourage Col. River scour in an attempt to reduce overall size of delta (shallow size of impaired habitat that juvenile salmon encounter). Chamberlin Lake could be beneficial location to build riparian forest using dredged material. Helps eliminates bass breeding areas in Chamberlin Lake. Be mindful of wildlife/Hwy 14 interactions.

General rule of thumb. For Sec 106 reasons you do not dredge within 3ft. of "native" riverbed (rocks, cobble, artifact, etc.)