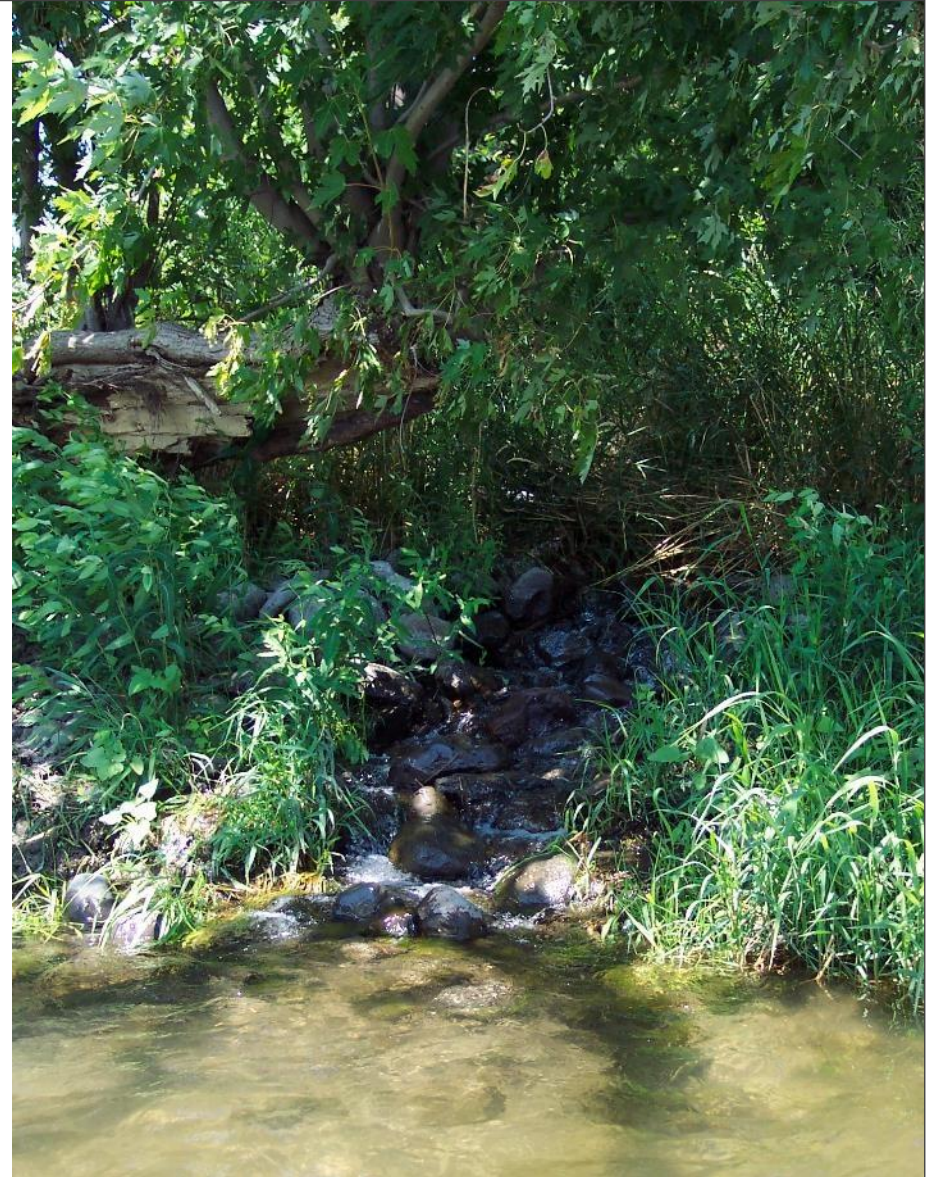


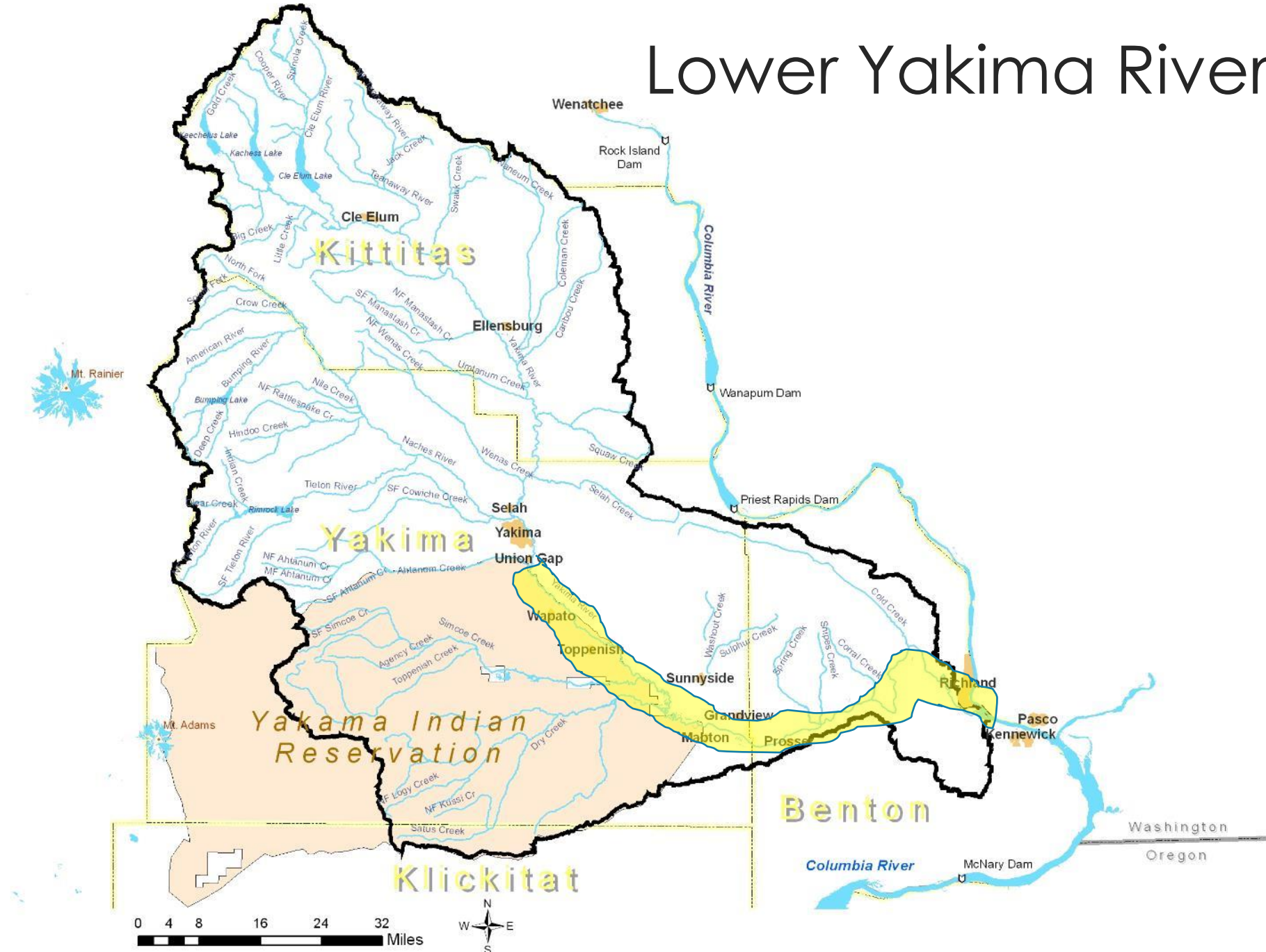


# COOL PROJECTS, HOT RIVER – CWR IN LOWER RIVER

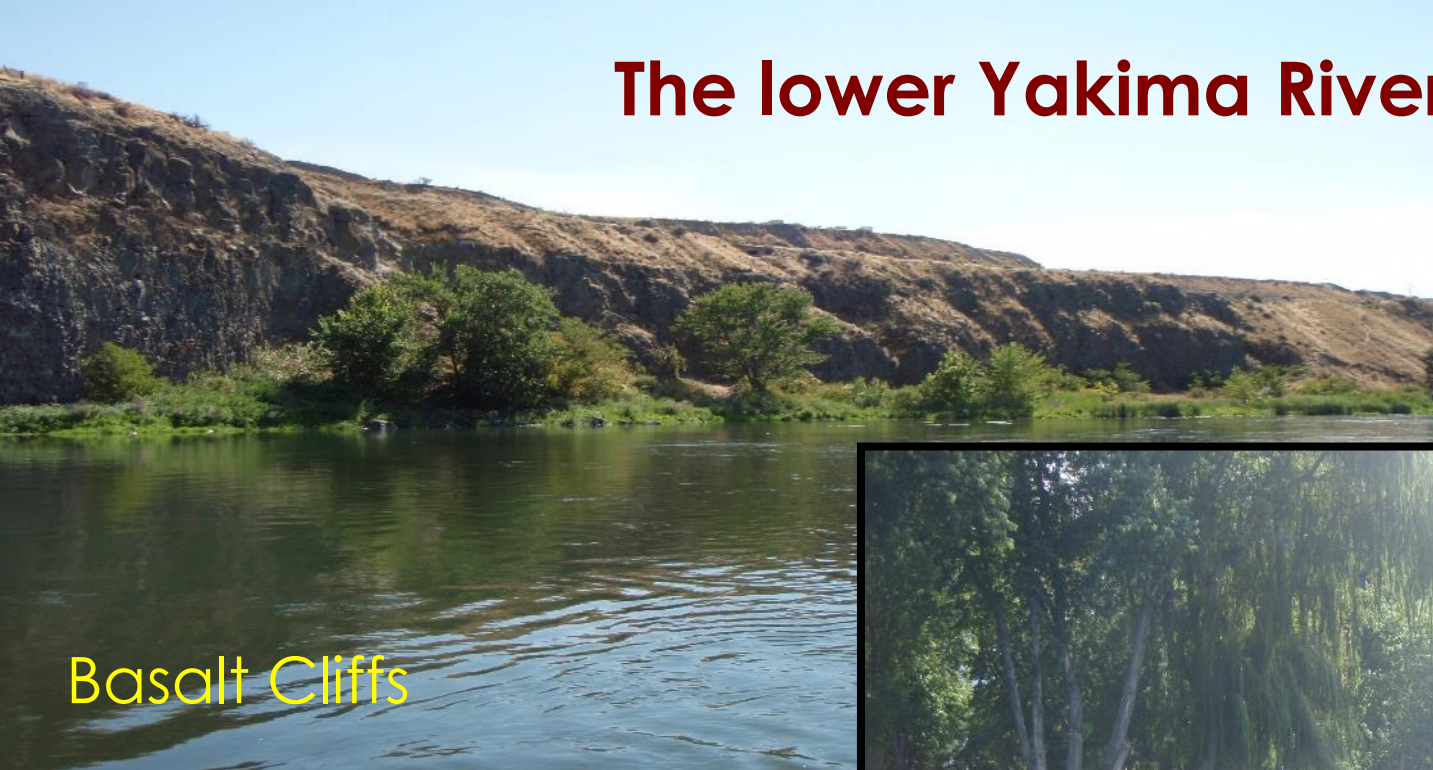
Marcella Appel, Benton CD  
Rebecca Wassell, Mid-Columbia Fisheries



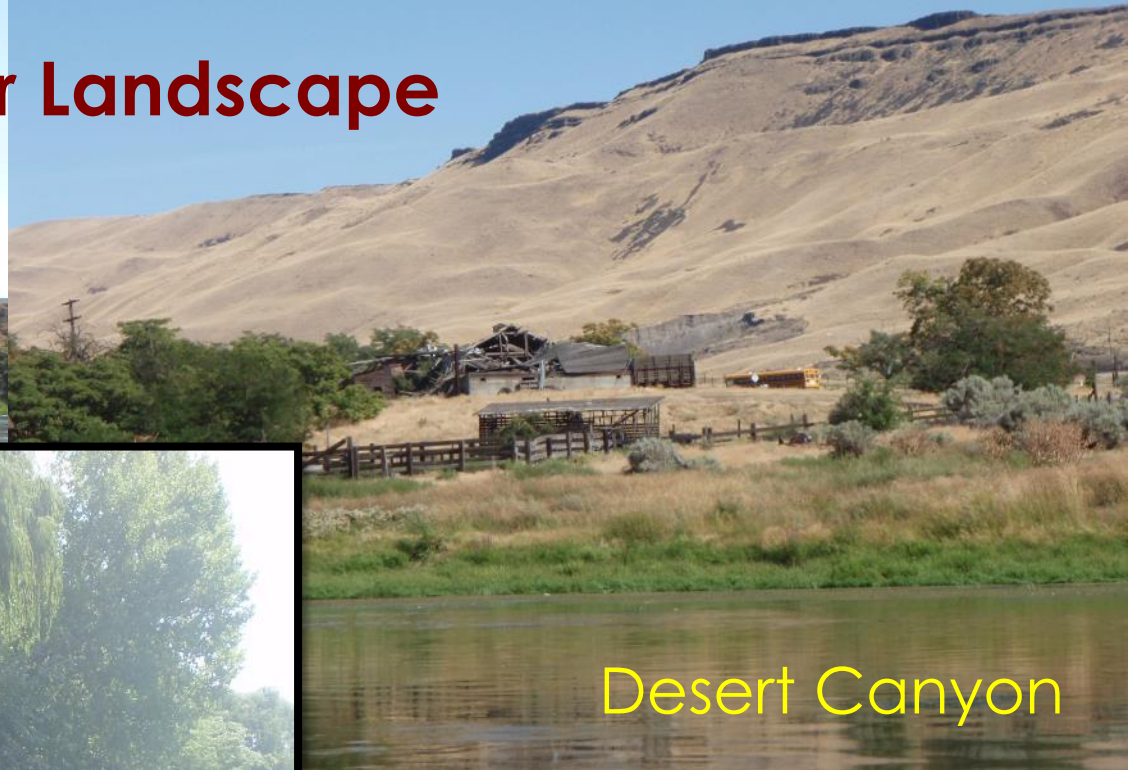
# Lower Yakima River



# The lower Yakima River Landscape



Basalt Cliffs



Desert Canyon



Private Ownership



Alluvial Floodplains

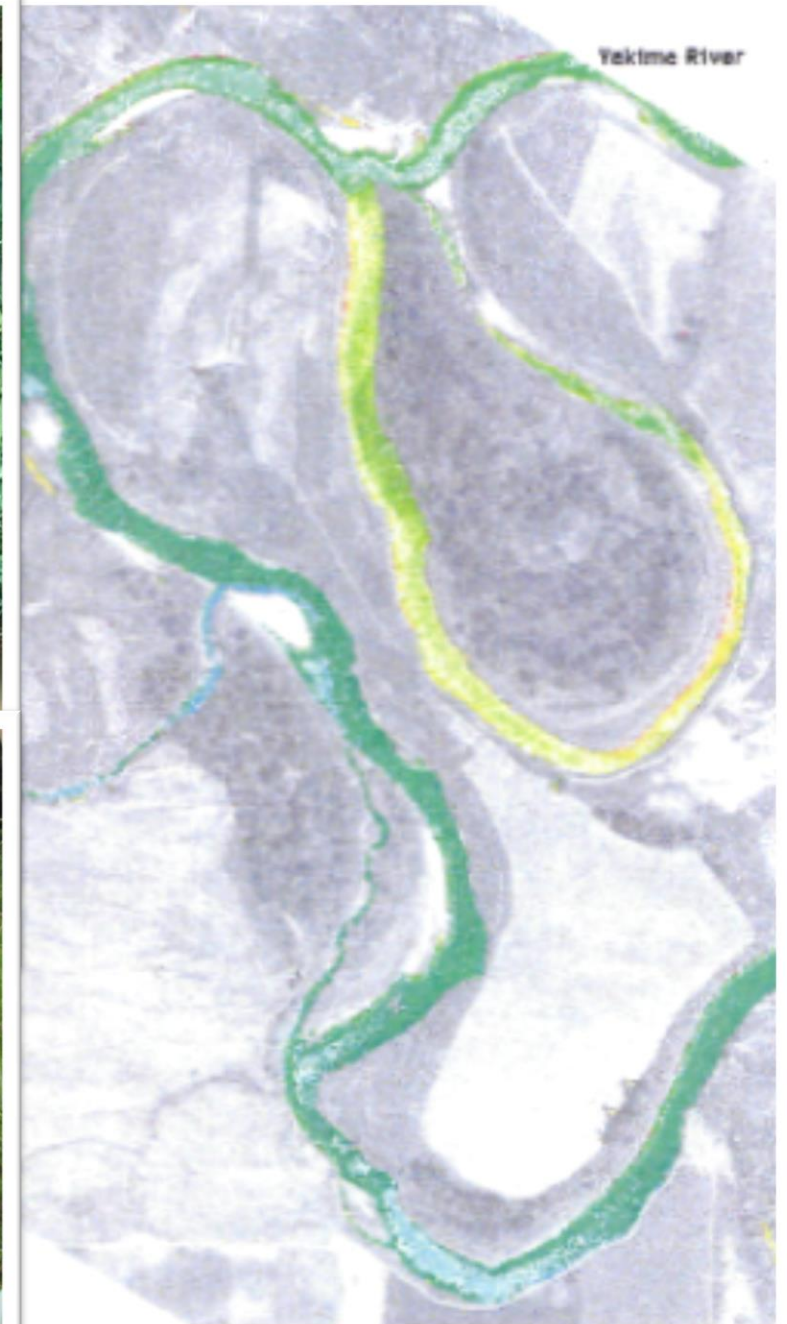


Vegetated Islands and side-channels

Past work:  
what we know

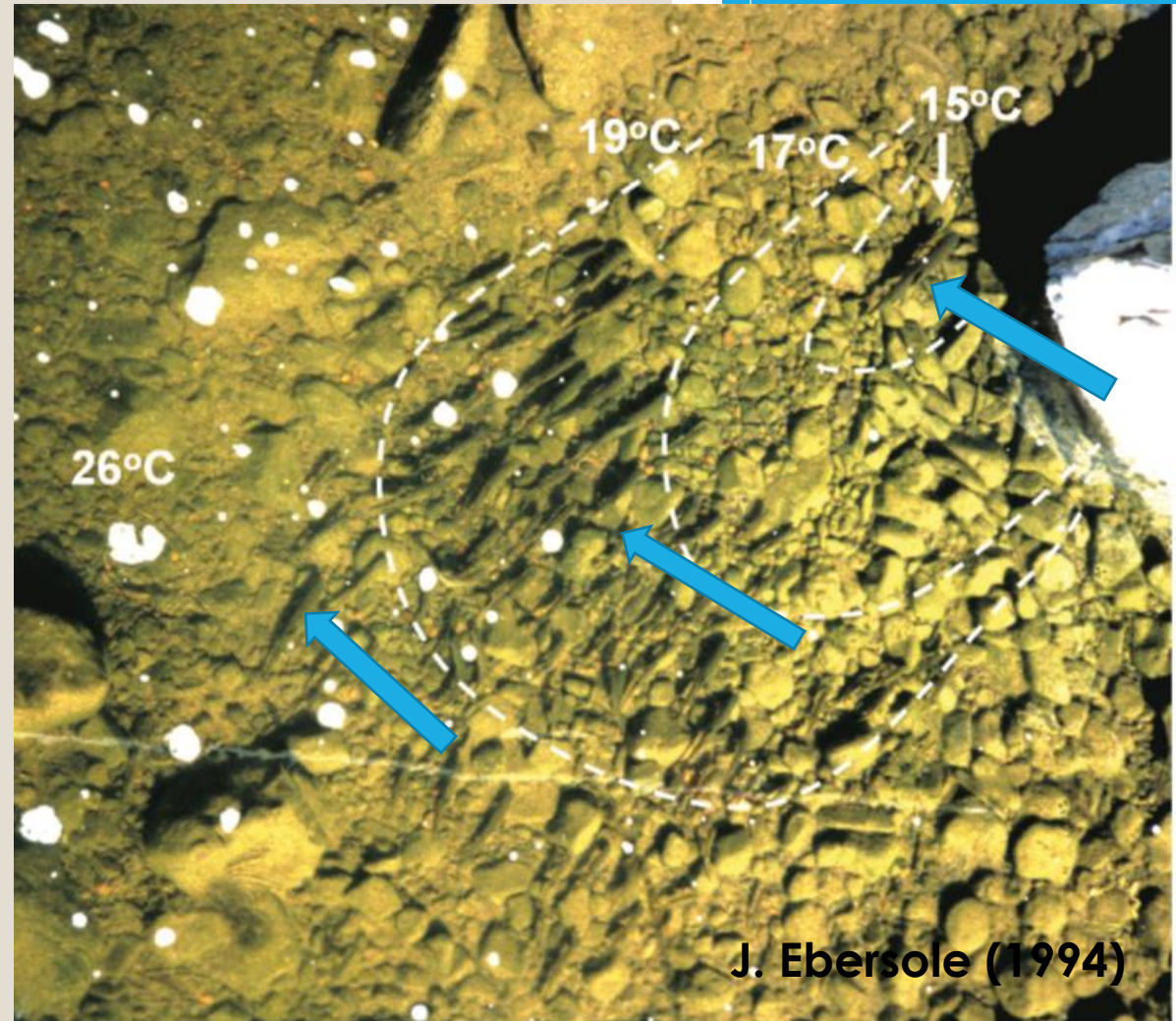
Monitoring:  
what we're learning

Projects:  
what we're doing



# What We Know: Thermal Habitat Refuge

- ❖ Keefer and others (2009) found that “entry and residence in non-natal areas can be . . . a thermoregulatory response to warm water temperatures in main stem rivers, with eventual departure from refuges as fish continue their migration to natal tributaries”
- ❖ Berman and Quinn (1991) described that habitat restoration on spawning and rearing grounds may not be sufficient to ensure long-term survival of **Yakima River salmonids without also protecting a series of cool water thermal refugia** for migrating fish.



J. Ebersole (1994)

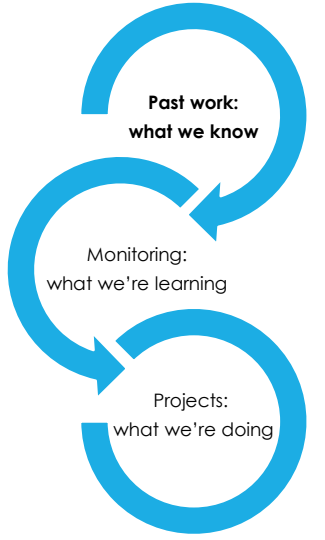
# Thermal refuge, lower river-style



Box Canyon Creek, Upper Yakima

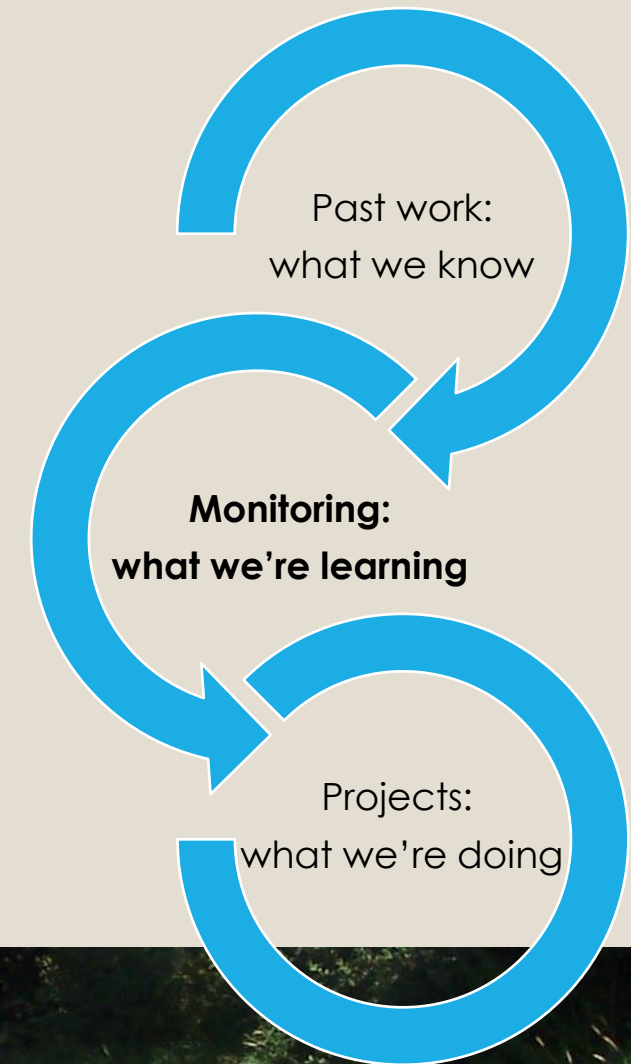


Right bank cool water below Prosser, Lower Yakima



# What we are learning . . .

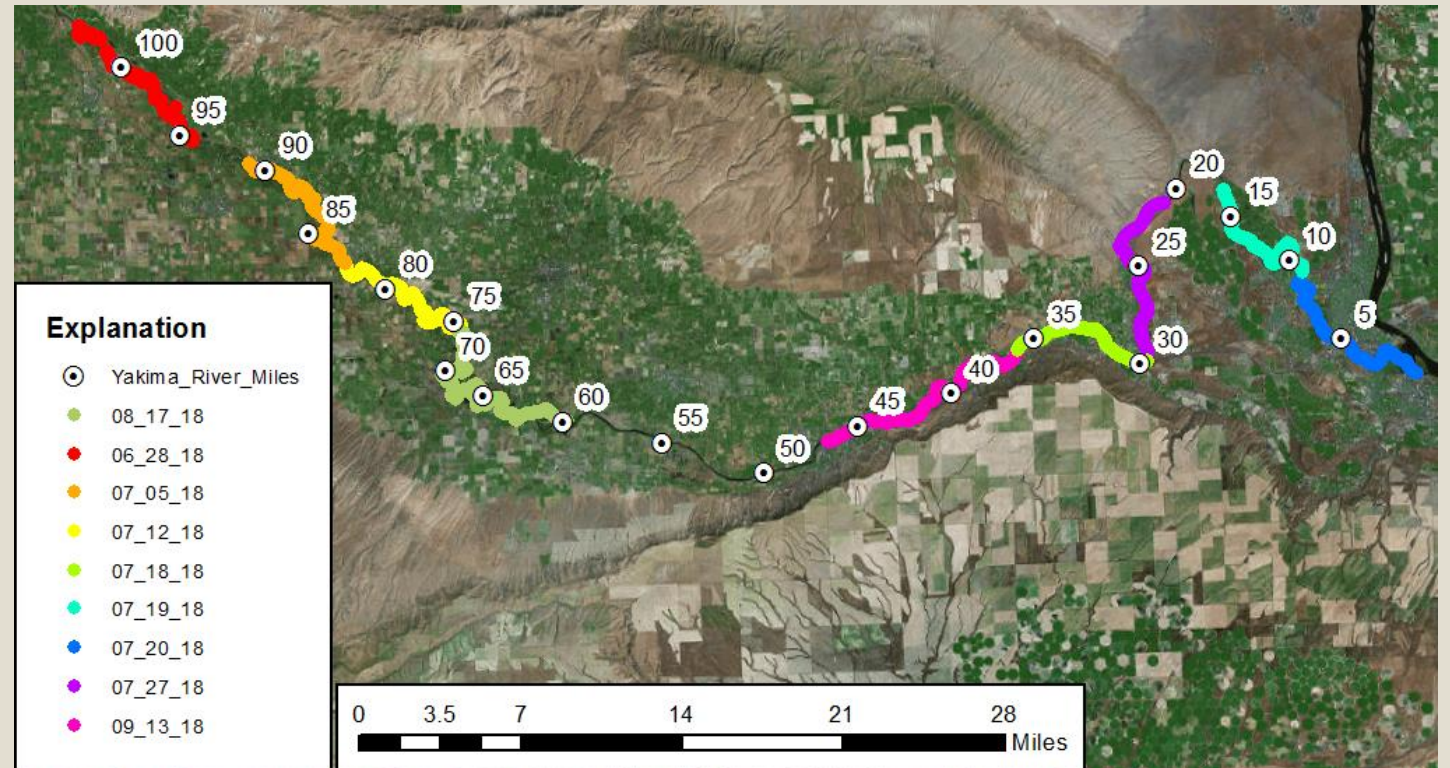
- **FLIR data:**
  - 1997 and 2020
- **Thermal profiles:**
  - 2002, 2008, 2009, 2018
- **Continuous temperature monitoring:**
  - 2011 – present, Delta
  - 2018 – 2020, USGS Kiona Reach
  - 2019 – present, Wapato Reach





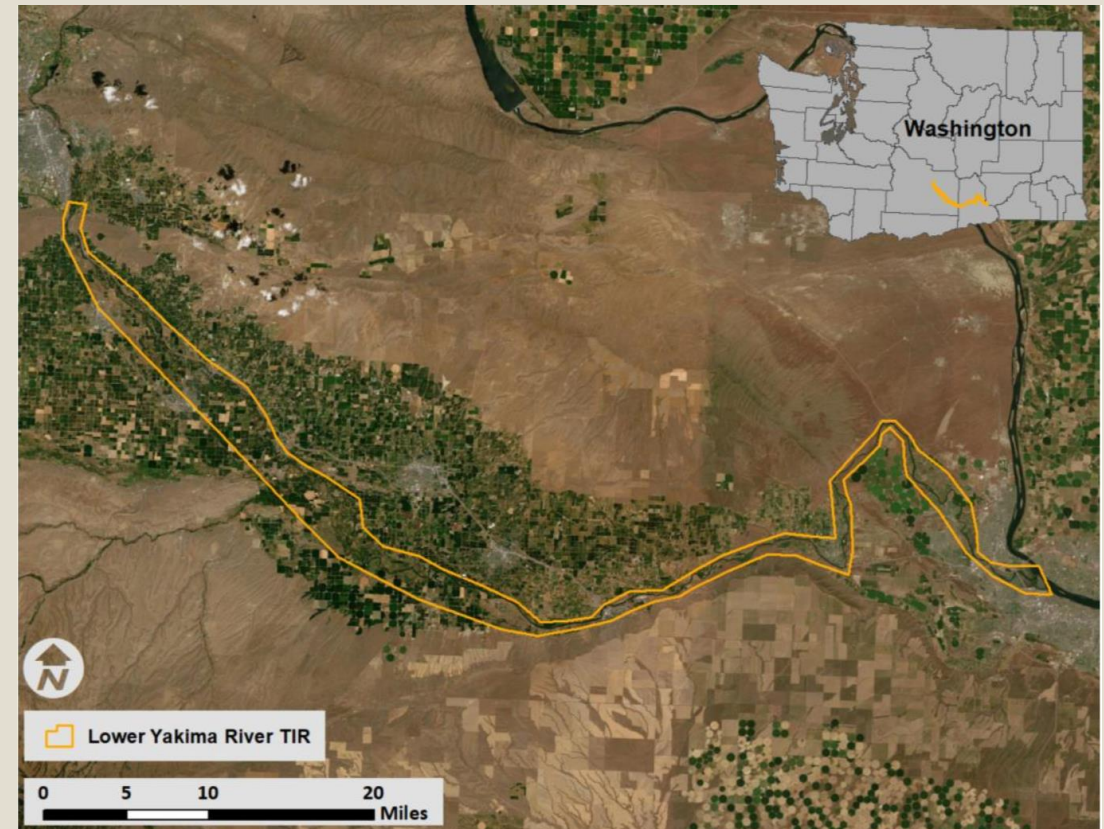
# Analysis of 2001 – 2009; 2018 Profiling Data

- Andrew Gendaszek, USGS, analyzing full set of Yakima River thermal profiling data
- Analysis of Geomorphic/Hydrologic Conditions
- Changes in River Morphology/Basin Groundwater/Surface Water Systems between sets
- USGS Investigations Report Winter 2021



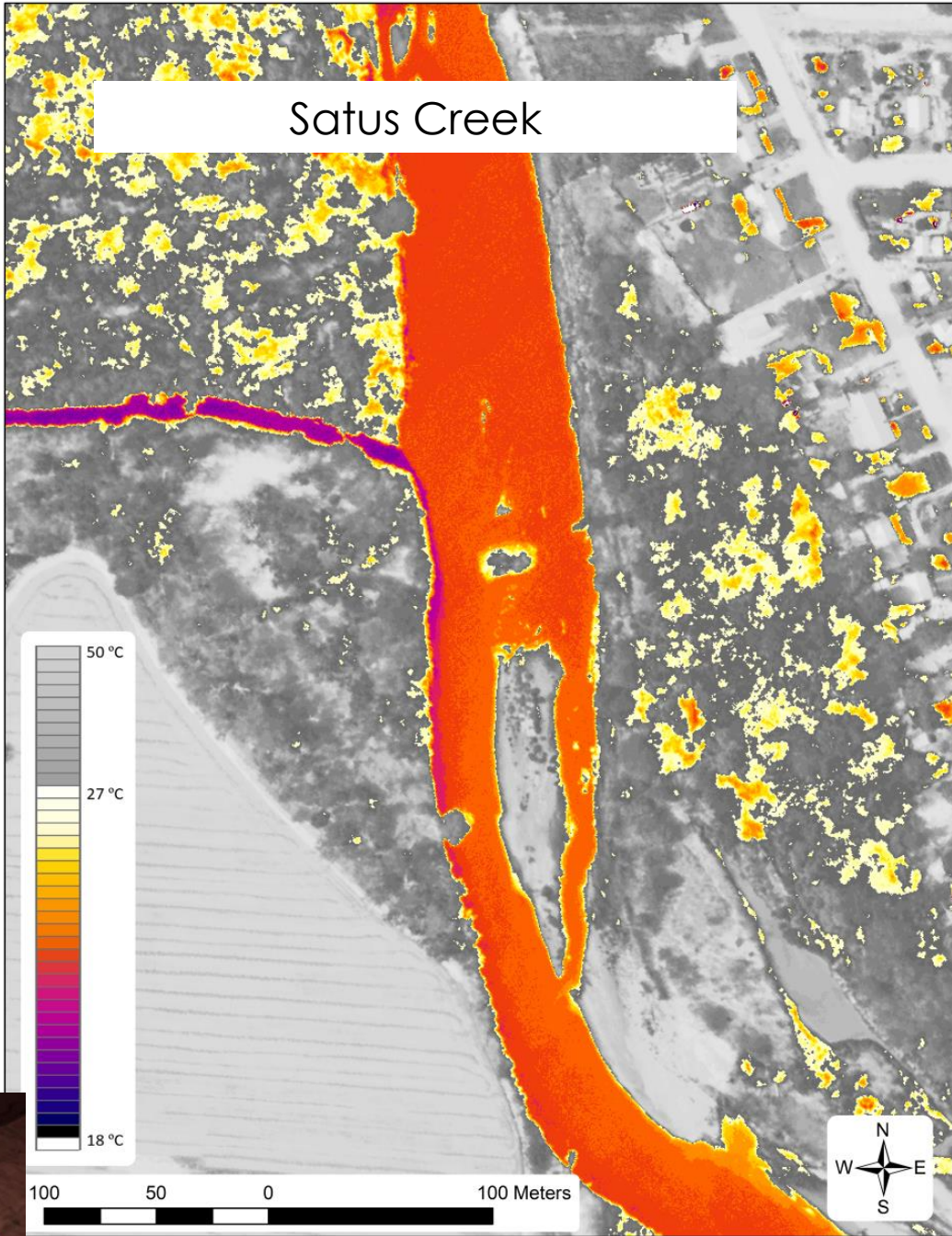
# Thermal Infrared Imaging 2020

- Project Goal: Evaluate thermal structure of the lower Yakima River for protection and enhancement of Cold Water Refuge
- Coverage: 108 River Miles
  - 0.5 meters spatial acquisition
  - 0.5C thermal resolution
- Images taken 1<sup>st</sup> week of August
- Work completed by Quantum Spatial, Inc.

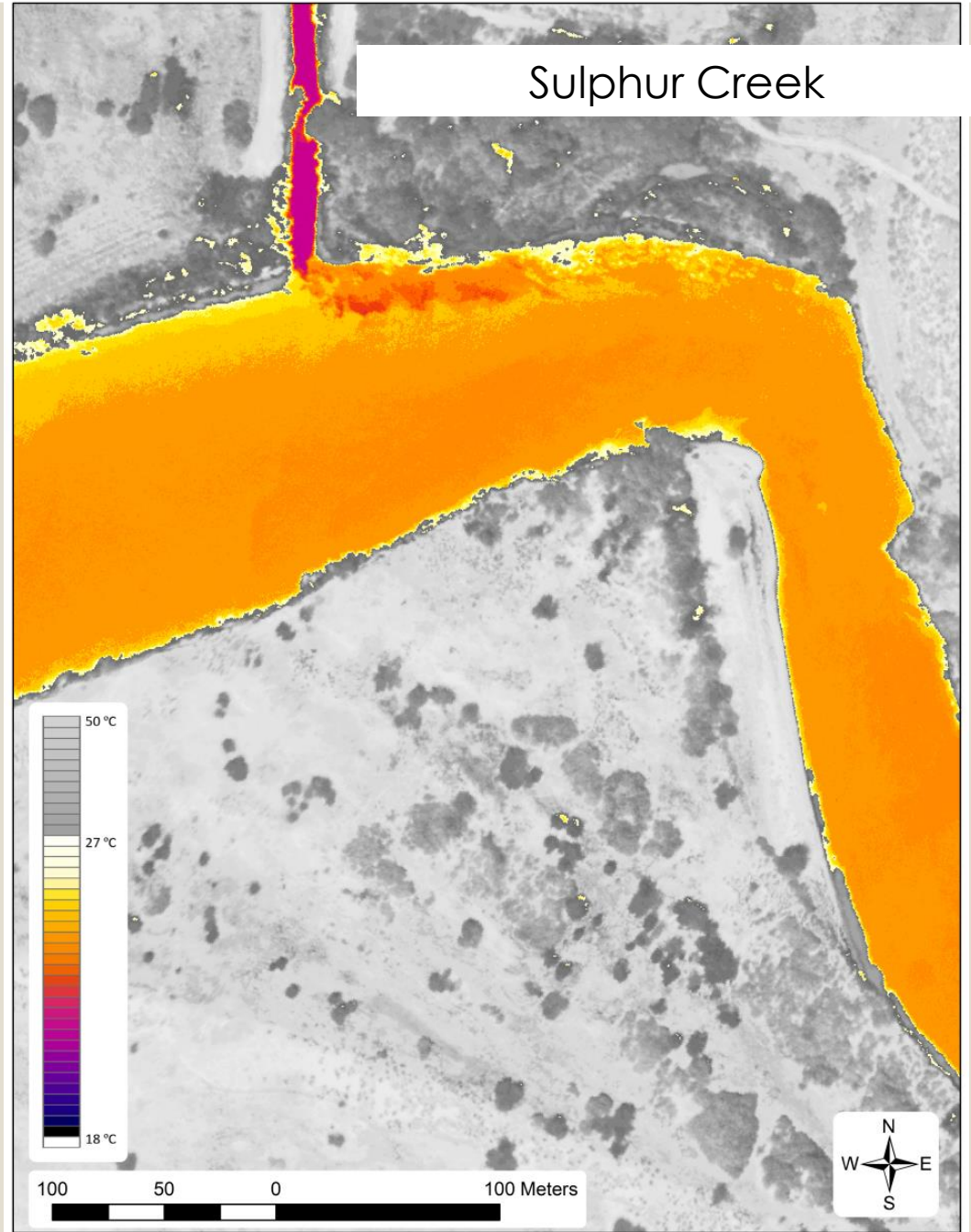


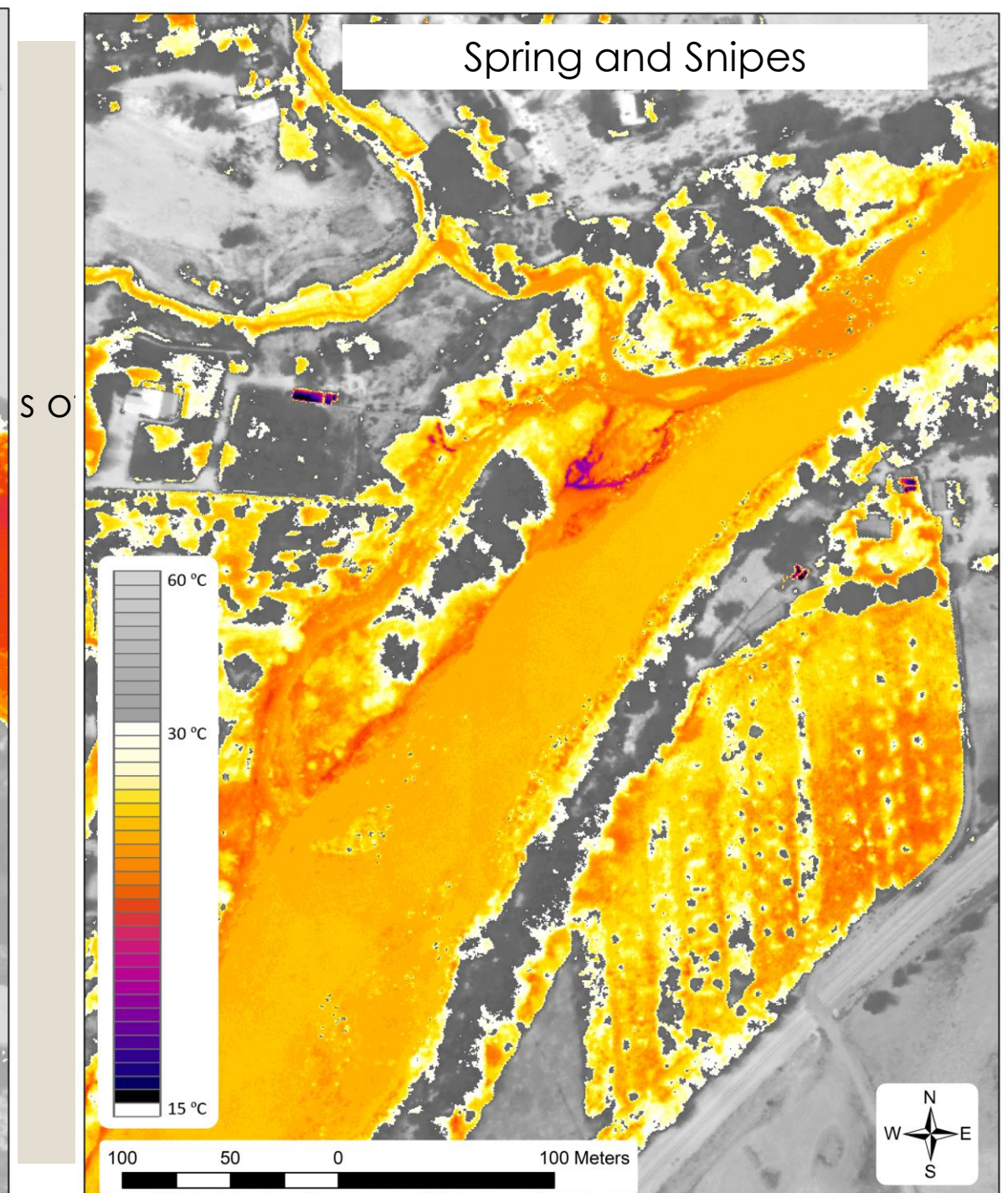
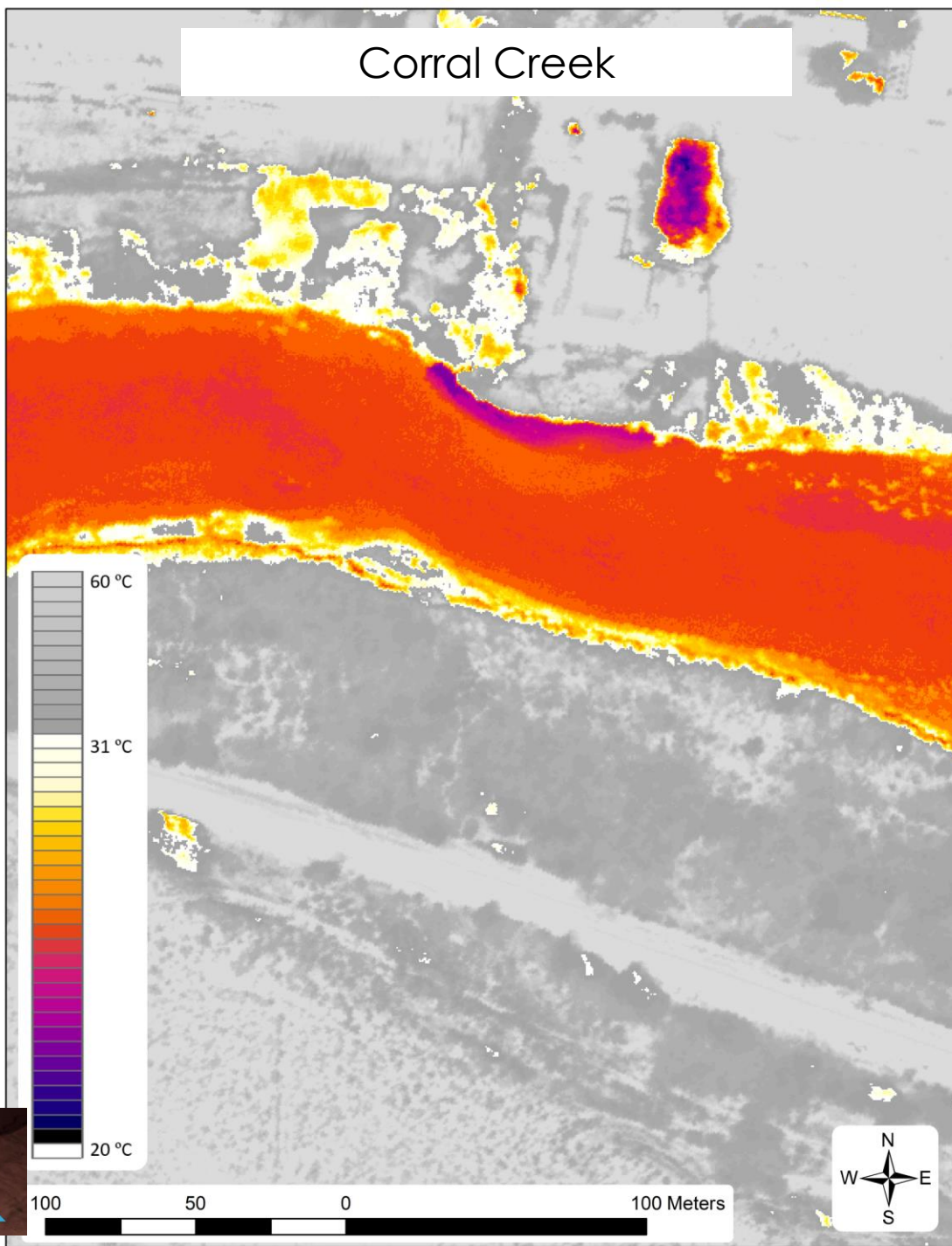
Preliminary Data— Subject to Revision

Satus Creek

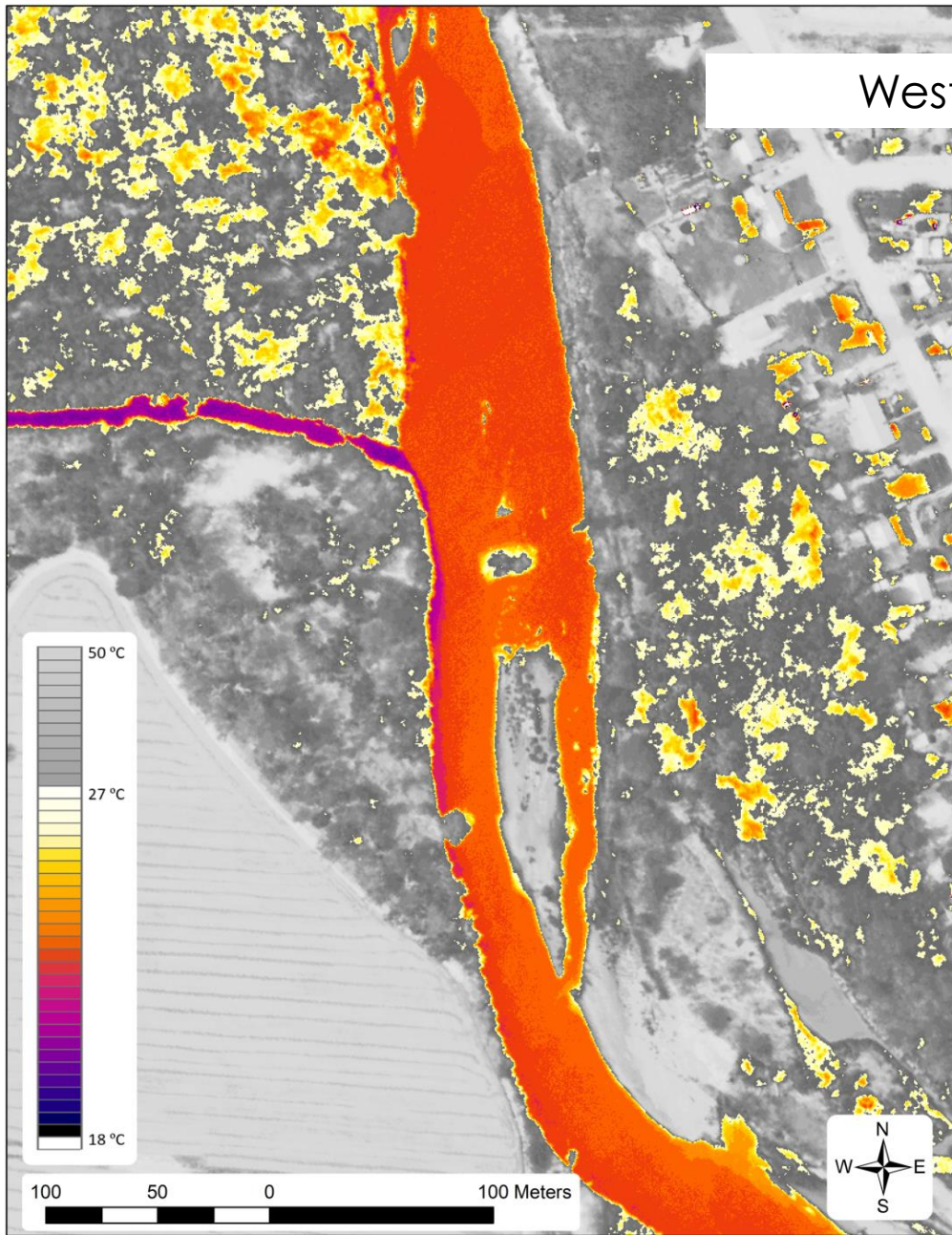


Sulphur Creek

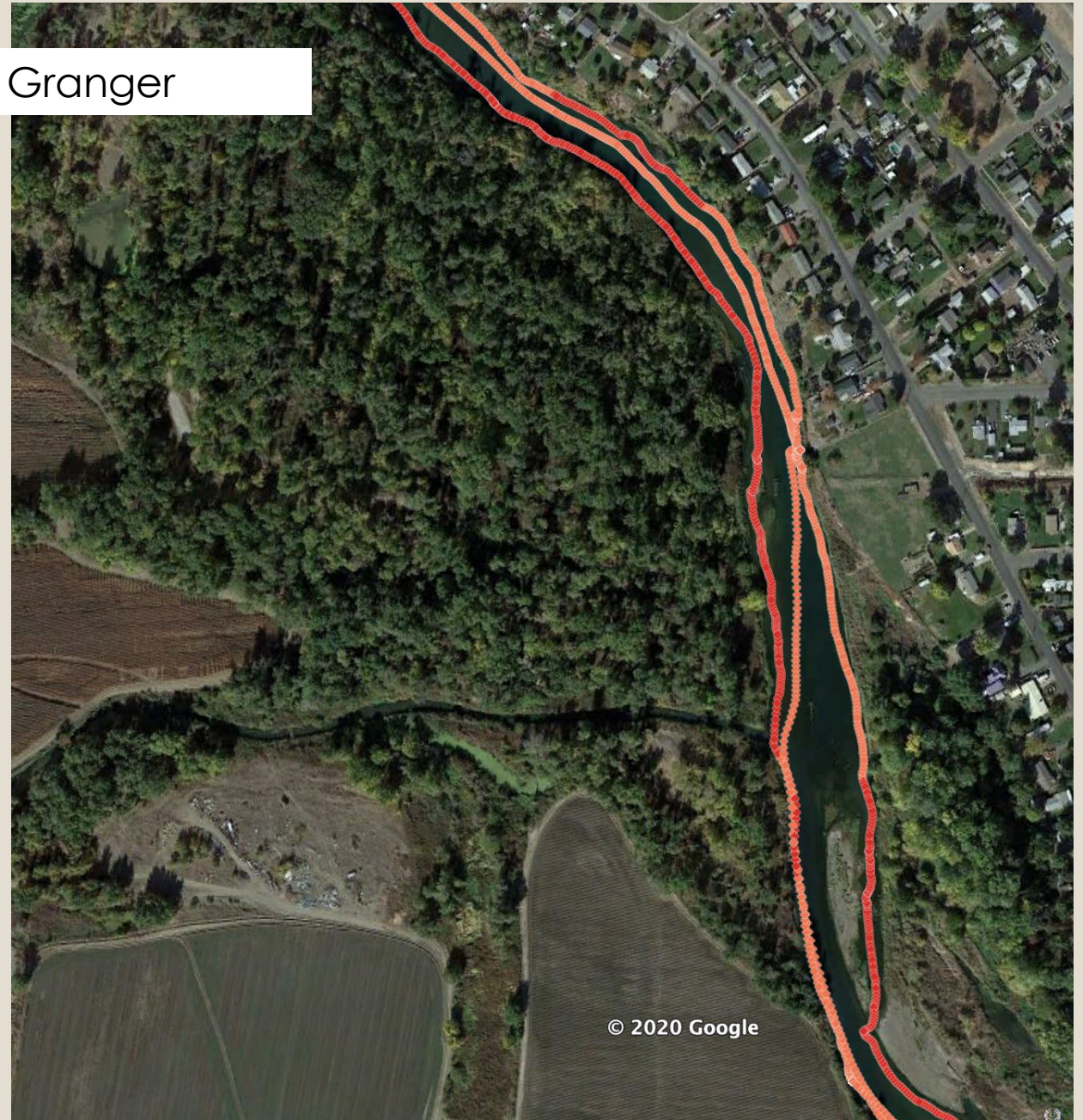




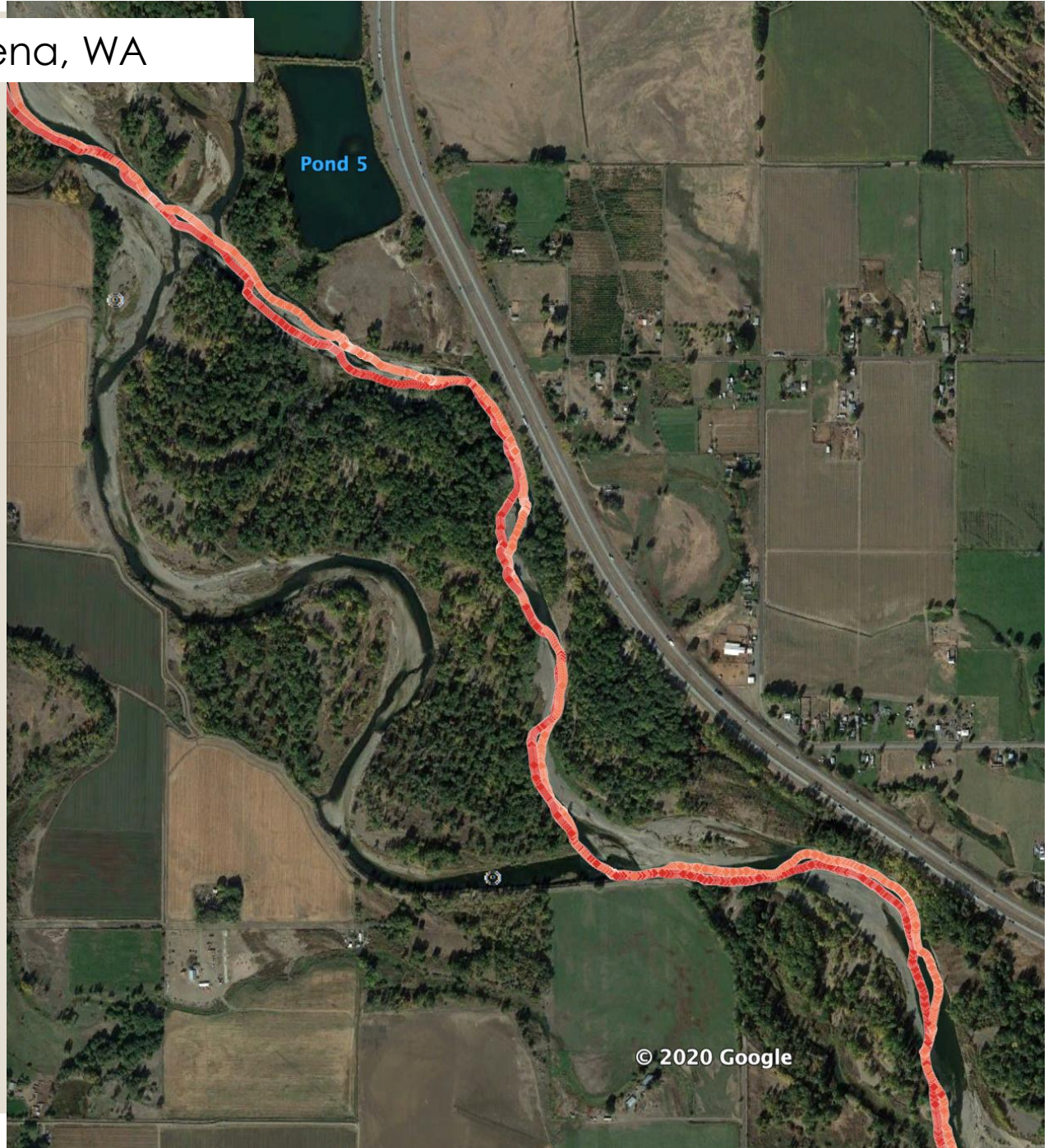
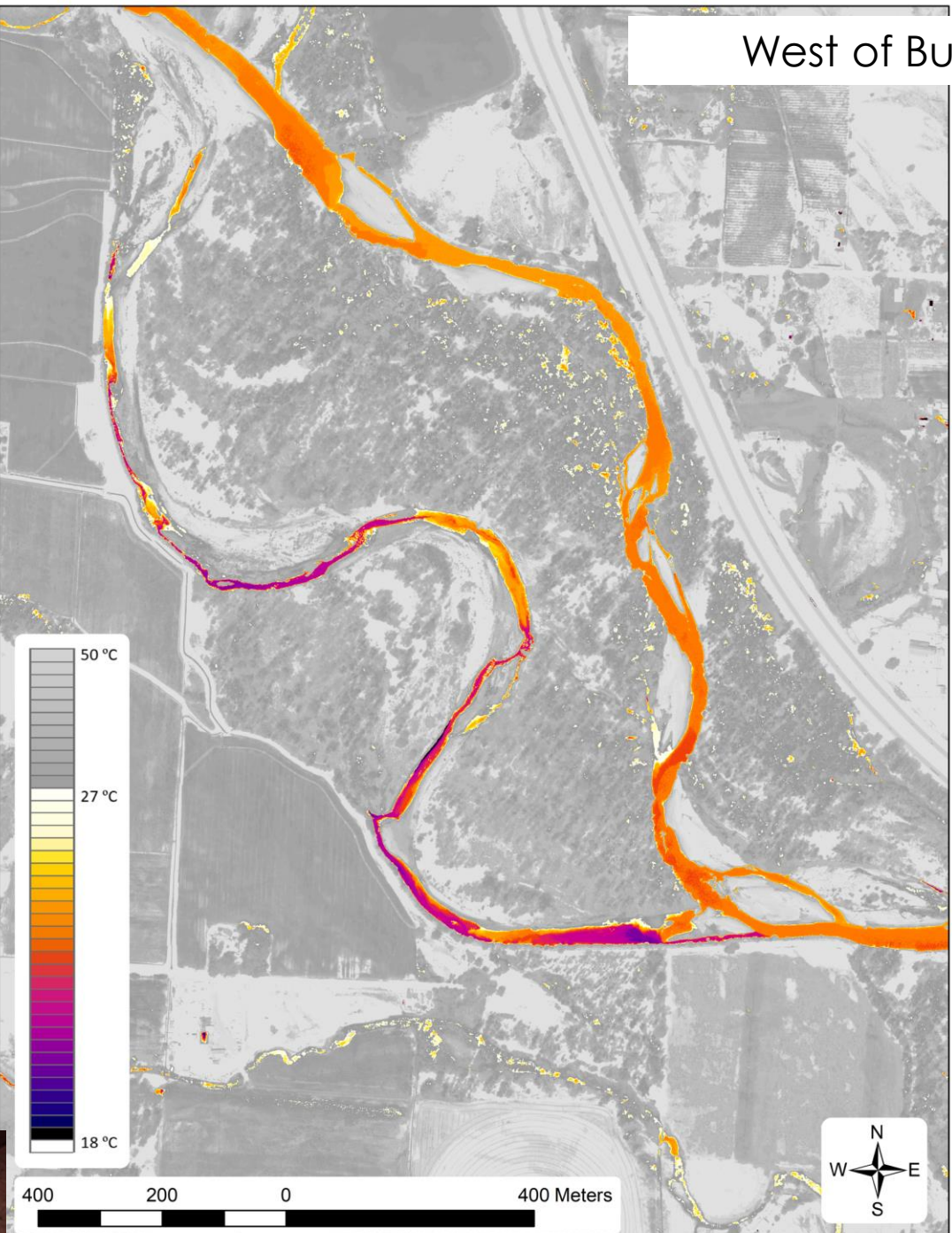
Preliminary Data- Subject to Revision



West of Granger



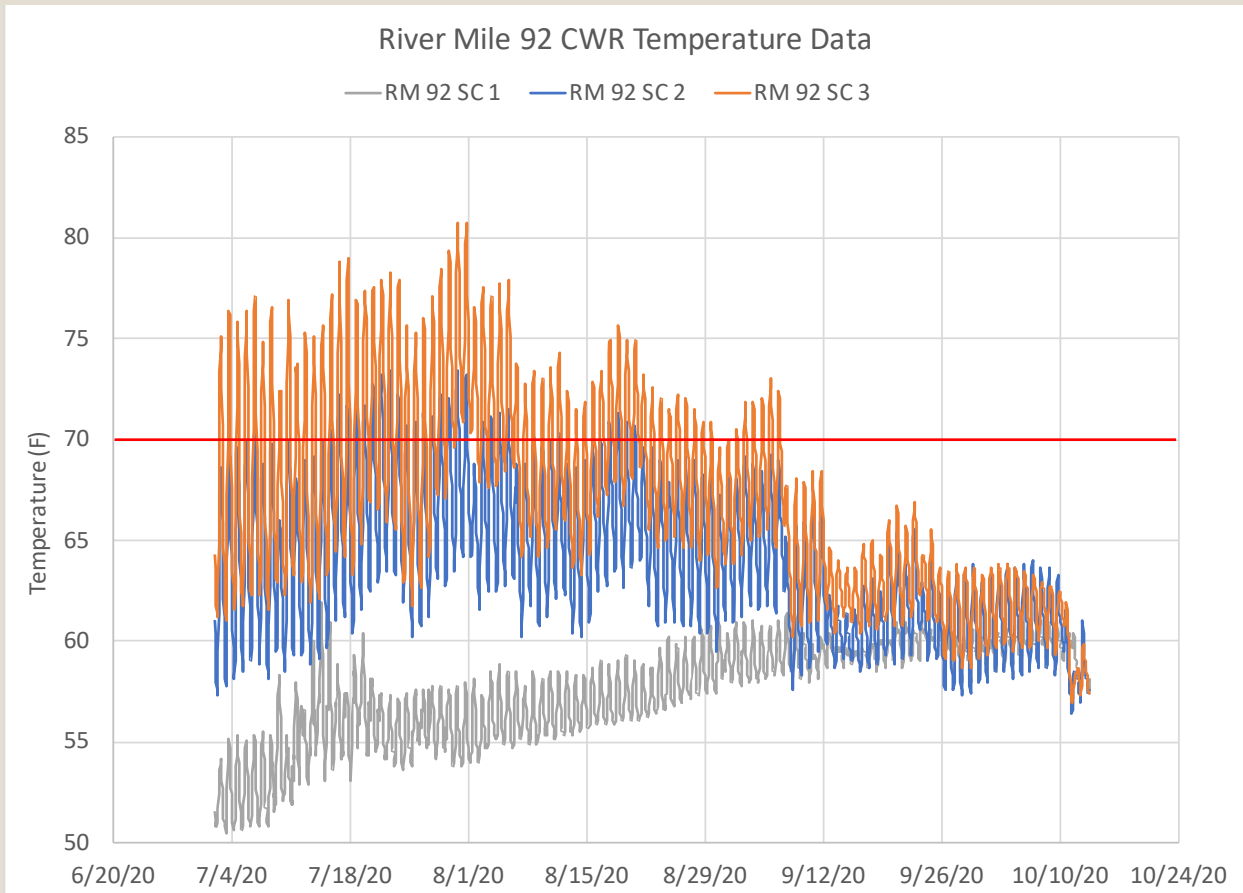
West of Buena, WA



# Wapato Reach CWR Monitoring



# Example: RM 92

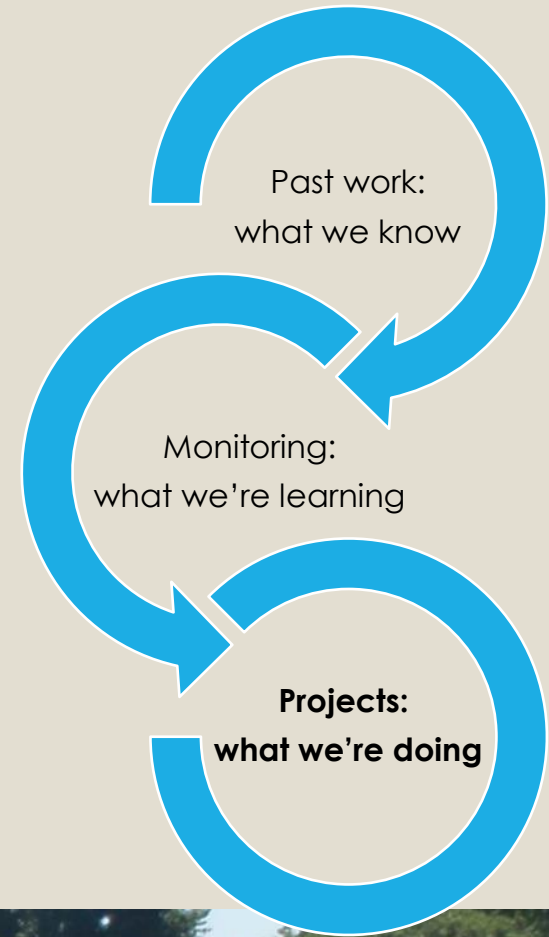




# What we're doing. . .

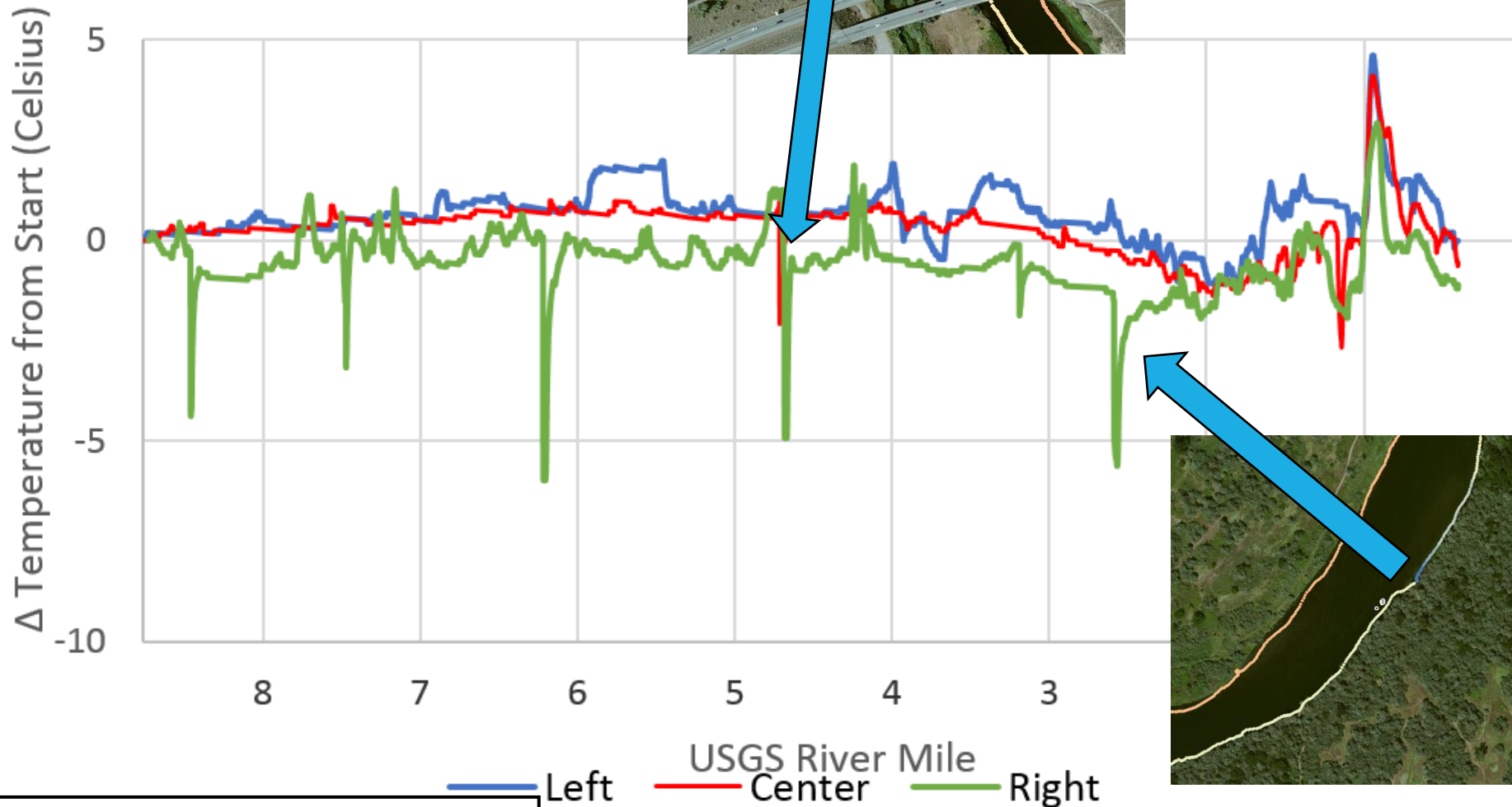
Working to implement projects that

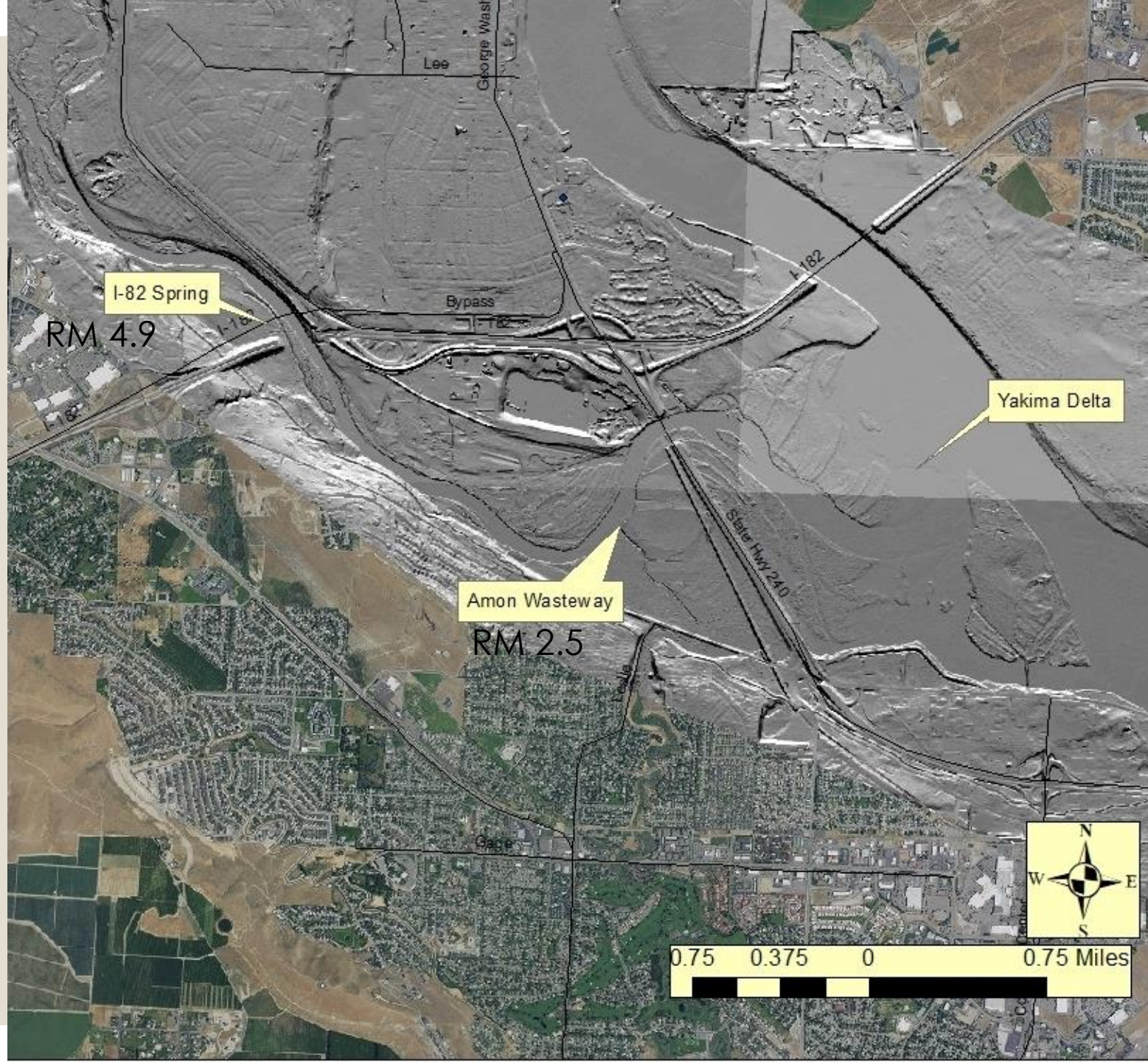
- Improve access
- Increase influence
- Increase persistence
- Contribute to cumulative impact

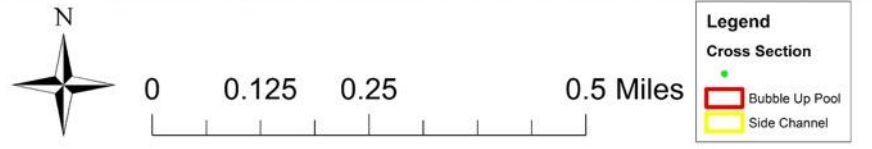
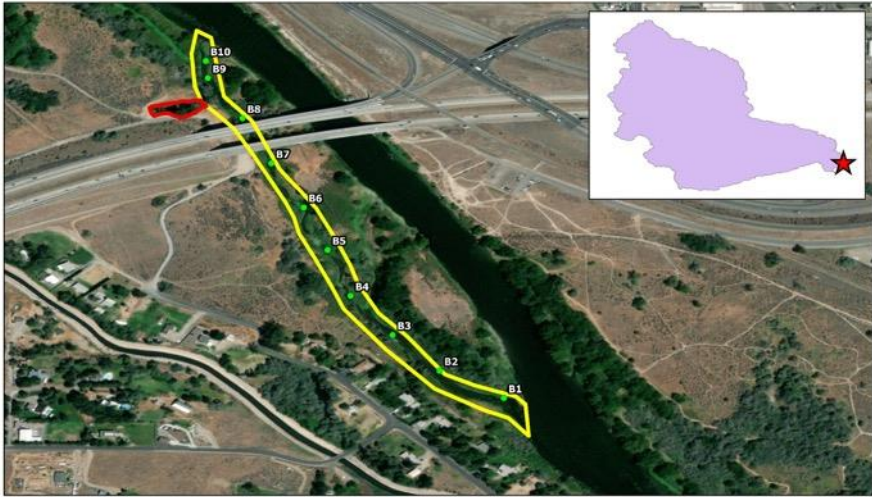


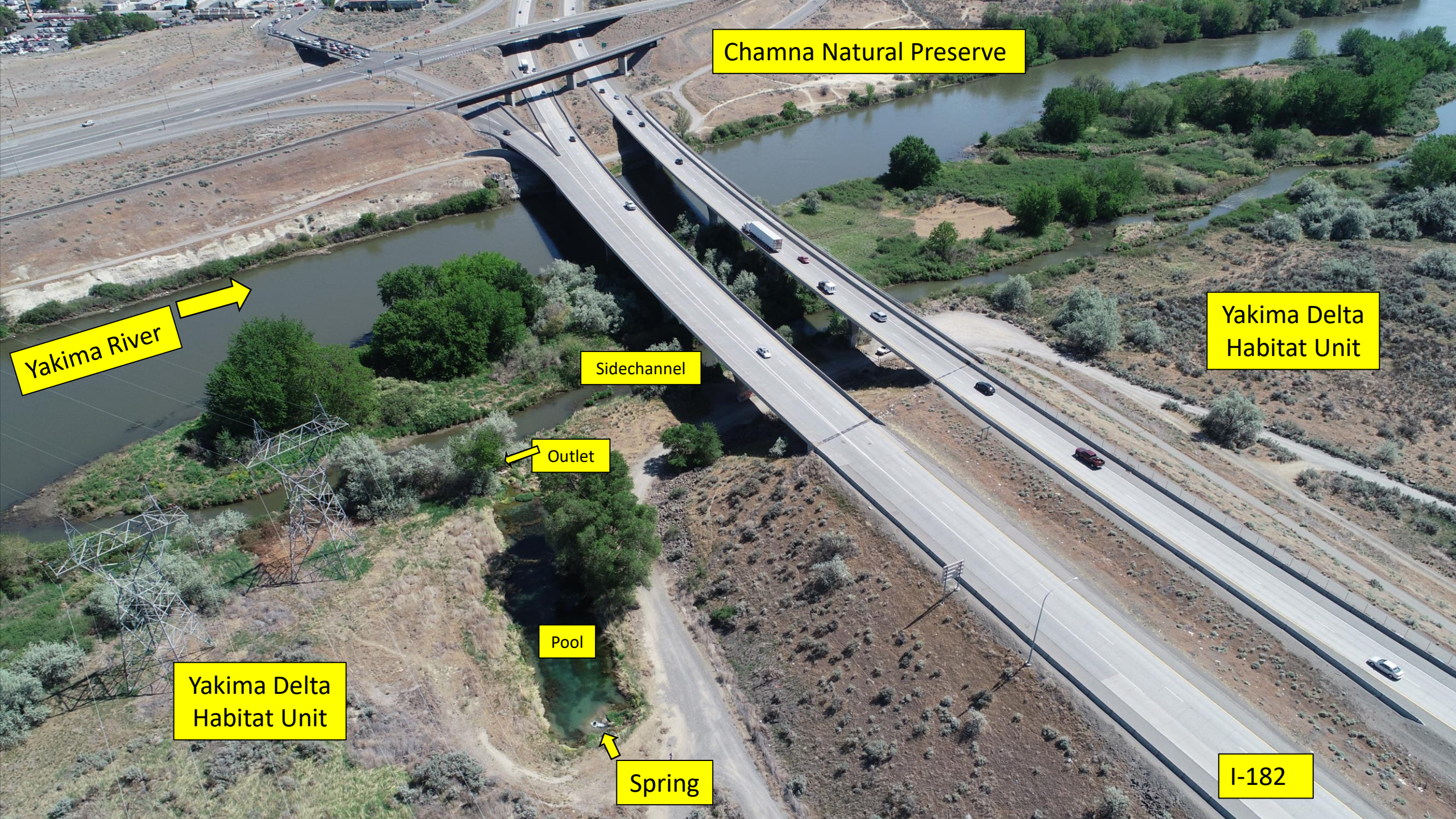
# RM 4.9 and 2.5

## Van Giesen to [unclear] land









Chamna Natural Preserve

Yakima River

Yakima Delta  
Habitat Unit

Sidechannel

Outlet

Yakima Delta  
Habitat Unit

Pool

Spring

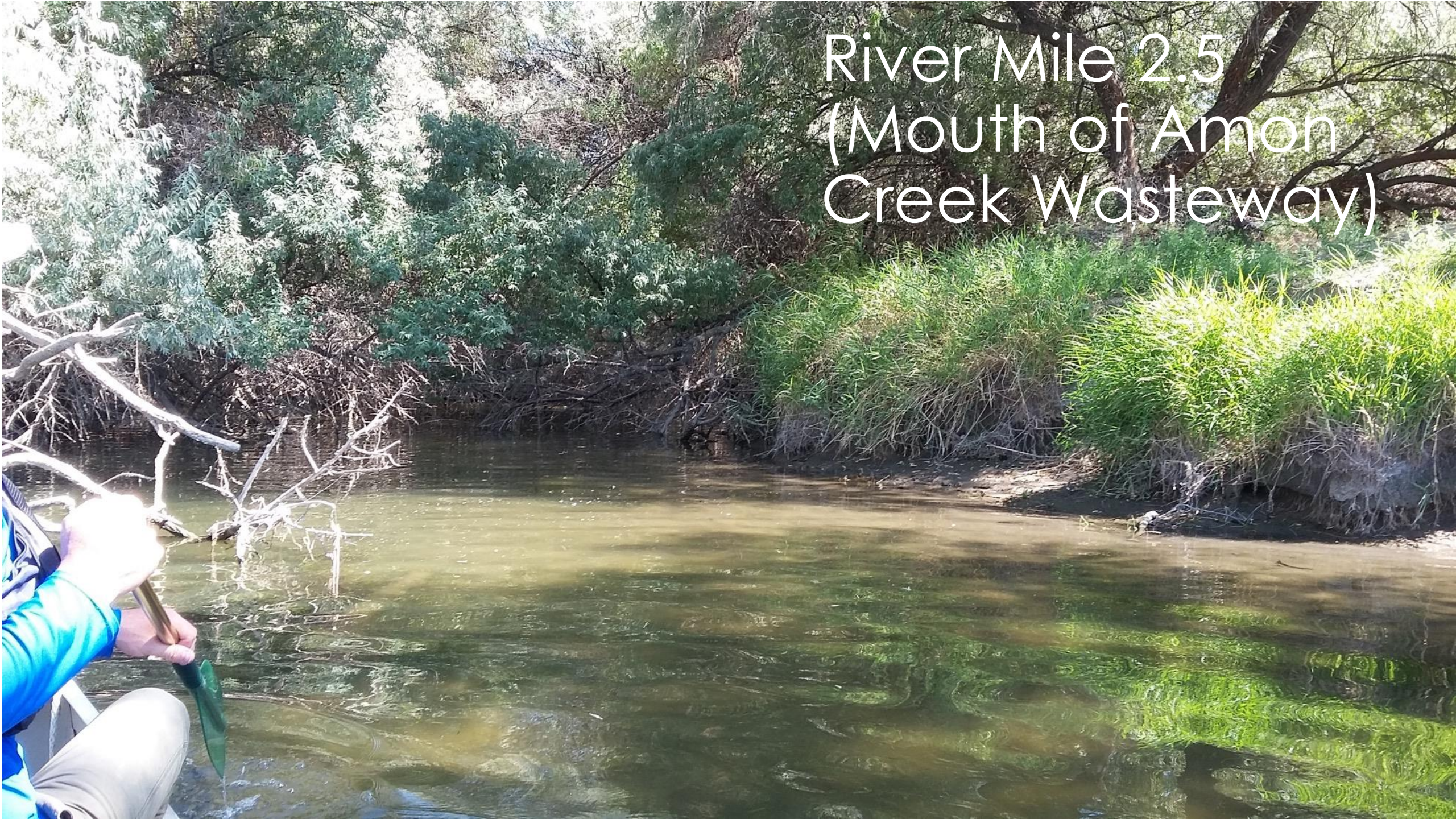
I-182

## RM 4.9 (July vs. September)

Enhance CWR at baseflow by preventing mixing, adding depth and holding capacity year round



River Mile 2.5  
(Mouth of Amon  
Creek Wasteway)



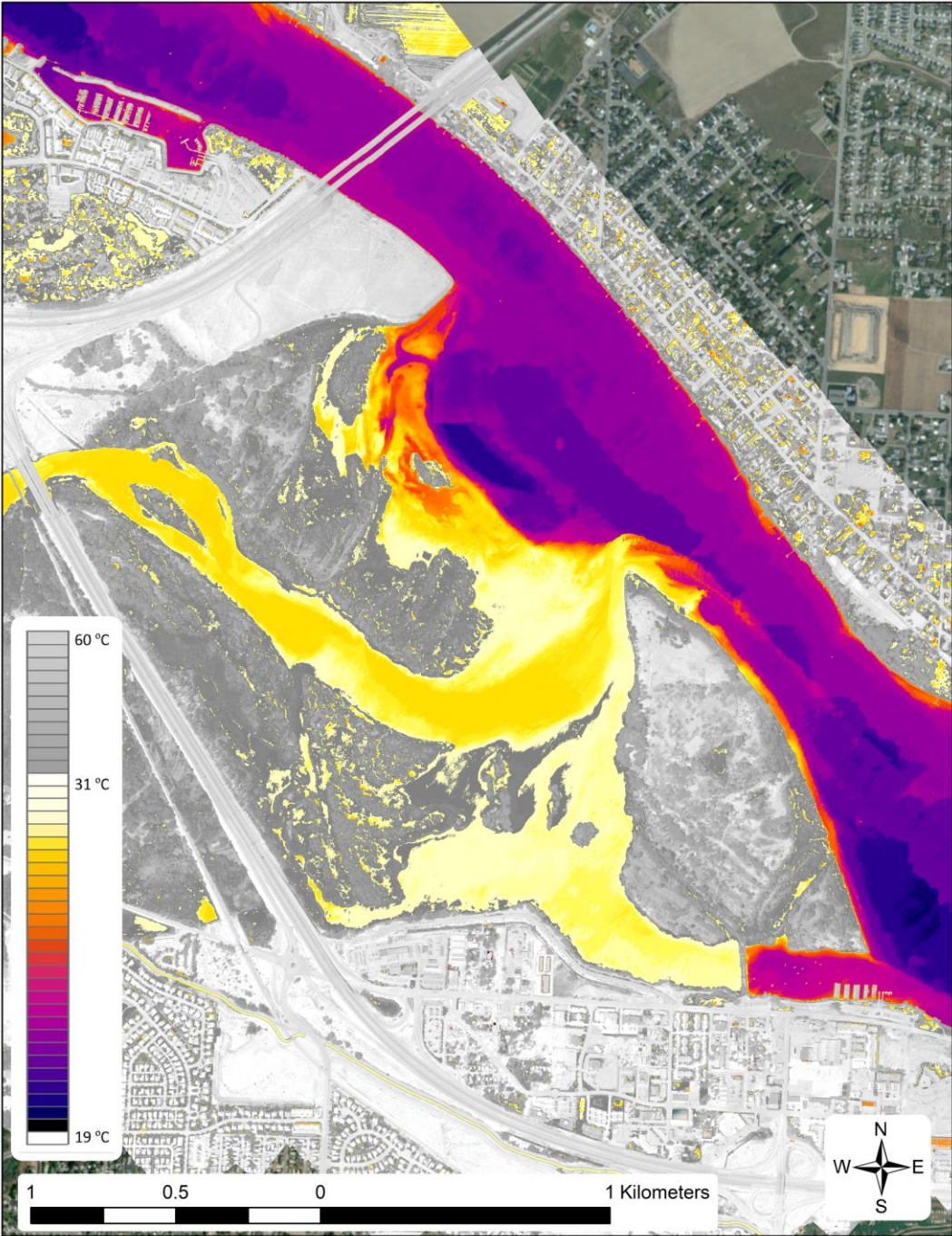
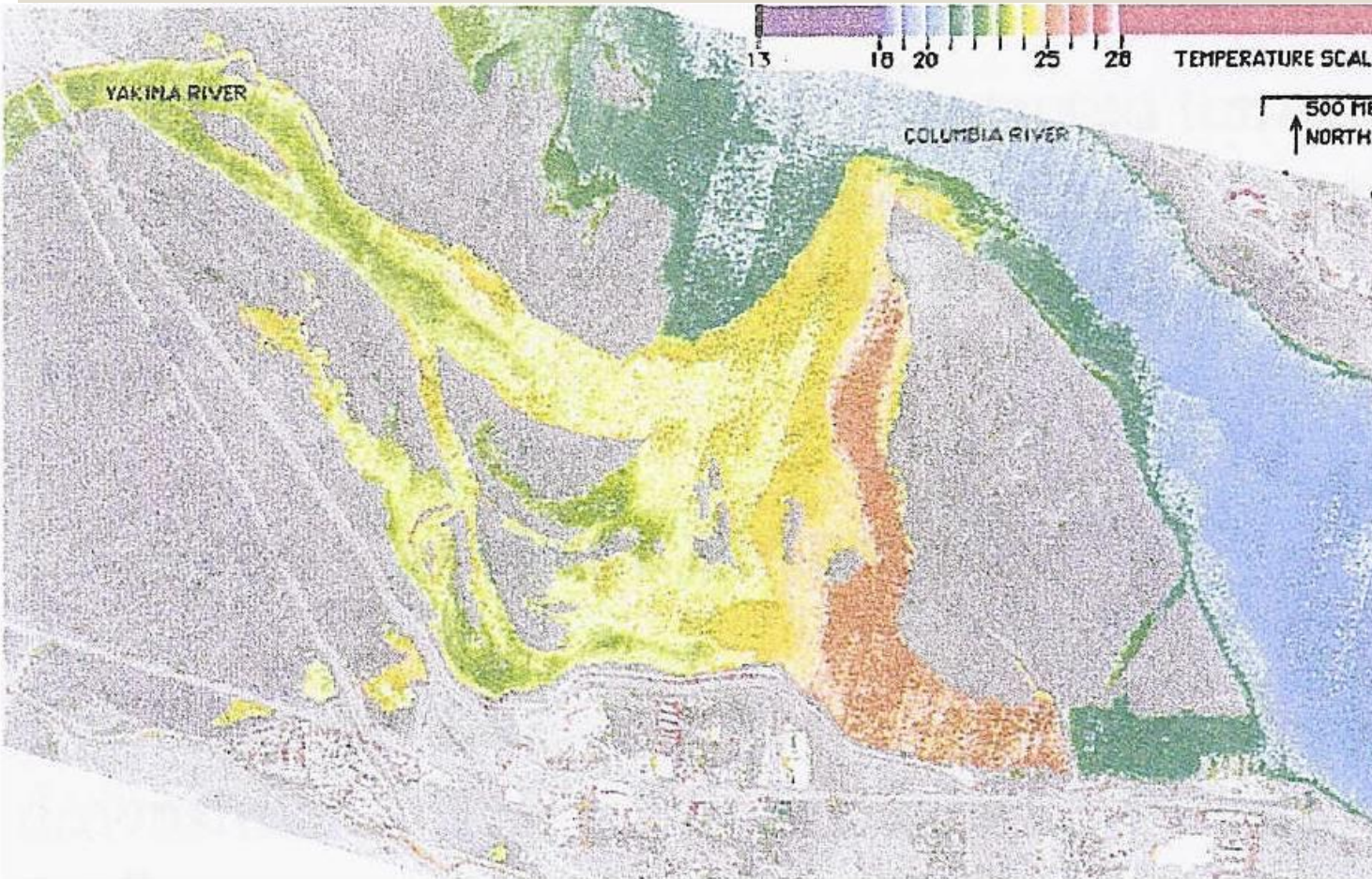


Amon  
CWR at 23.8 C.  
Mainstem temperature  
26.5 C





# Yakima Delta



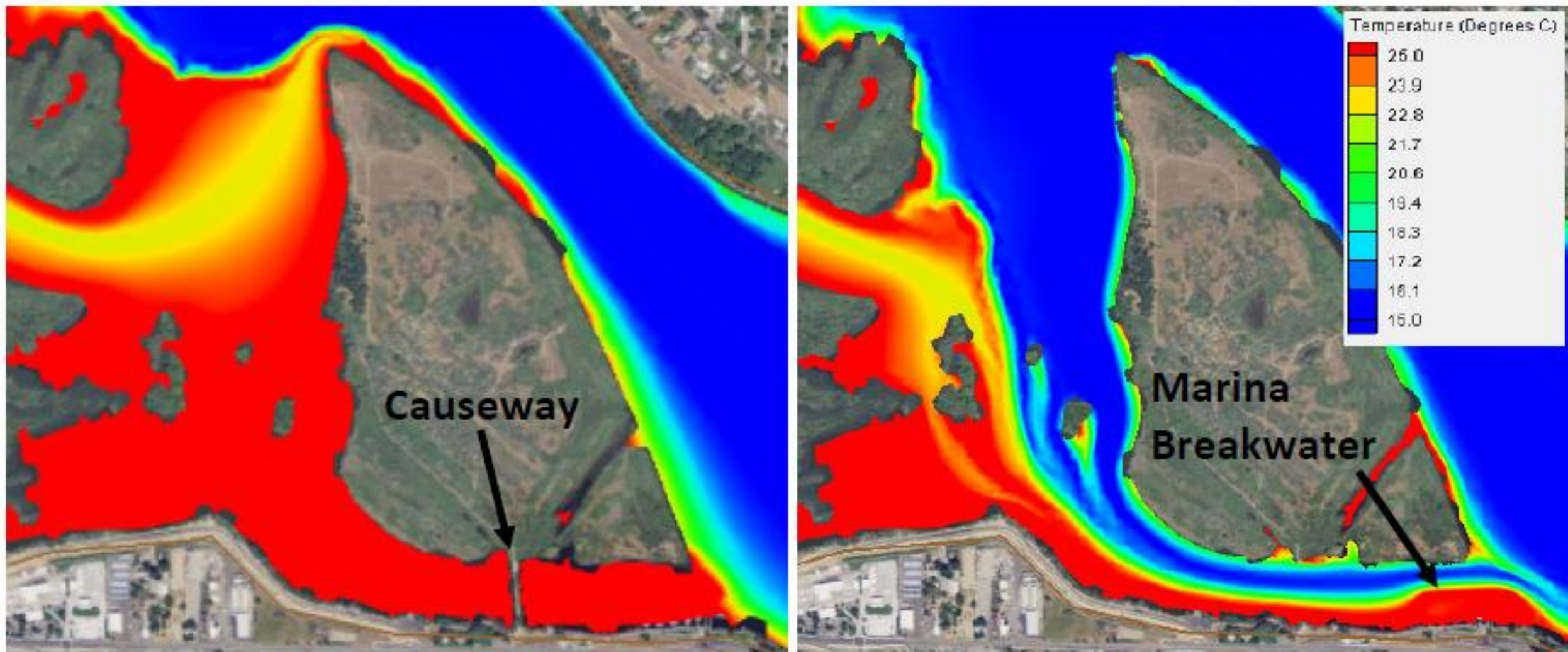


Figure EX1: Simulated Temperatures for a Moderately High Columbia River Discharge on July 8, 2012, (Left) Existing Conditions, (Right) Alternative 8, Full Causeway Removal with a Breakwater around Marina





Source: Michael Porter,  
YN



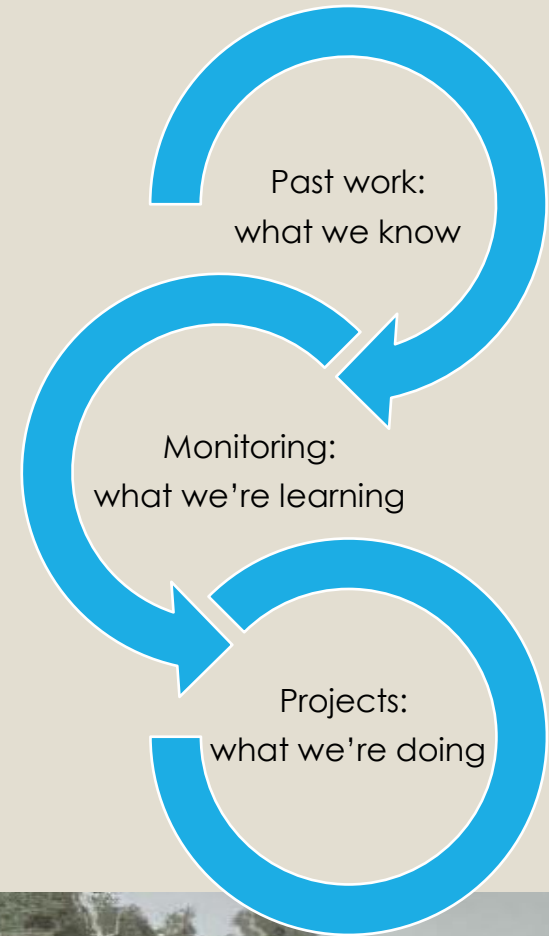
Enhancement :  
how do we  
know it when  
we see it?

- Improves access
- Increases influence
- Increases persistence
- Contributes to cumulative impact



# Funding – thanks!

- Washington Department of Ecology
- US Geological Survey
- Yakima Basin Integrated Plan
- Yakama Nation
- Salmon Recovery Funding Board
- US Army Corps of Engineers
- WA Department of Fish and Wildlife



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