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June 29, 2022

### **MEMORANDUM**

**TO: Committee Members**

**FROM: Leslie Bach**

**SUBJECT: Examples of climate change considerations in project planning and implementation**

### **BACKGROUND:**

**Presenters:** Matt Boyer, Montana Fish Wildlife and Parks, Gary James, Confederated Tribes of the Umatilla Indian Reservation, Ethan Crawford, Washington Department of Fish and Wildlife, Patrick Murphy, Idaho Department of Fish and Game

**Summary:** The panel will discuss how climate change considerations are being incorporated into ongoing project development and implementation. They will provide information from a diversity of geographies and different types of project actions. The presentation will cover both the potential effects of climate change on physical and biological conditions, and some of the adaptation mechanisms employed by managers to address those effects.

**Relevance:** The Climate Change strategy of the 2014/2020 Program directs the Council and others to consider climate change in all aspects of the program – program planning, project development, and project and program implementation and assessments. It calls for a better understanding of how the effects of climate change may impact mitigation and restoration efforts implemented under the Program, and directs project sponsors to consider and plan for different climate change scenarios that could affect their work. The Program's Public Engagement

Strategy calls for the Council to inform and involve the public on topics related to the Program through a variety of media formats.

**Background:** Projections for future climate in the Pacific Northwest suggest warming temperatures and changes in precipitation regimes. Warmer temperatures are expected to lead to diminished snowpack, and snowmelt will likely occur earlier in the season relative to current conditions. These changes will result in earlier and increased peak flows and lower summer low flow conditions and higher stream temperatures. Implications for fish and wildlife include altered migration timing and increased channel or redd scouring in the winter and reduced water supply and habitat availability in the summer.

In the most recent project review processes, the project proposal request included specific questions regarding potential implications of climate change on project planning and implementation. Project sponsors addressed these questions in their proposals, providing an excellent summary of expected climate change conditions and implications across the Columbia Basin. The specific questions addressed were: 1) How will climate change potentially impact your project in the future and what information sources were used to identify those impacts; 2) What adaptation measures were taken to adjust your project for these impacts; and 3) How could you evaluate the success of your adaptation measures to inform future projects? This presentation will provide a sample of the responses provided during the review process and the ongoing efforts to address climate change effects on projects.

# Strategies for Climate Change Adaptation and Mitigation

**NPCC  
Fish & Wildlife Committee Meeting  
6 July 2022**



**Habitat Protection**

**Cold Water Refuge**

**Hydro Operations**

**Monitoring and Applied Research**



*confluence of the North and Middle forks of the Flathead River*

# Habitat Protection - Acquisition

## Whitefish Lake Watershed Project

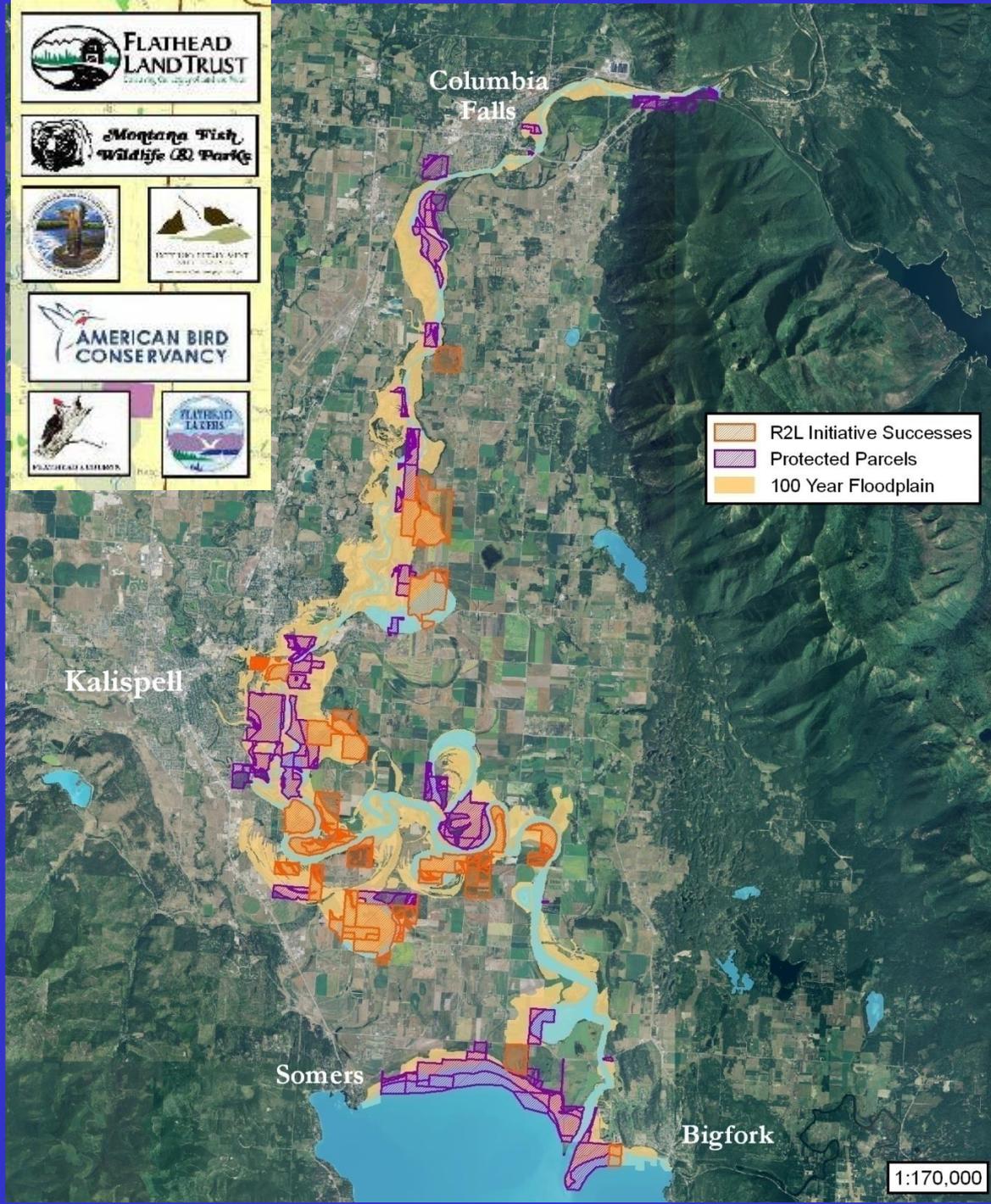
- 21 Section (~14,000-acre) acquisition
- BPA funded portion protects 3,200 acres of Swift Cr. riparian corridor



# Habitat Protection - Conservation easement

## River to Lake Initiative

- 45 projects (10 BPA funded)
- 29% of mainstem Flathead River protected (7 miles)
- 49% of ecological floodplain protected (5,000 acres)
- 4 miles of restoration projects completed
- 51% of wetlands protected
- Important shallow aquifer protected



# Habitat Protection - Conservation easement

Foys Bend Fisheries Conservation Area



Photo by:

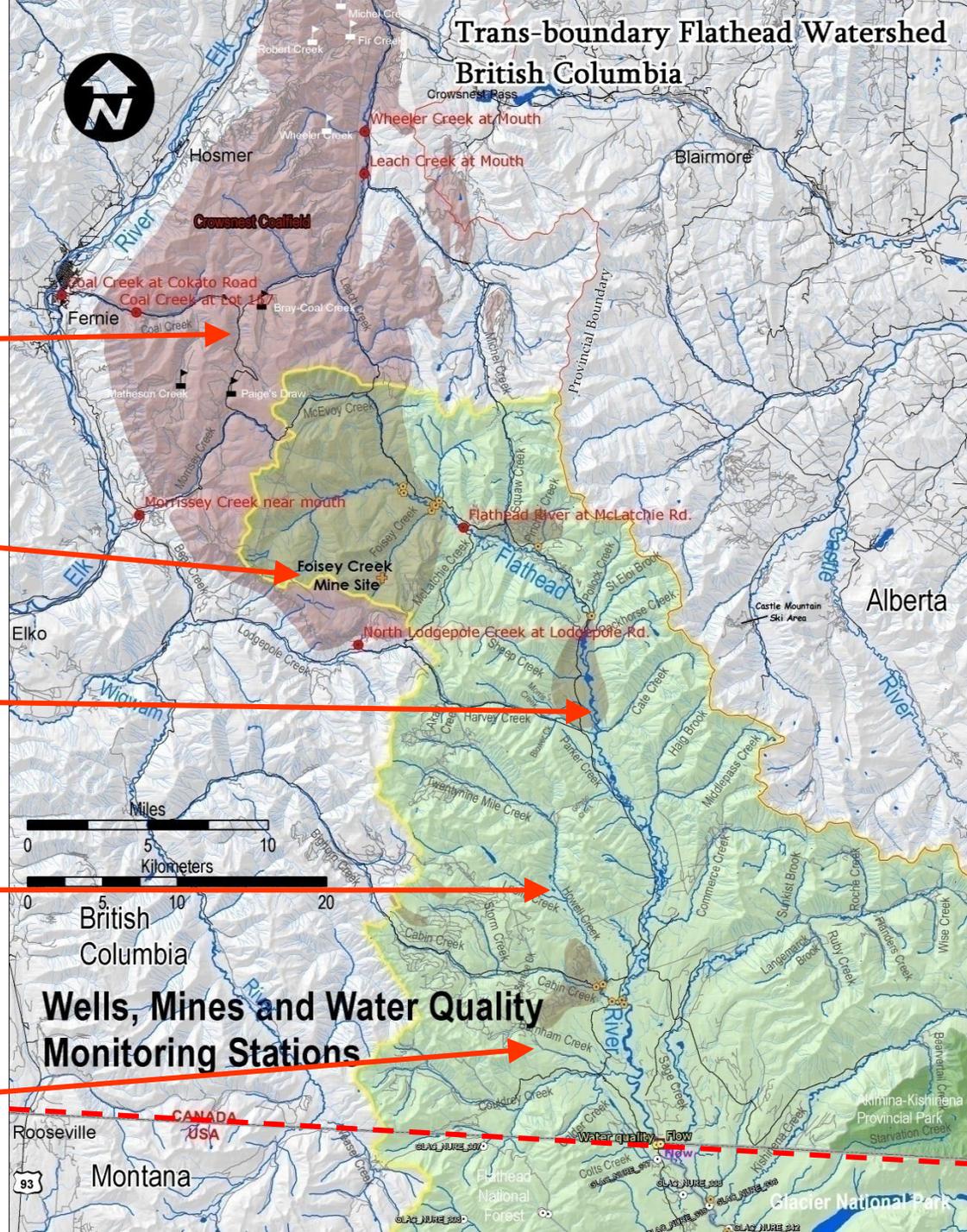
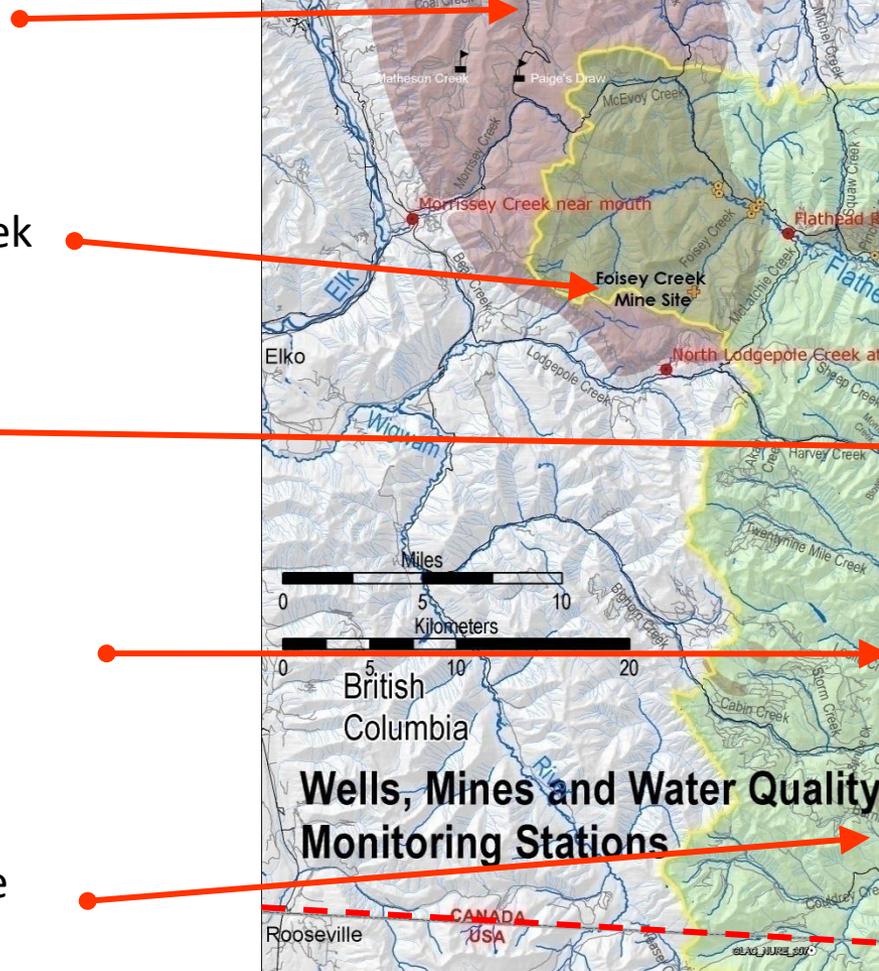
**Habitat Protection  
- Legislative action**



**Transboundary Flathead River**

# PROPOSALS FOR FOSSIL FUEL AND MINING DEVELOPMENT

- 
**British Petroleum**  
 CBM (2007 – 2010)
  
- 
**Cline Mine Foisey Creek**  
 (2004 – 2009)
  
- 
**Lillyburt Coalfield**  
 (2005)
  
- 
**Howell Creek Gold and Phosphate Exploration**  
 (2008 -2009)
  
- 
**Cabin Creek Coal Mine**  
 (1977)



# Habitat Protection - Legislative action



*coal mining in the Elk River valley, BC, Kootenay/ai watershed*

# Habitat Protection - Legislative action



*Memorandum of Understanding and Cooperation on*

## ENVIRONMENTAL PROTECTION, CLIMATE ACTION AND ENERGY

*between*

The Province of British Columbia

*and*

The State of Montana



# Cold Water Refuge

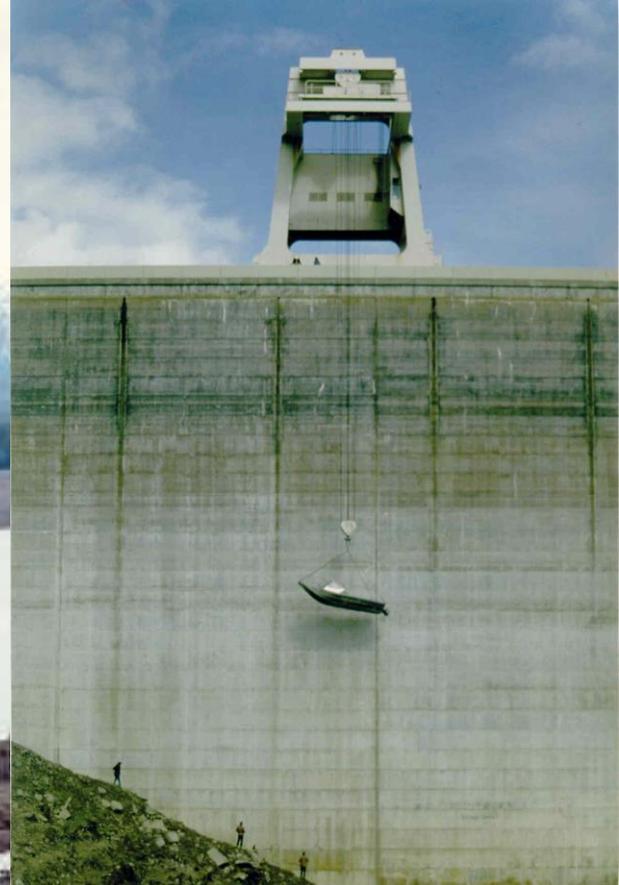
## - Species conservation

Lake Evangeline, Camas Lake, and the Camas Watershed: Glacier National Park



# Hydro Operations

- Temp. management and system productivity



# Hydro Operations

## - Water supply



# NFWF



Columbia Basin  
Water Transactions  
Program

Painted Rocks Reservoir, West Fork Bitterroot River



# Long term monitoring and applied climate change research

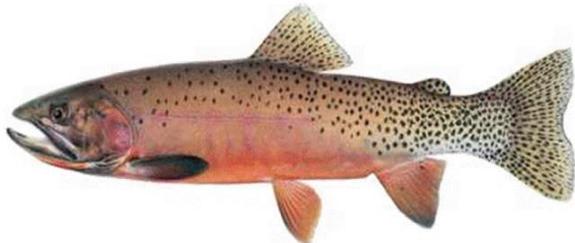
LETTERS

PUBLISHED ONLINE: 25 MAY 2014 | DOI: 10.1038/NCLIMATE2252

nature  
climate change

## Invasive hybridization in a threatened species is accelerated by climate change

Clint C. Muhlfeld<sup>1,2\*</sup>, Ryan P. Kovach<sup>2</sup>, Leslie A. Jones<sup>1,3</sup>, Robert Al-Chokhachy<sup>4</sup>, Matthew C. Boyer<sup>5</sup>, Robb F. Leary<sup>6</sup>, Winsor H. Lowe<sup>3</sup>, Gordon Luikart<sup>2</sup> and Fred W. Allendorf<sup>3</sup>

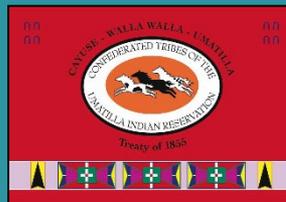


# Floodplains in Crisis

## CTUIR Floodplain Restoration Projects and Recommendations to Lessen Anticipated Impacts of Climate Change



**NPCC F&W Committee  
Panel Presentation  
July 5, 2022**



**Gary James**  
CTUIR Fisheries  
Program Manager

# Presentation Topics

1. CTUIR Floodplain Management Approach
2. Floodplain Benefits
3. Management Problems/Poor Current Conditions
4. CTUIR Floodplain Project Examples
5. Floodplain Restoration Recommendations

# Tribal Importance

**Floodplain Health is critical to accomplishment of CTUIR mission statements:**

## **CTUIR Department of Natural Resources:**

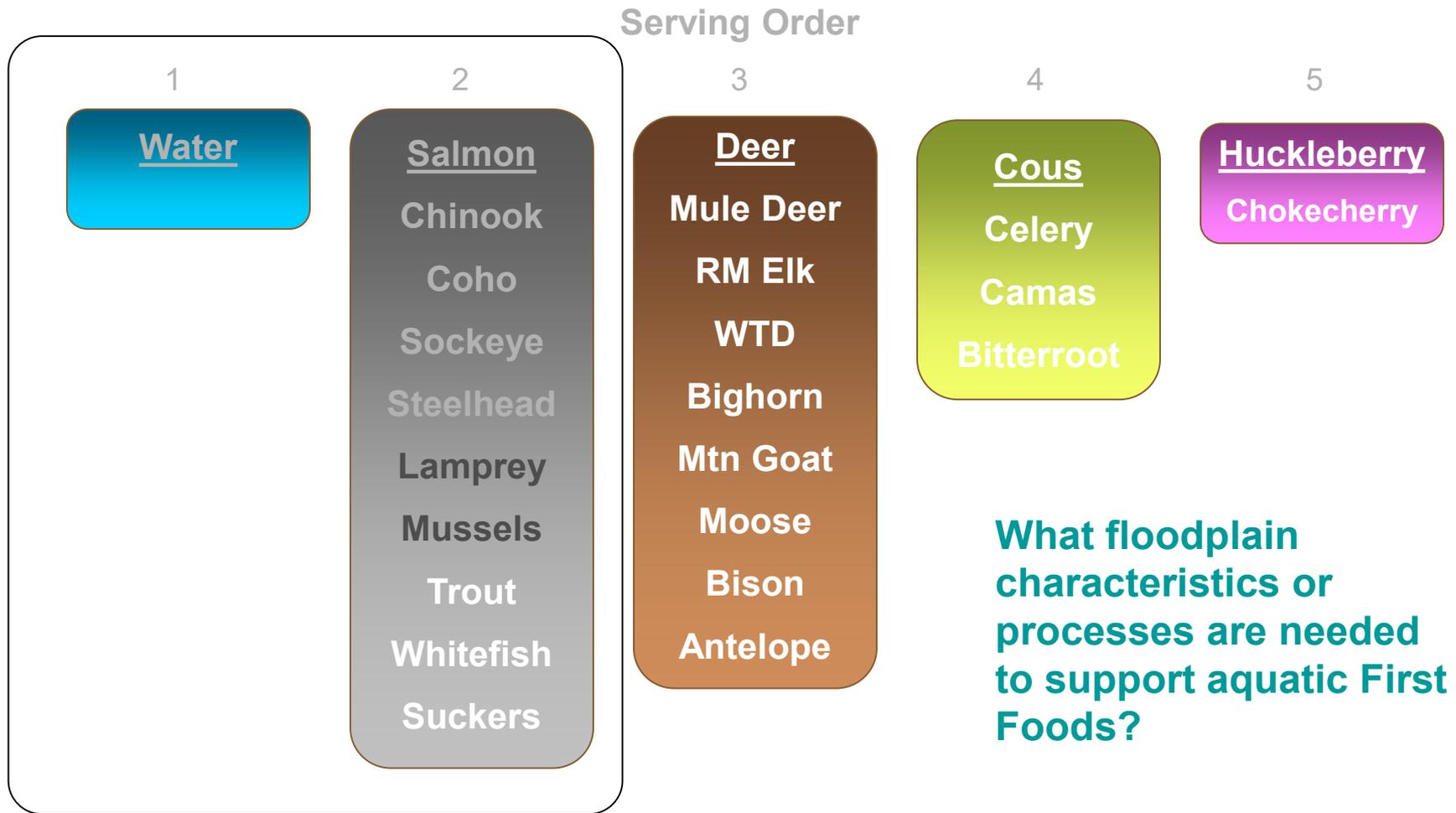
To protect, restore, and enhance the First Foods - water, salmon, deer, cous, and huckleberry - for the perpetual cultural, economic, and sovereign benefit of the CTUIR. We will accomplish this utilizing traditional ecological and cultural knowledge and science to inform: 1) population and habitat management goals and actions; and 2) natural resource policies and regulatory mechanisms.

## **CTUIR Fisheries Program:**

Provide sustainable harvest opportunities for aquatic species of the first food order by protecting, conserving and restoring native aquatic populations and their habitats.



# Using a First Foods-Based River Vision to Guide Fisheries Actions



# CTUIR's First Foods-Based River Vision to Guide Fisheries Restoration

## First Foods Serving Order:

1



2



3



4



5

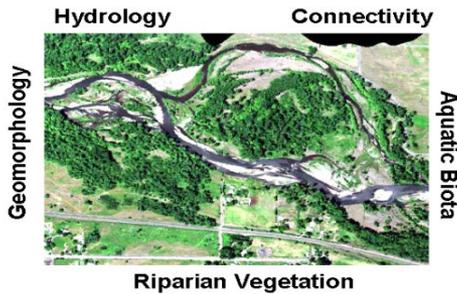


## River Vision Touchstones:



Goal:

**Restore Floodplain and Increase First Foods for Tribal Use**



# River Vision Touchstones

(stream health indicators)

## Hydrology

- Timing and volume of river flow
- Water quality

## Geomorphology

- Topographically diverse and unrestricted channel
- Complex braided channel with islands and large wood

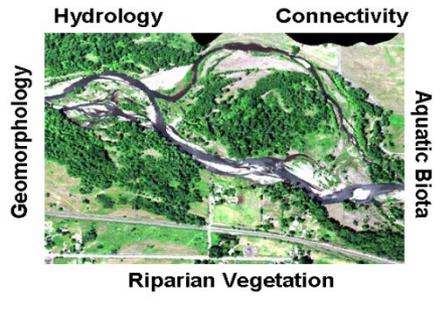
## Connectivity

- Stream accessibility to floodplain
- Longitudinal, lateral and vertical

## Riparian Vegetation

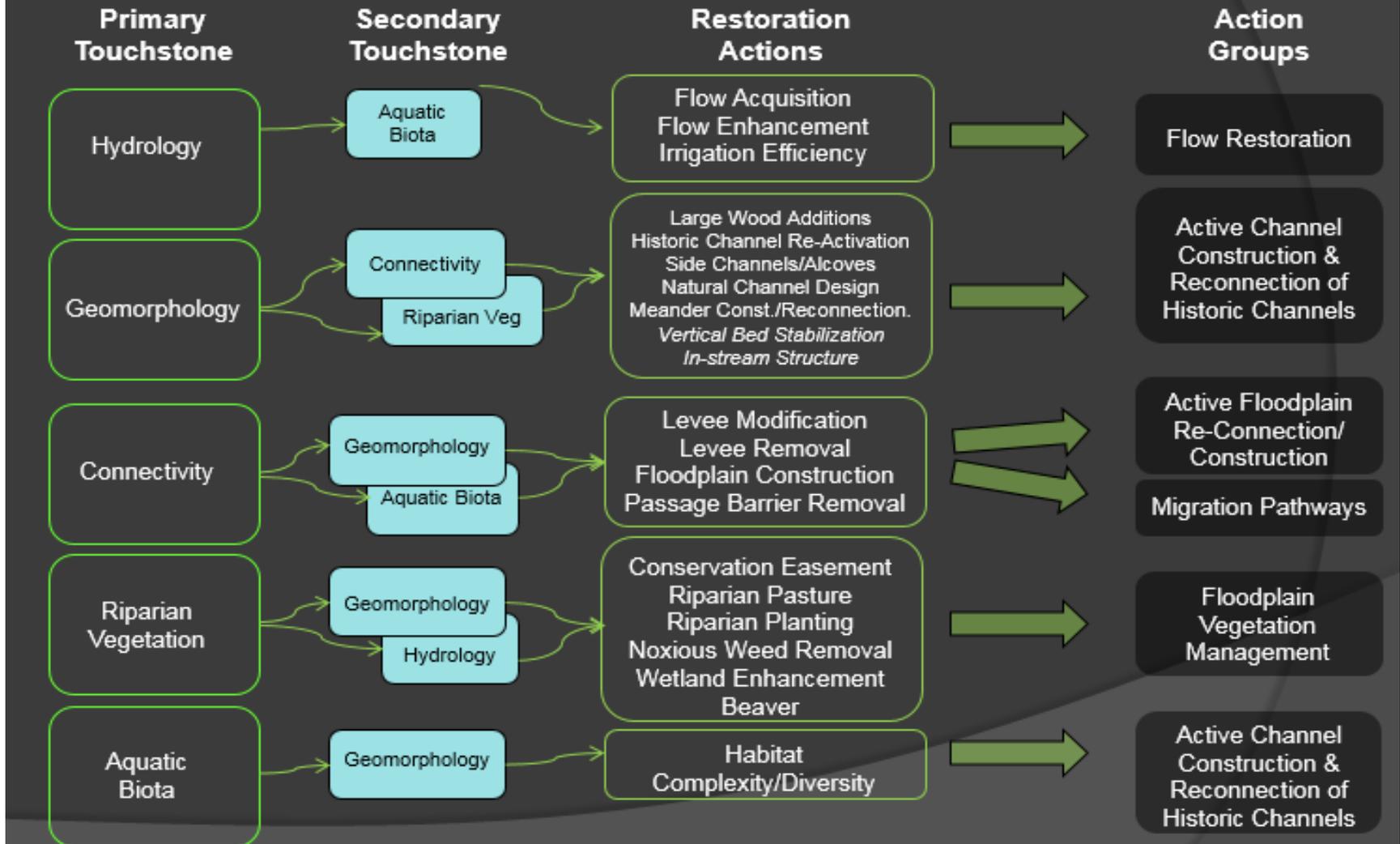
- Diverse community of self-sustaining native vegetation
- Contributes shade, bank stability, large wood and leaf litter

# Aquatic Biota



## *Healthy Native Species*

# River Vision Application: Fisheries Habitat



River Vision principles applied in assessments, design, implementation and M&E

# Healthy Floodplain Benefits

## (Watershed Resources)

### Natural Flood and Erosion Control

- Flood storage and conveyance, reducing flood peaks and velocities
- Reduce erosion impacts and sediment loading
- Replenish soils, enhancing riparian vegetation

### Surface Water Quality Maintenance

- Filter nutrients and improve water quality
- Enhance surface-to-groundwater exchange and temperature reduction

### Groundwater Recharge

- Promote stream access to floodplain for infiltration & aquifer recharge
- Reduce frequency & duration of low surface flows (enhance base flow)



# Healthy Floodplain Benefits

## (Biologic Resources)

### Biological Productivity

- Increase habitat complexity
- Maintain biodiversity of plants and animals, abundance of food - integrity and productivity of ecosystem
- Increase spawning and rearing habitat by maintaining stream length and access to side channels



# Healthy Floodplain Benefits

## (Societal Resources)

### Harvest of Wild and Cultivated Products

- Increase abundance and harvest of native foods associated with floodplain
- Enhance agricultural productivity by increasing/maintaining groundwater levels
- Reduce flood risk and limit loss of agricultural lands by decreasing scour and erosion

### Provide Cultural, Aesthetic and Recreational Use Values

- Contain cultural resources (historic and archeological sites)
- Increase recreational opportunities and aesthetic pleasure

# Current Condition of Floodplains

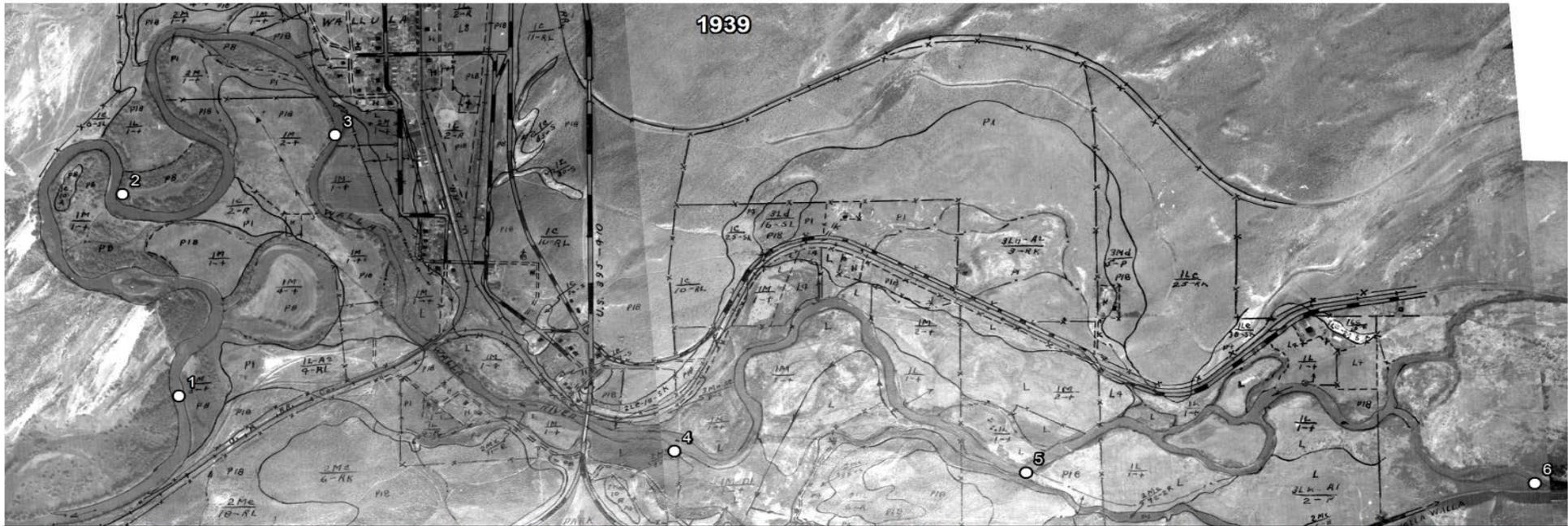
## Floodplain Health

- Endangered Species Act (ESA) recovery planning efforts determined that “watershed function” for subbasins in NE Oregon and SE Washington ranged from 25-50% due to poor watershed health and floodplain development.
- About 75% of streams in the Umatilla and Walla Walla basins have been channelized which has drastically reduced stream length and floodplain connectivity. In-basin smolt mortality at 50-60%.
- In the Umatilla and Walla Walla Subbasins, riparian wetland habitat has declined about 90% due to floodplain development over the last century.

# Anthropogenic Fish Mortality Rates in Columbia Basin 2020 CBPTF Modeling

Fish Population	Man-Induced Fish Mortality Rates				
	Hydro	Tributary Habitat	Predation	Estuary	TOTAL
Snake River Spring Chinook	62%	50%	29%	16%	94%
Mid-Columbia Steelhead	23%	80%	33%	28%	96%

# Mouth of Walla Walla River – loss of meanders due to channelization



# Grande Ronde River State Ditch construction cut off 45 stream miles



# Problems in Floodplains

## Wrong Management Emphasis

- Goal of flood loss reduction
- Natural processes in broad floodplains has been second priority
- Development-centered uses such as agricultural, municipal and roads have taken precedence over protection of floodplain function

## Physical Changes

- Reduced floodplain area and formation of channelized floodway
- Armoring of banks with rip-rap to control erosion (creates incising)
- Reduced stream length, increase in gradient & water velocity
- Loss of instream and substrate habitat diversity
- Disrupted geomorphic processes (channel migration, side channels, islands, sediment transport and sorting and large wood transport)
- Over-appropriation of surface flows and shallow groundwater
- Loss of instream flows and decreasing groundwater levels
- Construction of dams – disrupt fish passage and habitat diversity
- **Climate change will exacerbate all of the above (FP's in CRISIS)**

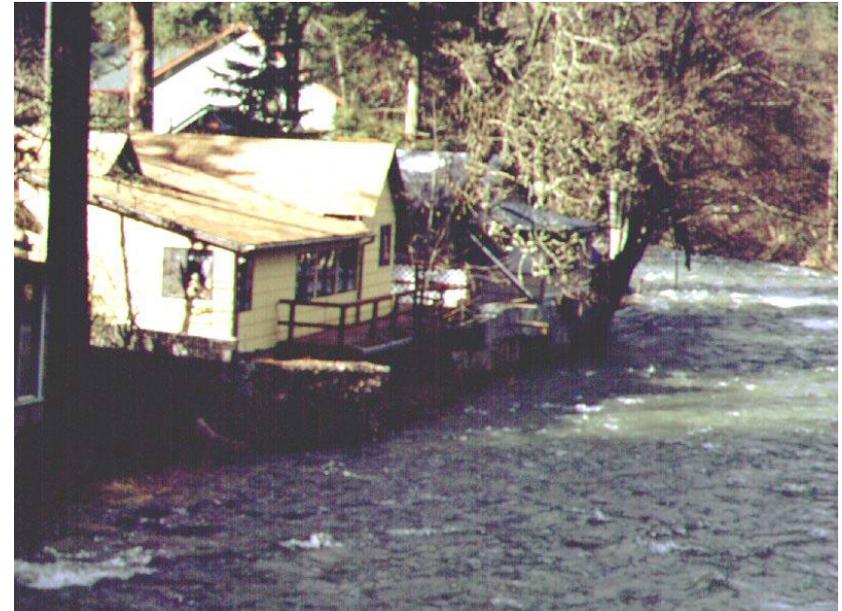
# Climate Change Impacts on Floodplains

- Decreased summer base instream flows
- Increased summer water temperatures
- Decreased summer fish carrying capacity; decreased suitable rearing habitat (already a primary limiting factor)
- Increased magnitude and frequency of fall and spring high flow events
- Reduction of peak snow water equivalent
- Climate change perhaps greatest threat to salmonid viability in CRB
- Increasing floodplain health (implementing River Vision) perhaps the greatest opportunity to offset climate change impacts

# Floodplain Land Management Recommendations

## 1. Halt or Minimize New Development in Floodplains and Wetlands

- Strengthen land use regulations to prohibit further development in floodplains, springs & wetlands and historic stream channels.





Feedlot near stream



Concrete backyard stream



Highway and levee encroachment



Ditch runoff erosion



Residential and agricultural development



Channelization with weirs and summer cesspools

# Floodplain Land Management Recommendations

## 2. Reconnect Streams with Floodplains

- Identify locations to reclaim natural floodplain habitat and function.
- Address fish passage impacts from instream development
- Promote removal or set back of dikes and levees.
- Increase area of riparian conservation easements.
- Consider condemnation of “critical value” floodplain developments.
- Promote relocation of flood-damaged development rather than redevelopment in floodplain.
- Implementation of above floodplain restoration actions may be the best preventative action for minimizing anticipated effects of climate change.



# CTUIR Floodplain Restoration



## ➤ Assessments for Comprehensive & Scientifically Defensible Restoration Strategies

- Completed 7 sub-drainage and 3 reach assessments (2 more ongoing) with associated strategic action plans for future River Vision-based floodplain restoration.
- By Subbasin: UM – 3; WW – 2; GR – 2; TUC – 1; JD - 2

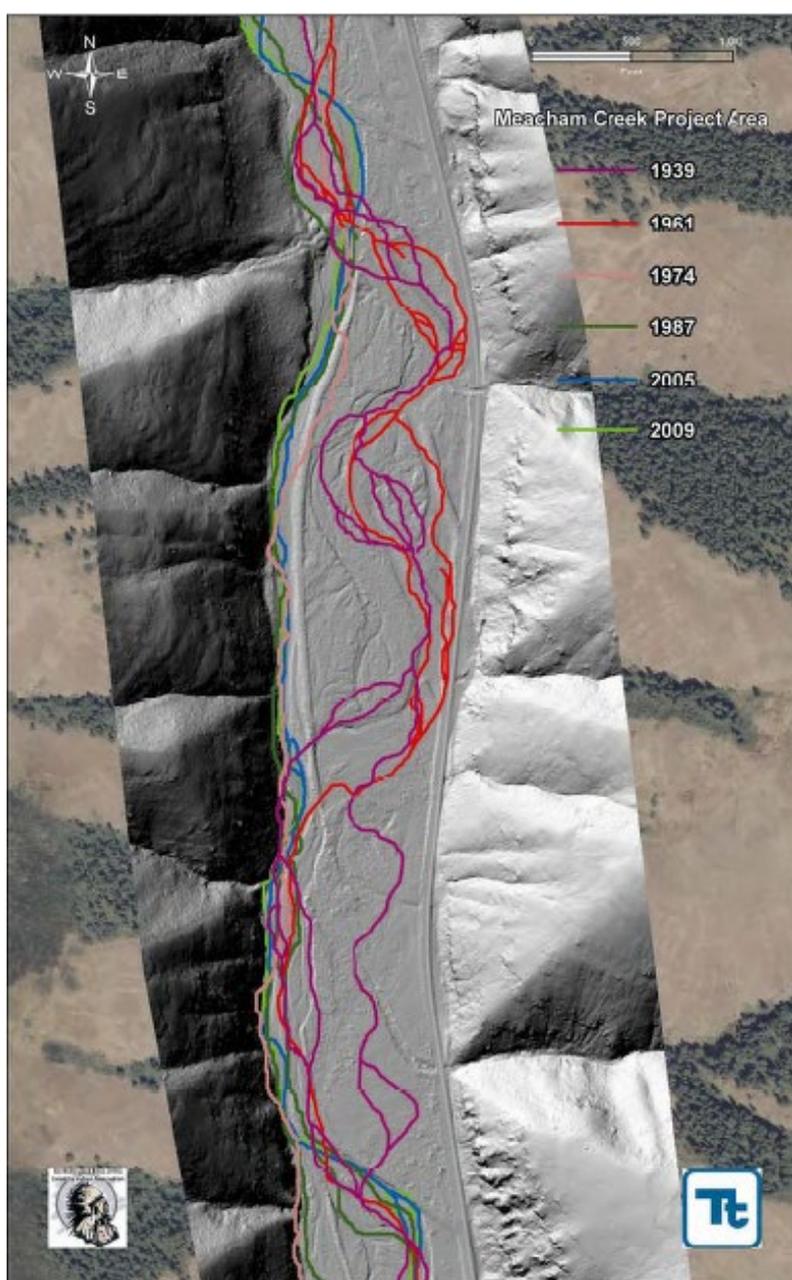
## ➤ Restoring floodplains, channels and riparian habitat

- Changing land use to benefit fish – livestock fencing, planting native plants, controlling noxious weeds
- Managing about 104 land-owner conservation agreements and easements which cover 138 stream miles; 24,000 floodplain acres
- Reactivating the floodplain, removing levees, increased channel length, and adding habitat; 37 completed projects cover 53 stream miles



South Fork Walla Walla River Before (2014) and After (December 2016)





## Meacham Creek floodplain restoration project - before (2011) and after (2013)





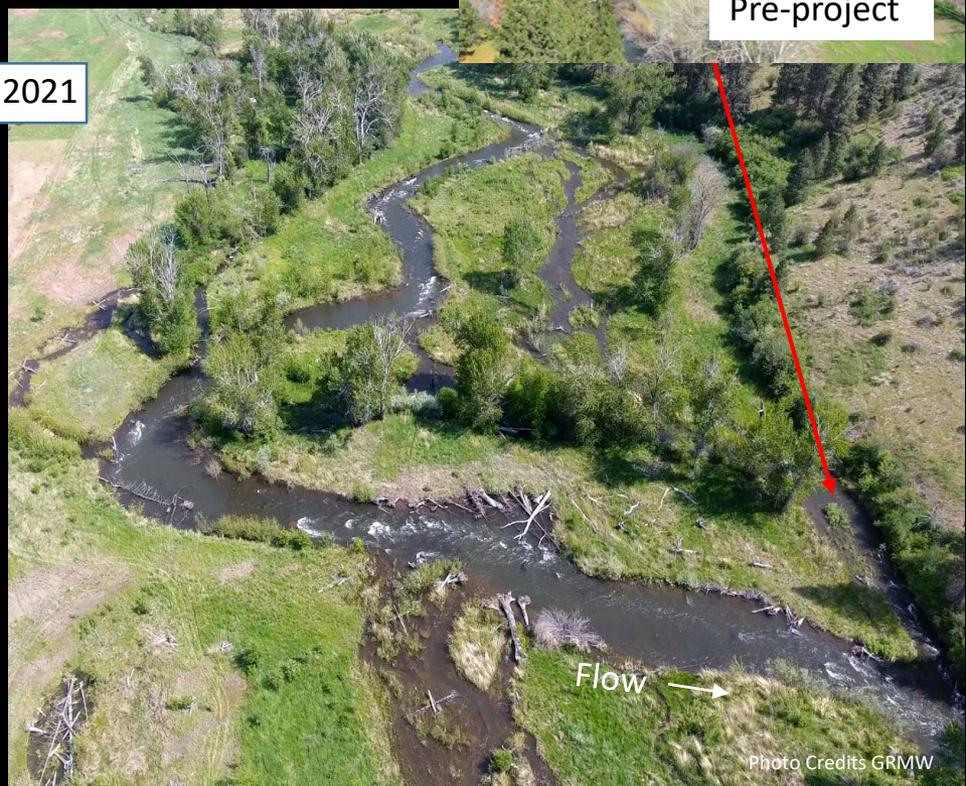
## 5-mile ditch-type reach is constrained by levees and is deeply incised



Figure 11.—Walla Walla River in the 1964 flood showing meanders in a channelized section near Milton-Freewater. (Source: OSU Archives)

# Catherine Creek – Southern Cross Fish Habitat & Floodplain Restoration

(Construction 2015 to 2016)



# Grande Ronde River Bird Track Springs

(Constructed 2018 - 2019)

- Disconnected Floodplain
- Over-widened, armored bed
- 70% historic pool loss
- Poor riparian
- Altered thermal regime



## Legend

- Bankfull (1324 cfs) - Proposed
- 2-year - Proposed
- 10-year - Proposed



NOVEMBER 2019 ORTHO IMAGE (95% CONSTRUCTION COMPLETED)



Downstream Views Longley Meadows



Google Earth



Upstream Views



Google Earth



# Habitat Enhancement Effectiveness Monitoring

## Purpose

- Determine the physical and biological responses of stream habitat enhancements across five NE Oregon/SE Washington basins



## Approach

- Compare 7 sets of representative treatment and control reaches, before and after restoration implementation
- Measure habitat features, fish survival, abundance and productivity in response to habitat enhancements

## Initial Results

- Positive impacts on River Vision Touchstones: Increased floodplain connectivity, hydraulic diversity, channel complexity, and riparian measurements.
- Increased fish abundance and species diversity
- Increases in desirable fish habitat preferences (i.e. pool area, large wood, high flow refugia)



Control



Treatment

# Floodplain Water Management Recommendations

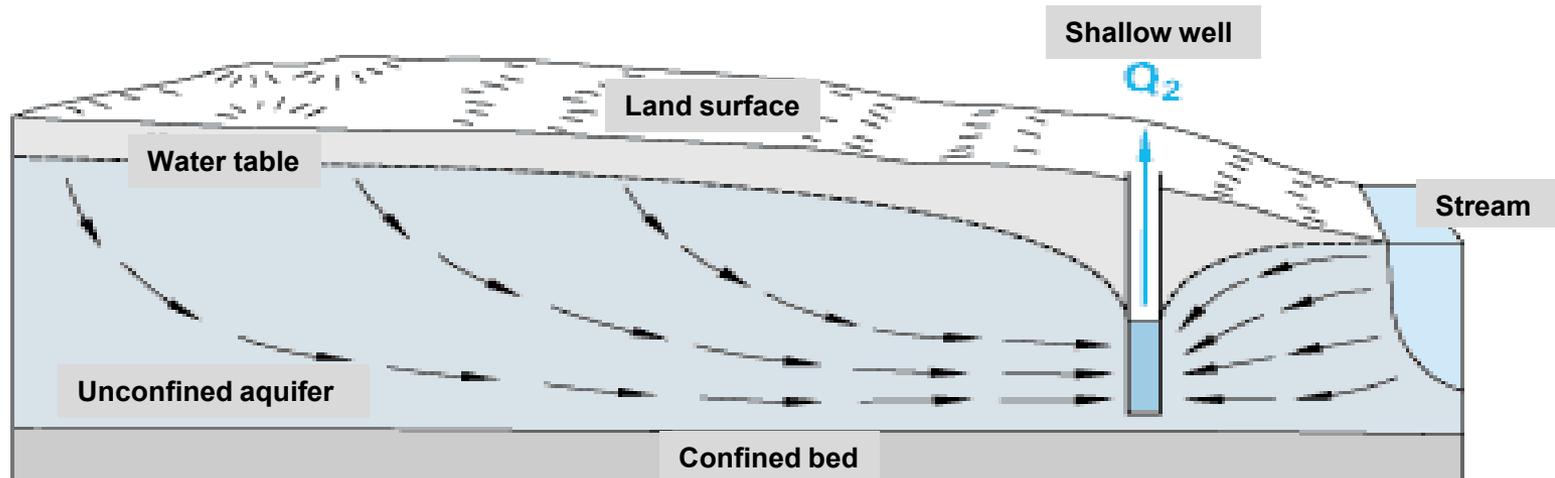
## 1. Surface Water Regulatory Statutes

- Increase opportunities or incentives for development of conservation projects such as irrigation efficiency, water transaction projects, shallow aquifer recharge (SAR) and restoration of natural floodplains.
- Strengthen water law to identify, quantify and protect increased instream flows resulting from water conservation efforts.
- Encourage and develop legal mechanism for irrigators to access groundwater supplies, enhanced through recharge efforts (ASR), in exchange for protected surface flows.
- Quantify and protect ecological flows from further appropriation (particularly spring/winter flows which are often considered “available”).

# Floodplain Water Management Recommendations

## 2. Groundwater Withdrawal Impacts to Surface Flows

- Strengthen the legal connection and co-management linkage between surface water rights and groundwater rights and increase regulating groundwater usage impacting surface flows.
- Identify areas where floodplain groundwater use impacts surface flow and promote aquifer recharge to lessen impacts.



# Floodplain Water Management Recommendations

## 3. Monitor, Protect and Enforce Instream Flows

- Strengthen state and local monitoring and protection of quantified instream water rights -- particularly “new conservation project flows” that would otherwise be absorbed by junior water right holders.
- Shift water management focus and funding priorities from developing new agriculture water supplies to monitoring and enforcement of existing agricultural rights and protecting new instream water rights



Stream dewatering from surface diversions



Same reach - increased flow

# CRITFC Future of Our Salmon (FOOS) Conference

## Healthy Floodplains, Living Rivers - October 2016 - Call to Action

**Goal** – Proceed from this conference to implement a river vision that recognizes the multiple purpose values of healthy and ecologically sustainable floodplains in the Columbia River mainstem and its tributaries that is **resilient to anticipated climate change impacts**.

**Problem** - Land and water development and management in the floodplains of the Columbia Basin over the last 150 years has not recognized the benefits and environmental capital of properly functioning floodplains. Status quo floodplain management in the Columbia River Basin is not adequate to reverse the negative ecological and social impacts. **These concerns are expected to increase as a result of the greatly diminished and altered current condition of our floodplains coupled with climate change.**

# CRITFC Future of Our Salmon (FOOS) Conference

## Healthy Floodplains, Living Rivers - October 2016 - Call to Action

**Recommendations** – A collaborative and unified whole-basin vision and action framework must be developed and implemented. Such a framework would target and focus actions to connect all agencies, tribes and communities through support of common objectives for improved natural floodplain health and ecological function in the Columbia Basin. An action framework would immediately call for no net loss of floodplain habit and then prescribe widespread floodplain **enhancement actions**. To initiate development of this approach, form a post-conference trans-boundary planning committee to:

1. **Identify entities** which have management authorities related to Columbia Basin floodplain land or water management.
2. Send inquiries to entities requesting that they delineate how their respective authorities can be implemented (as per “Workshop Call to Action Points”) to **increase efforts to address natural floodplain function** in order to achieve net ecological/cultural/social/economic benefits.
3. **Compile** responses into a draft master list of improved Columbia Basin **floodplain and water management actions**.
4. Utilize GIS designation of historic, current and planned floodplain areas to locate restoration actions and **track floodplain area recovery**.
5. Develop **education and outreach** approach which identifies necessary stakeholders and promotes understanding and benefits of actions.
6. Disseminate draft framework to agencies, tribes and stakeholders for comment.

# Entities with Responsibilities or Authorities that Effect Fish Survival in Tributary Habitat (draft submitted by CTUIR for CBC Process)

Entity Type	Entity	General Responsibility or Management Authority
Federal	NMFS	Administer ESA programs for listed anadromous fish
	USFWS	Administer ESA programs for listed resident fish
	USFS	Manage federally-owned lands; generally in headwaters
	BLM	Manage federally-owned lands; generally located downstream of USFS lands
	BOR	Manage water storage projects and fish passage and habitat mitigation projects
	USACE	Construct/maintain/manage flood risk projects; floodplain permitting
	NRCS	Manage land conservation programs and implement projects
	EPA	Manage and grant funding for land/water quality improvement
State	Fish Managers	Floodplain project review and permitting and watershed project implementation
	Water Resource Managers	Manage and appropriate instream flow and groundwater
	Land Resource Managers	Manage state-owned lands
	Highway Departments	Manage road transportation networks in floodplains near and over streams
Tribal	Indian Tribes	Manage reservation lands and implement projects on and off reservation
Local	Counties	Administer land use and zoning laws
	Cities	Manage lands within city limits
	Watershed Councils	Facilitate stakeholder support and implement watershed projects
	CD's	Facilitate land conservation programs and implement projects
	Land Trusts/Cons. Partnerships	Implement watershed projects
Mitigation Programs	NPCC	Adopt Columbia Basin F&W Program and conduct project science reviews
	BPA	Fund F&W mitigation projects through Columbia Basin F&W Program
	State	Implement watershed pjcts: WA Recovery Brd, OR Watershed Enh. Brd, FP by Design, etc.
Private	Individual landowners	Manage private owned lands
	Corporate landowners	Manage private owned lands
	Railroads	Manage rail transportation networks in floodplains near and over streams

# QUESTIONS?



# Climate Impacts to Status and Trend Monitoring in Southeast Washington

Ethan Crawford  
Fish Biologist 3  
WDFW, Fish Science



# Project Overview

-BPA Project numbers:

[2002-053-00 Lower Snake Steelhead VSP](#)

[2000-039-01 Touchet Steelhead VSP](#)

-Both projects are status and trend monitoring projects focused on collecting high quality data to inform VSP metrics for summer run steelhead and trajectory toward recovery.





- Tools:**
- Weirs
  - Instream PIT Detection Systems(IPTDS)
  - Rotary smolt traps

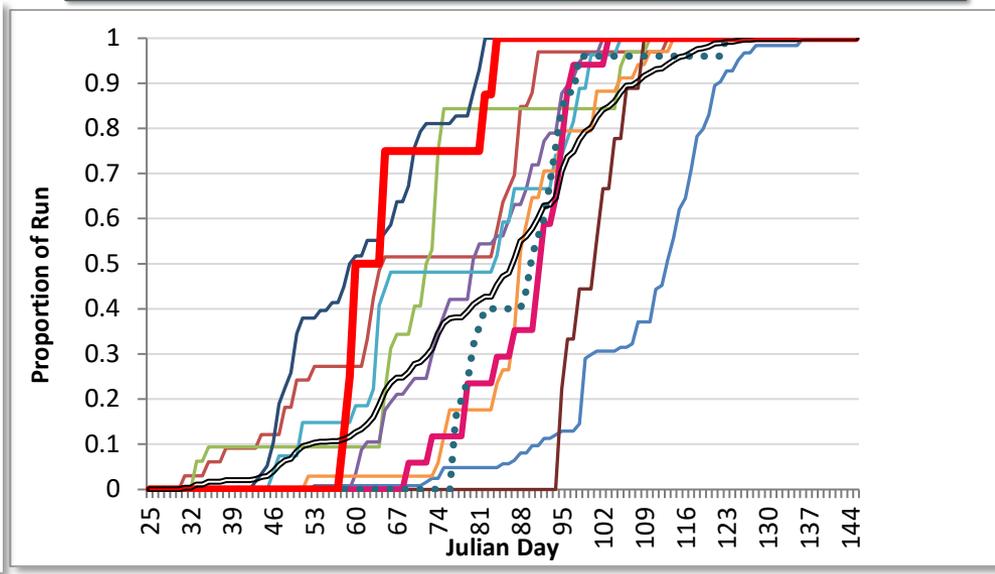
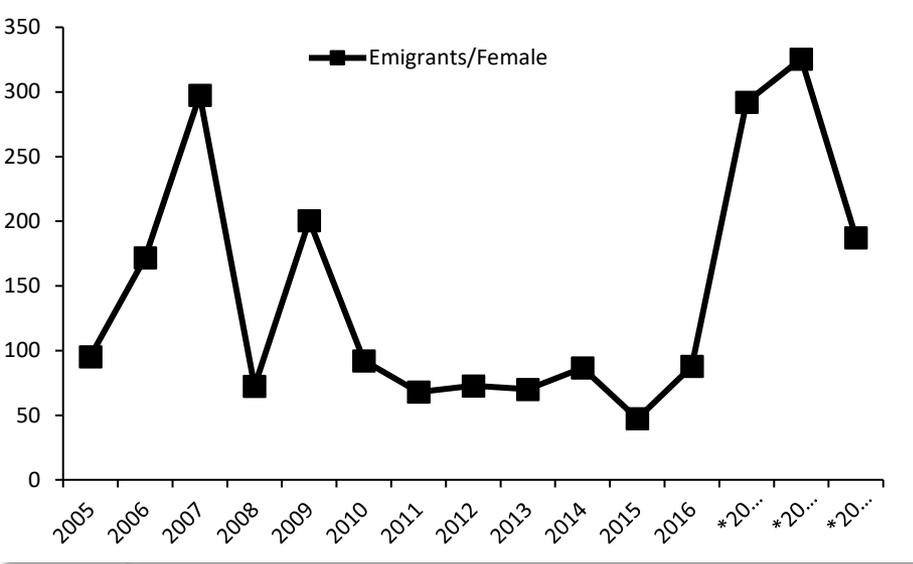
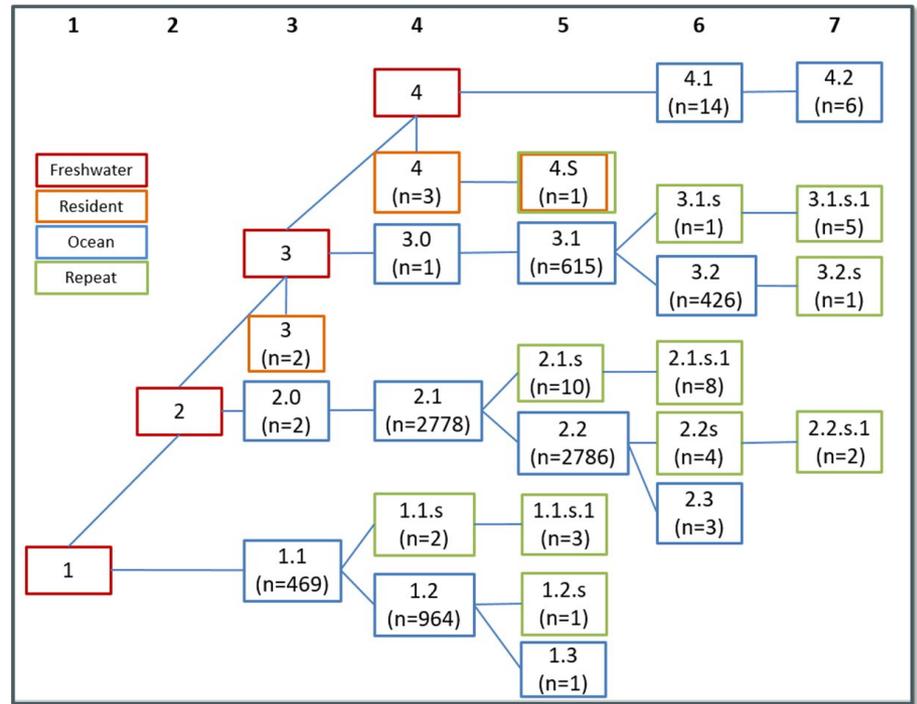
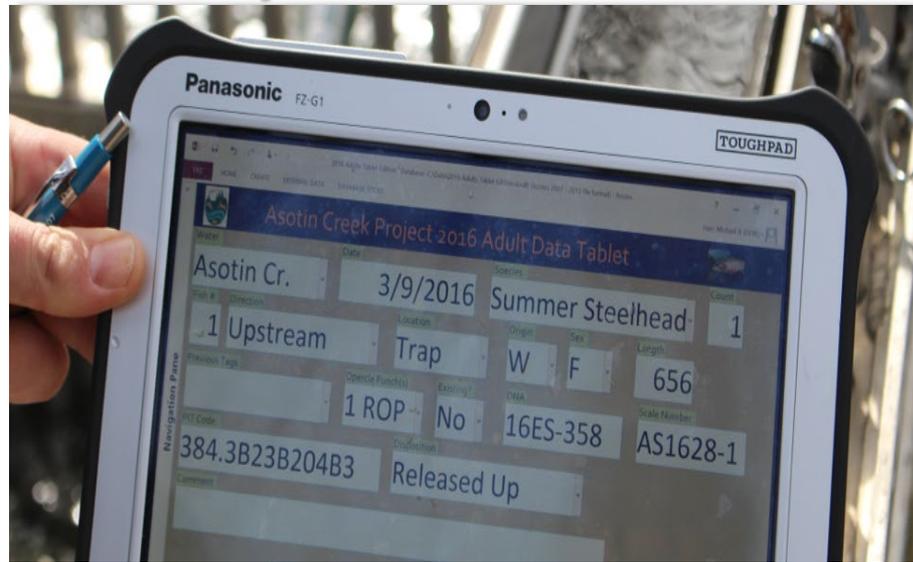


# Data Generated

- Adult Abundance and Composition (pHOS)
- Emigrant Abundance
- Productivity
- Diversity
- Spatial Structure



# Utility Of The Data



# Direct Climate Impacts

- Earlier runoff
- Increasing flooding magnitude & frequency
- Higher summer peak temperatures & longer duration
- Wildfire risk, magnitude & frequency



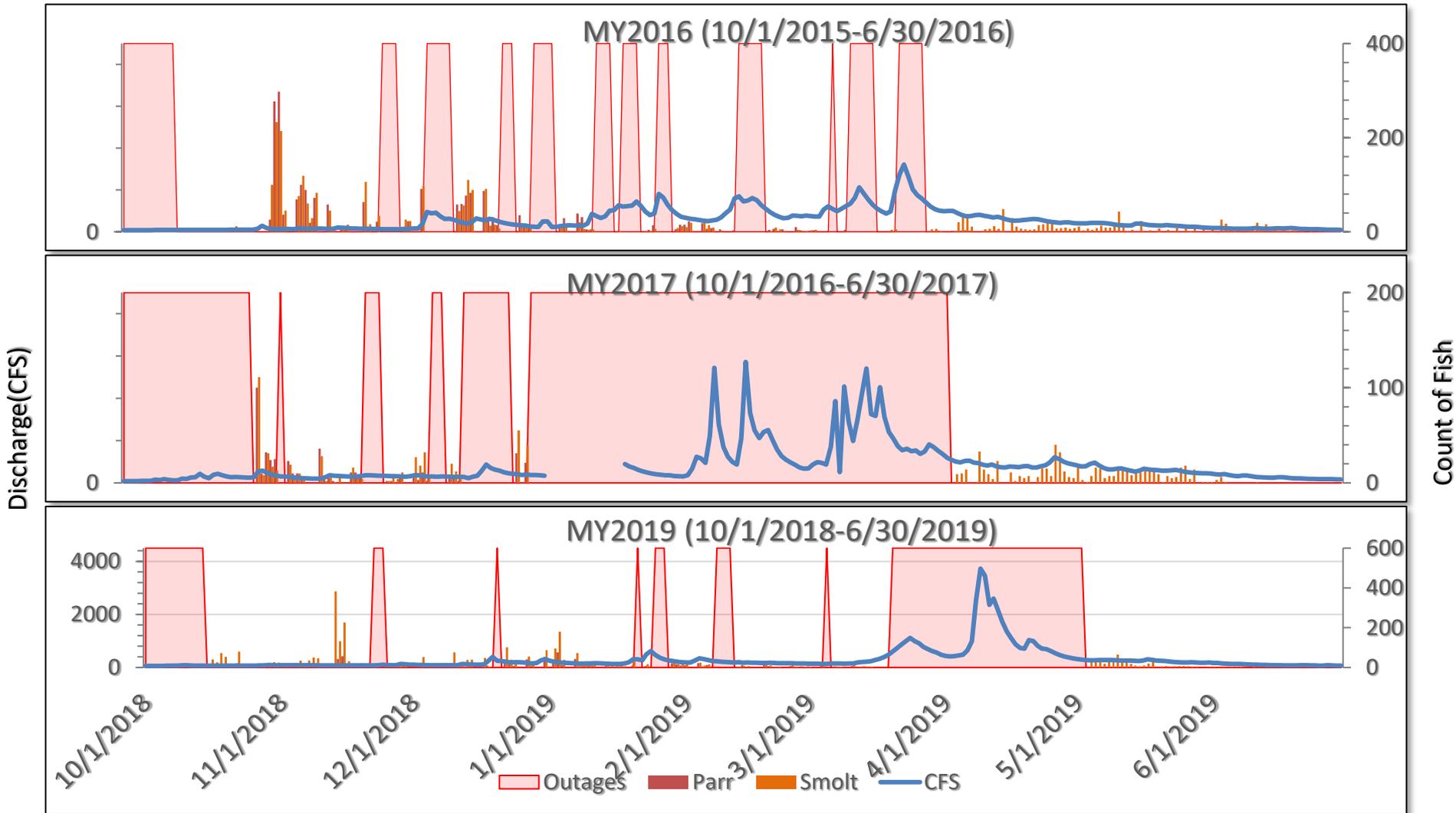
# Impacts to Implementation

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- Trap locations
- Operational Schedule
- IPTDS washouts
- Increased repair & maintenance



# Touchet Smolt Trapping



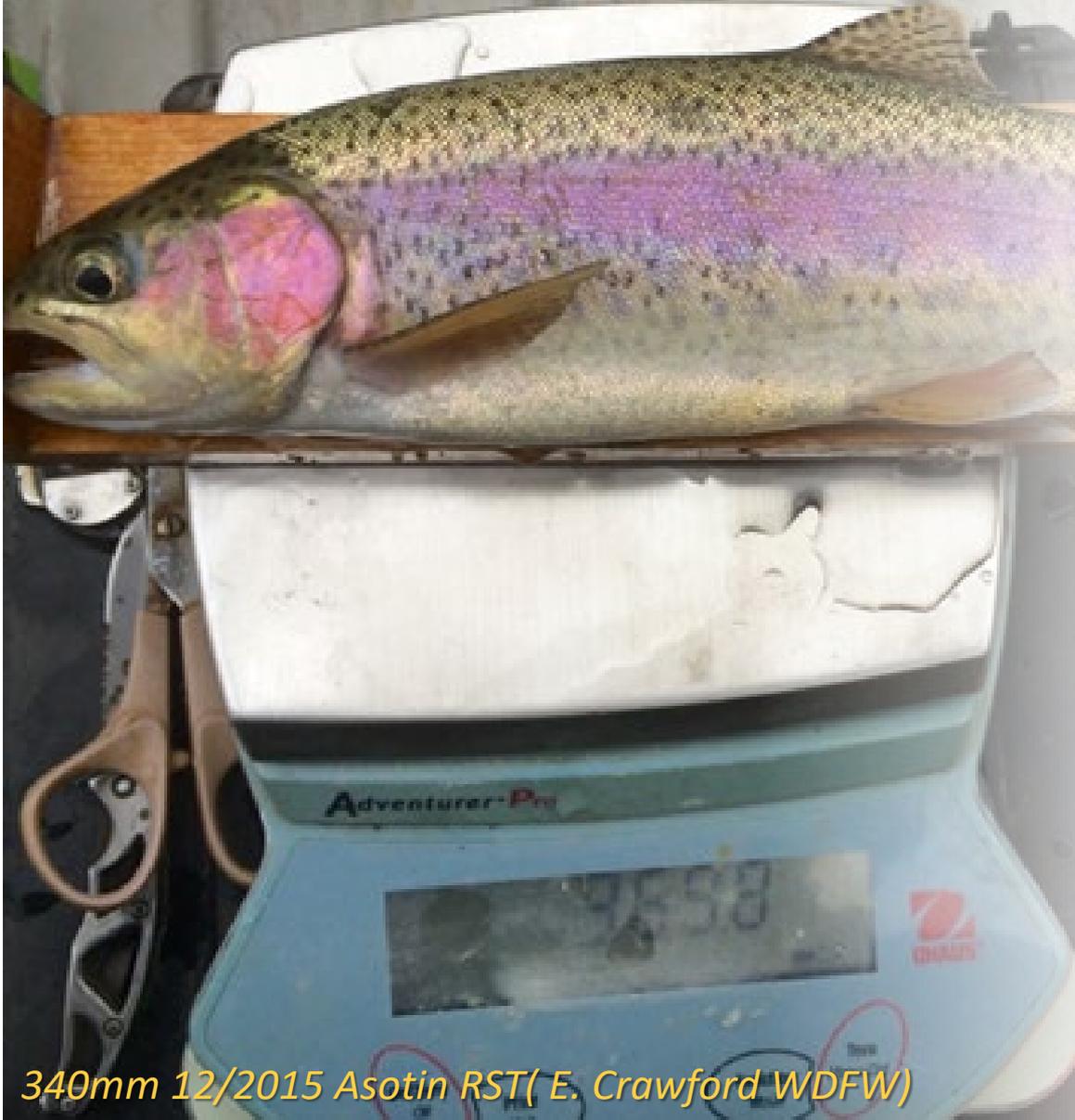
# Changes to the Hydrograph

- increased mortality risks due to prolonged holding periods of summer steelhead
- flooding presents numerous risks across steelhead life stages
- exacerbate tributary bypass/overshoot behavior (Siegel et al 2021)
- Increasing scour/geomorphic change
- Changes to travel time in the migration corridor
- Spawning distribution



# Increasing Temperature

- constricting suitable instream habitat
- Overshoot/bypass
- Migratory corridor mortality
- Life history strategies?



340mm 12/2015 Asotin RST( E. Crawford WDFW)

# Changes in Aquatic Communities

- range expansion by non-native fish (walleye, bass, channel catfish, American shad, etc.)
- Changes in nesting conditions for avian predators



# In Summary...

- It's happening, status and trend projects should continue and improve monitoring to detect changes in focal populations and watersheds.
- Building for resiliency, both in our operations and the populations we monitor.



A scenic landscape featuring a river with white-water rapids flowing through a valley. The river is surrounded by lush green trees and bushes. In the background, rolling green hills are visible under a sky filled with white and grey clouds. The overall scene is vibrant and natural.

**Questions?**







# **IDFG Anadromous Fish Screen Program – *Climate Change Considerations and Potential Confounding Factors***

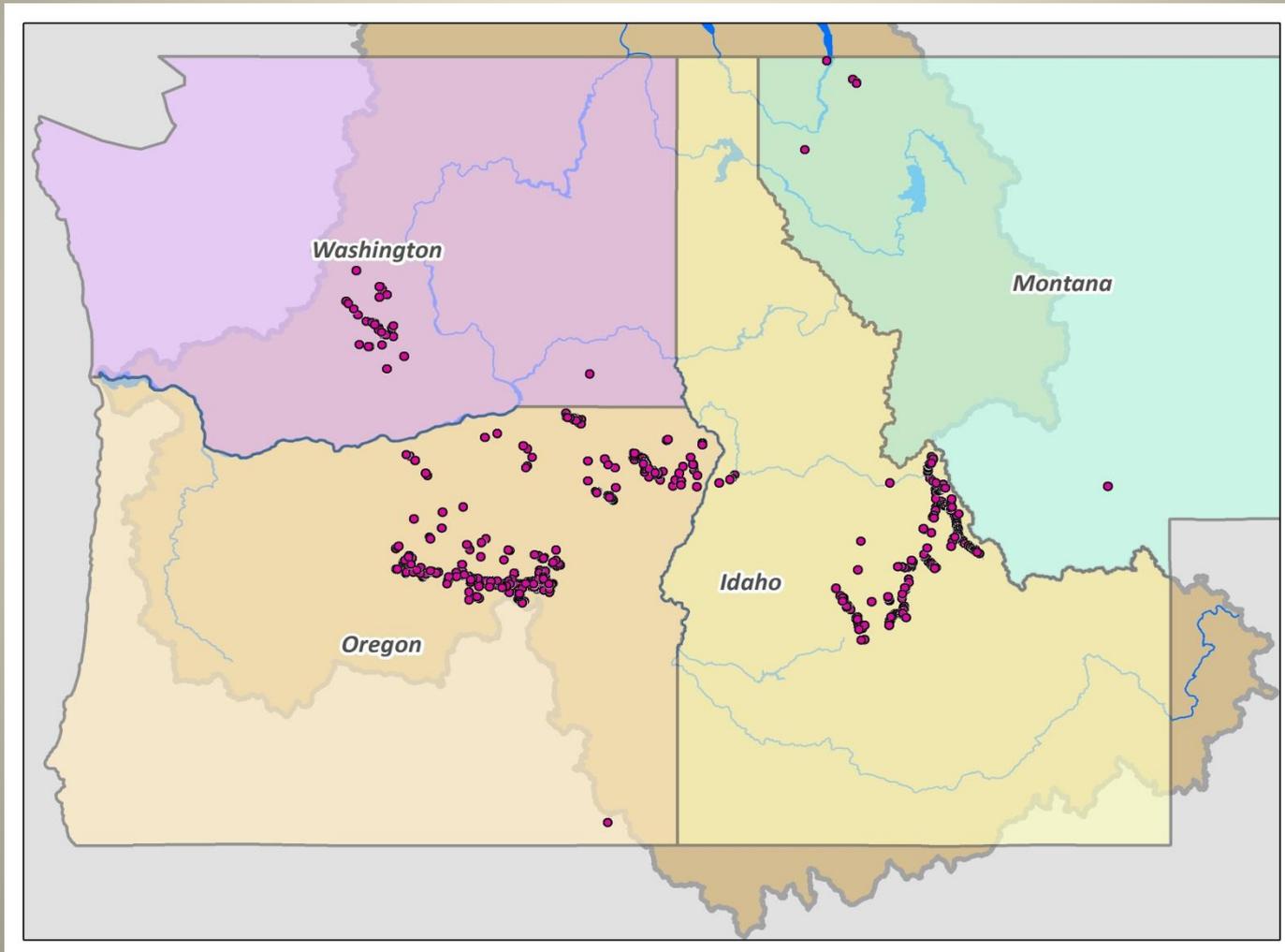


**Idaho Fish Screening Improvement Project – 1994-015-00 – Expense  
Upper Salmon Fish Screen and Tributary Passage - 2007-399-00 – Capital**



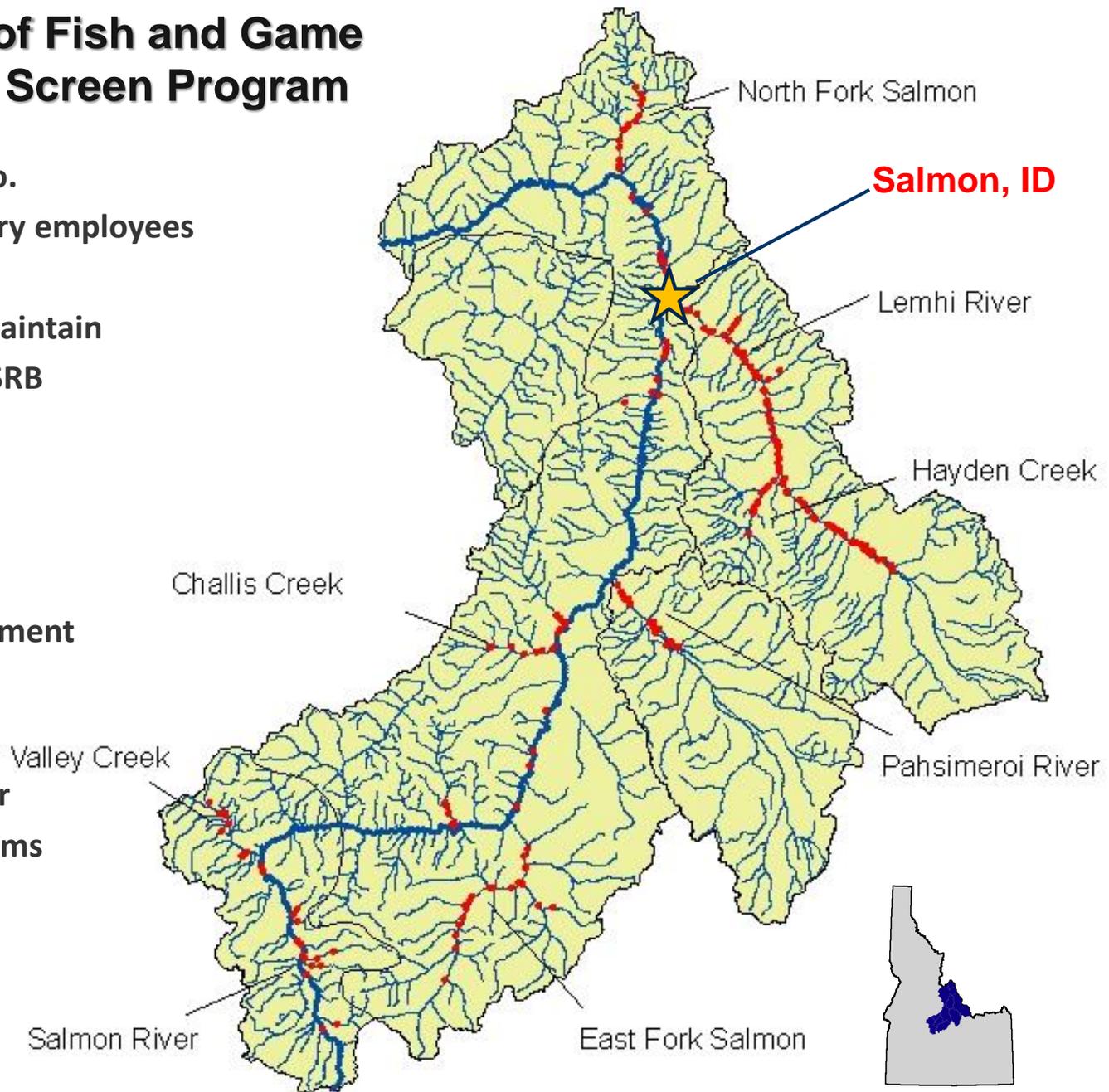
**Paddy Murphy – Program Coordinator  
Anadromous Fish Screen, Passage, and Habitat Program  
Idaho Department of Fish and Game  
Region 7 – Salmon, Idaho**

# Existing Fish Screens by State



# Idaho Department of Fish and Game Anadromous Fish Screen Program

- Located in Salmon, Idaho.
- 12 full-time/ 17 temporary employees
- Installed, operate, and maintain 281 fish screens in the USRB
- NOAA Mitchell Act / BPA
- Major Limiting Factor:  
Fish passage and entrainment
- 350 miles mainstem river
- 130 miles tributary streams

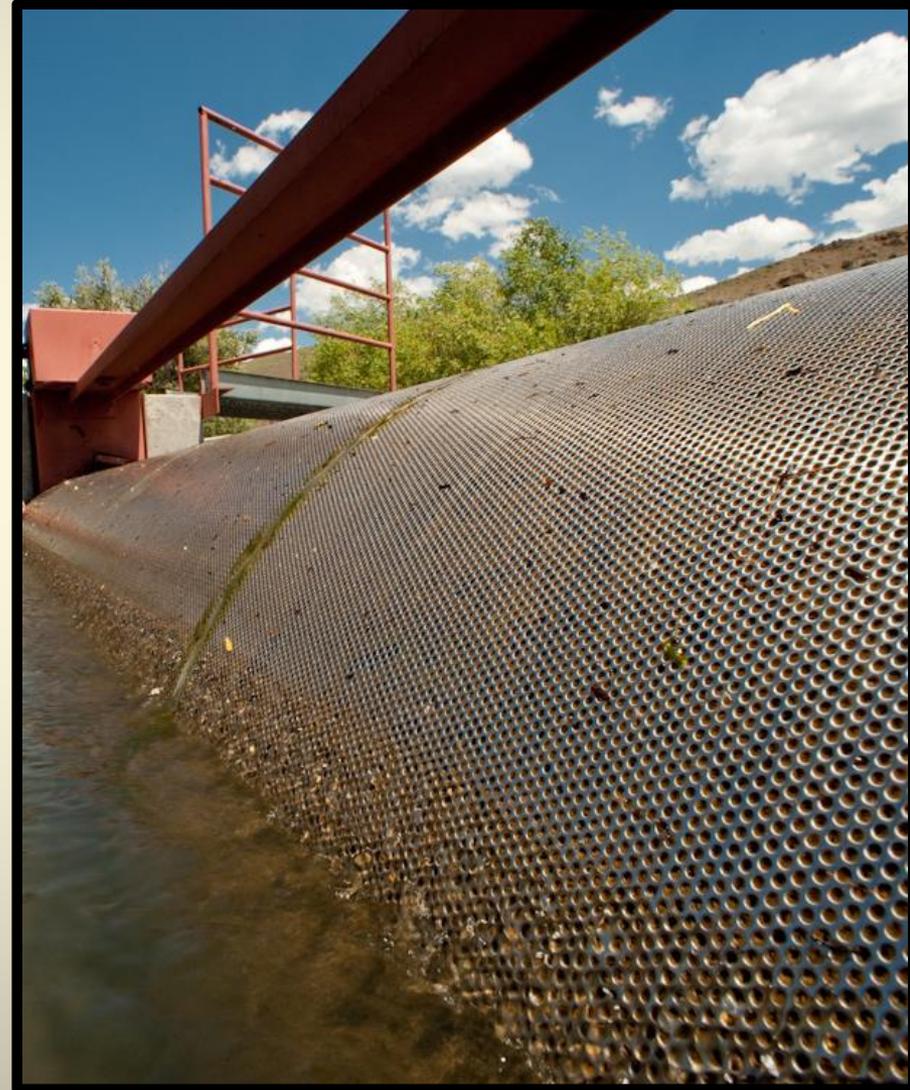


# Objectives

## **Goal -**

***Increasing fry to smolt survival of anadromous salmon and steelhead***

- Operate and maintain 281 fish screens on a daily basis
- Improving fish passage to critical tributary habitat



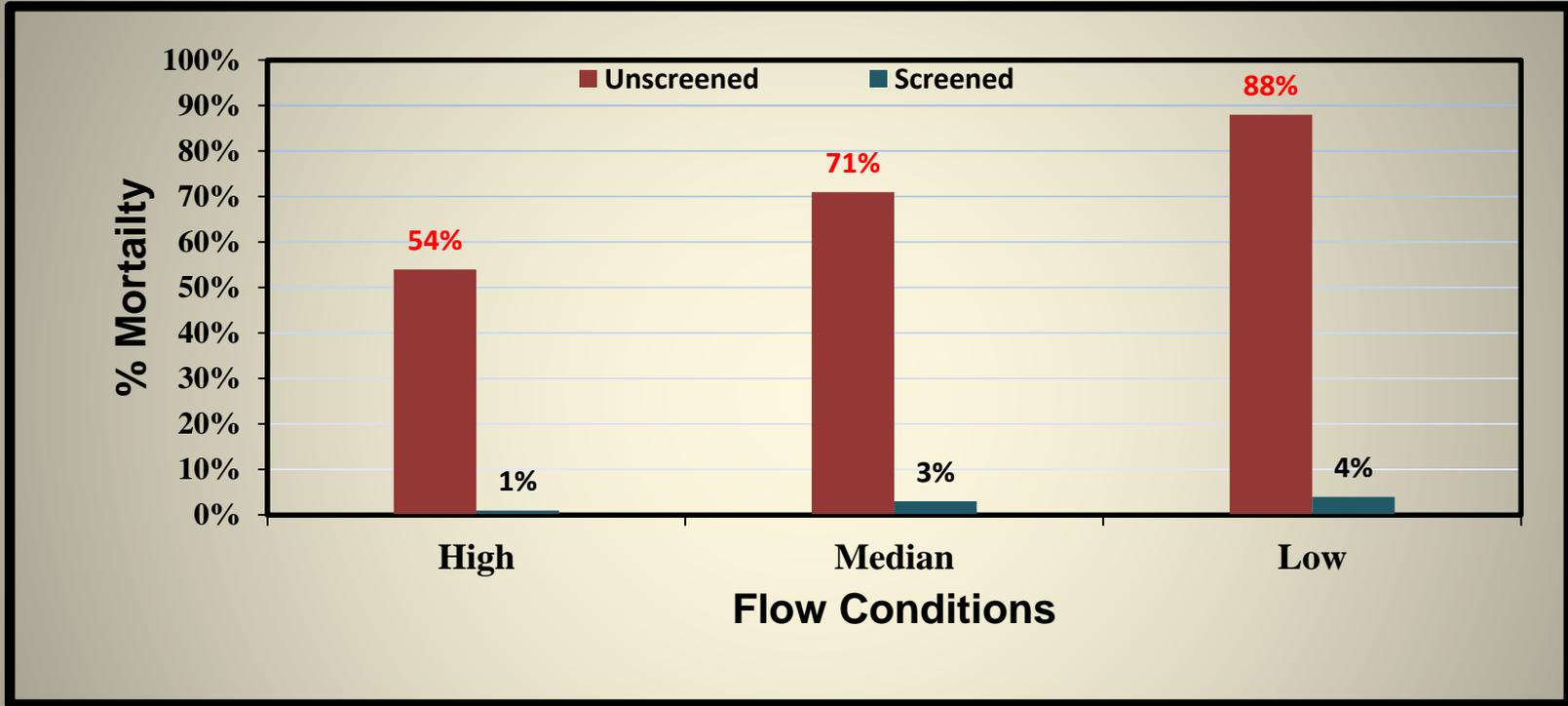
# Chinook Salmon Entrainment

## Lemhi River

- High entrainment losses into irrigation systems provided the impetus for fish screening in the late 1950's.
- In 1958, it was estimated that 423,000 salmon fingerlings were lost in 90 irrigation canals (Gebhards 1958).
- In 1961 and 1962, it was estimated that 84 screens on the Lemhi River bypassed 271,000 and 91,500 juvenile Chinook salmon (Corley 1962).



# Entrainment Rates



Annika W. Walters, Damon M. Holzer, James R. Faulkner, Charles D. Warren, Patrick D. Murphy & Michelle M. McClure (2012): **Quantifying Cumulative Entrainment Effects for Chinook Salmon in a Heavily Irrigated Watershed**, Transactions of the American Fisheries Society, 141:5, 1180-1190

# Limiting Factor: Water Diversion

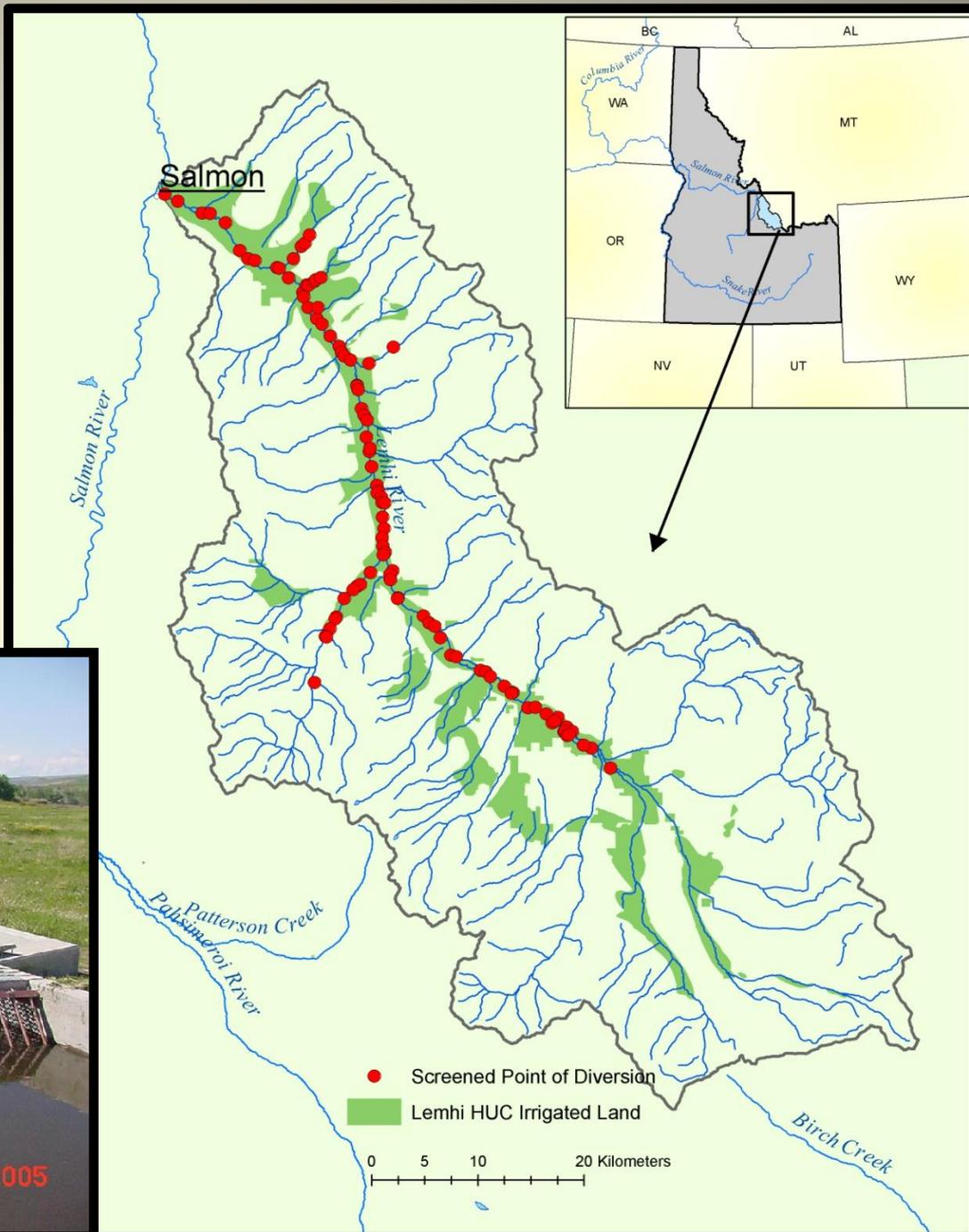
*Climate Change will further compound these issues:*

- *Entrainment*
- *Fish passage /Migration barriers*
- Isolation of populations
- Alters fluvial processes
- Decreases available habitat
- Decreases productivity
- Increases water temperatures



# Upper Salmon River Basin Fish Screening

- High percentage (> 90%) of Chinook salmon spawn on private property
- All mainstem diversions are screened
- Rotary drum screens built to NMFS Juvenile Fish Screen Criteria
- High Priority – Subbasin Plans, Recovery Plans



# Emphasis on Water Conservation and Partnerships

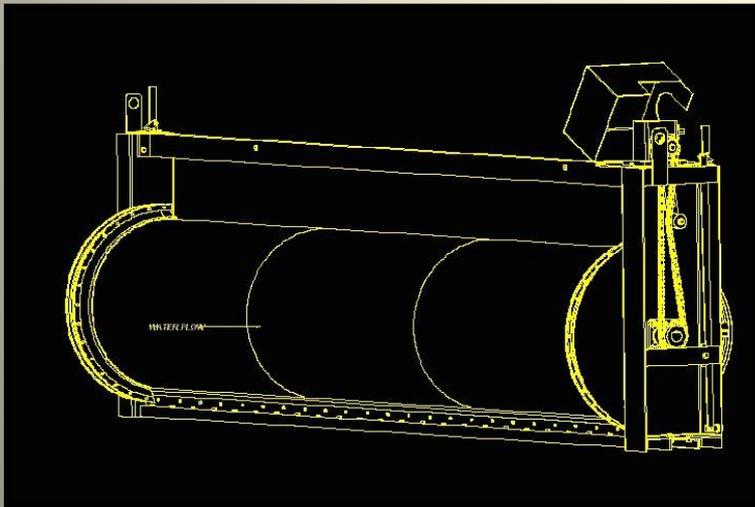
- *Fish screens can't resolve habitat issues*
- **Screen installation is the last action**

- Water conservation
- Diversion eliminations
- Diversion consolidations
- *Conservation* agreements
- Purchase water rights
- Pipeline for conveyance loss
- Sprinkler system to reduce consumption



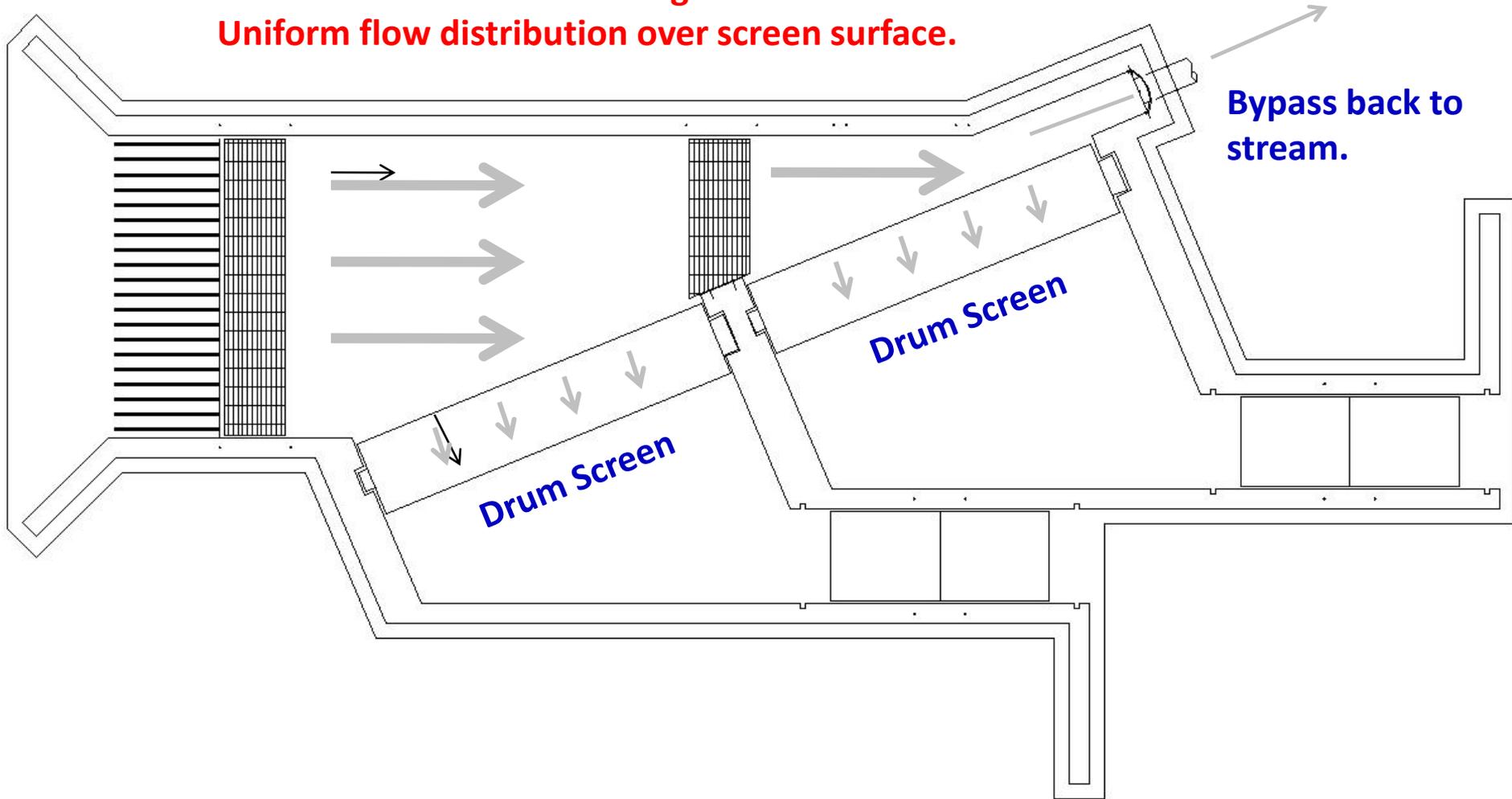
# Fish Screens are Complex

- Needs a true Bio-Engineering approach
- Every site has its own unique characteristics
- Engineering is critical to meet criteria
- Biological interactions need consideration
- Maintenance cannot be underestimated



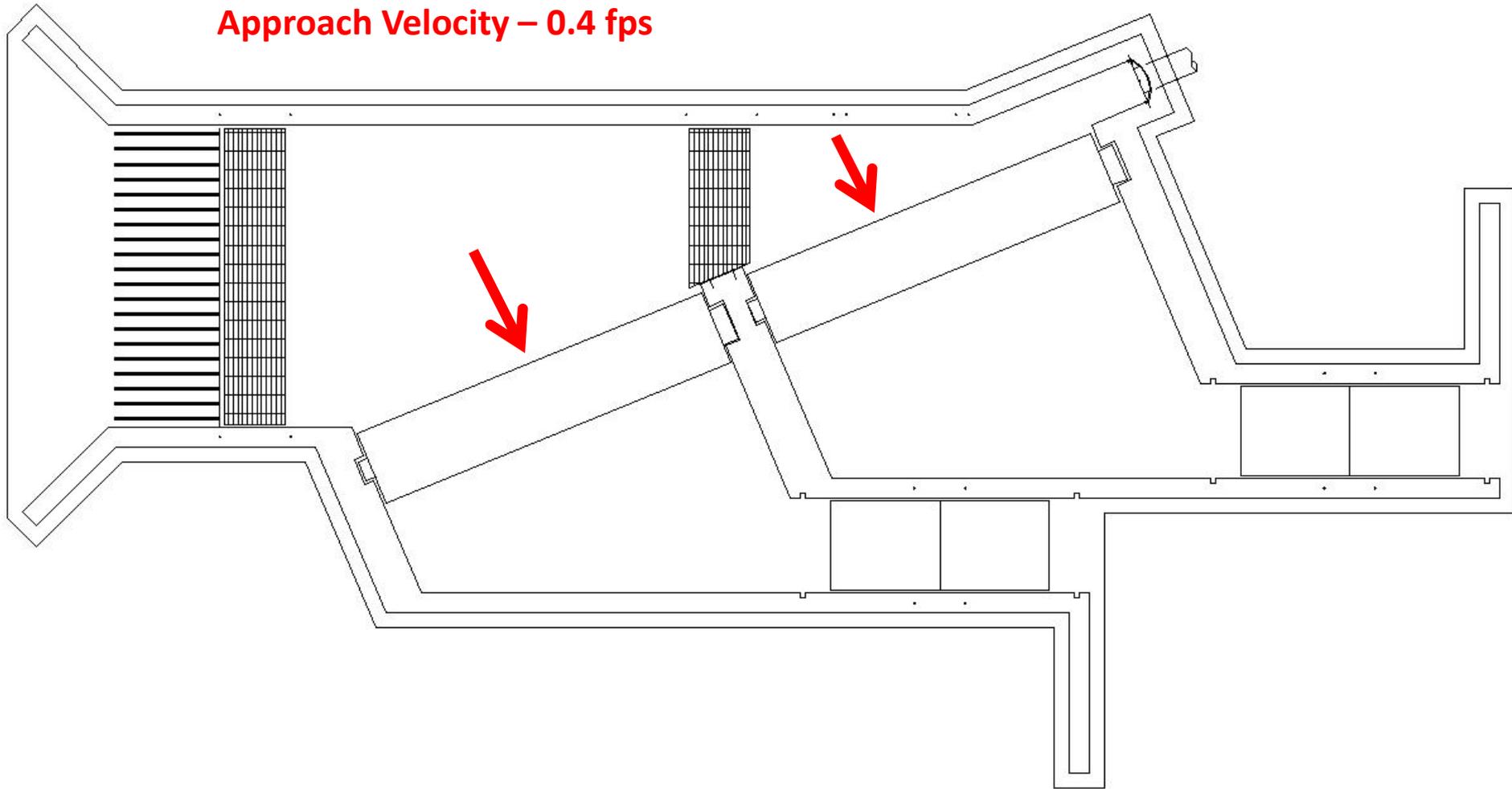
# Juvenile Fish Screen Criteria

**Uniform laminar flow coming into fish screen.  
Uniform flow distribution over screen surface.**



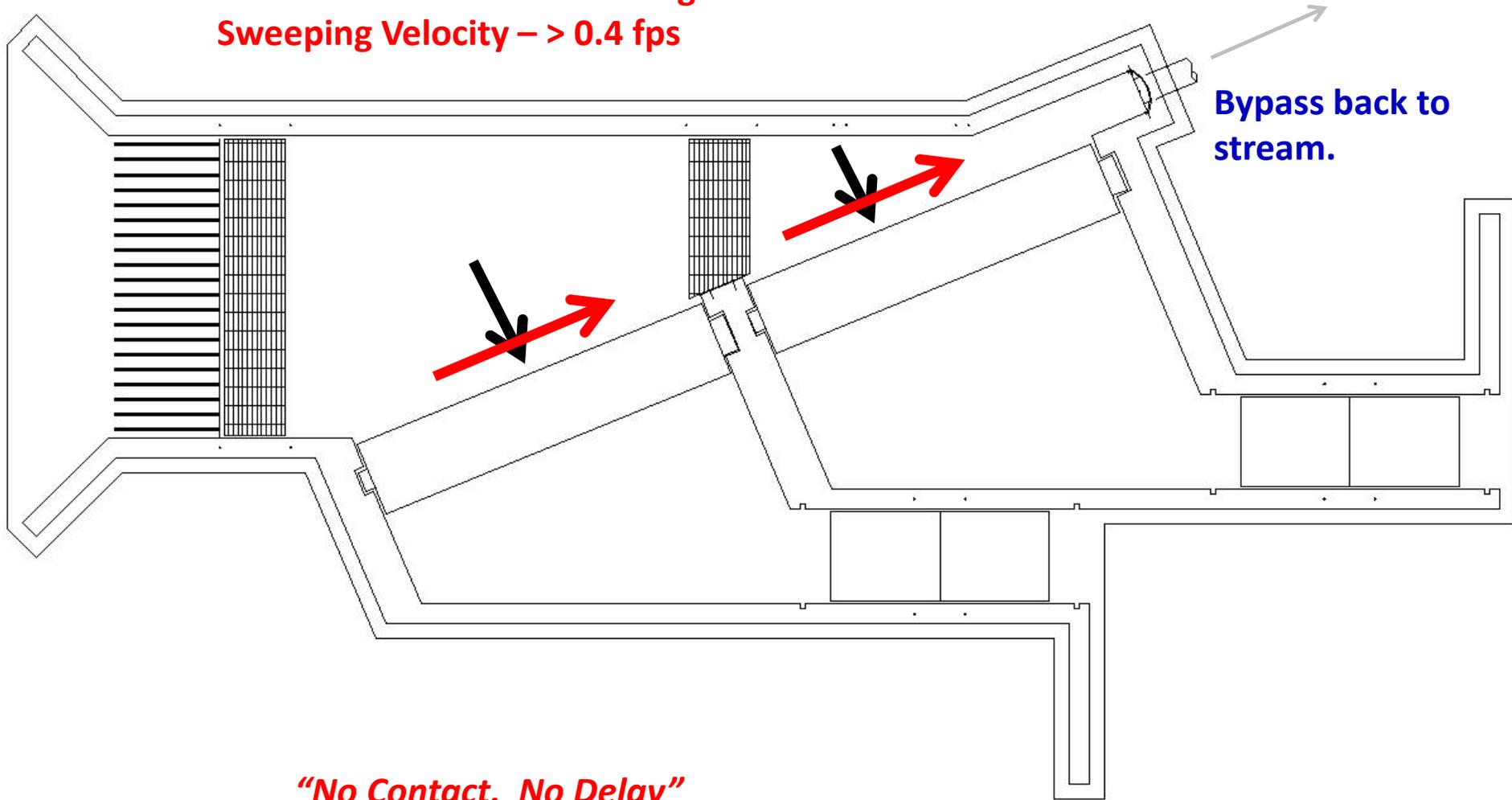
# Juvenile Fish Screen Criteria

**Active Screens – Self-Cleaning Mechanisms**  
**Approach Velocity – 0.4 fps**



# Juvenile Fish Screen Criteria

**Active Screens – Self-Cleaning Mechanisms**  
**Sweeping Velocity –  $> 0.4$  fps**



***"No Contact, No Delay"***

# Screen Tenders



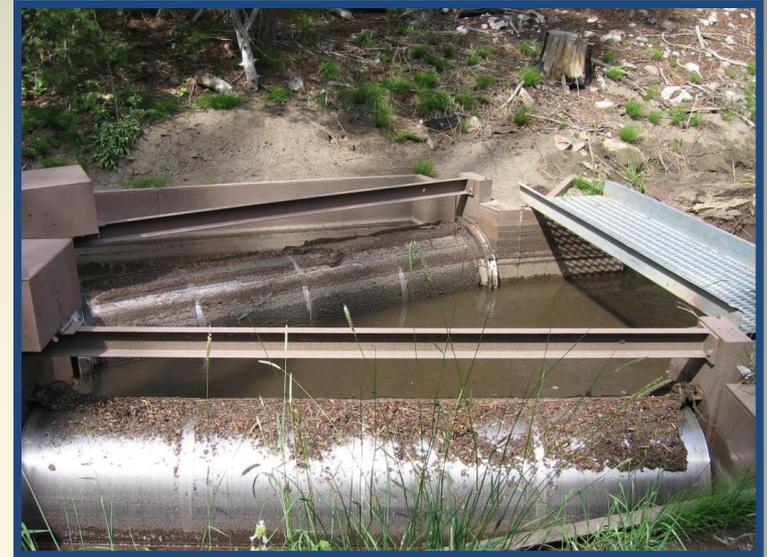
**“Predictable Performance with Predictable Biological Effects”**



You get what you pay for..



**“Efficient passage means that passage opportunity is continually maintained by vigilant operation and maintenance.”**







● 44.611851°N, 114.169014°W ±16.4ft ▲ 4849ft



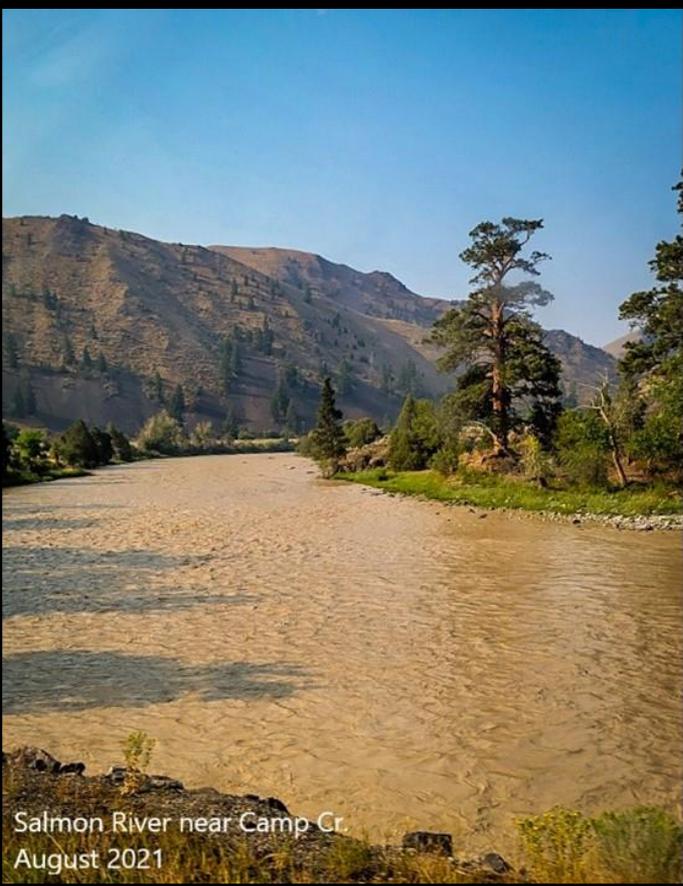
A. Cassel IDWR

Morgan Creek  
10 May 2017, 2:35 PM

# High Water Damage



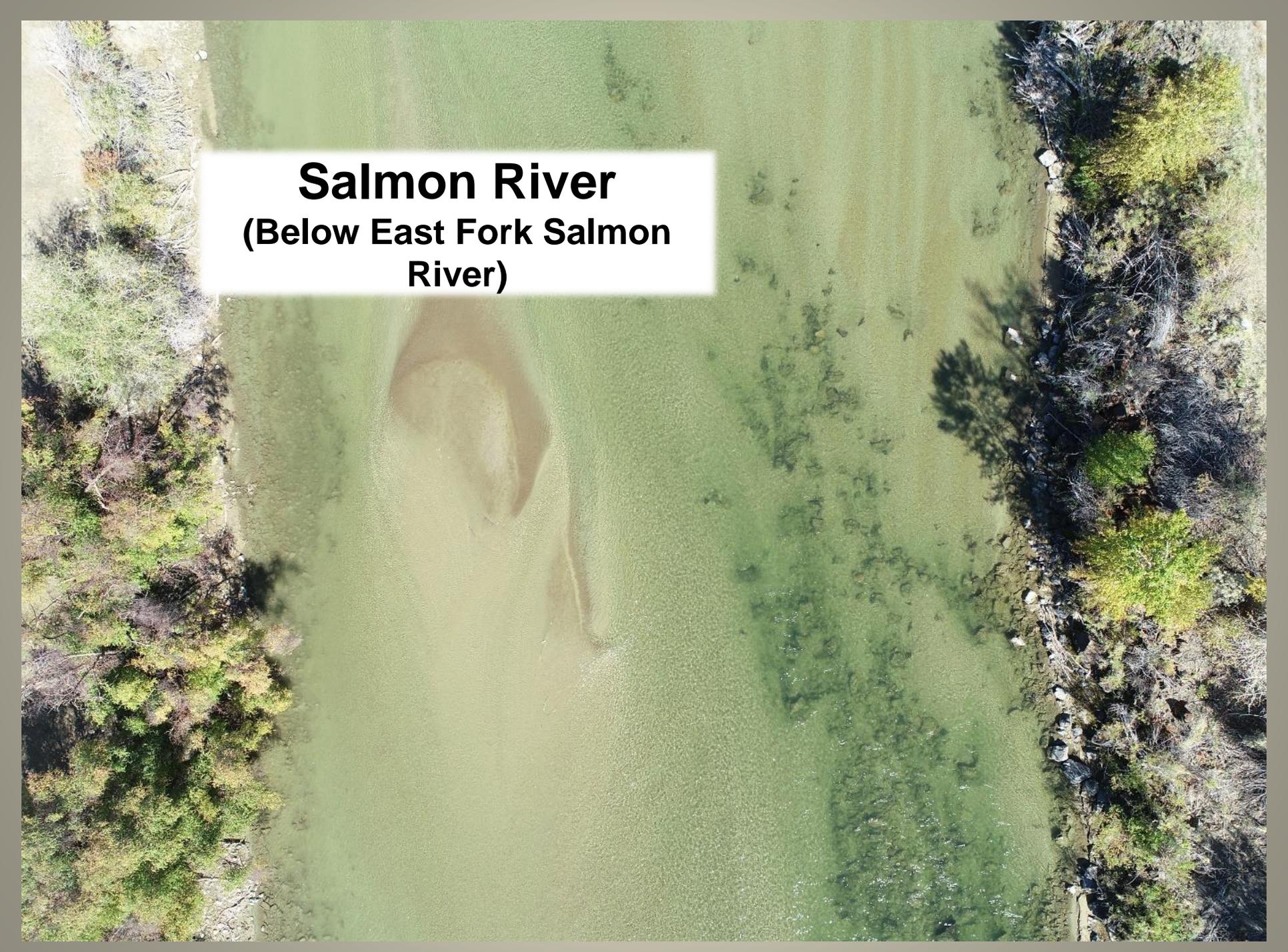
# Storm Events - Severe Thunderstorms/Microburst



Salmon River near Camp Cr.  
August 2021



Spar Canyon Road after  
August mudslide

An aerial photograph of a river with a large, light-colored sandbar in the center. The water is a greenish-brown color, and the surrounding banks are covered in dense, green and brown vegetation. The text is overlaid on a white rectangular background in the upper left quadrant.

**Salmon River**  
**(Below East Fork Salmon**  
**River)**

East Fork Salmon River near Spar Canyon Road  
2020



East Fork Salmon River near Spar Canyon Road  
2021



Salmon River below Malm Gulch  
2020



Salmon River below Malm Gulch  
2021





# Forest Fires



# A Foundation Built on Relationships

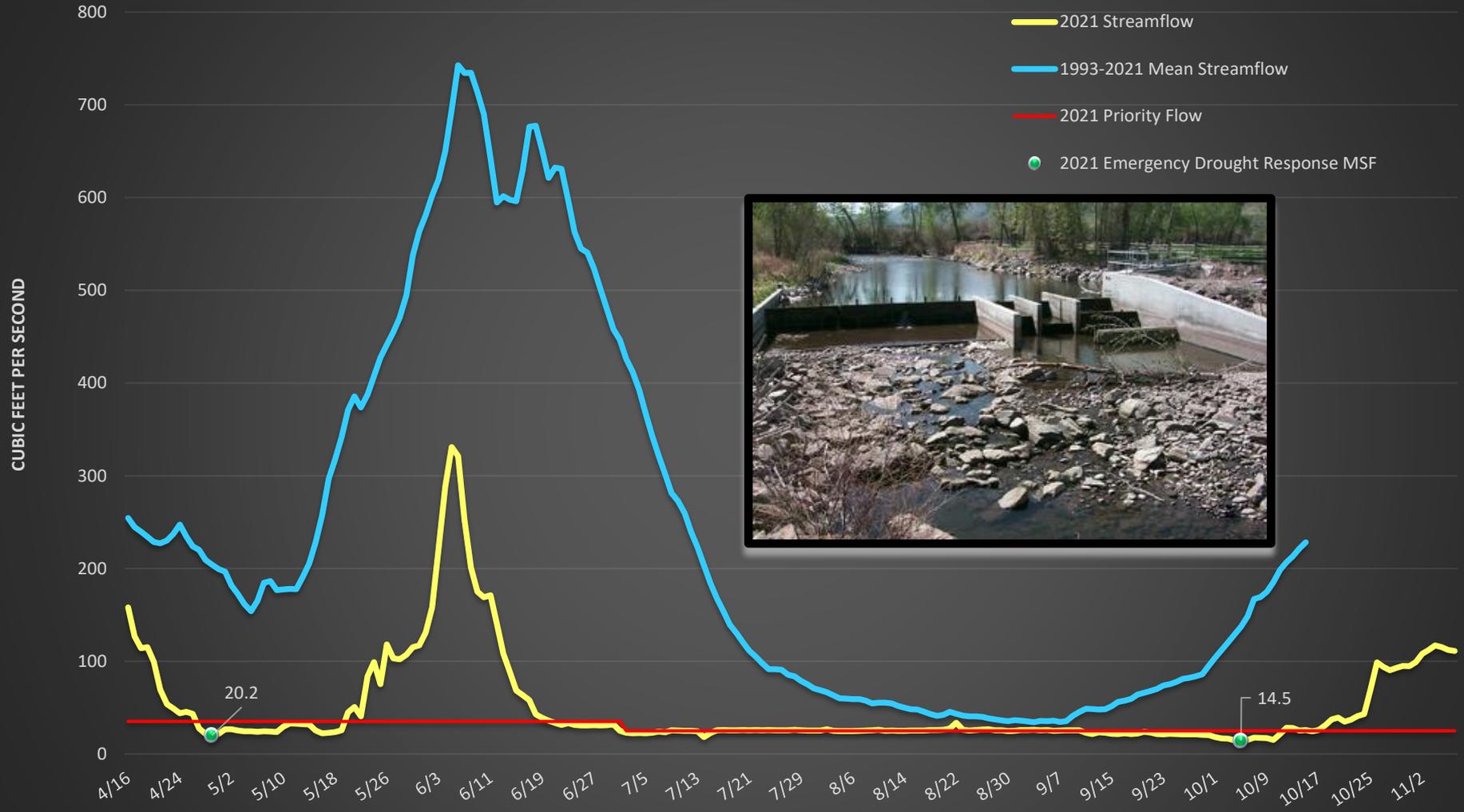


MAY 31 2006

# Low Flow Conditions



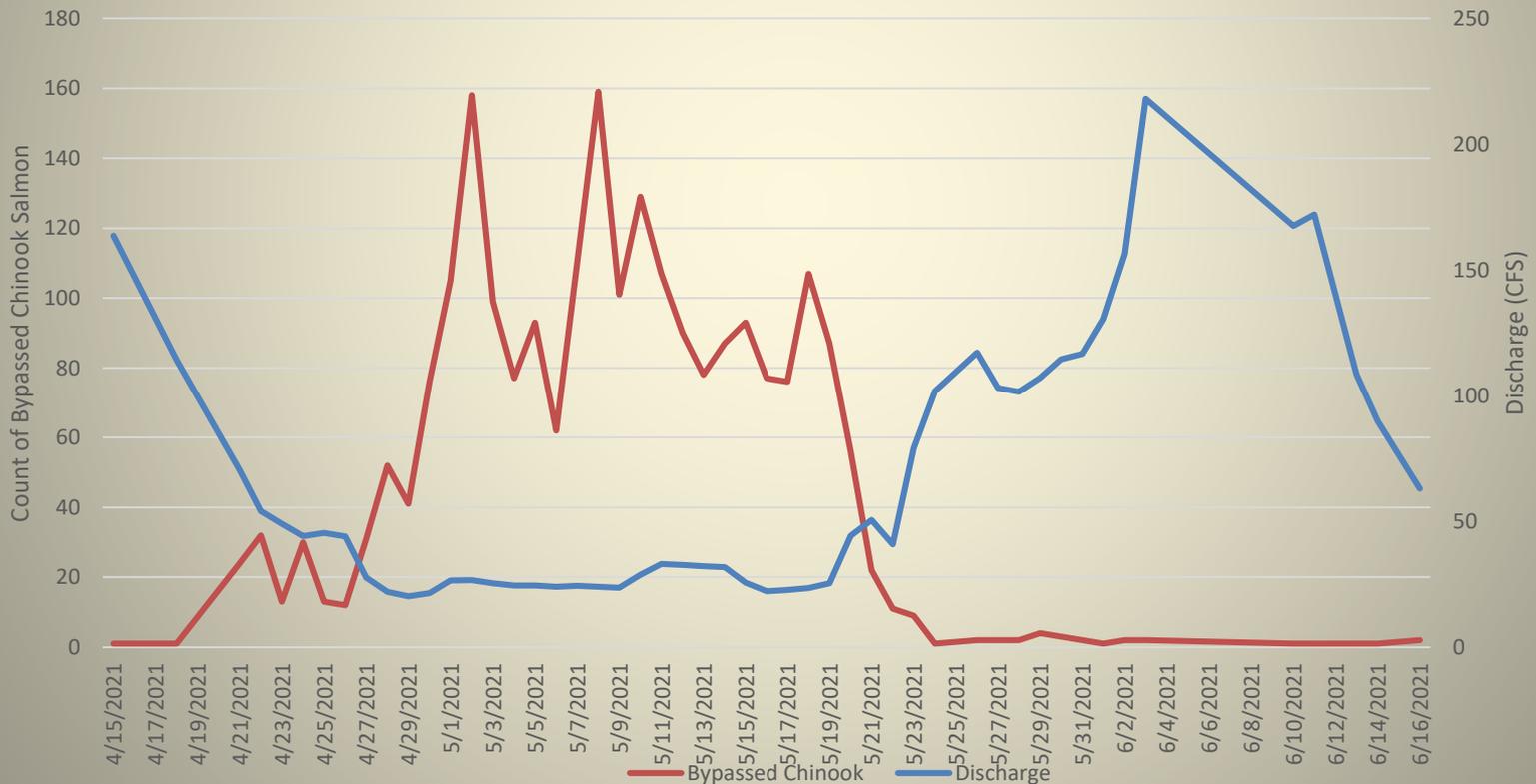
# 2021 – Low Flow Conditions





# Entrainment Rates

Outmigrating Chinook Salmon Bypassed at L-03 Fish Screen in 2021,  
**57.6%** of Total Tagged Chinook Salmon at LLR Screw Trap



# Tributary Screening



# **Building Resiliency**

- **More extreme hydrographs both at high and low water periods.**
- **Earlier, spring run-off**
- **Rain on snow events**
- **Intense thunderstorms/microbursts**
- **Increasing scour and bedload inputs**
- **Low water, warm temperatures**
- **High entrainment rates**
- **Operator stress**

# Questions

PC: Ron Troy

09.02.2014 18:14