

Remote Site Incubation System



Yurok Tribe Fisheries Program, United States Bureau of Reclamation, and California Department of Fish and Wildlife



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Overview

1. Coho Salmon Development
2. What is an RSI?
3. How are they are used
4. Why utilize RSI systems
5. 2023-24 Season Overview
6. 2024-25 Season Plan
7. Site Selection workflow



Smolt



Ocean Adult



Coho Salmon Life Cycle

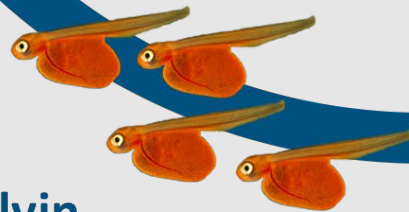
Spawning Adult



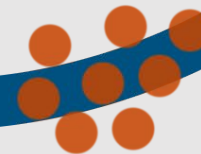
Young of the Year (YOY)



Aelvin



Eggs



Smolt



Ocean Adult

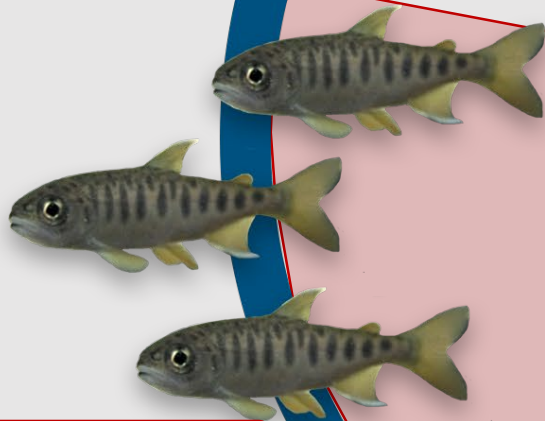


Coho Salmon Life Cycle

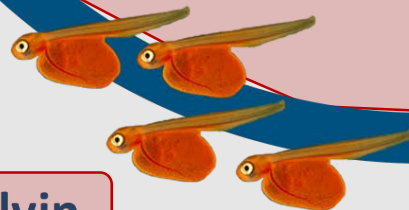
Spawning Adult



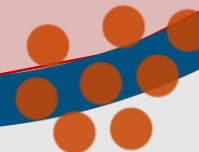
Young of the Year (YOY)



Aelvin



Eggs





28 Days
Eyed-Up



39 Days
Hatching



41 Days



47 Days



52 Days



59 Days



66 Days
Swim-up Fry

<-----Alevin----->



69 Days



75 Days



81 Days



88 Days



90 Days



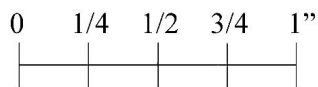
96 Days



103 Days



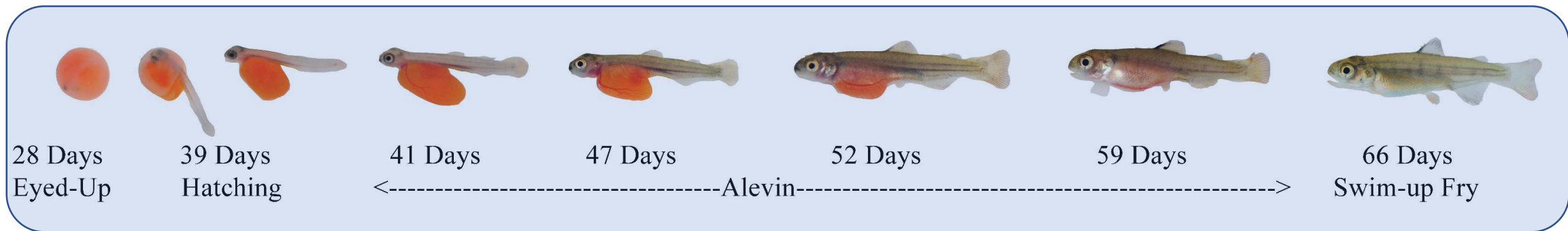
106 Days



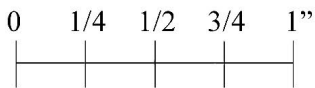
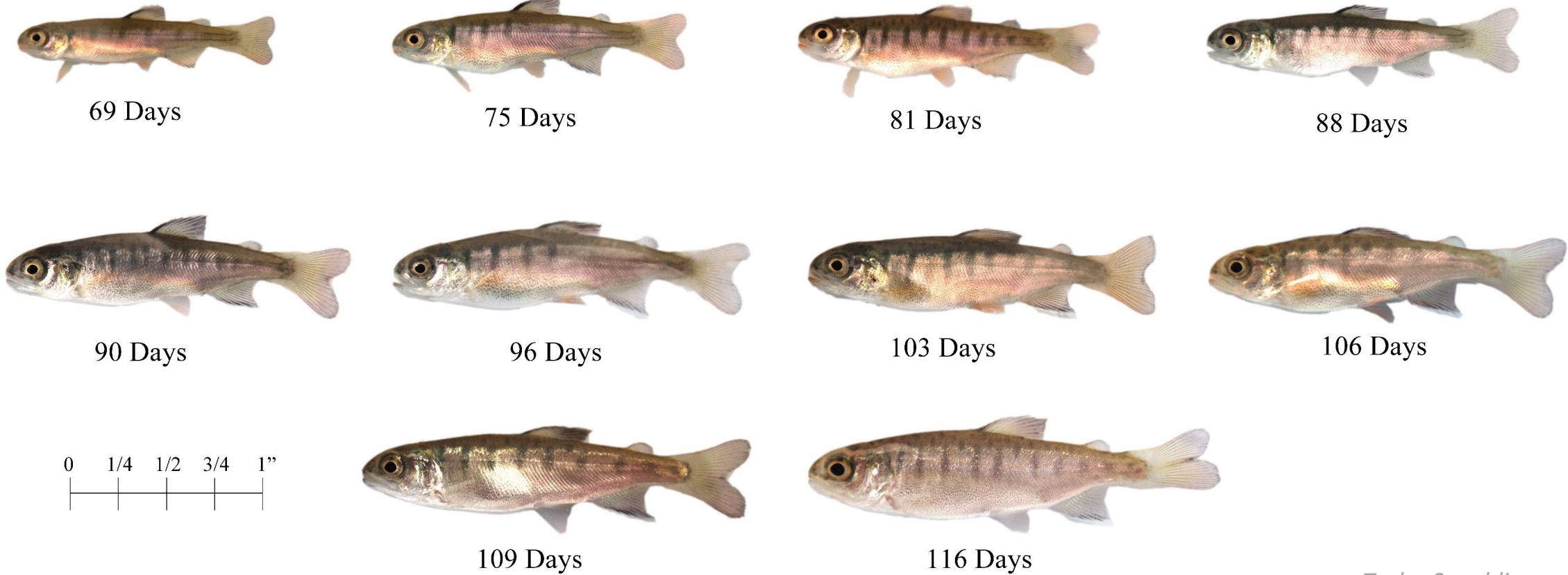
109 Days



116 Days



INTRA-GRAVEL



*Days at Warm Springs Hatchery, Geyserville CA



Accumulated Thermal Units (ATU)

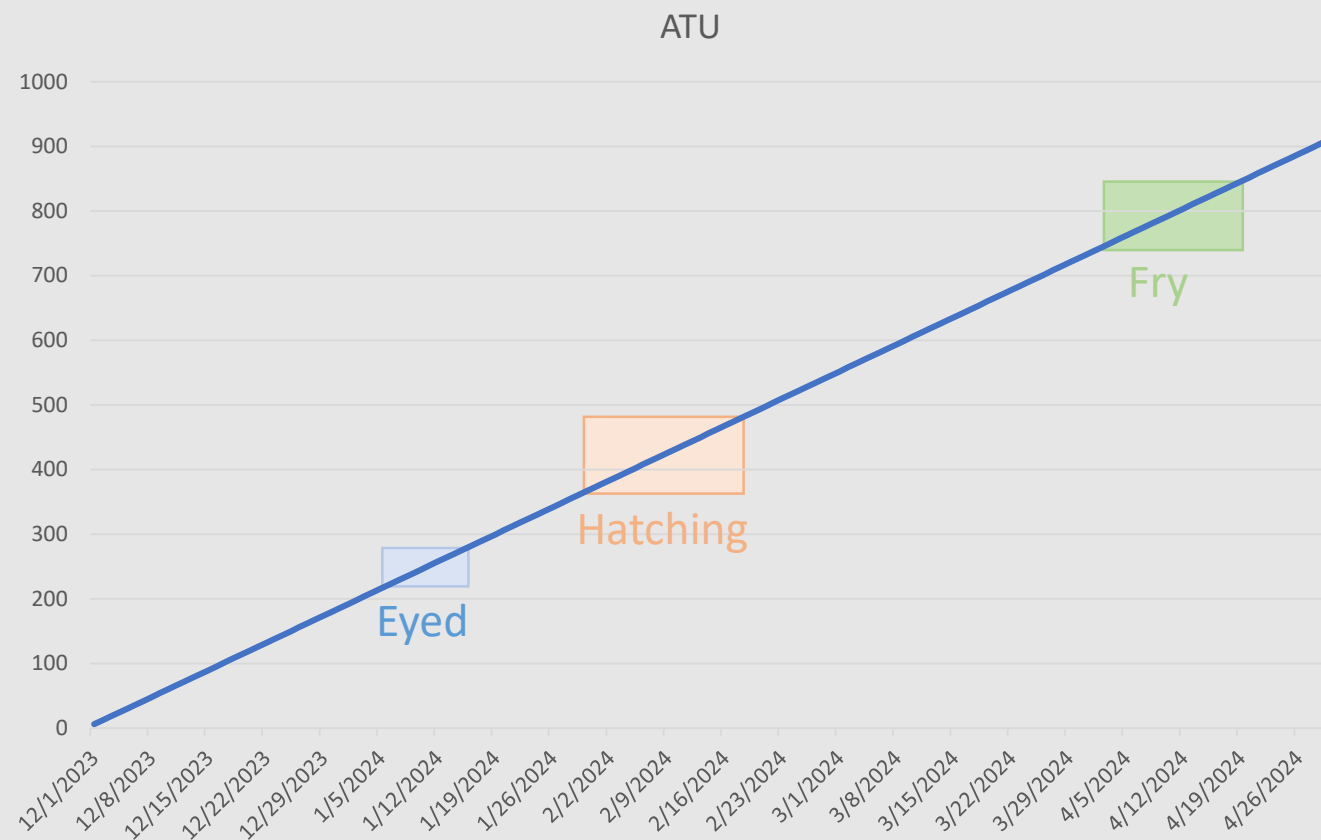
Coho Salmon ATU (C)

Eyed: 217-237

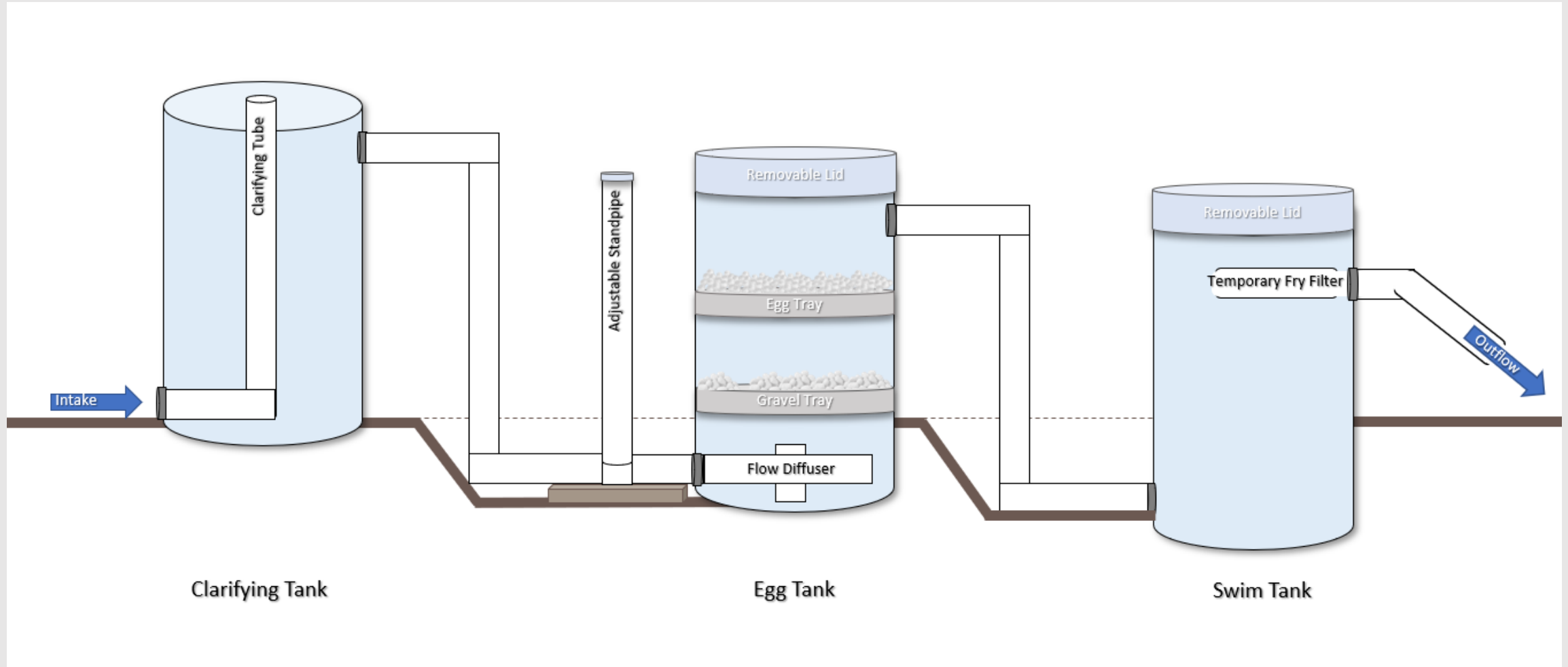
Hatching: 380-480

Fry: 777-829

Date	Water Temp	ATU	
12/1/2023	6	6	
12/2/2023	6	12	
12/3/2023	6	18	
12/4/2023	6	24	
12/5/2023	6	30	
12/6/2023	6	36	
12/7/2023	6	42	
12/8/2023	6	48	
12/9/2023	6	54	



Remote Site Incubation Systems



Remote Site Incubation Systems



Scalable Design



PROS

- Utilization of excess eggs
- Limits Domestication
 - No added food
 - Natural fluctuations
 - Low stray rates
- No risk of redd scour
- Alleviates space at hatchery
- Location
- Low Tech, Low Cost
- Temporary Use

CONS

- Monitoring Complications
- Crew/Travel Time
- Site constraints
- Hatchery Genetics

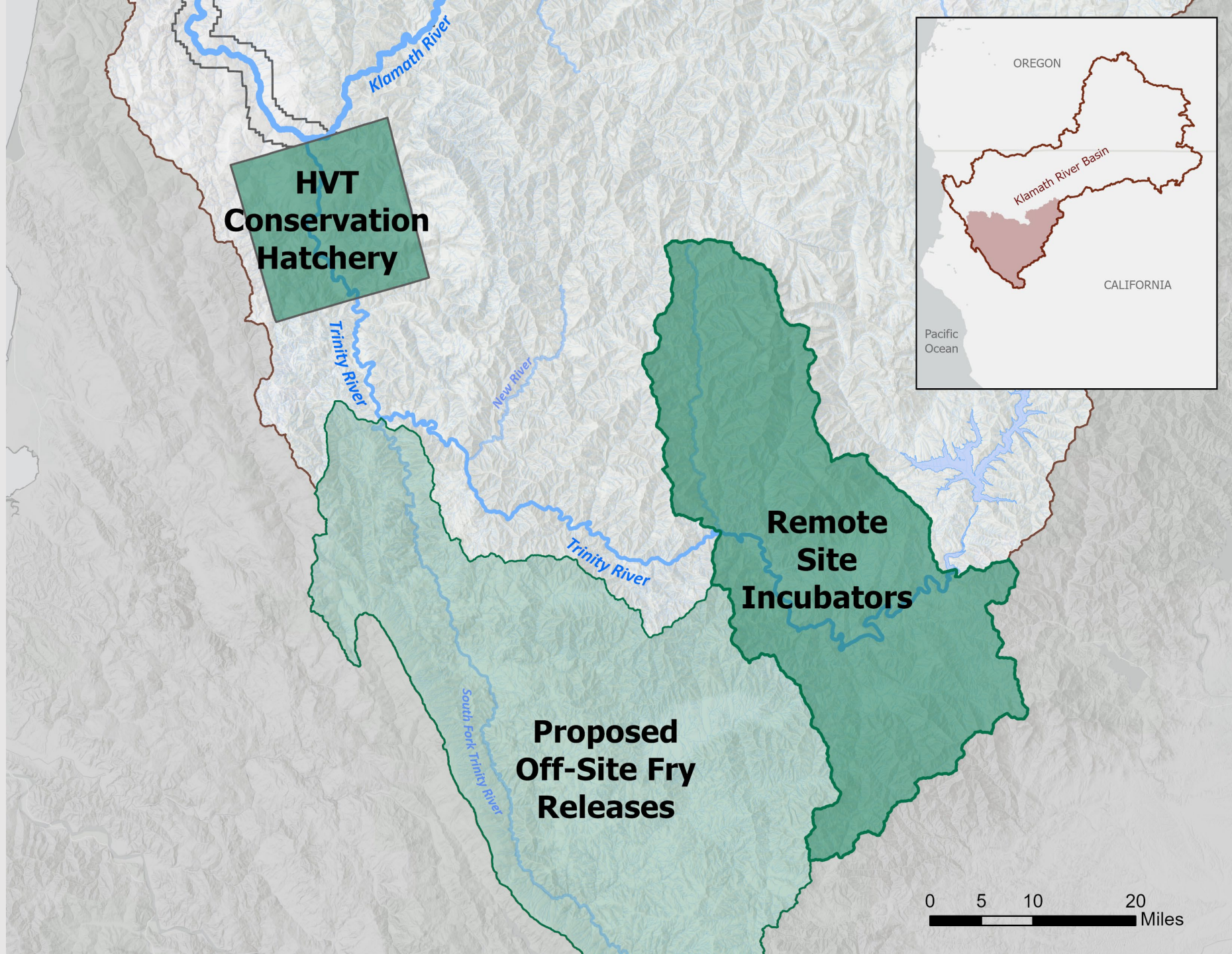




Why utilize RSI in Trinity River?

Reasonable and Prudent Measure 3a of the 2020 National Marine Fisheries Service (NMFS) Biological Opinion for the 4d Limit for the Trinity River Coho Salmon Hatchery Genetic Management Plan (HGMP) states:

“.... provide all eggs, fry, juvenile, or adult coho salmon in excess of those needed to produce smolts released at TRH to an entity with a supplementation plan approved by NMFS, for supplementation of tributaries (in any of the three Trinity River coho salmon population units) for conservation of the populations....”



A photograph showing a large number of small, translucent, orange-colored tadpoles or larvae, likely of the genus Acanthocyclops, clustered together in a shallow container. The organisms have long, thin bodies and prominent, fan-like structures at their posterior ends. They are resting on a dark, textured surface.

Partners:



— BUREAU OF —
RECLAMATION



NOAA FISHERIES



Funding:



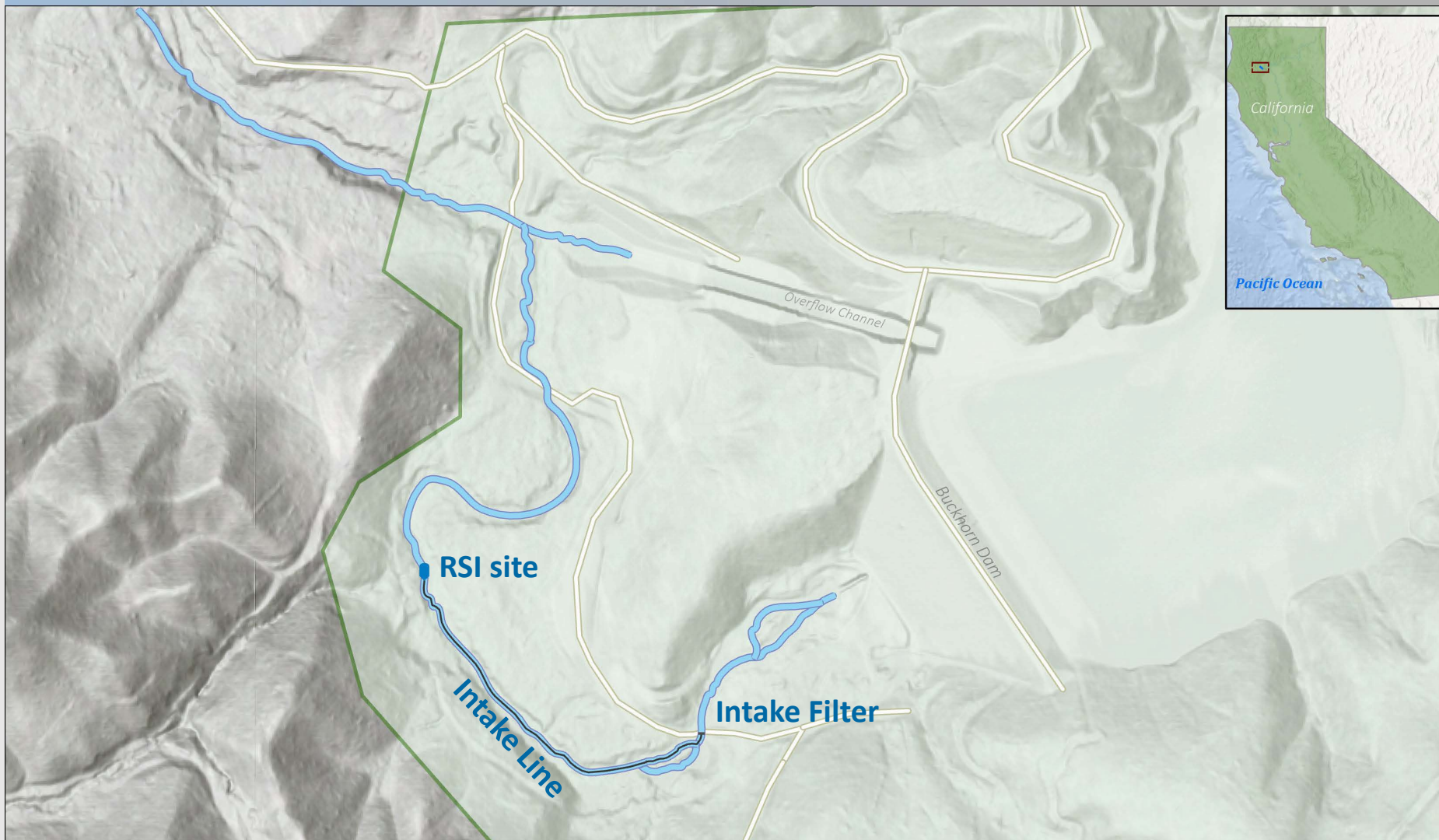
— BUREAU OF —
RECLAMATION

NORTHERN CALIFORNIA AREA OFFICE (NCAO)



Grass Valley Creek Coho Salmon Remote Site Incubator

Yurok Tribe Fisheries Program: Trinity River Division



0 125 250 500
Feet

RSI
Intake Hose

Access Road



Although information from land surveys may have been used in the creation of this map, in no way does it represent or constitute a land survey. The lines and areas represented on the map are only approximate and their actual location on the ground may vary. While every effort has been made to assure the accuracy of this information, it should be understood the data is intended to be used for general planning purposes only. The Yurok Tribe assumes no liability or responsibility in the use or misuse of this map and the information within.

Operation Timeline



FERTILIZATION
12/5/2023

EYED EGGS
1/10/2024

MOVED TO RSI
1/22/2024

TRINITY RIVER HATCHERY

GRASS VALLEY CREEK

FRY EMERGENCE

2/2/2024

2/23/2024

3/21/2024

4/25/2024

ALEVIN TO FRY DEVELOPMENT

HATCHING

DEC

JAN

FEB

MAR

APR

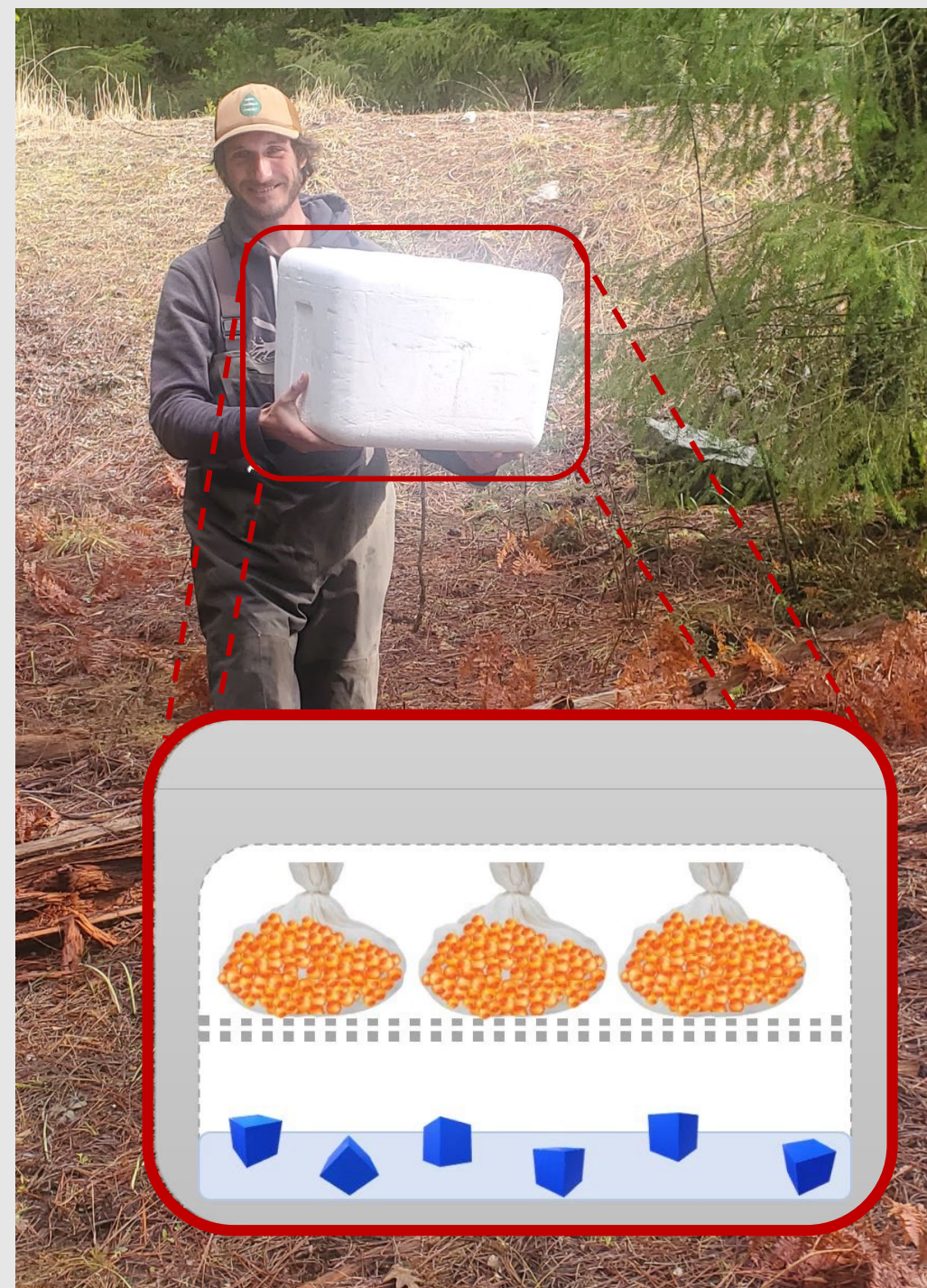
MAY

**RSI EQUIPMENT
FINALIZED**
1/18/2024

**RSI EQUIPMENT
REMOVED**
4/25/2024

Egg Transportation

- 10,078 Coho Salmon eggs from Trinity River Hatchery
 - Coho Marked, Lot 6
 - 102 oz (98.81egg/ounce)
- Eggs wrapped in moist cheesecloth, placed into cooler with elevated platform.
 - 1 egg mortality during preparation
 - 12.7 mile transit
 - 1 egg mortality the following day
 - 7 within a week



Data Collection

RSI Data:

- Intake Status
- Temperature and Dissolved Oxygen
 - Intake
 - Clarifying Tank
 - Incubation Tank
 - Swim Tank
 - Creek
- Flow Rate (Gallons per minute)
- Mortalities and Deformities

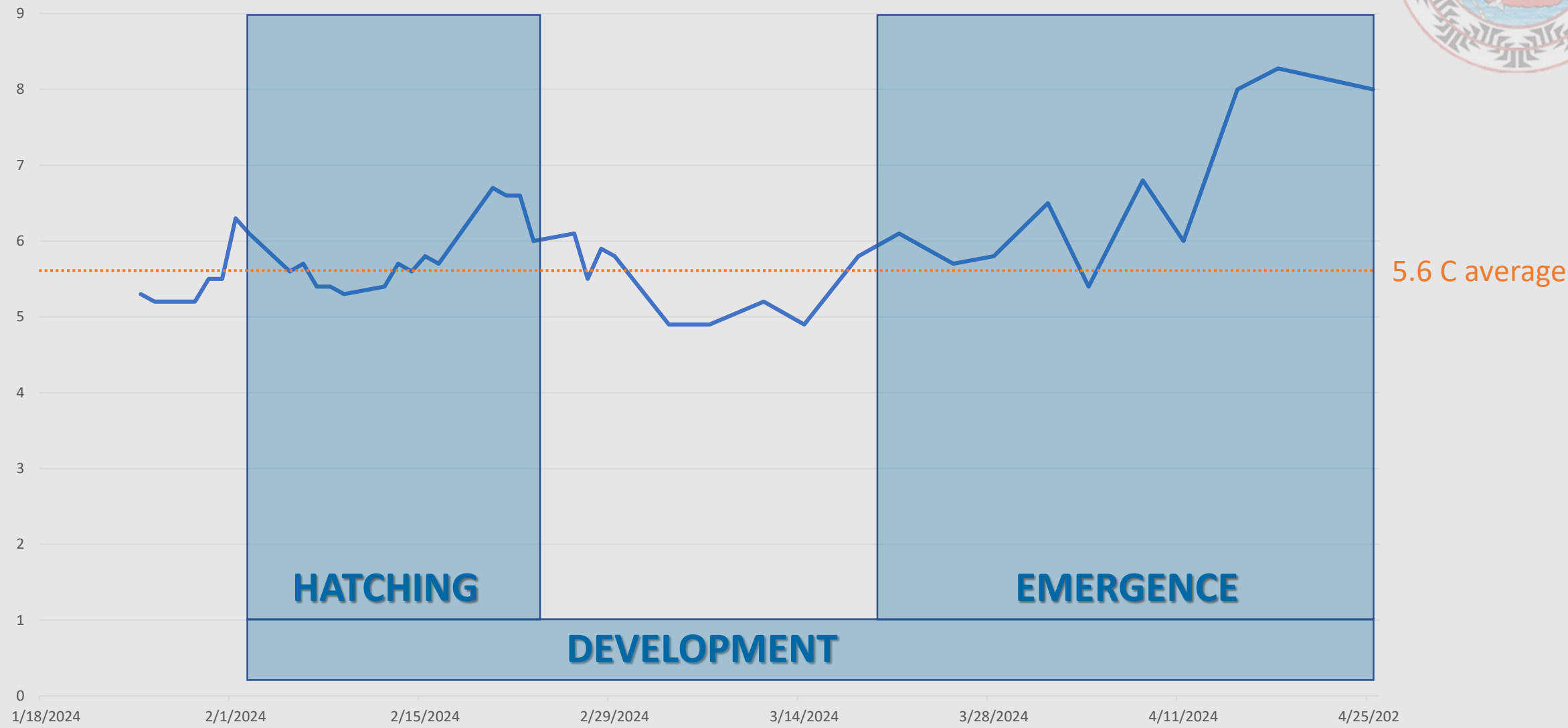
Site Data:

- Road Conditions
- Spillway Conditions
- Ford Crossing Conditions
- Air Temperature
- Time In, Time Out

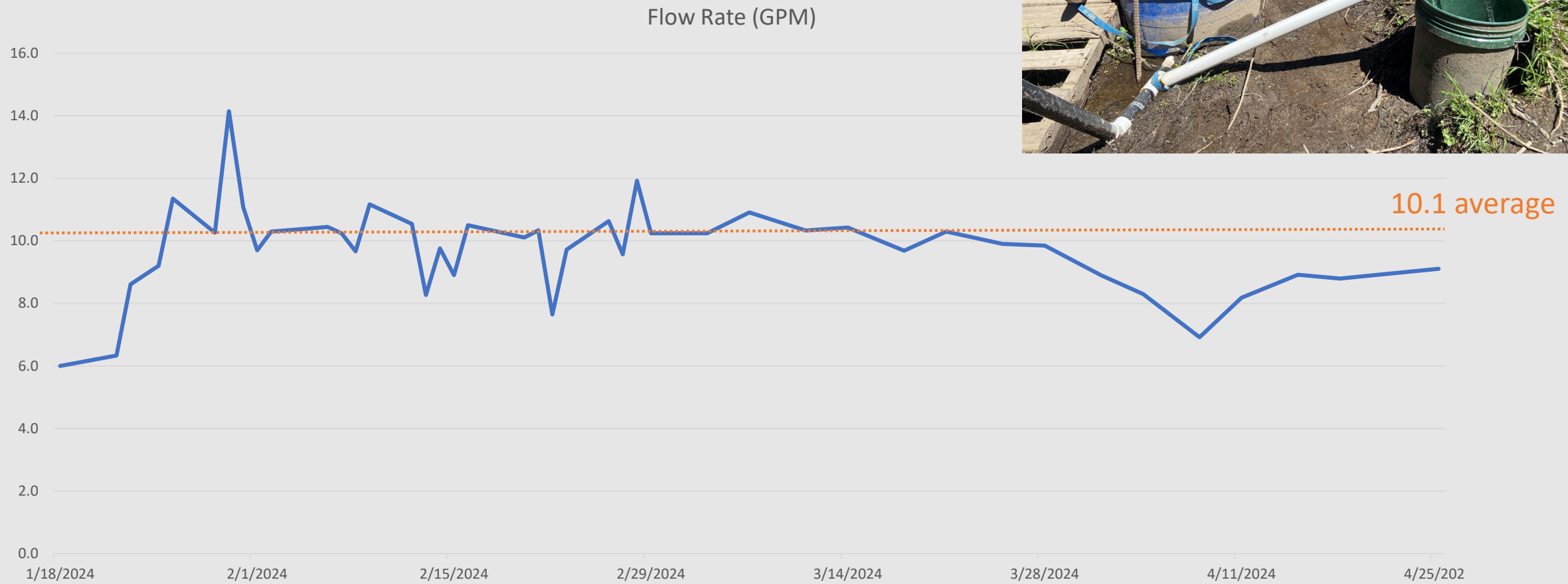




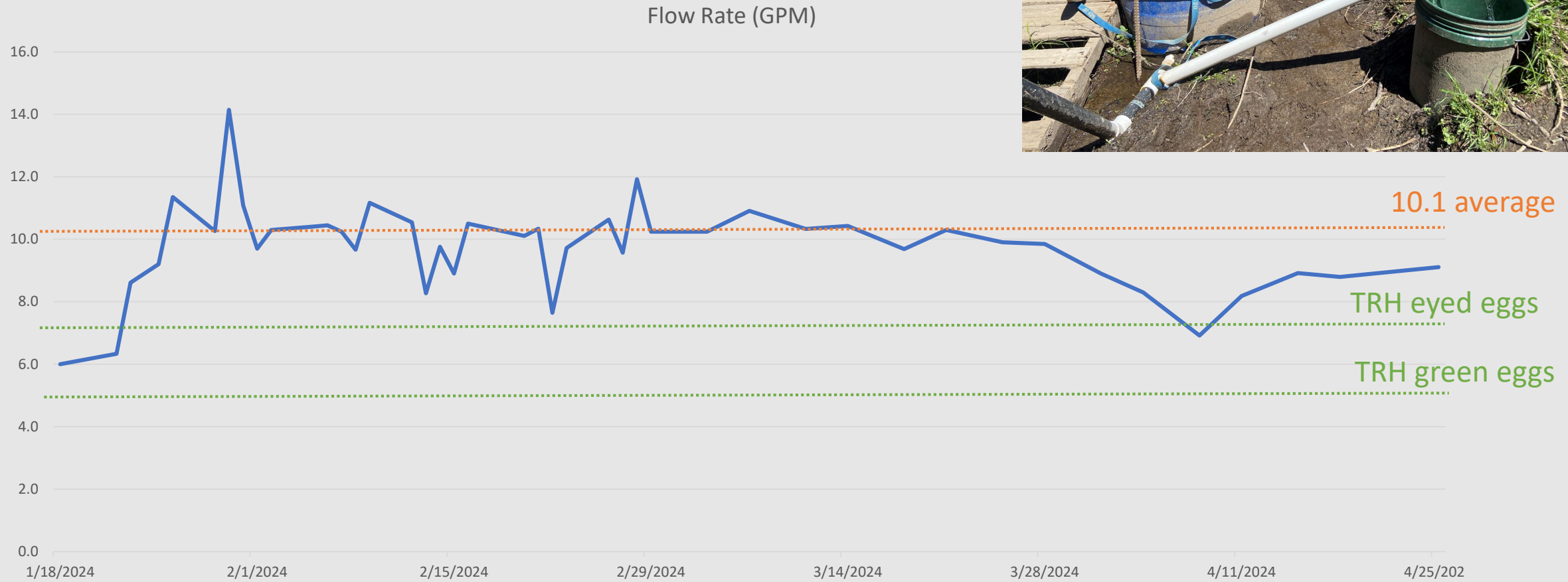
Temperature and Life stage



Flow Rate



Flow Rate



RSI Survival Summary



Egg Loss



Total: 101
Daily Max: 29

Alevin Loss



Total: 133
Daily Max: 20

Deformities



Total: 5
Daily Max: 2

10,078 eggs ➡ 9,977 Alevin ➡ 9,844 fry ➡ 97.7% survival



RSI Reference Guide Working Draft

Remote Site Incubator (RSI) Guide

Prepared by Yurok Tribe Fisheries Program: Trinity River Division, 2024



Table of Contents

Installation Guide.....	2
Overview	2
Materials List.....	3
Intake Hose Set-Up	3
Clarifying Tank Set-Up.....	4
Standpipe Set- Up	4
Egg Tank Set-Up.....	6
Swim Tank	8
Maintenance and Monitoring.....	8
Egg Transportation.....	8
Maintenance Checks.....	9
Data Collection	9
Project Monitoring.....	10
Future Use.....	10
Acknowledgements.....	11
References:	11

Remote Site Incubator: Incubation Tank

1/4" x 2" inch rods and bolts to hold screen (8)
silicone to seal bolt holes
1 1/2 inch bulkhead fittings (1)
gravel screen
egg screen
flow diffuser
fly filter
locking lid/cap



Figure 7. Schematic of the egg/incubation tank with measurements and material list.

Flow Diffuser

Located at the bottom of the egg tank barrel, the flow diffuser forces water across the barrel to form a more uniform flow. A PVC cross will be used with 4 sections of 1.5 inch PVC cut to 8 inches. All four sections will have holes drilled evenly down the sides which will help distribute water flow. Three of the sections will be sealed with glued slip end caps. The final section will be pressed into a 1.5 inch pvc connector, which should be screwed into the bulkhead first.



Remote Site Incubator: Flow Diffuser

1.5 inch PVC cross connector (1)
1.5 inch PVC end caps (3)
1.5 inch PVC at 8 inches with 5/16 holes drilled into sides (4)
connects to bulkhead at bottom of incubation tank

Figure 8. Schematic of the flow diffuser, which is installed at the bottom of the egg/incubation tank



RSI Reference Guide Working Draft

Part	Quantity	Est. Cost	Part	Quantity	Est. Cost
<u>Barrels</u>	3	300.00	<u>Intake Screen</u>	1	16.00
Barrell Lids	2	0.00	<u>1.5 inch PVC</u>	10 ft.	15.00
1.5 inch Polypipe	100 ft.	100.00	4 or 6 in PVC	2 ft.	25.00
<u>Polypipe B-B</u>	1+	2.00	<u>90 PVC</u>	6	18.00
<u>Polypipe B-MPT</u>	2	4.00	<u>45 PVC</u>	3	9.00
<u>Bulkheads</u>	6	48.00	<u>PVC Tee</u>	1	5.00
<u>Gravel Screen</u>	1	32.00	<u>3-way pool</u>	2	32.00
<u>Egg Screen</u>	1	55.00	<u>Threaded PVC</u>	11	44.00
<u>¾ Pipe Insulation</u>	2	6.00	<u>Threaded Cap</u>	1	4.00
Gravel	10 gal	0.00	<u>Slip End Cap</u>	3	8.00
<u>Rebar stakes</u>	1	15.00	<u>PVC Cross</u>	1	10.00
<u>Garden Hose</u>	1	22.00	<u>Plumbers strap</u>	1	6.00
<u>1.5 to ¾</u>	1	3.00	<u>Pipe cutters</u>	1	32.00
<u>¾ adaptor</u>	1	2.00	<u>Sandpaper</u>	1	2.00
Pallets	4	0.00	<u>PVC primer/ glue</u>	1	12.00
Feather	2	0.00	<u>Hoseclamps</u>	3+	12.00
<u>Turkey Baster</u>	1	7.00	<u>Pool Thermometer</u>	1	8.00

Total Materials \$854.00

Budget Breakdown



- Materials: ~\$900
- 43 site visits (2 people)
- 112 crew hours on site
- 129 crew hours transit time

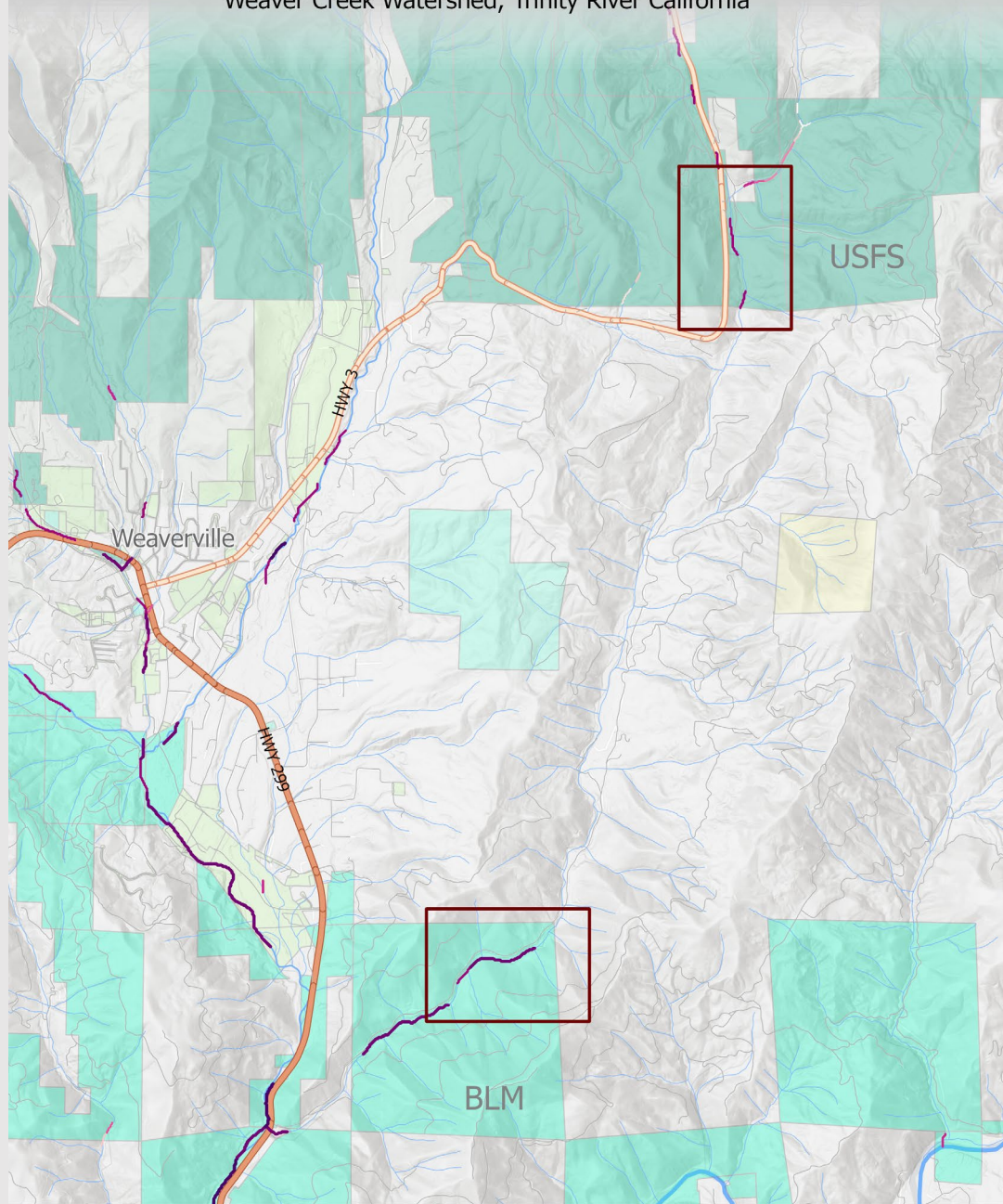




A blue plastic tub filled with water. A yellow rubber duck is floating on the left side. A white PVC pipe is inserted vertically into the water on the right side. In the background, there is a wooden barrel with a wooden lid and a wooden pallet. The scene is outdoors with trees and foliage in the background.

RSI Potential Location: Little Browns Creek

Weaver Creek Watershed, Trinity River California





Future RSI Site Selection Tools

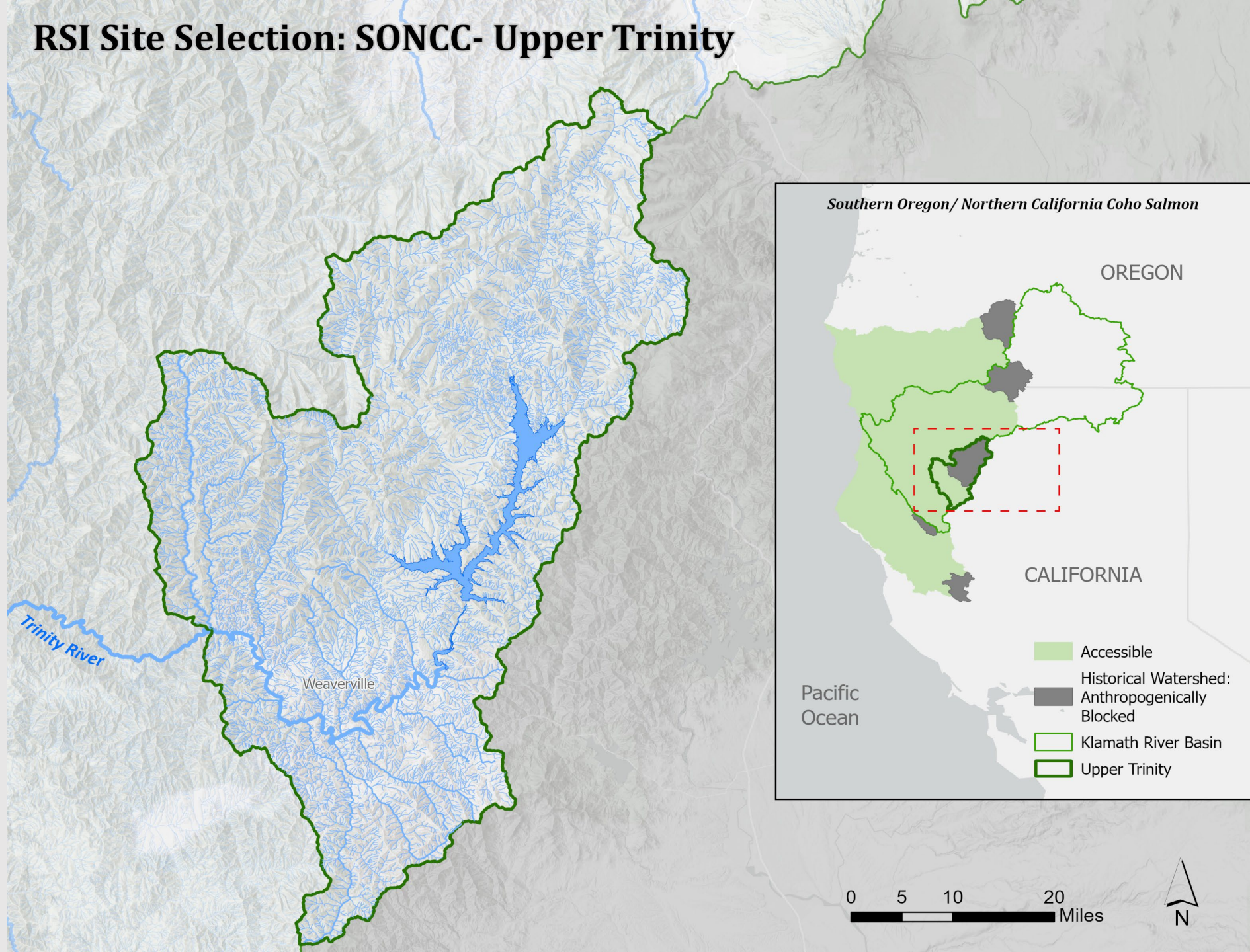
NOAA Intrinsic Potential Model
CDFW Passage Assessment Database
Landowner Access
Stream Reports
Restoration Actions
Proximity to JC Weir
Distance to Road/ Winter Access
Professional Judgement
Summer Rearing Habitat



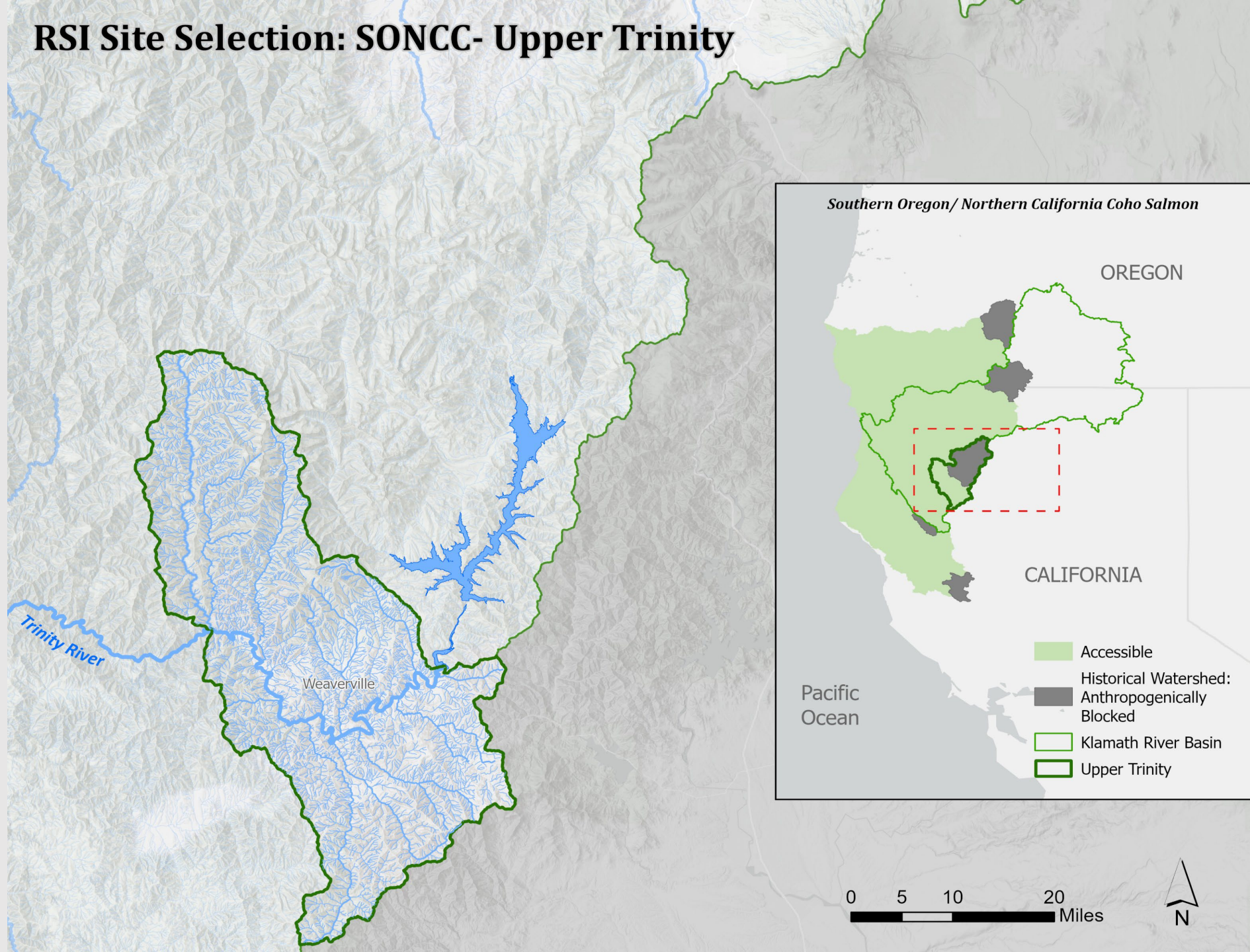
Field Reconnaissance

Ranking Metrics	Multiplying Factor
Fish Passage	5
Total stream length with IP value	4
Proximity to Junction City Weir	3
Coho Salmon current usage	2
Restoration Actions	1

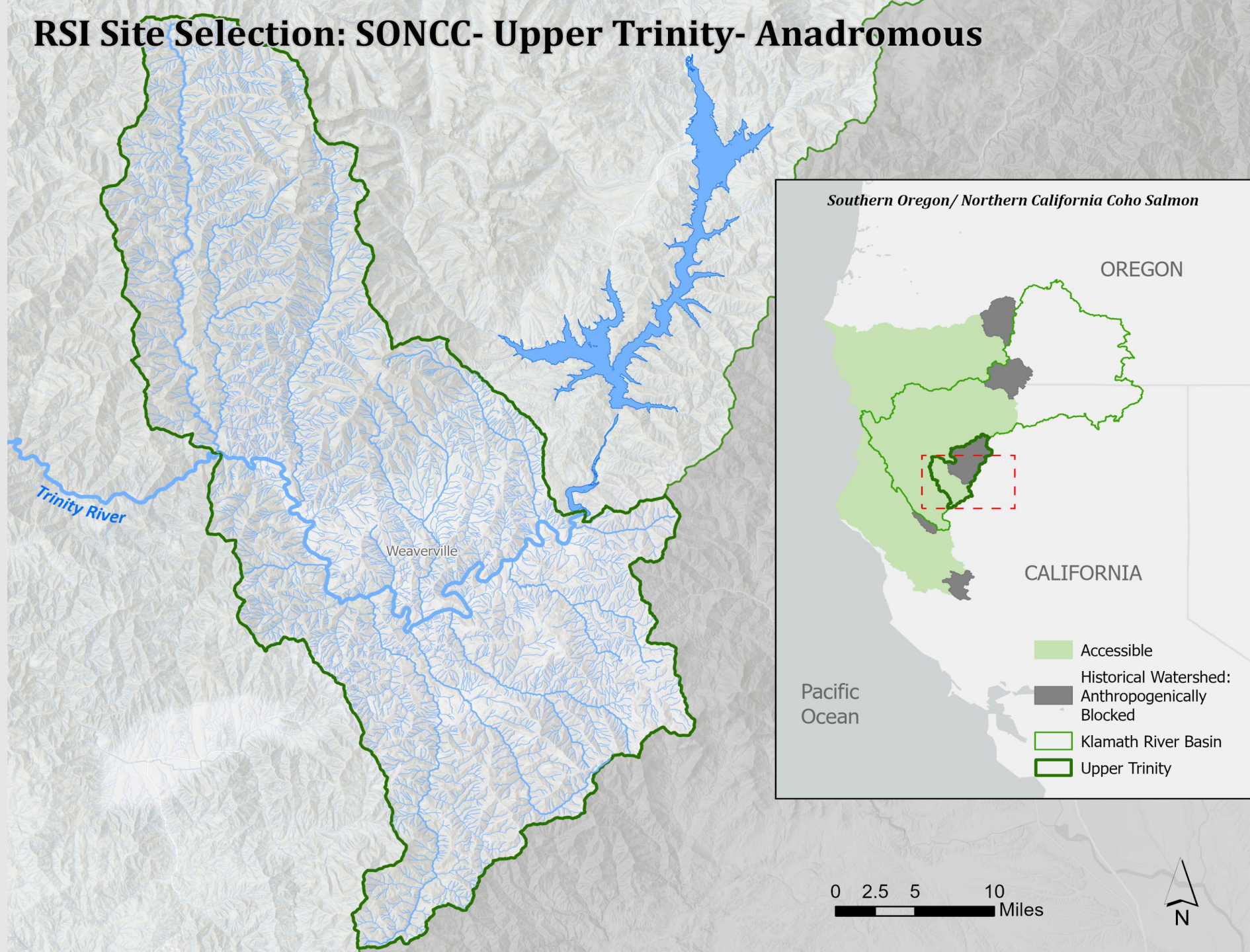
RSI Site Selection: SONCC- Upper Trinity



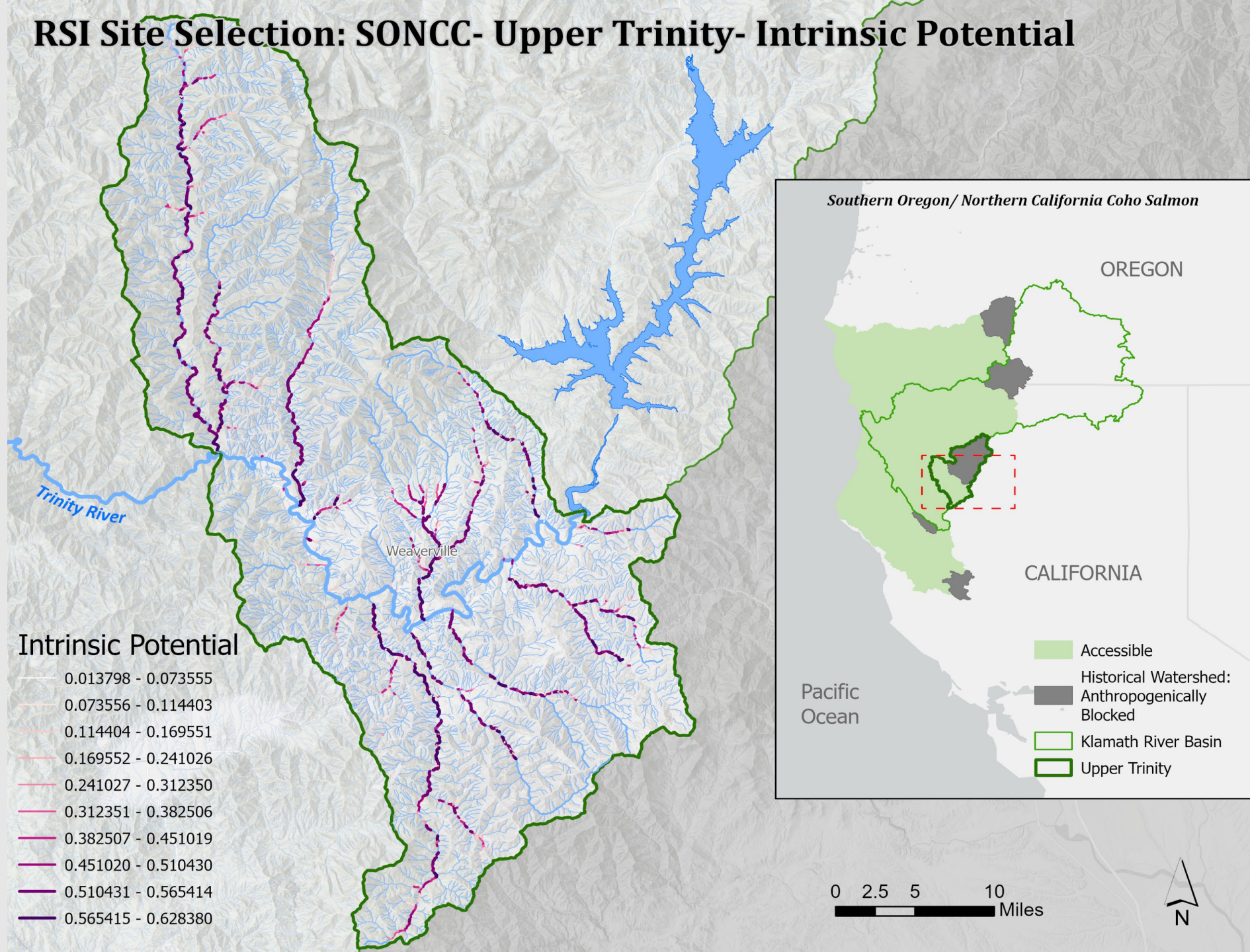
RSI Site Selection: SONCC- Upper Trinity



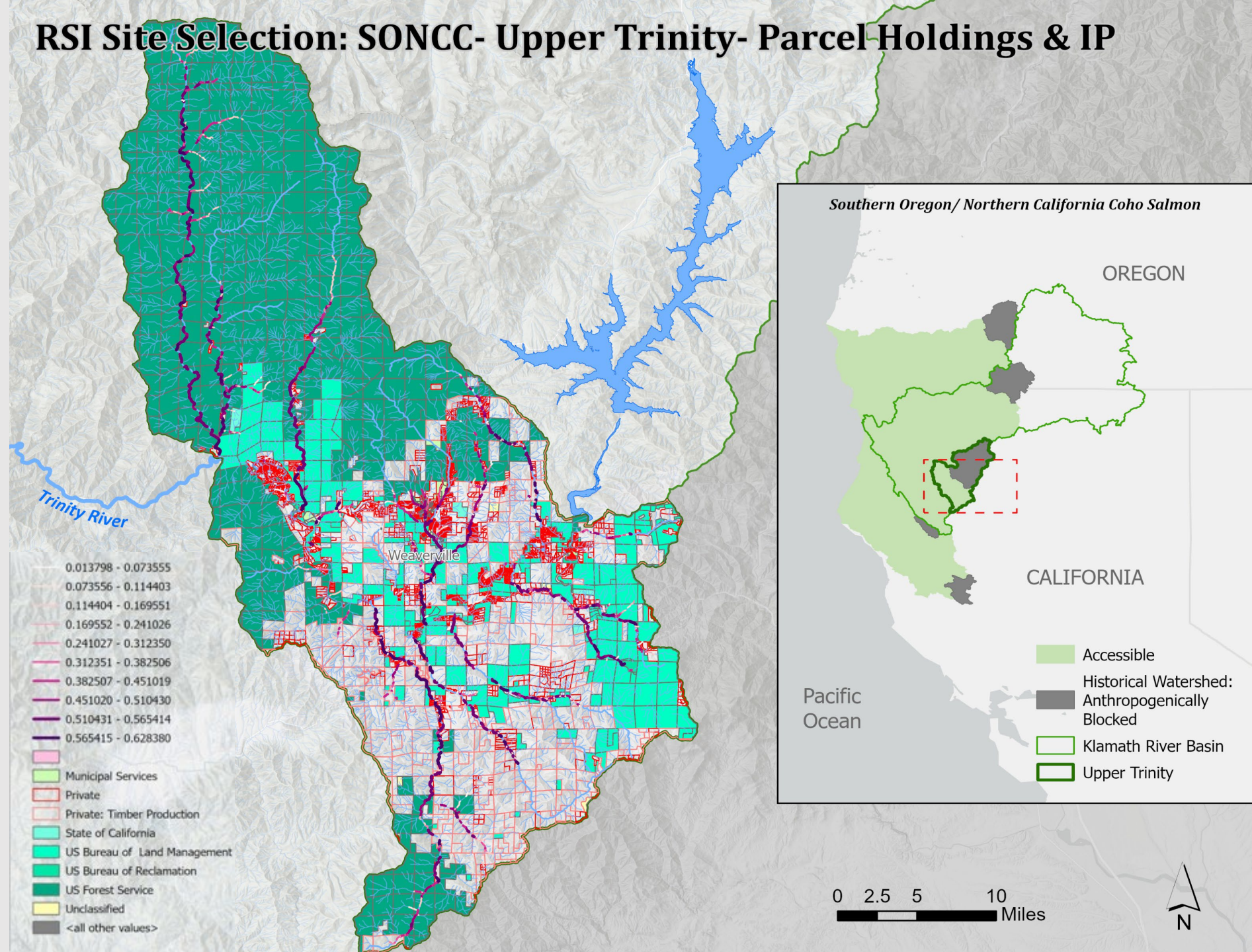
RSI Site Selection: SONCC- Upper Trinity- Anadromous



RSI Site Selection: SONCC- Upper Trinity- Intrinsic Potential



RSI Site Selection: SONCC- Upper Trinity- Parcel Holdings & IP



RSI Site Selection: SONCC- Upper Trinity- Public Land IP

Accessibility Legend:

- 0.013798 - 0.073555
- 0.073556 - 0.114403
- 0.114404 - 0.169551
- 0.169552 - 0.241026
- 0.241027 - 0.312350
- 0.312351 - 0.382506
- 0.382507 - 0.451019
- 0.451020 - 0.510430
- 0.510431 - 0.565414
- 0.565415 - 0.628380
- <all other values>

Land Ownership Legend:

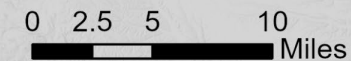
- Municipal Services
- Private
- Private: Timber Production
- State of California
- US Bureau of Land Management
- US Bureau of Reclamation
- US Forest Service
- Unclassified

Geographic Labels:

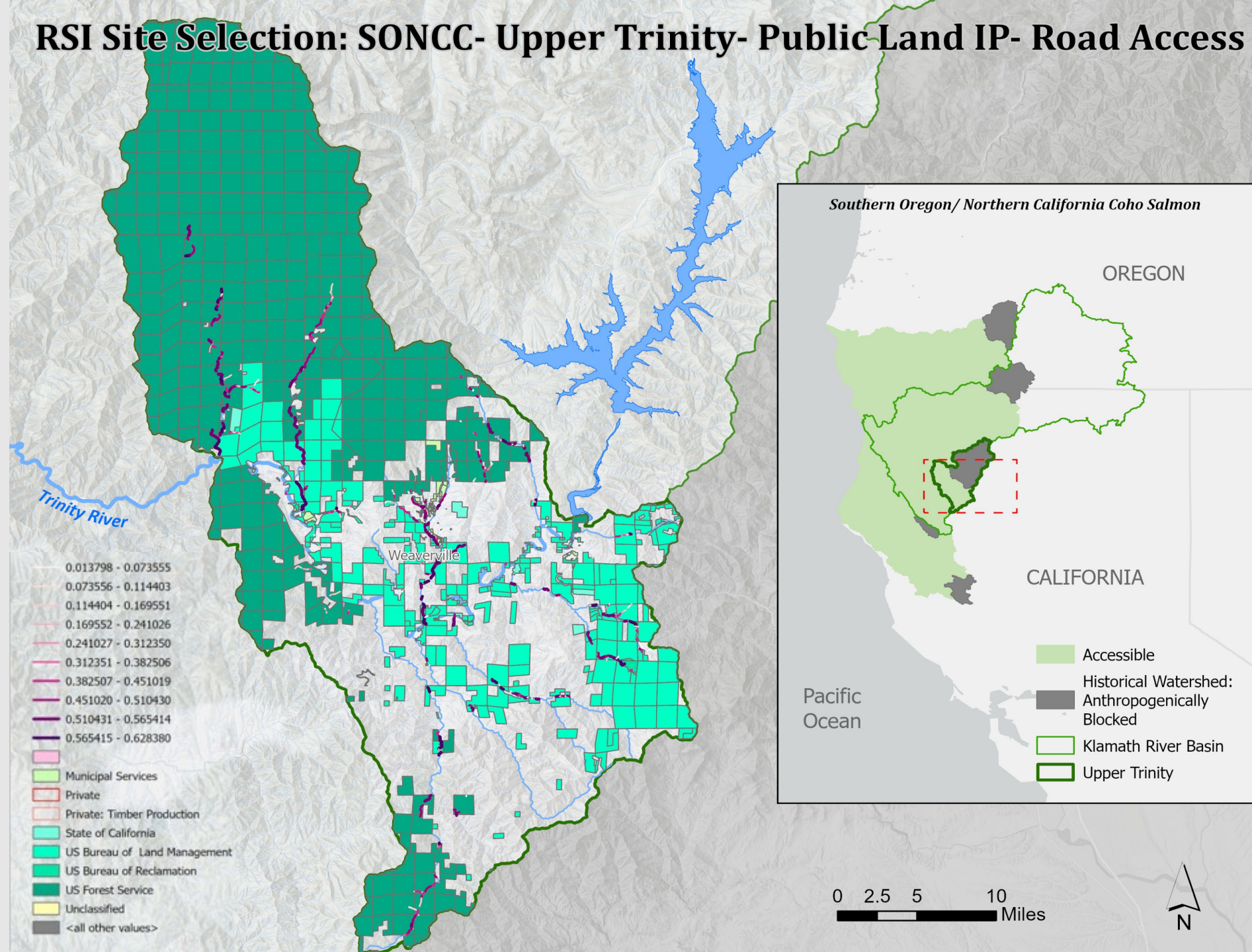
- Trinity River
- Weaverville
- Pacific Ocean
- OREGON
- CALIFORNIA
- Klamath River Basin
- Upper Trinity

Scale and Orientation:

- 0 2.5 5 10 Miles
- North Arrow (N)



RSI Site Selection: SONCC- Upper Trinity- Public Land IP- Road Access



Future RSI Site Selection



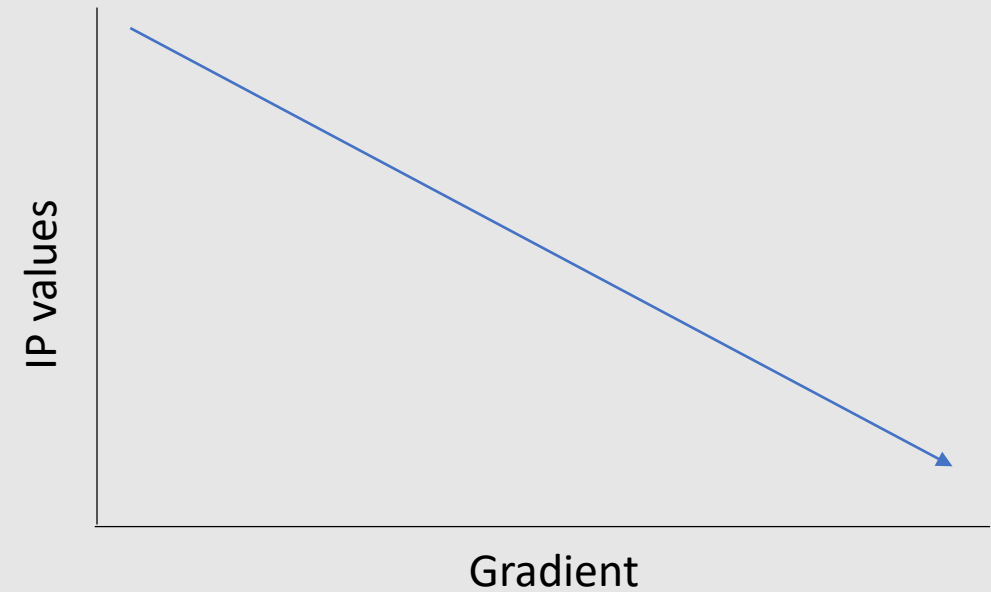
Ranking	Watershed	Streams	Removal
1	Grass Valley Creek	Grass Valley Creek	
2	Indian Creek	Indian Creek	Need Private
3	Deadwood Creek	Deadwood Creek	High Stray
4	Reading Creek	Reading Creek	Need Private
5	Rush Creek	Rush Creek	High Stray
6	Weaver Creek	Little Browns Creek	
		East Weaver Creek	
		Middle Weaver Creek	
		Garden Gulch	
		West Weaver Creek	
		Sidney Gulch	
7	North Fork Trinity River	Rich Gulch	
		East Fork North Fork Trinity River	
		North Fork Trinity River	
		Brock Gulch	
8	Canyon Creek	Canyon Creek	
		Clear Gulch	
9	Maxwell Creek	Maxwell Creek	
10	Browns Creek	Browns Creek	
11	Soldier Creek	Soldier Creek	lacks rearing, no floodplain
12	Conner Creek	Conner Creek	deep incision, bedrock
13	Oregon Gulch	Oregon Gulch	passage barrier

RSI Field Recon



Specific Site Selection

- Gradient vs IP model
- Intake Locations
- Tank Locations



Questions?



Batch Marking

Method	Type	Location	Life Stage	Specialized Equipment
Thermal	Environmental	Otolith	2 weeks after eyed	Temperature controls
Dry	Environmental	Otolith	Embryonic	Moisture controls
Alizarin Complexone	Chemical	Otolith	Embryonic	Fluorescence microscopy
Strontium Chloride	Chemical	Otolith	All Stages	Electron backscatter detector
Calcein	Chemical	Calcified Tissues	All Stages	Fluorescence microscopy
Oxytetracycline	Chemical	Calcified Tissues	Fry	Veterinary Feed Directive to administer
PBT marking	Genetic	Genetics	All Stages	Genotyping
Adipose Clipping	Visual	Adipose	Fry	

Parental Based Tagging (PBT)

- Mass batch marking near 100%
- Genotype marker also “tags” off-spring for multiple generations
- No tag loss if sampling
- Non-lethal analysis at every lifestage
- Samples can be stored and analyzed at later dates
- Utilization of new technologies (Campbell et al 2015)
 - Illumina next-generation sequencing platform
 - Genotyping-in-Thousands (GT-Seq)
- Currently needs parental samples from both parents
- Genotyping costs decreasing with technology development

