

# SITE PLAN

WAVE ATTENUATOR

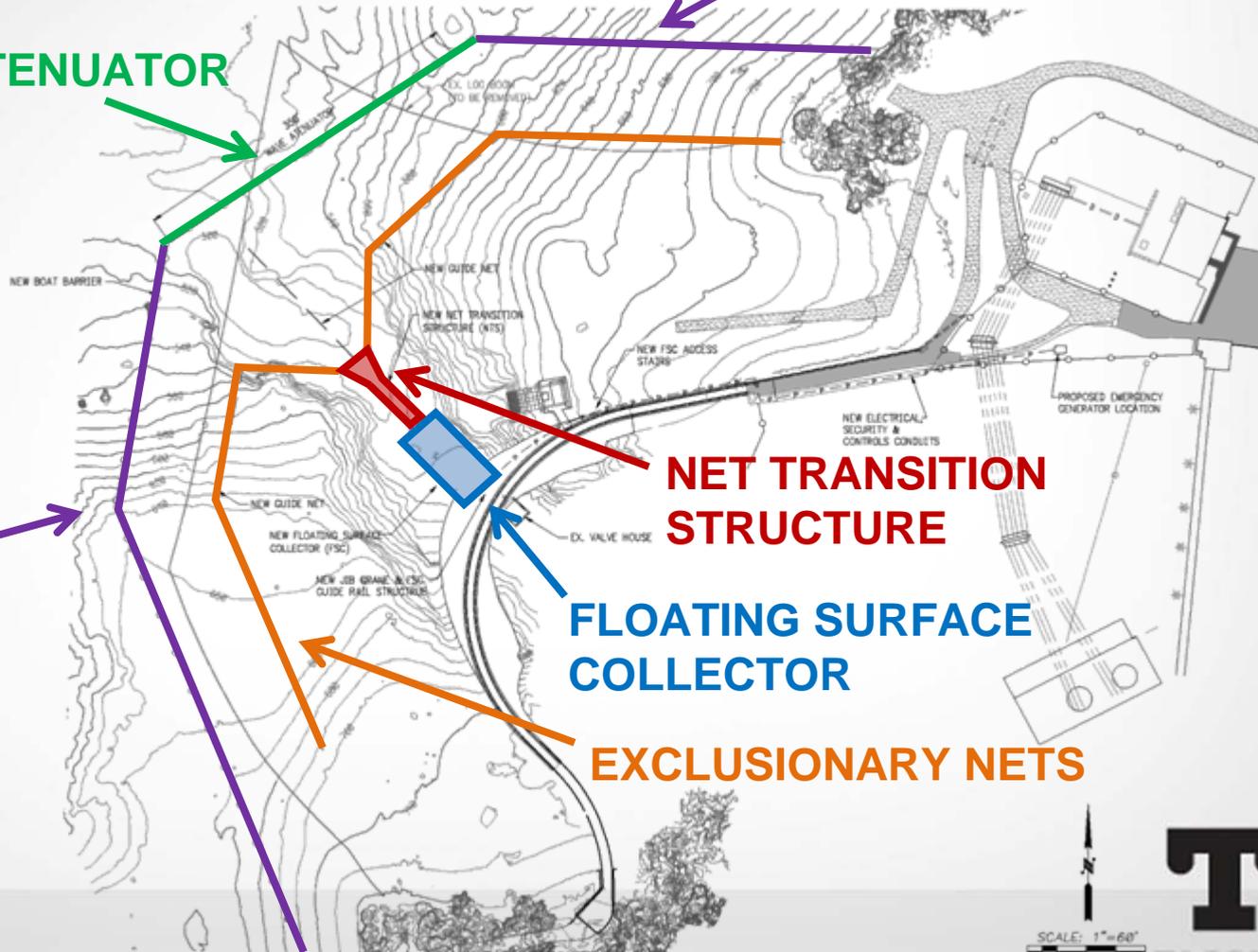
BOAT BARRIER

BOAT BARRIER

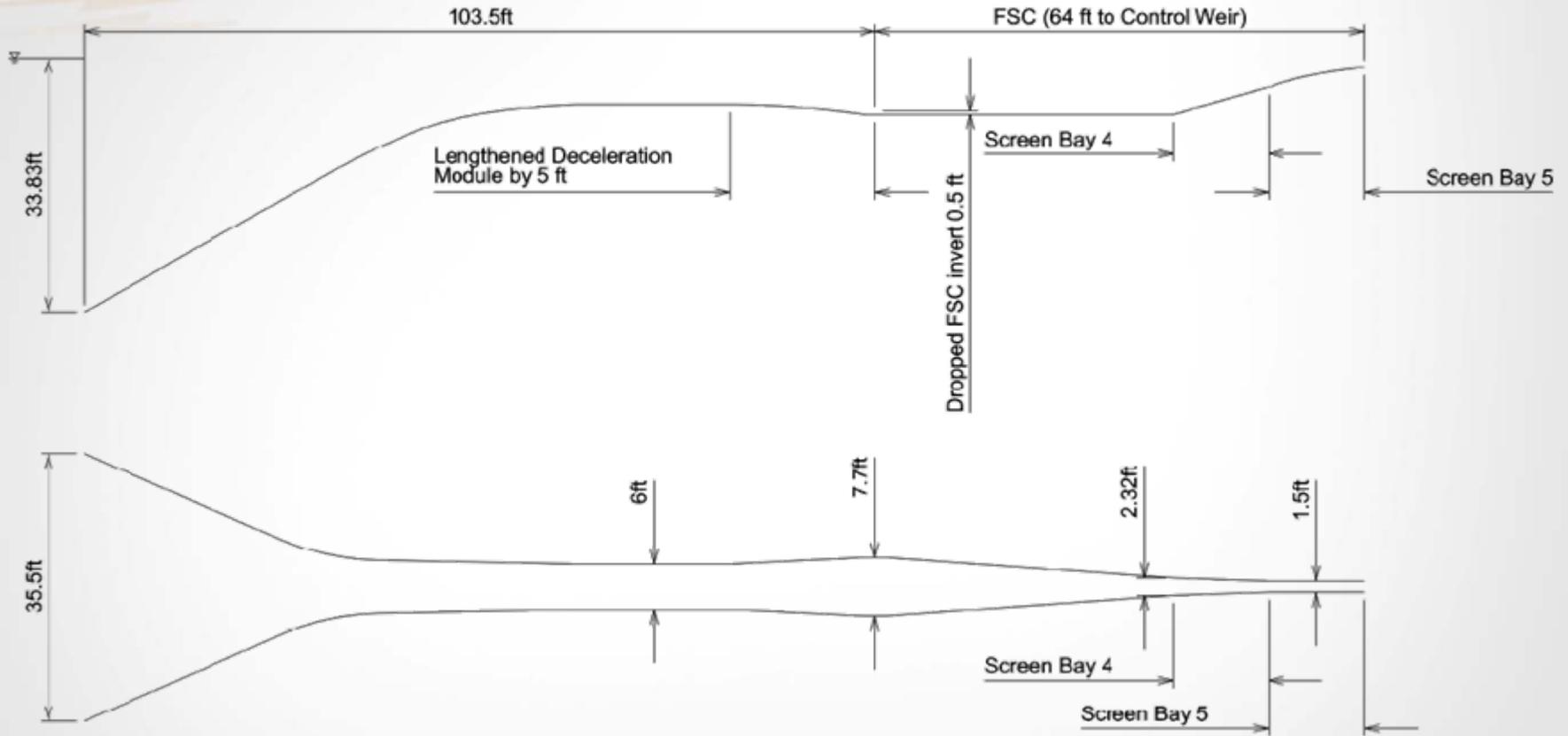
NET TRANSITION STRUCTURE

FLOATING SURFACE COLLECTOR

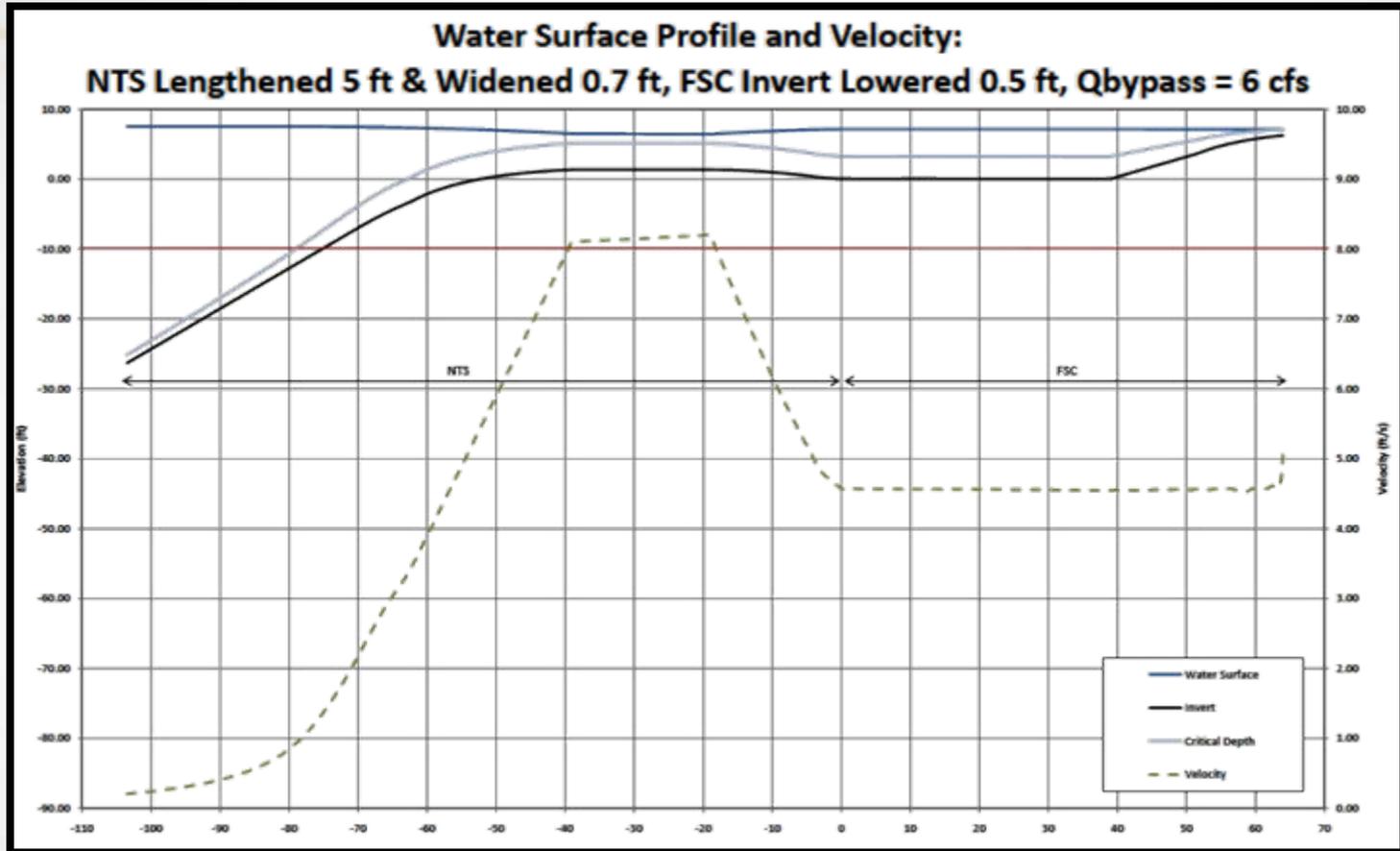
EXCLUSIONARY NETS



# FINAL FISHWAY GEOMETRY



# VELOCITY PROFILE



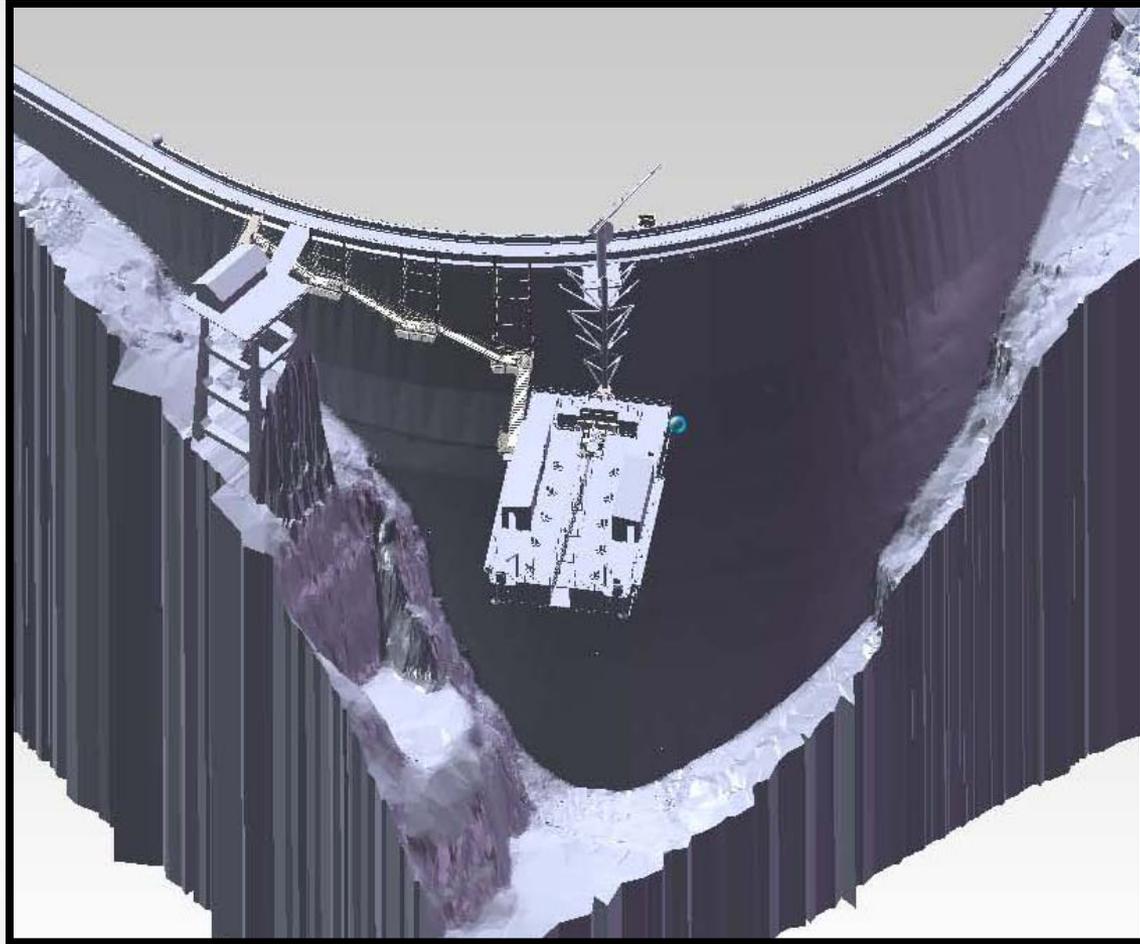
# NET TRANSITION STRUCTURE (NTS)

## SYSTEM COMPONENTS:

- Perimeter Floats
- Debris Control
- Fish Capture Segment
  - Water Velocity: 8 fps
  - Capture Length: 20 ft

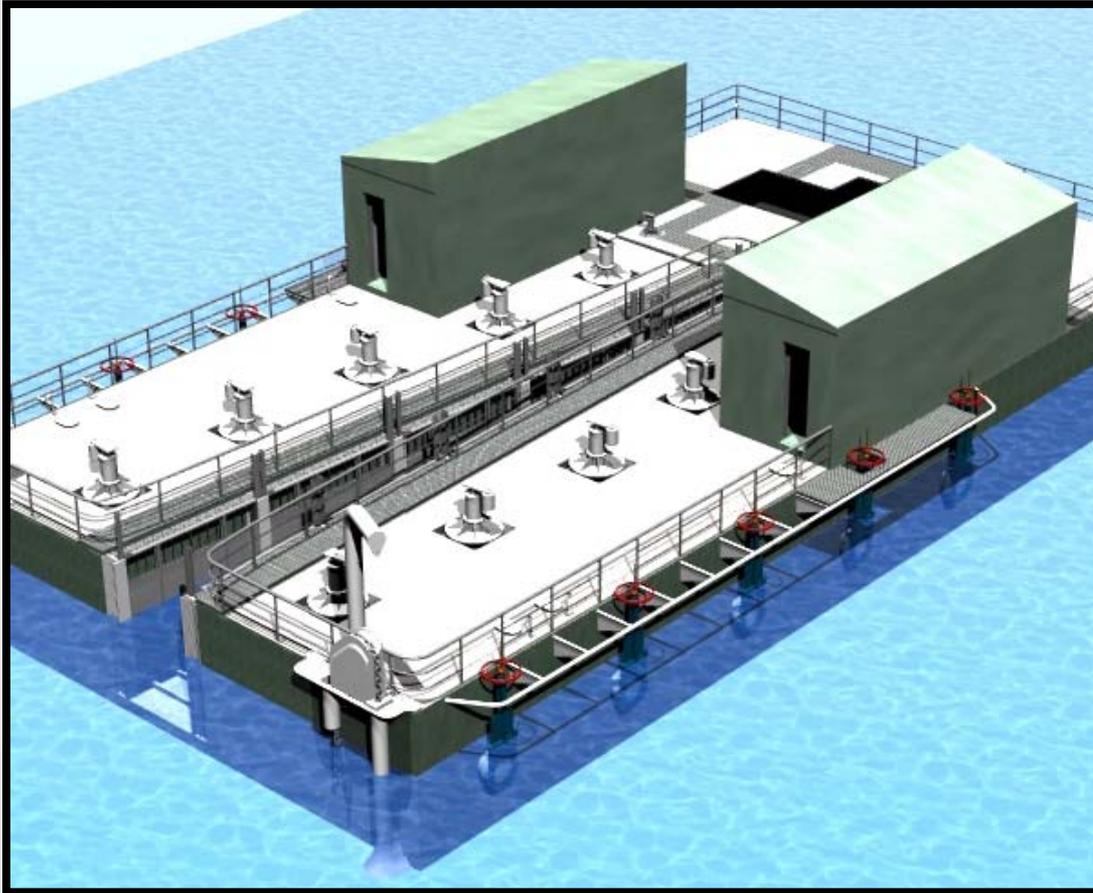


# MODEL VIEW OF FSC & DAM





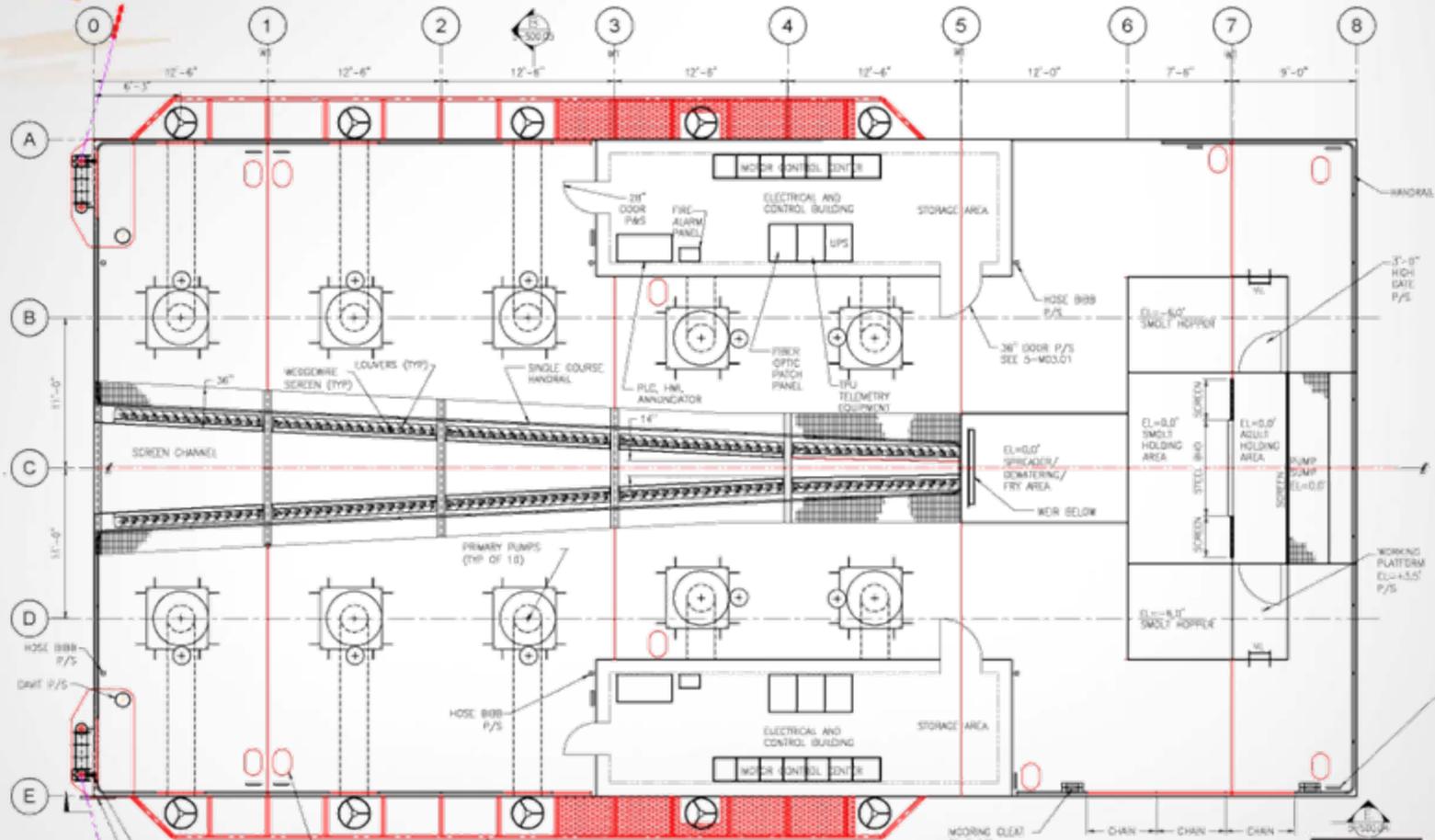
# FLOATING SURFACE COLLECTOR



## SYSTEM COMPONENTS:

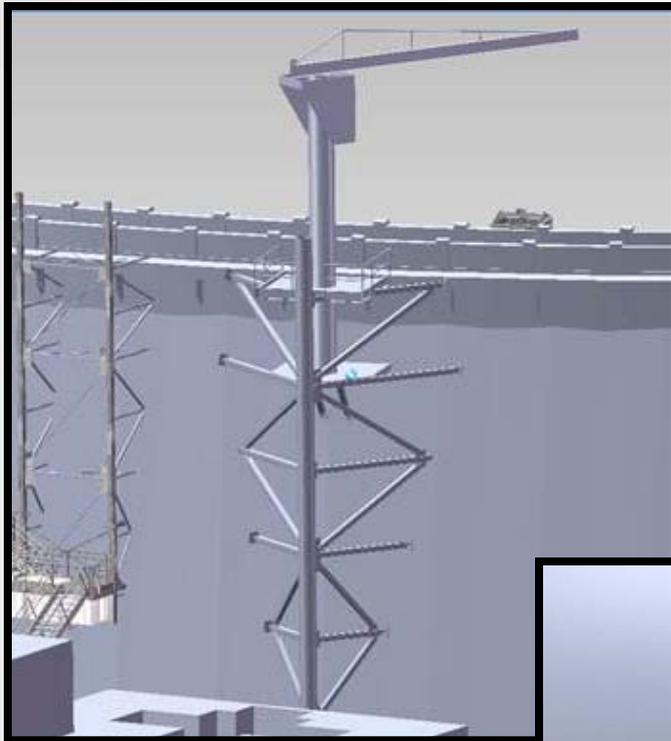
- **Traveling Dewatering Screens**
- **Backwash System**
- **Porosity Plates**
- **Primary Attraction Pumps**
  - (10) 25 CFS Pumps
  - 250 CFS total flow

# FSC – DECK PLAN





# FSC GUIDE RAIL/ANCHOR SYSTEM

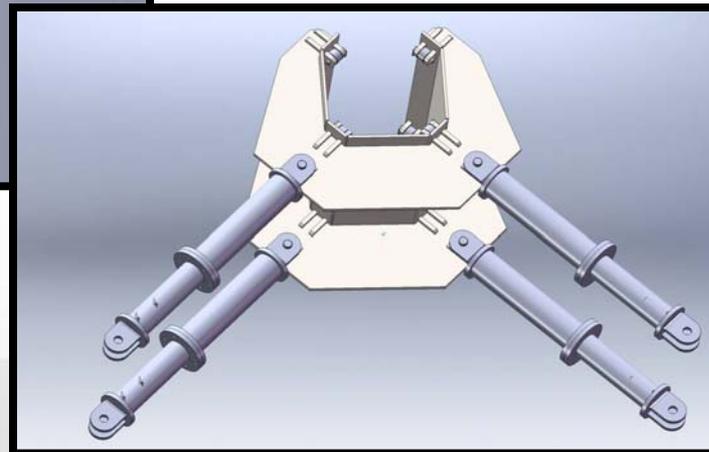


## GUIDE RAIL/ANCHOR STRUCTURE

- Triangular Truss
- Laterally Braced in Orthogonal Directions

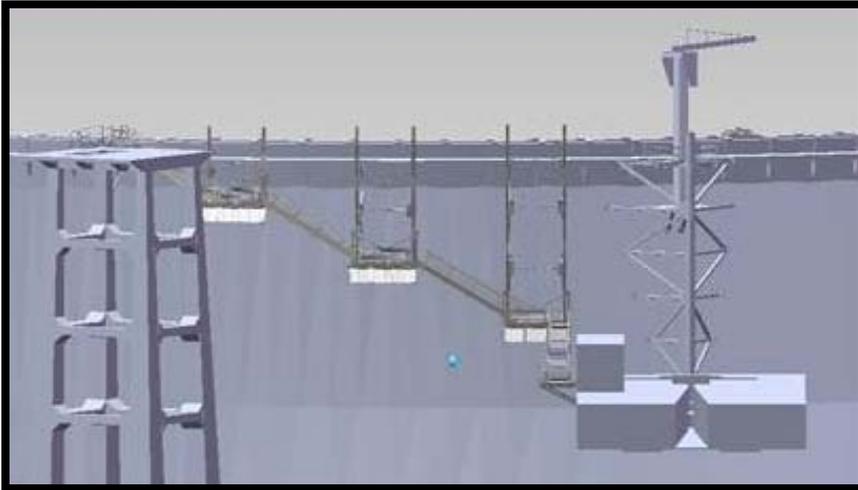
## FSC ANCHOR

- 4 Compression Spring Dampers
- Rail Follower Guide Ring





# ACCESS STAIR SYSTEM



## STAIR RUNS

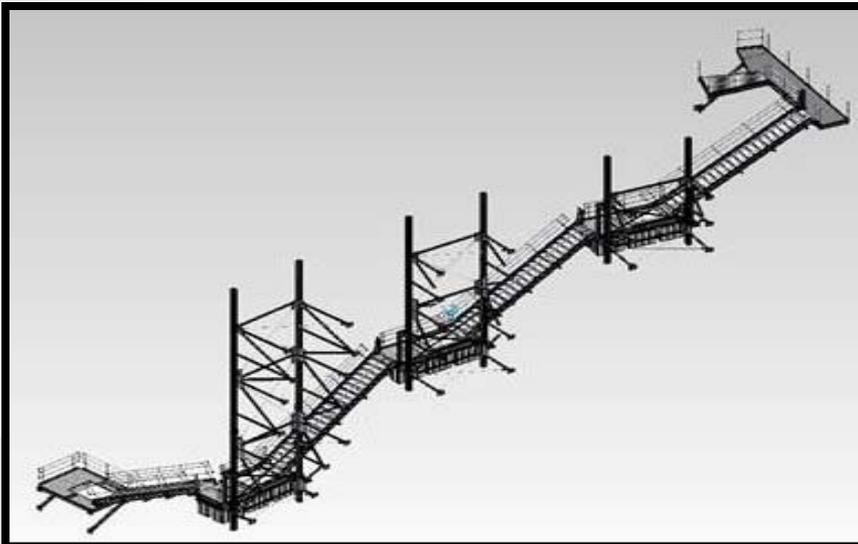
- Self Adjusting Stairs
- Anti-Slip Treads

## STAIR LANDING:

- Polystyrene HDPE Floats with Elevation Stops

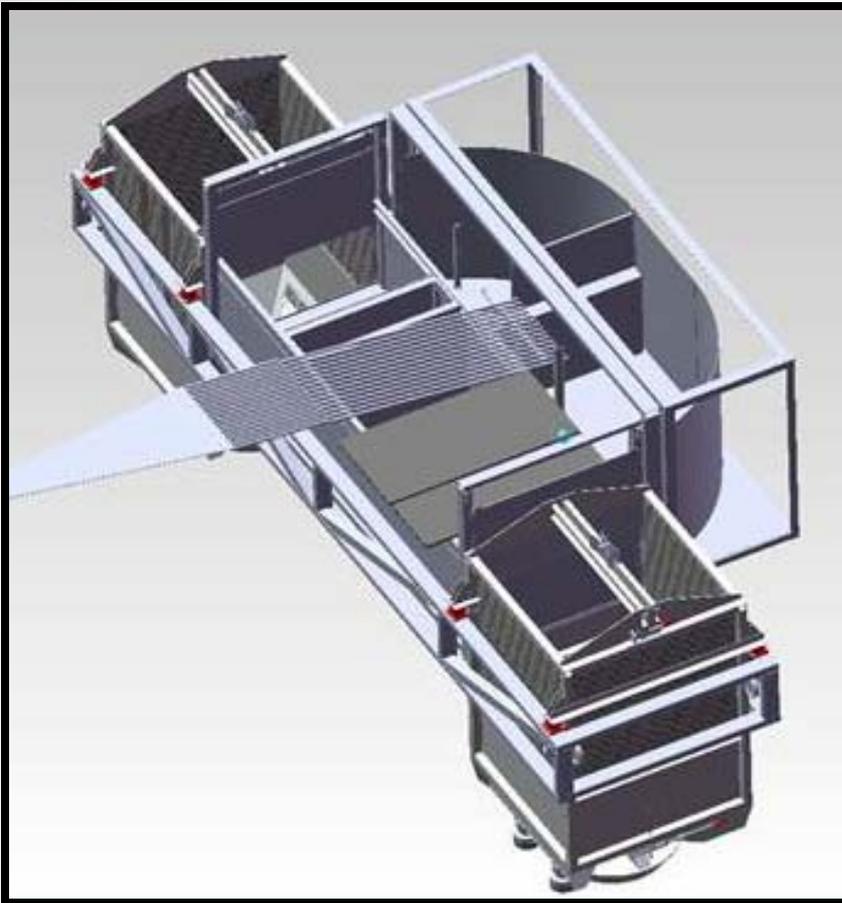
## SUPPORT TRUSSES

- Lateral/Vertical Support Dam Mounted Truss Guides





# COLLECTION MODULE



## MODULE COMPONENTS

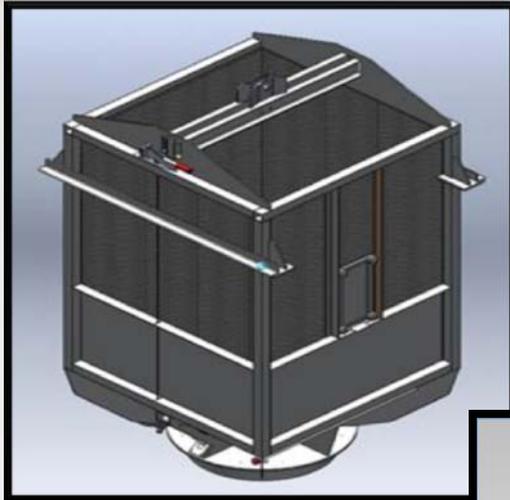
- Water Tight Bulkhead
- Isolation Gate
- Control Weir
- Dewatering
- Fry Separation/Holding
- Smolt Separation/Holding
- Adult Holding
- Pumps/Pump Chamber
- Recessed Working Platforms
- Spray Bars
- Debris Management system
- Counting Camera
- Canopy Structure



# TRANSPORTATION MODULE

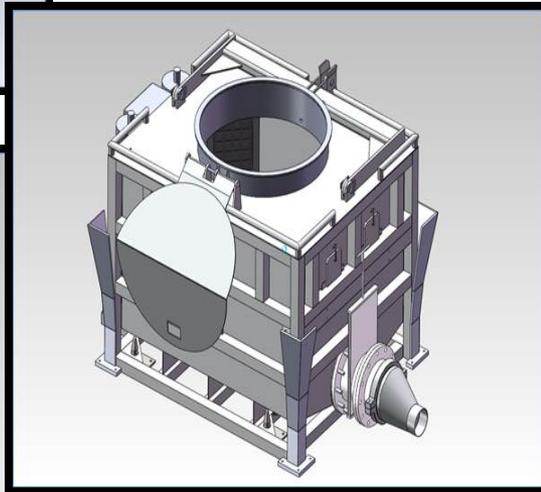
## ADULT/JUVENILE HOPPER

- Juvenile Holding Volume: 10,000
- Adult Holding Volume: 65



## JIB CRANE

- Maximum Reach: 36 ft
- Rated Capacity: 5 tons



## TRANSPORT VESSEL

- On-Board Oxygen and Oxygen Sensor

## TRANSPORT VEHICLE

- Flatbed Truck with Boom





# LAKE KOKANEE





# CUSHMAN NO. 2 DAM

PREFERRED SITE FOR UPSTREAM FISH COLLECTION  
AND DOWNSTREAM FISH PLACEMENT



Slide <#>



# POWERHOUSE DECISION ANALYSIS SUMMARY

- **Grant Opportunity – Renewable energy with environmental benefits = \$4.7 million (20% Matching ARRA Grant)**
- **Business Case concluded we should move forward with the development of the North Fork Project:**

## Net Values (Benefits – Costs)

- Base Case  
\$13.80/MWh
- High Cost Case (25% higher cap)  
\$6.91/MWh

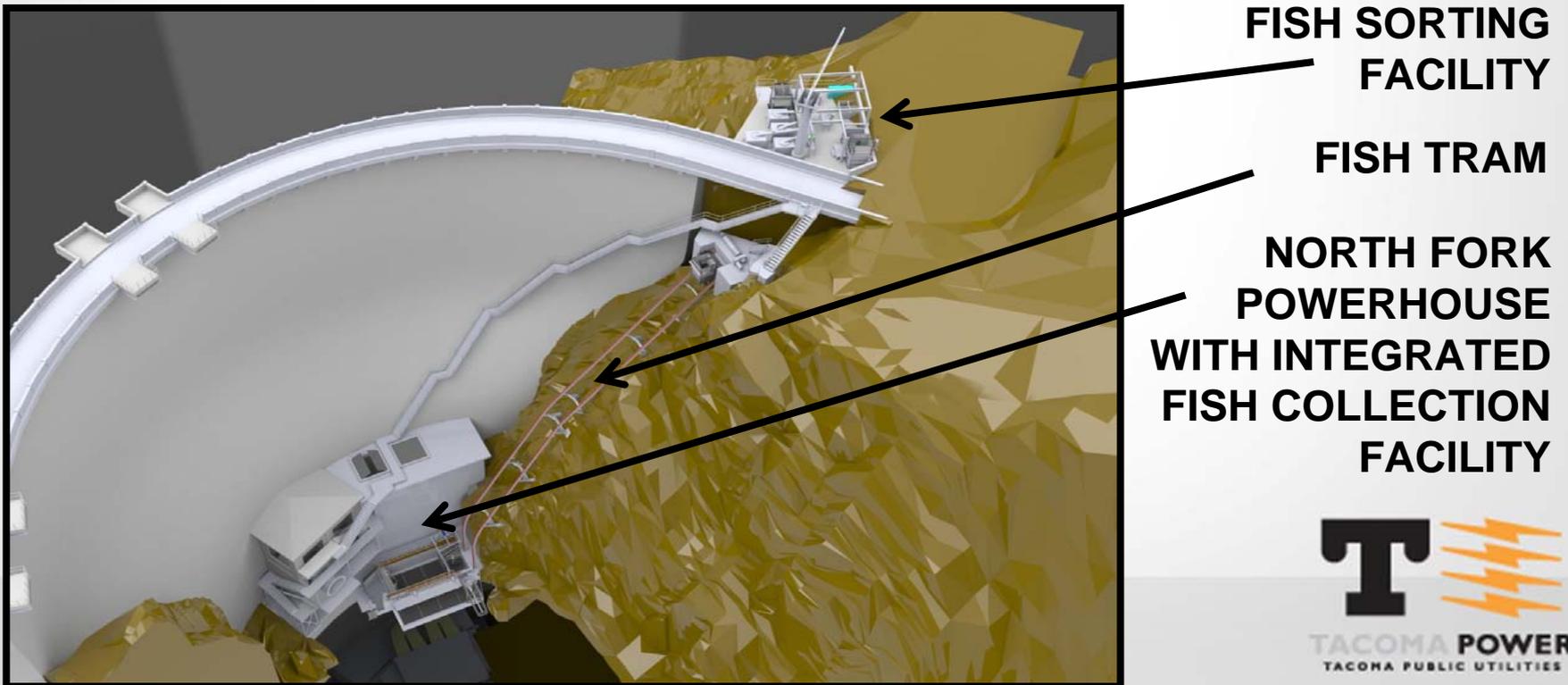
## Net Present Value Levelized

- \$6.8 M
- \$3.4 M



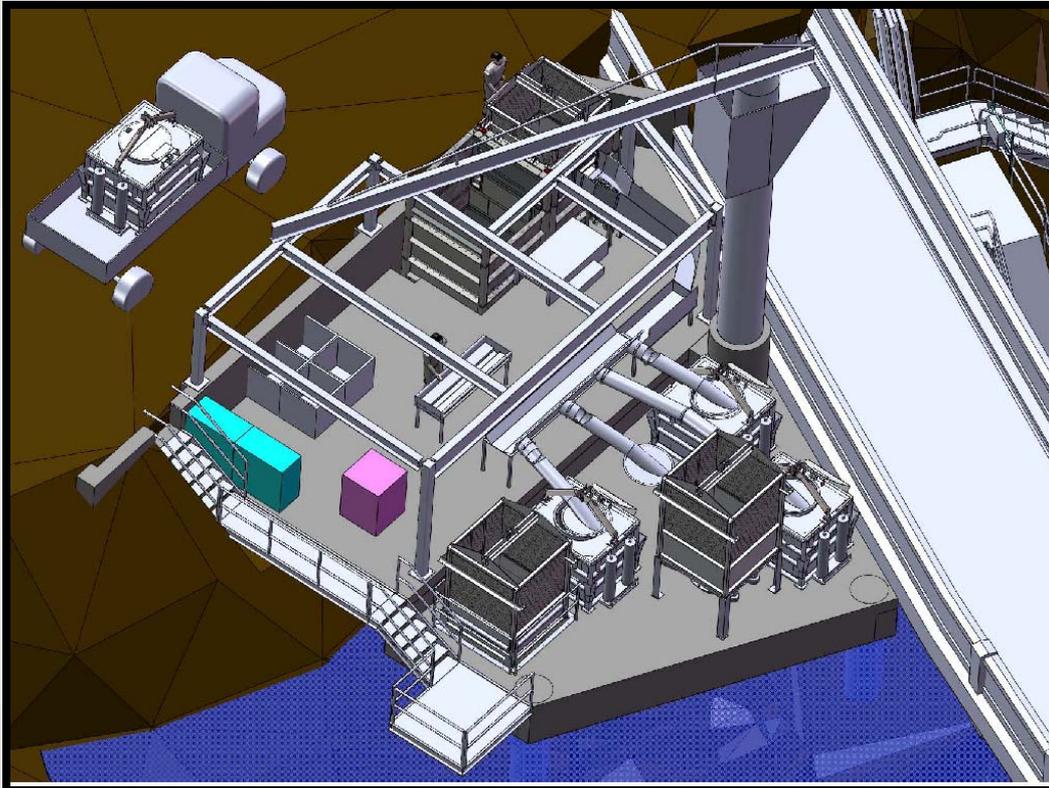
# PROJECT OVERVIEW

- The Fish Collection Facility provides fish passage over the Cushman #2 dam
- Includes two 1.8 MW turbine-generator units to pass the required flows into the North Fork while generating approximately 24 million kW-hours of Clean, Renewable Energy each year





# FISH SORTING FACILITY

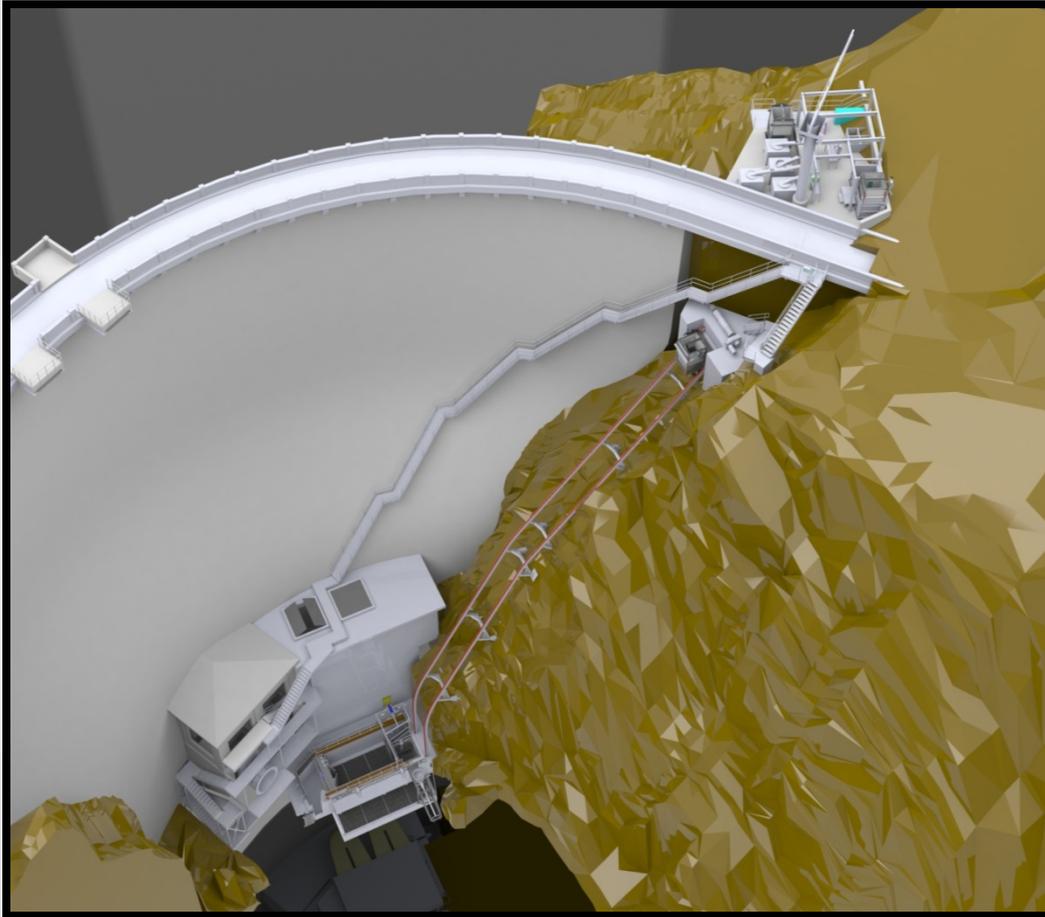


## Fish Sorting Facility

- Located over Lake Kokanee
- Two-level, reinforced concrete structure
- Includes Jib Crane w/ a concrete foundation that is doveled into upstream face of dam



# FISH TRAM

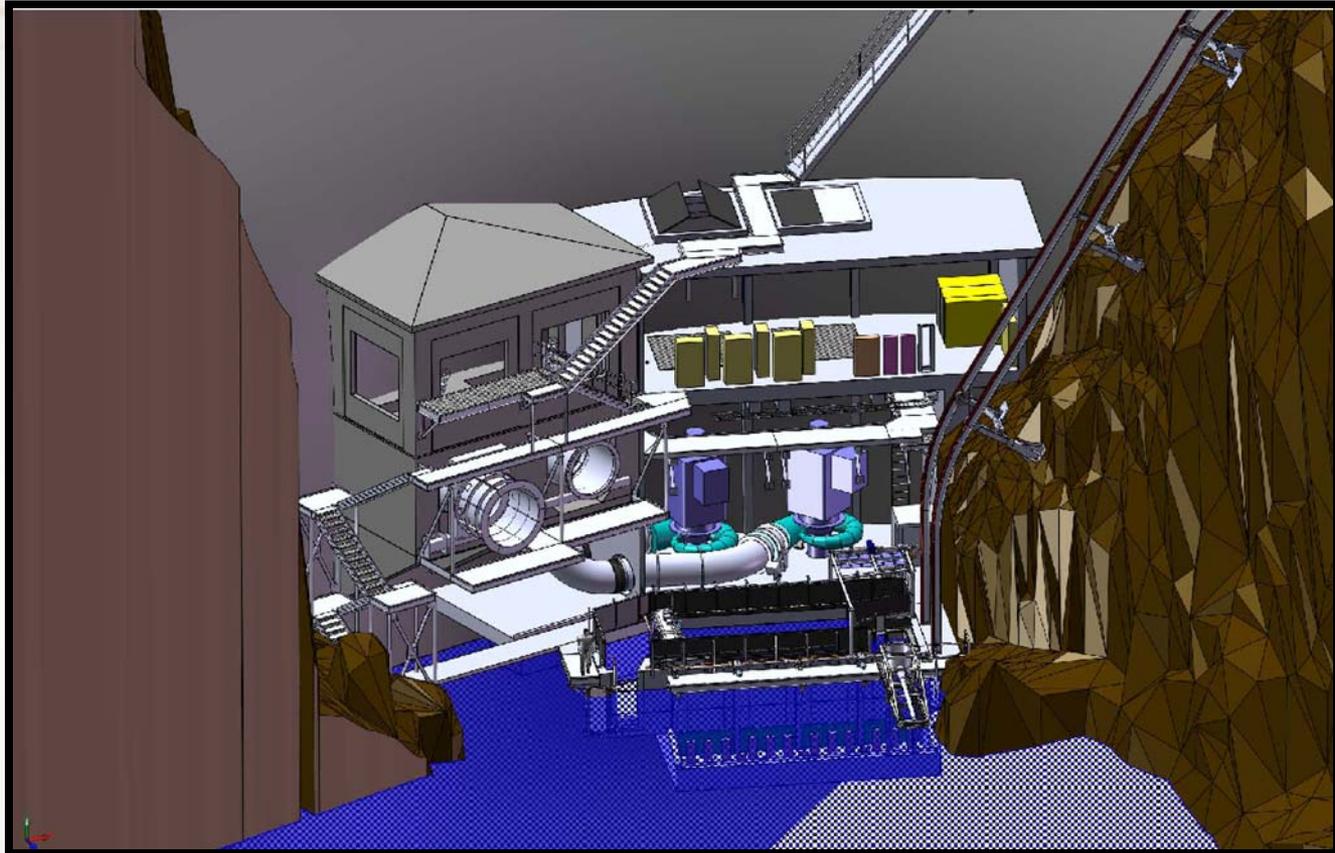


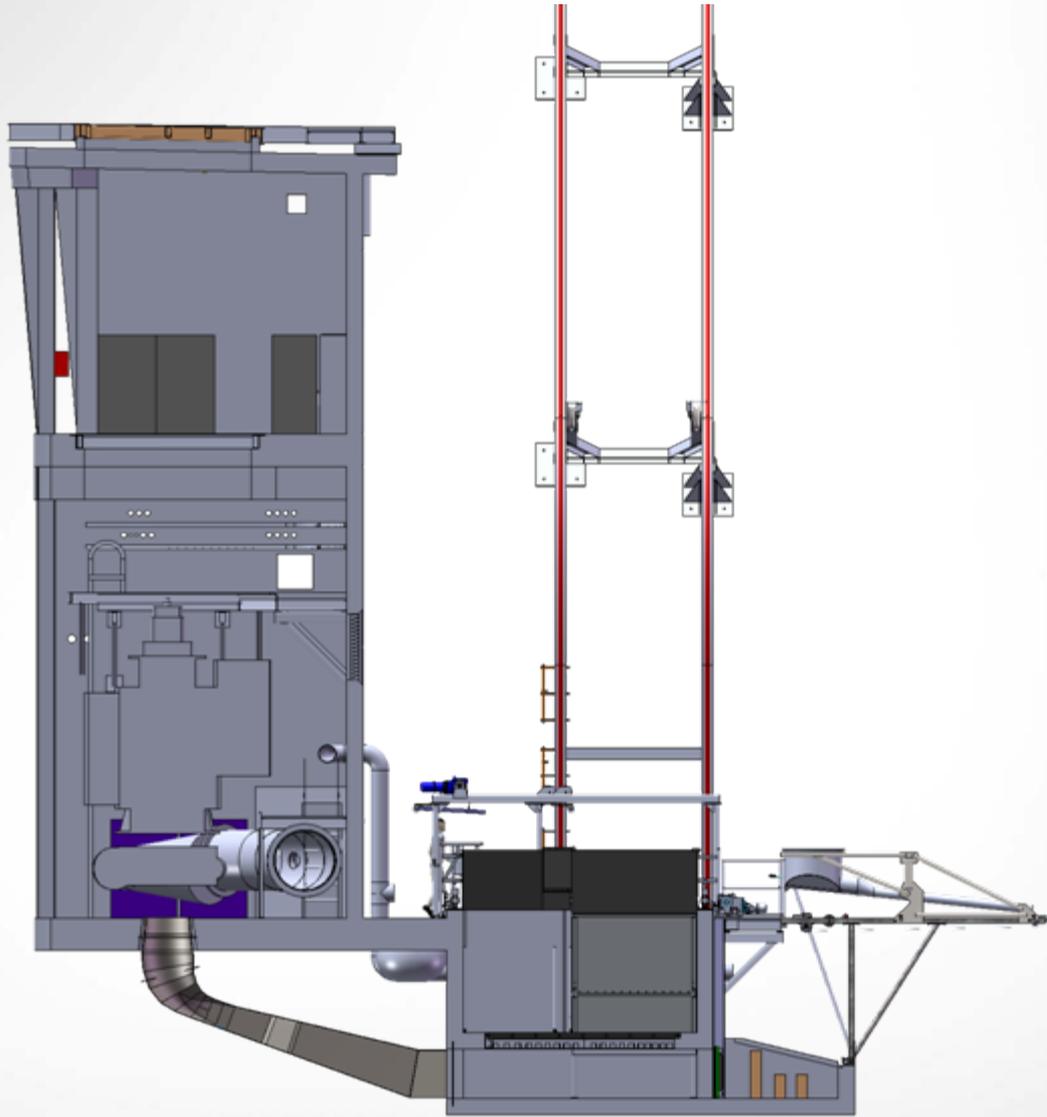
## Fish Tram

- Structure is hung from new concrete platform at the base of left gravity section
- Inclined at slopes of between 45 and 90-degrees
- Intermediate supports along face of left abutment

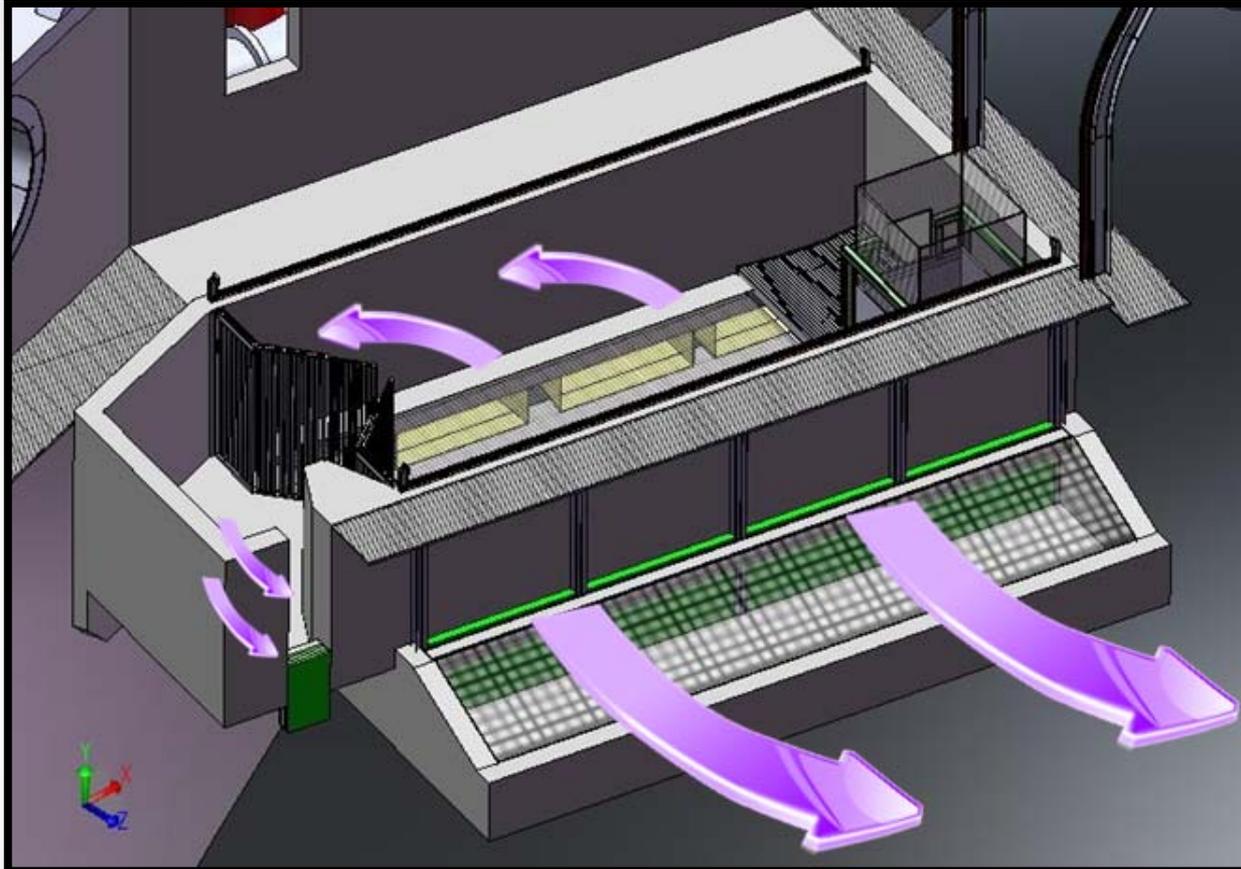


# UNIQUE DESIGN FEATURES





# FISH COLLECTION FACILITY



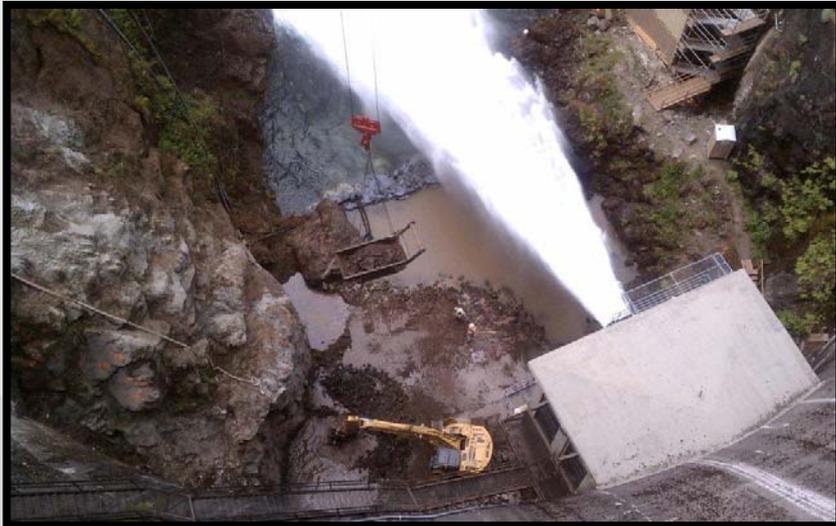


# FISH COLLECTION FACILITY



- **1:5 scale model by Northwest Hydraulic Consultants**
- **Verified facility met National Marine Fisheries Service (NMFS) velocity criteria**

# CONSTRUCTION PROGRESS



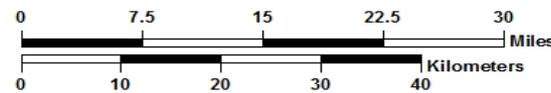
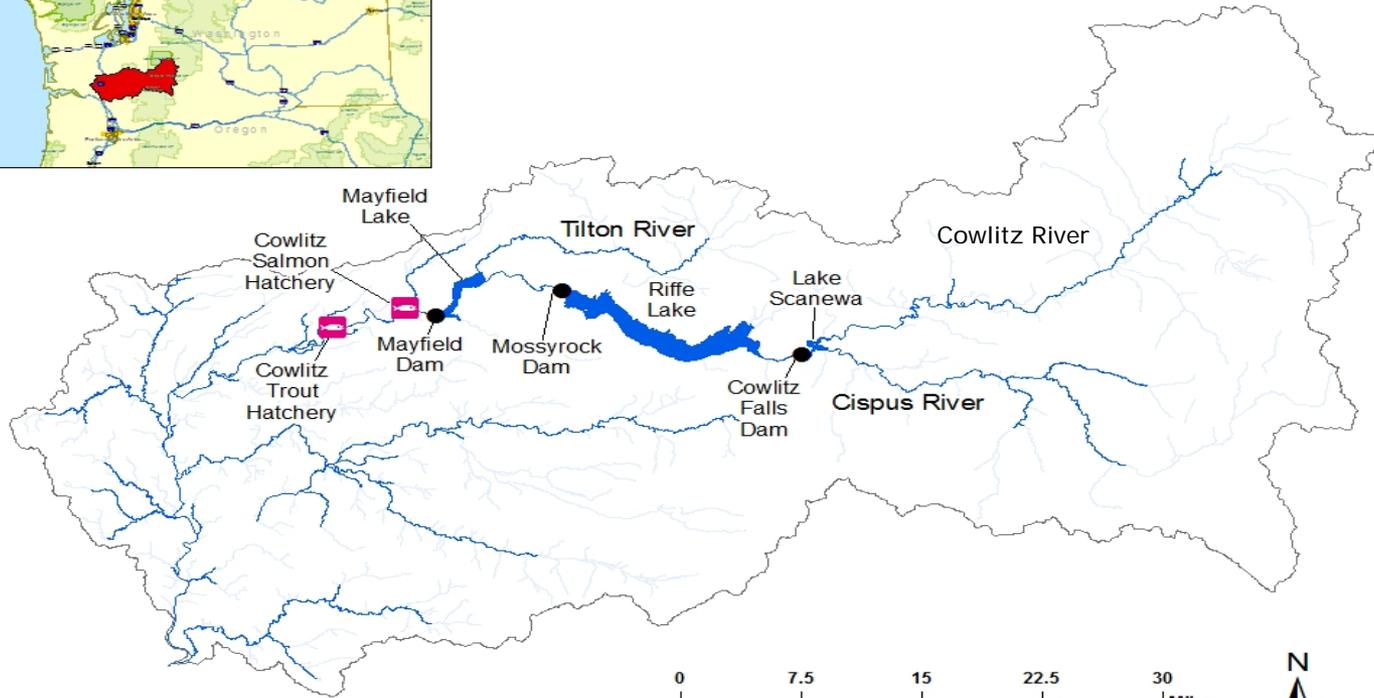




# COWLITZ PROJECT OVERVIEW



Cowlitz River Basin

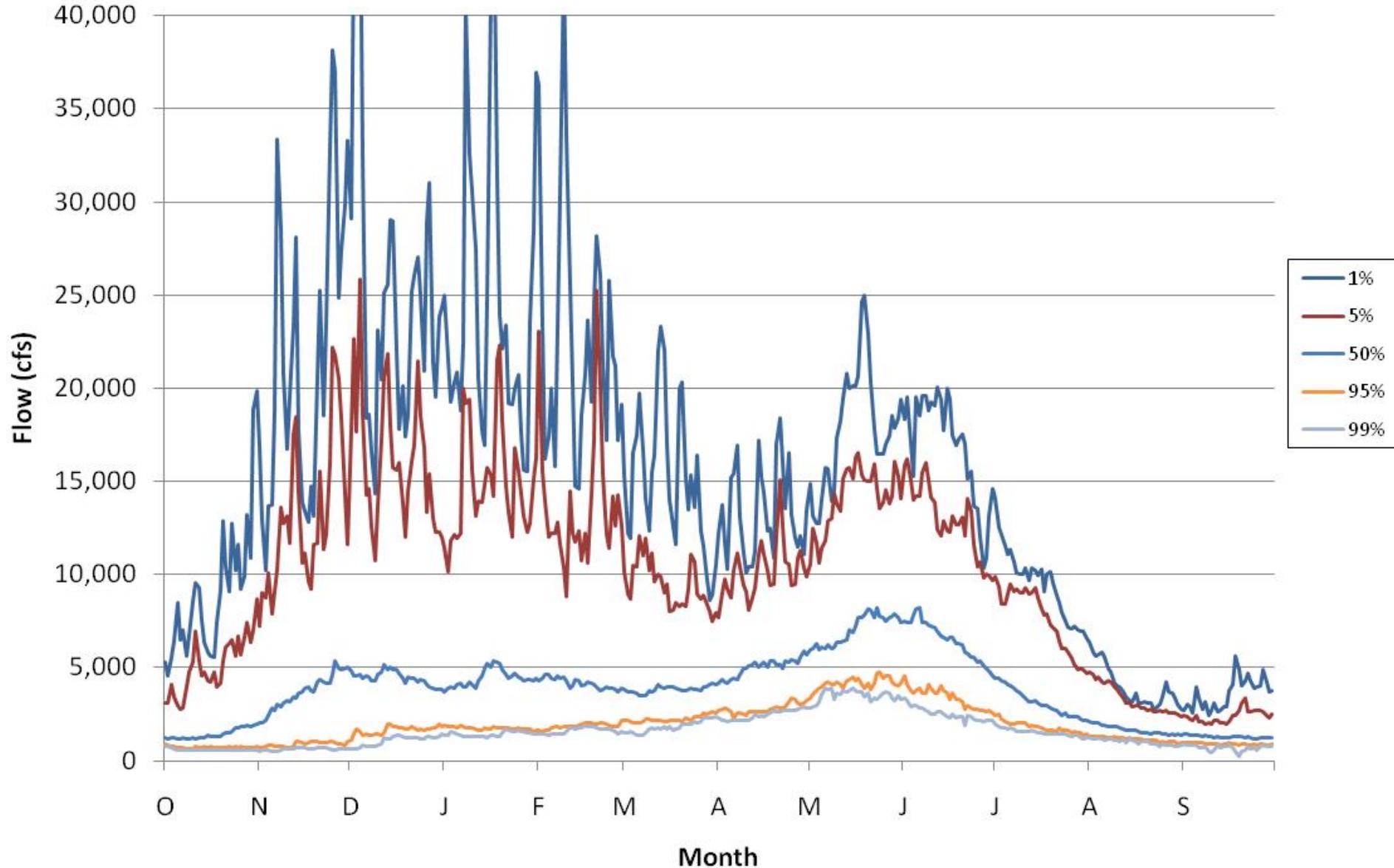




# LAKE SCANEWA



# Exceedance Flows at Cowlitz River Near Kosmos, Wa (USGS Gage 14233500) 1948 through 2010





# COWLITZ FALLS DAM - 1994



**DAM OWNER:**  
LEWIS COUNTY PUD  
(LCPUD)

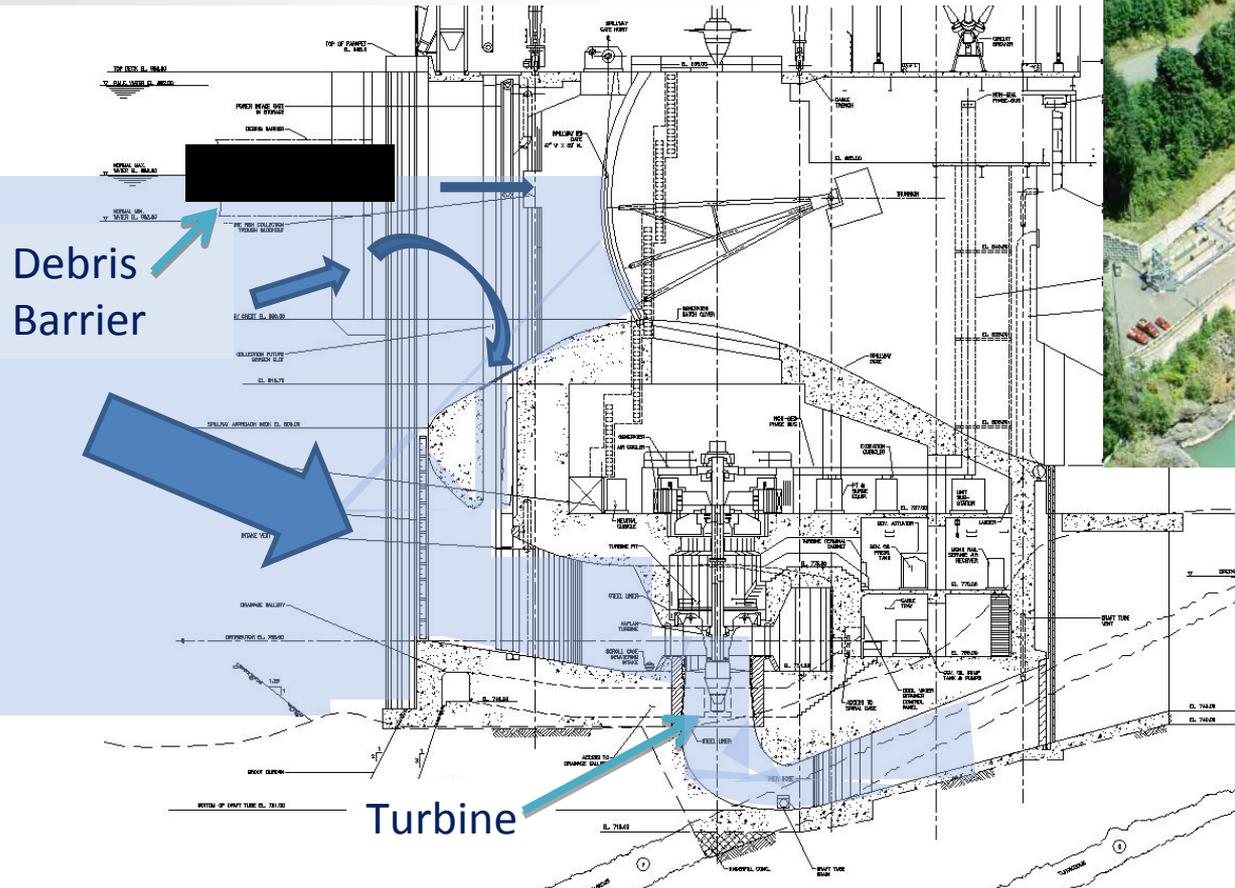
**FISH COLLECTION FACILITY  
OWNER:**  
BONNEVILLE POWER  
ADMINISTRATION  
(BPA)

**LICENSE REQUIREMENT:**

- DOWNSTREAM FISH PASSAGE
- GOAL OF 95% FPS
- REQUIREMENT FOR USE OF BEST AVAILABLE TECHNOLOGY UNTIL AT LEAST 75% FPS FOR ALL SPECIES.

# COWLITZ FALLS DAM

## SECTION THROUGH COWLITZ FALLS DAM





# CURRENT FISH COLLECTOR





# TACOMA POWER BEGINS WORK AT COWLITZ FALLS DAM

## 2002

- Regional fish passage experts recommended collection of outmigrating smolts at Cowlitz Falls
  - Existing fish collection system
  - Collect fish before turbines
  - Riffe Lake fish collection unsuccessful.

## 2003-2004

- Executed an access agreement with LCPUD & BPA
- Conducted various fish studies in conjunction with LCPUD & BPA



# DOWNSTREAM FISH COLLECTION

**2005-2007**

- Design and fabrication of Cowlitz Falls Fish Screen
- Installed within a spillway bay on the Cowlitz Falls Dam
- Fish did not enter the mouth of the trap at high rates of efficiency.

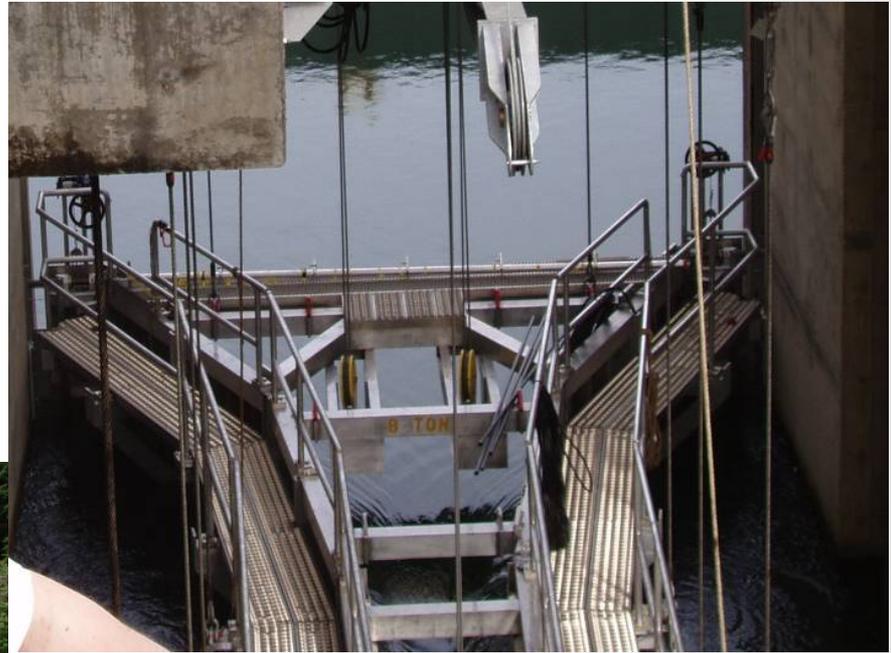




# DOWNSTREAM FISH COLLECTION

## 2008

- Made more changes to try and improve fish screen collection
- Installed Merwin Traps in Lake Scanewa to supplement fish collection efforts



# BACK TO THE DRAWING BOARD

## ➤ Alternatives Scored :

### ➤ Technical

- Successful Precedents
- Construction Complexity
- Operational Complexity
- Operational Risk
- Tacoma Power Control of Facility

### ➤ Biological

- Smolt Survival
- Collection Efficiency of Device

Title	Successful Precedents	Construction Complexity	Operational Complexity (Routine Ops)	Operational Risk	Tacoma Power Control of Facility	Average Technical Performance Index	Technical Performance Ranking	Average Biological Performance Index ALL SPECIES *	Average Biological Performance Index STEELHEAD *	Average Biological Performance Index COHO *	Average Biological Performance Index CHINOOK *	Cost (\$M)	Estimated In-Service Date
Weighting Factor ***													
11 - Weir Box + SFO at CFD	3.00	2.00	2.00	3.00	1.00	22.00	1.00	88	88	85	86	17	Sep 2013 Jun 2015
3 - SFO at CFD	3.00	2.00	2.00	3.00	1.00	22.00	1.00	82	85	77	80	15	Jun 2015
18 - Weir Box + SFO at CFD + Mid-Riffe	3.00	1.00	1.00	3.00	1.00	20.00	2.00	94	95	91	91	122	Sep 2013 Jun 2015 Oct 2019
6 - SFO at CFD + Mid-Riffe	3.00	1.00	1.00	3.00	1.00	20.00	2.00	92	94	88	88	120	Jun 2015 Oct 2019
17 - Weir Box + SFO at CFD + Mossyrock	3.00	1.00	1.00	3.00	1.00	20.00	2.00	91	95	89	86	61	Sep 2013 Jun 2015 Sep 2018
7 - SFO at CFD + Mossyrock	3.00	1.00	1.00	3.00	1.00	20.00	2.00	88	93	83	80	59	Jun 2015 Sep 2018
1 - Weir Box at CFD	1.00	3.00	3.00	3.00	1.00	20.00	2.00	89	84	89	89	2	Sep 2013
8 - Weir Box + Scaneva Coll	2.00	2.00	2.00	2.00	1.00	17.00	3.00	88	88	85	86	48	Sep 2013 May 2016
2 - Lake Scaneva Collector	2.00	2.00	2.00	2.00	1.00	17.00	3.00	82	85	77	80	46	May 2016
14 - Weir Box + Scaneva Coll + Mid-Riffe	2.00	1.00	1.00	2.00	1.00	15.00	4.00	94	95	91	91	153	Sep 2013 May 2016 Oct 2019
12 - Scaneva Coll + Mid-Riffe	2.00	1.00	1.00	2.00	1.00	15.00	4.00	92	94	88	88	151	May 2016 Oct 2019
15 - Weir Box + Scaneva Coll + Mossyrock	2.00	1.00	1.00	2.00	1.00	15.00	4.00	91	95	89	86	92	Sep 2013 May 2016 Sep 2018
13 - Scaneva Coll + Mossyrock	2.00	1.00	1.00	2.00	1.00	15.00	4.00	88	93	83	80	90	May 2016 May 2016
4 - Mid Riffe Lake Collector	2.00	1.00	1.00	1.00	2.00	15.00	4.00	74	86	71	81	105	Jun 2017
5 - Mossyrock Collectors	2.00	1.00	1.00	1.00	2.00	15.00	4.00	85	83	86	87	44	May 2016
10 - Weir Box + Mossyrock	1.00	1.00	1.00	1.00	2.00	13.00	5.00	71	87	73	80	46	Sep 2013 May 2016
9 - Weir Box + Mid-Riffe	1.00	1.00	1.00	1.00	1.00	10.00	6.00	83	89	82	75	107	Sep 2013 Jun 2017

\* - Derived from Biological Assessment Model

\*\* - Scored: 0 = show stopper, 1 = poor, 2 = average, 3 = good

\*\*\* - Weighted in order of relative importance: 1 = low, 2 = moderate, 3 = high

Unacceptable BPI (75)  
BPI <85 or lower half technical ranking  
BPI ≥85 and upper half technical ranking



# DOWNSTREAM FISH COLLECTION

## 2010-2011

### ➤ Behavioral Guidance System (BGS) and Barrier Net

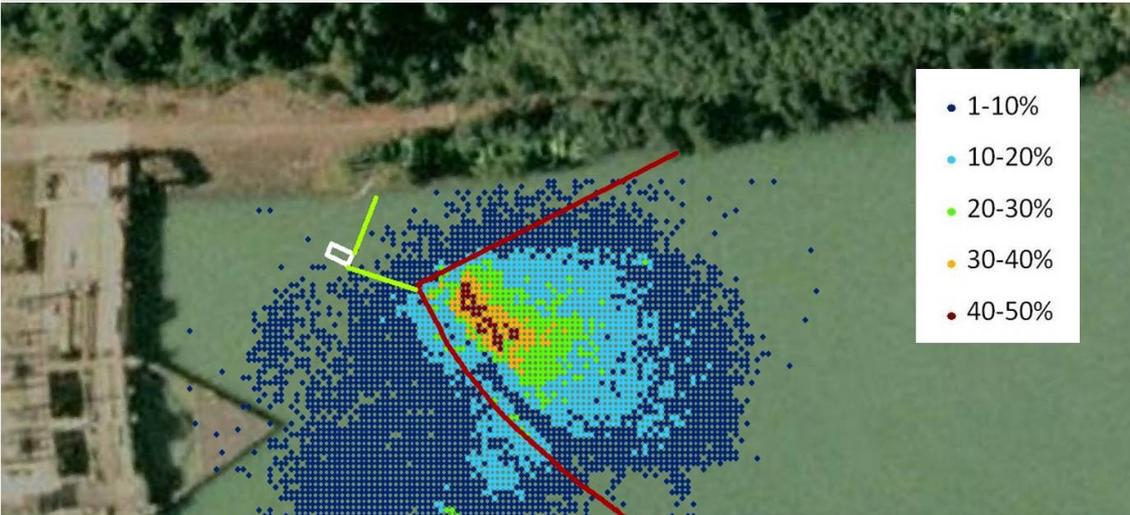
- Guide fish to collection point 300 ft upstream of dam
- Guide fish to the north side of the reservoir and near the Floating Fish Collector
- 2010, Composed of 20-foot (long) x 4-foot (deep) steel panels with integral floats that link together to span the reservoir.
- 2011, BGS from Bonneville Dam was used, 20-foot (long) X 10-foot (deep) panels.
- Anchored to either shoreline
- Includes “Breakaway Assembly” that allows for the safe removal during flood events



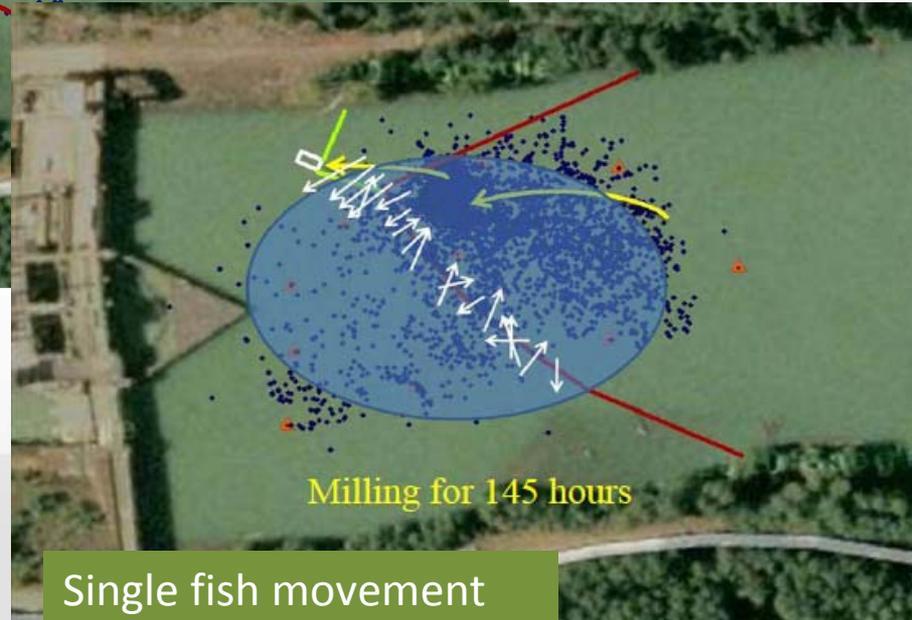


# DOWNSTREAM FISH LOCATION DATA

- BGS is apparently effective at moving fish away from face of dam and across reservoir to North side.
- Fish move throughout the reservoir and go where they want to go.



Frequency Distribution of Coho Salmon



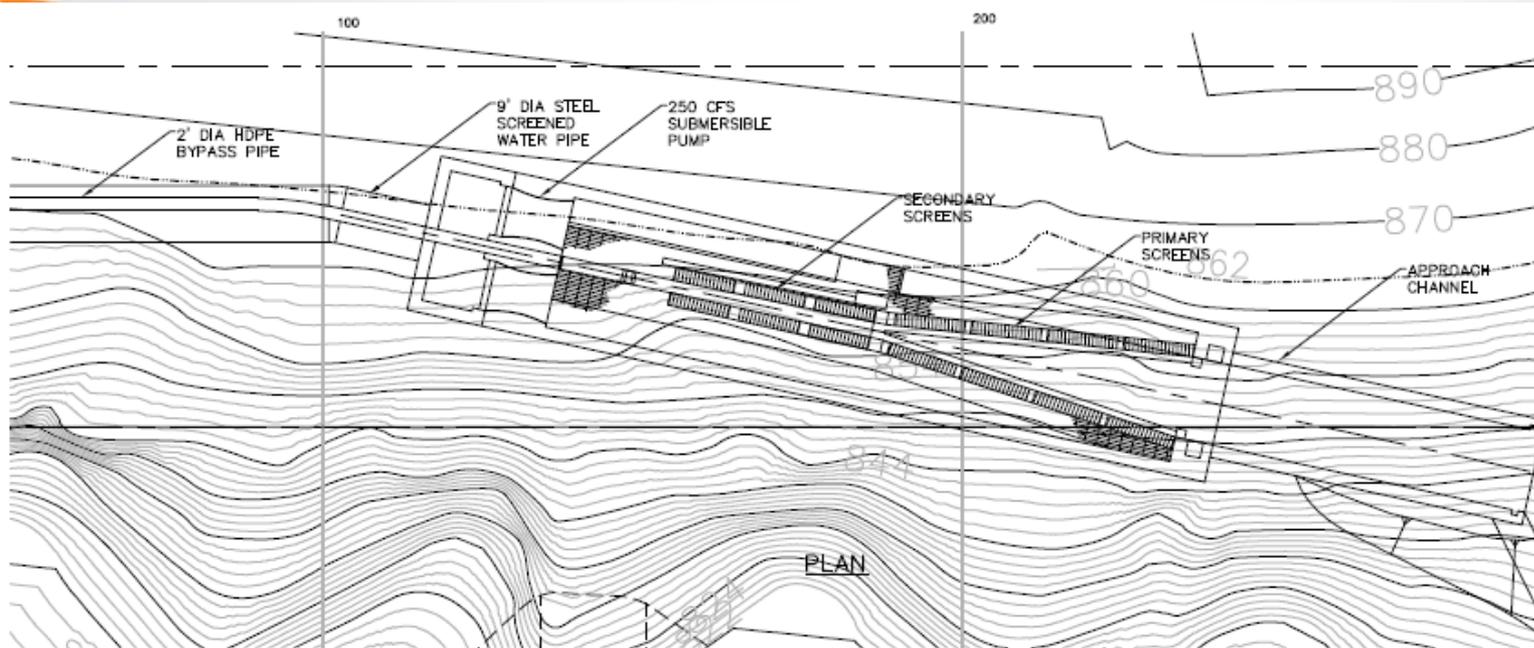
Single fish movement



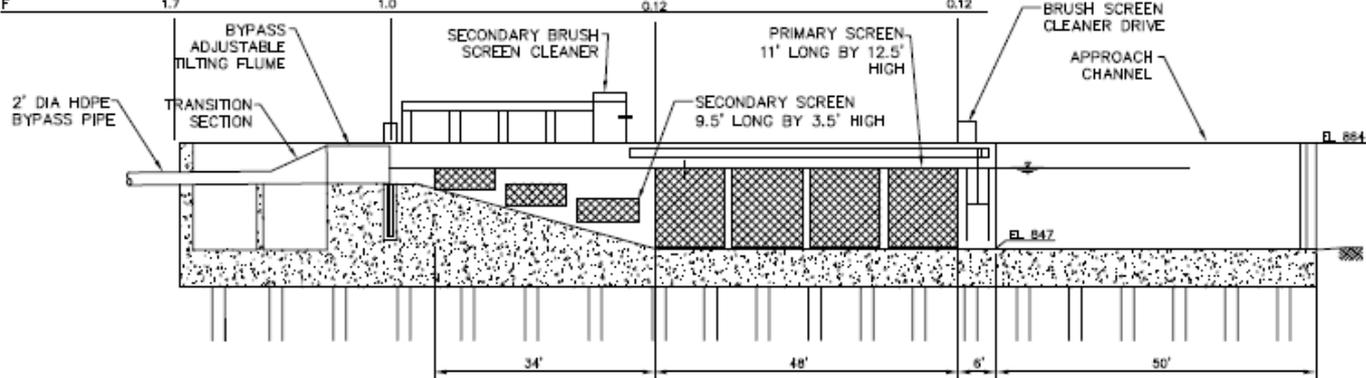
# Cowlitz Falls



# V-SCREEN ALTERNATIVE



Q (CFS)	20	20	94	500
D (FT)	1.2	1.5	14.4	14.4
V (FPS)	9.7	6.9	2.7	2.7
W (FT)	2.0 DIA.	2.0	2.5	13.0
F (FT)	1.7	1.0	0.12	0.12







# DOWNSTREAM FISH COLLECTION

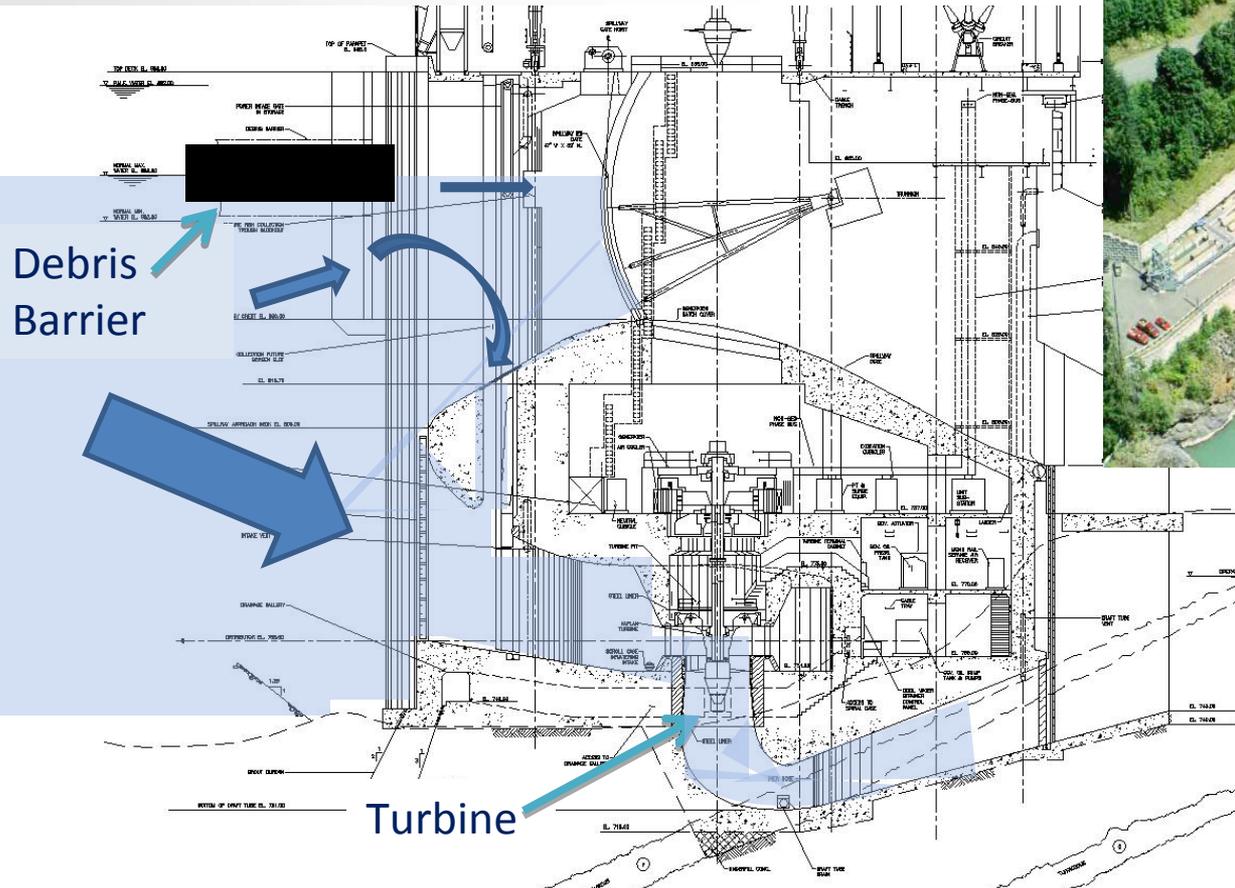
**2009**

- Weir box testing showed early favorable results
- Dam safety and the ability to remove the weir box in a timely manner during emergency spill



# COWLITZ FALLS DAM

## SECTION THROUGH COWLITZ FALLS DAM



**QUESTIONS?**



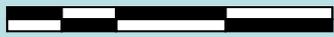
**Pelton Round Butte Project on the Deschutes  
River.**

**Don Ratliff  
Chad Croft  
PGE**

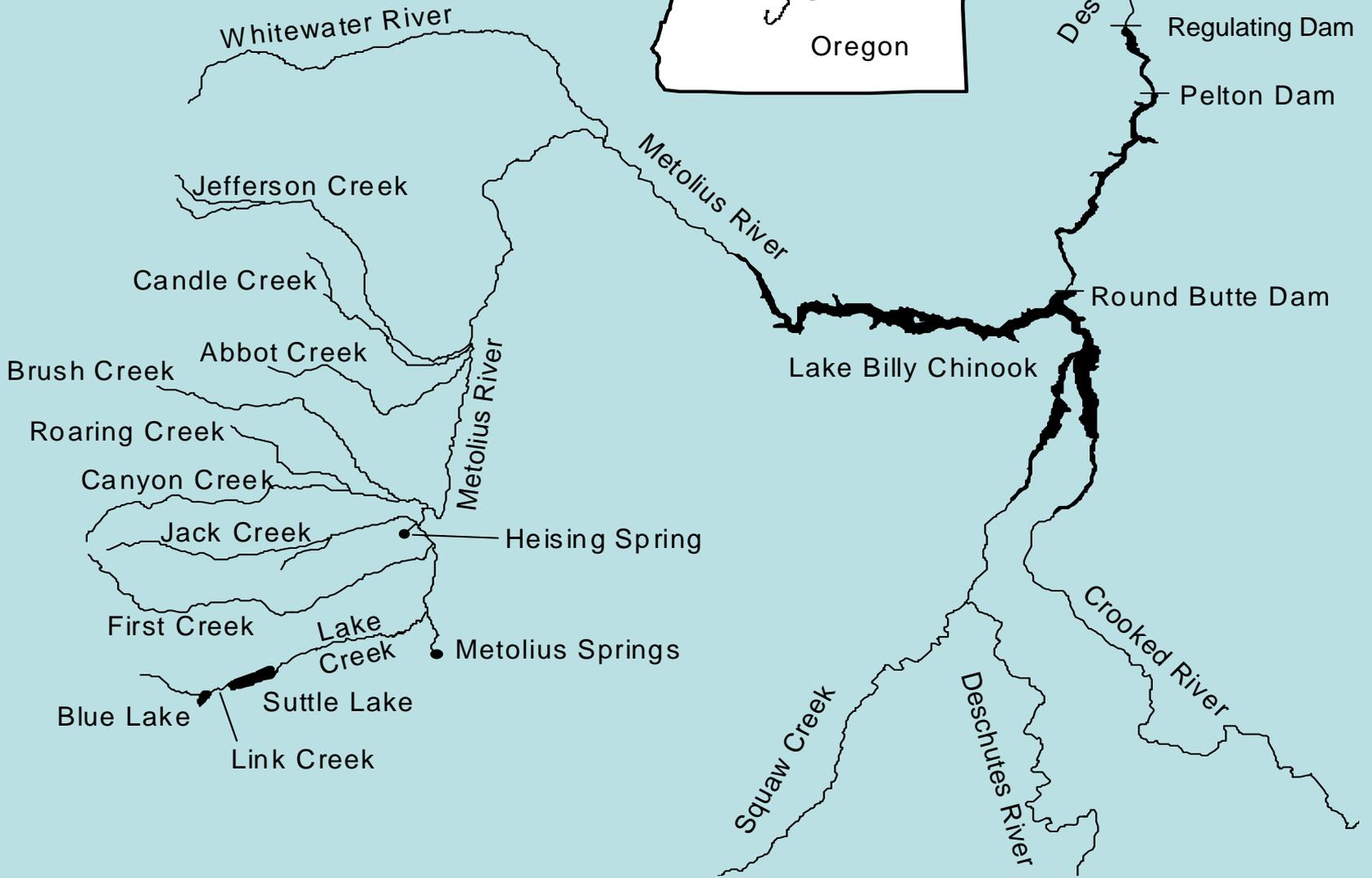




4 0 4 8 Kilometers



Oregon



An aerial photograph of a dam project. The dam is a long, low structure with several spillways. To the left is a large reservoir of dark blue water. To the right is a smaller reservoir. The surrounding terrain is dry and hilly, with some green vegetation. A road or path runs along the right side of the dam. The text "Reregulating Dam RM 100" is overlaid in the center-left of the image.

Reregulating  
Dam  
RM 100

Pelton Dam RM  
102.5



An aerial photograph showing a large concrete dam with a reservoir behind it. The dam is a long, straight wall across a valley. In the foreground, a river flows through a canyon, with a small town or village situated on the right bank. The surrounding terrain is rugged and rocky, with some sparse vegetation. The sky is clear and blue.

**Round  
Butte Dam  
RM 110**

## **Two Major Problems to Address during FERC Relicensing-1995-2004**

**Problem 1. Surface currents do not move to the dam, and thus fish passage is not possible under the present conditions as smolts can not find their way out of the reservoir.**

**Problem 2. Deschutes River Discharges from the Project are too warm in the late summer and fall.**

**Background Fisheries Work in anticipation  
of Reintroduction of Anadromous Fish and  
Fish Passage**



**HISTORICAL SALMON AND STEELHEAD RUNS  
OF THE UPPER DESCHUTES RIVER BASIN  
AND THEIR ENVIRONMENTS**

**Willa Nehlsen, Ph.D.  
Independent Consultant**

**1995**