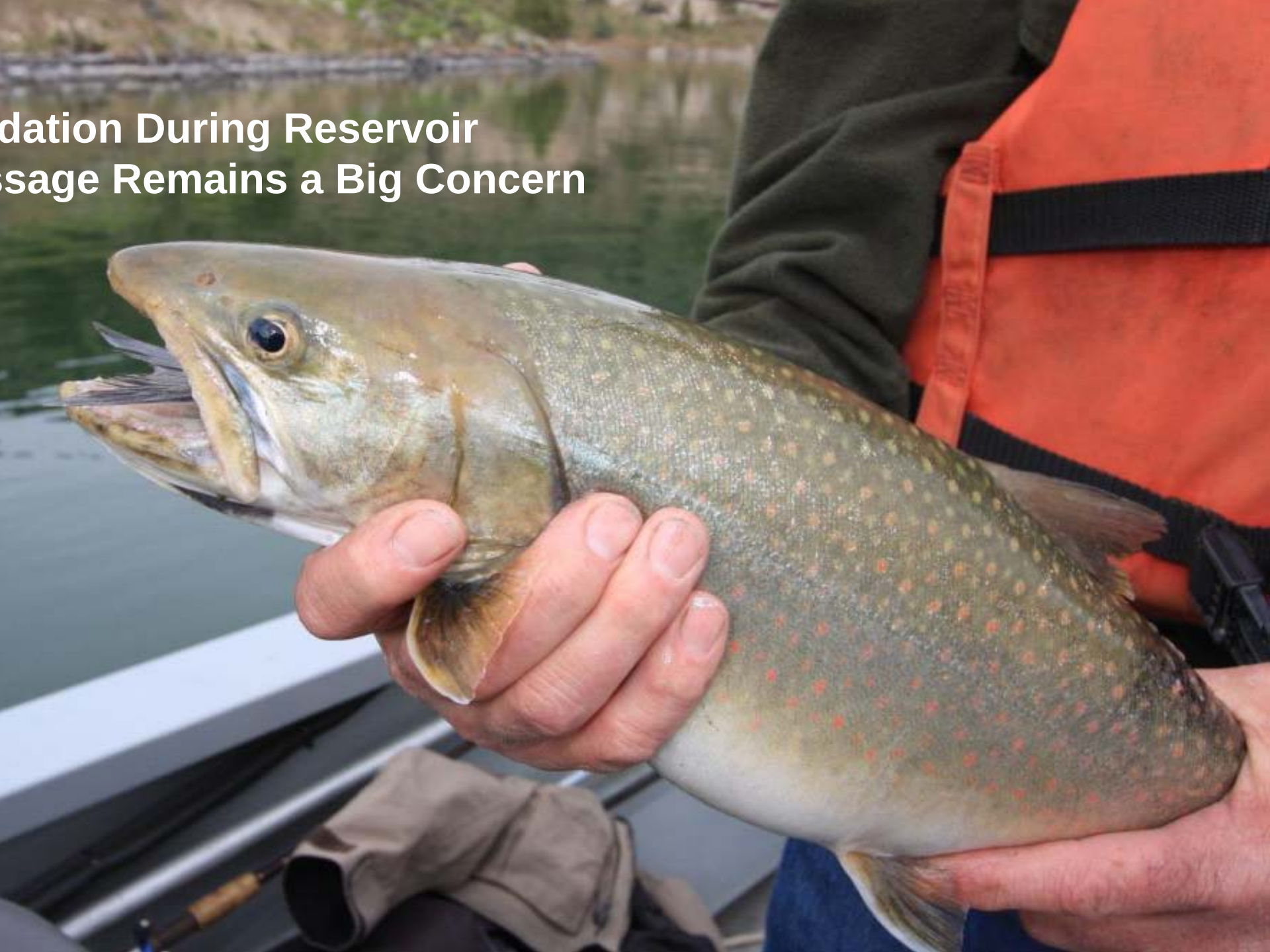
		# Tagged at	2011	2010
	FCF Catch	Screwtraps	Percent	Percent
Chinook				
Hatchery Smolts Metolius	**28**	**389**	**7.20%**	**na**
Hatchery Smolts Crooked	**251**	**389**	**64.52%**	**50.5%**
Hatchery Smolts Deschutes	**164**	**387**	**42.38%**	**33.8%**
Naturally Reared Metolius	**101**	**394**	**25.63%**	**29.2%**
Naturally Reared Crooked	**10**	**22**	**45.45%**	**45.7%**
Naturally Reared Deschutes	**8**	**17**	**47.06%**	**24.3%***
Steelhead				
Naturally Reared Crooked	**117**	**376**	**31.12%**	**24.2%**
Naturally Reared Deschutes	**22**	**46**	**47.83%**	**11.5%***
*small sample size				



dation During Reservoir
ssage Remains a Big Concern

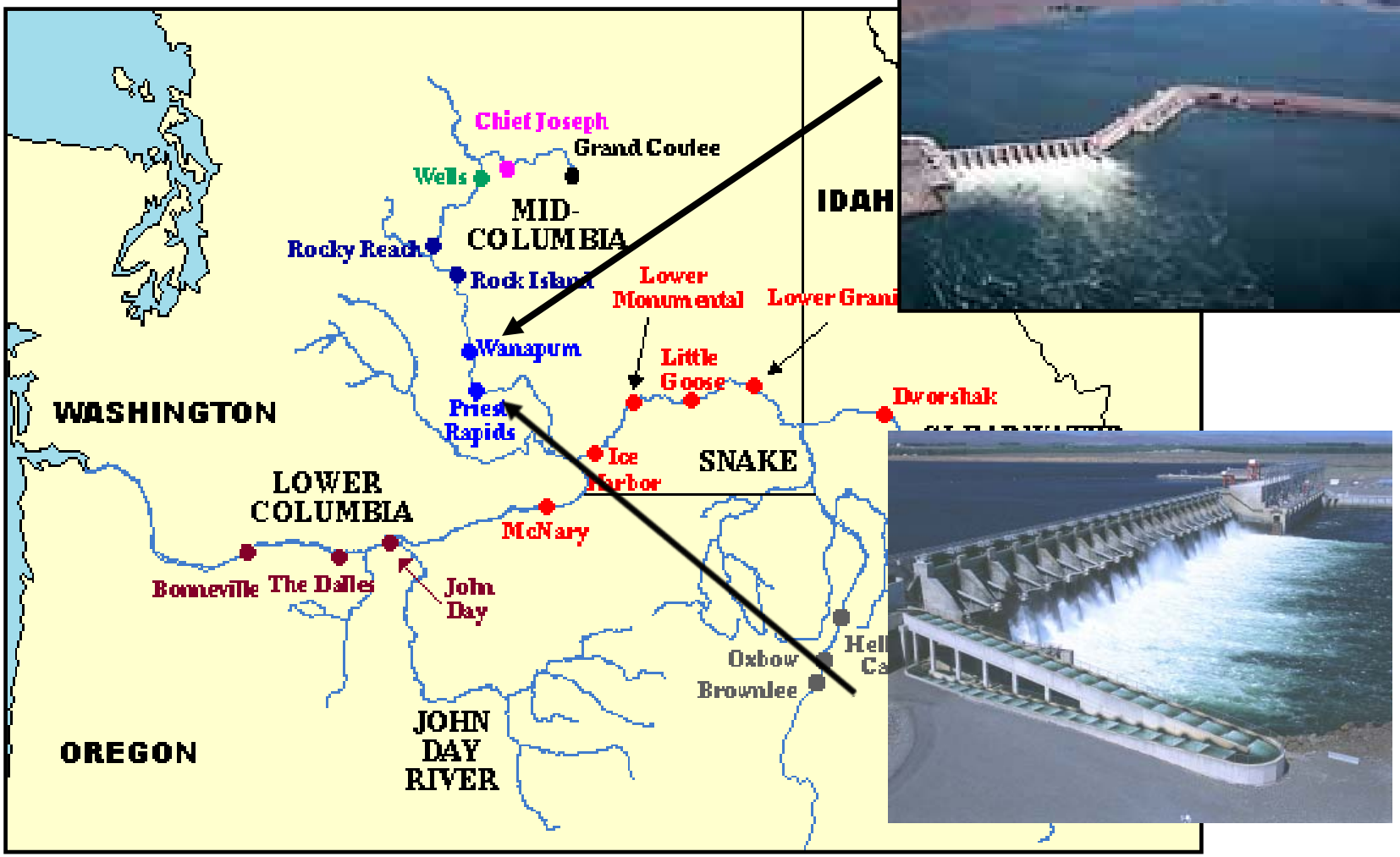

www.deschutespassage.com

Win-Win Success Stories: Fish Passage Improvements, Resulting Survival Estimates, and Increased Generation at Wanapum & Priest Rapids Dams

Curt Dotson and Dana Jeske

Grant County PUBLIC UTILITY DISTRICT

Wanapum and Priest Rapids Dams



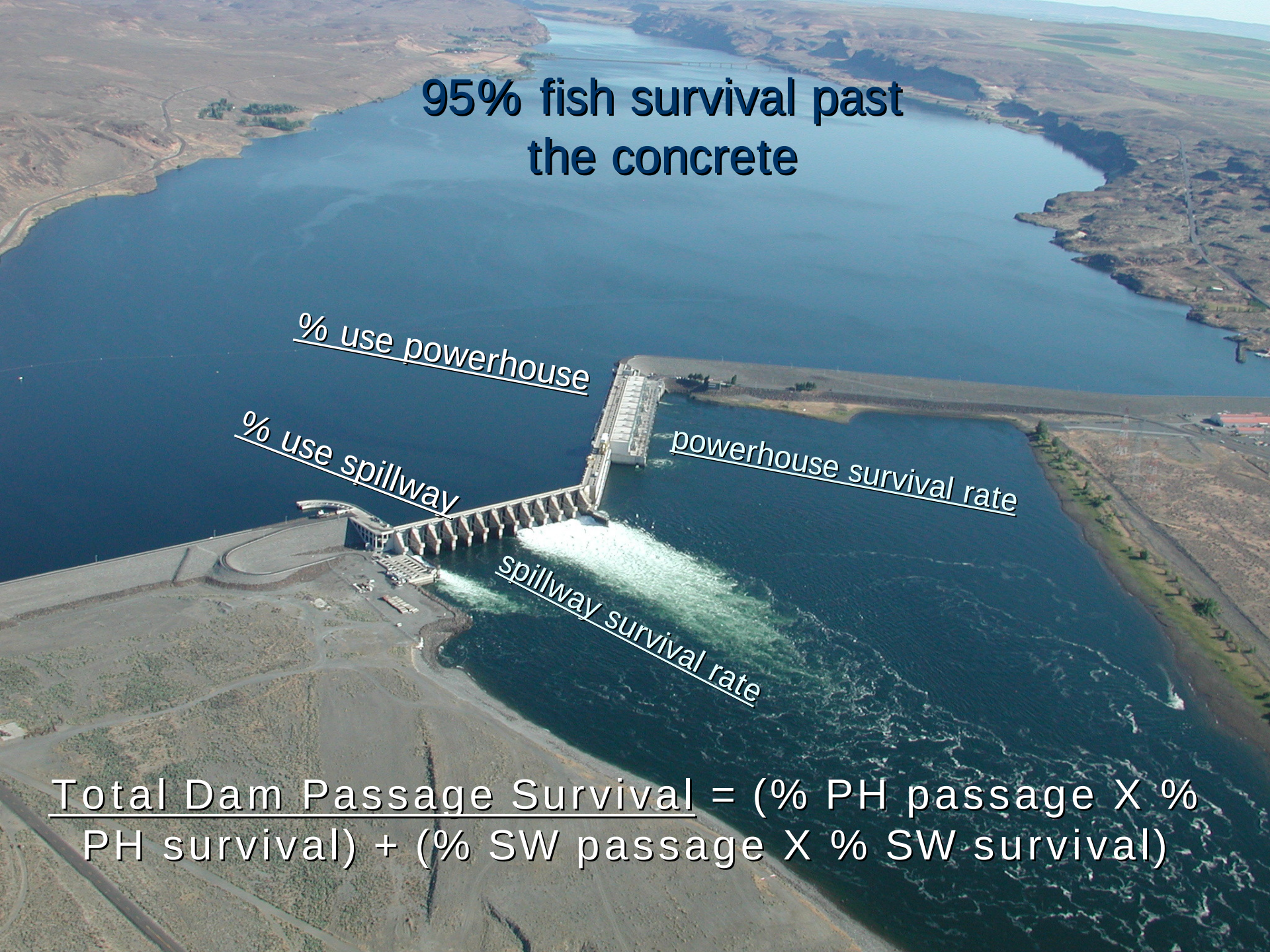
Performance Standards Required of Grant County PUD by FERC

93% survival thru the reservoir and past the dam

Bi.Op. & SSSA:

95% survival past the concrete

95% fish survival past the concrete



Total Dam Passage Survival = (% PH passage X % PH survival) + (% SW passage X % SW survival)

Wanapum Dam MOA Spill

43% of total daily river flow (spring spill)

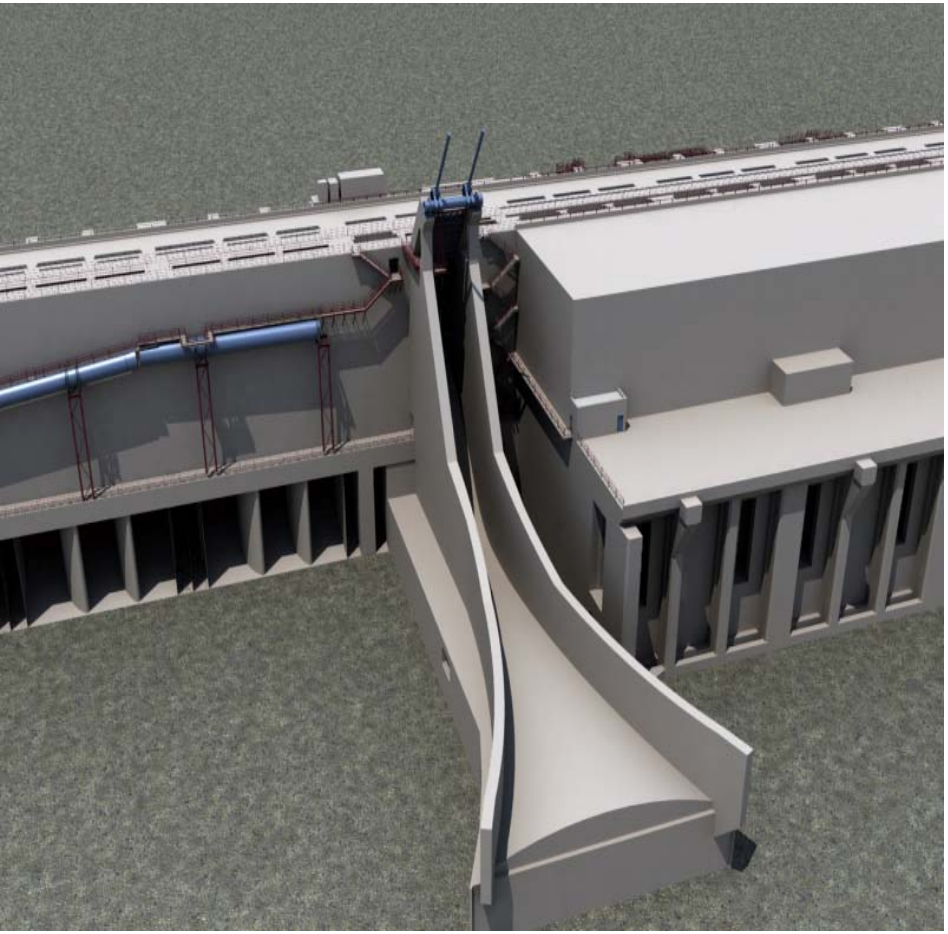
59% of total daily river flow (summer spill)

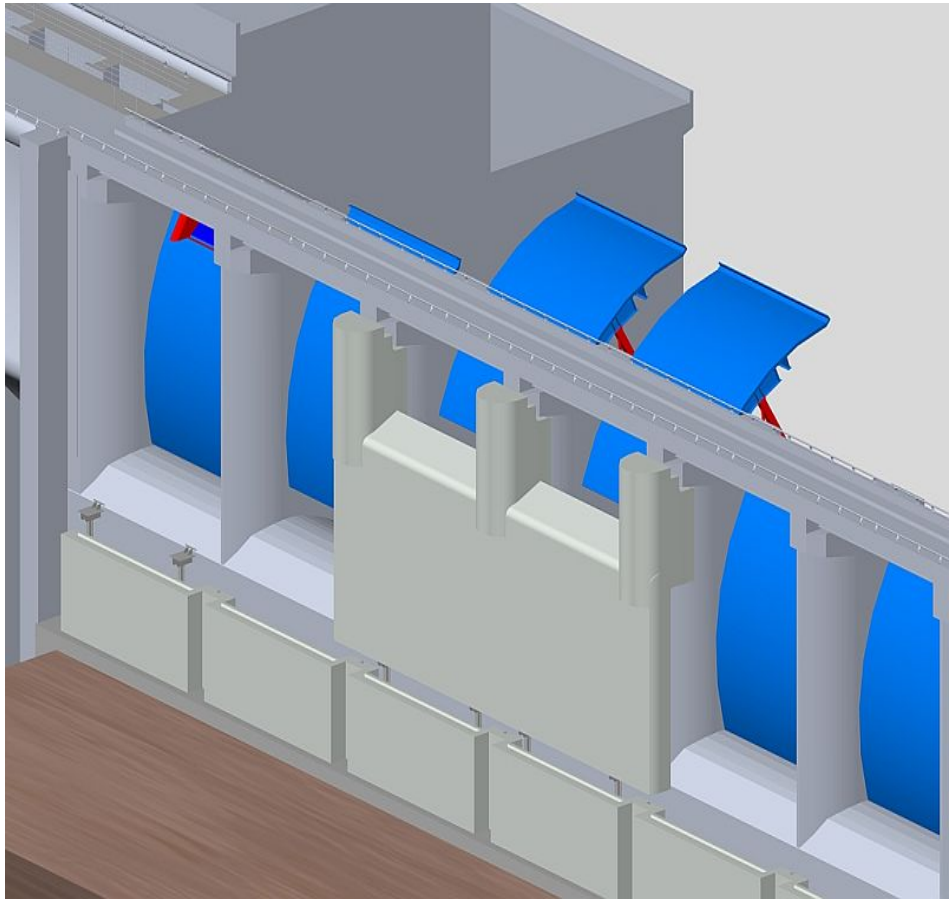
Priest Rapids Dam MOA Spill

61% of total daily river flow (spring spill)

39% of total daily river flow (summer spill)

Build Fish Bypass Structures





Overview – Developing Downstream Passage Options

- For successful passage, a design must:
  - Identify and utilize location of migration corridor
  - Consider behavior and biomechanical ability of species to pass
  - Match hydraulic cues from passage device to migration corridor, behavior and ability
  - Integrate project operations and hydrology
  - Avoid passing through dangerous routes

Work with a "Team Approach" of the PRCC and Grant PUD

Project Objective

- The objective of the project was to assist Grant PUD in meetings the requirements of the NMFS 2008 BIOP, which were included in the FERC License Order

- Reduce spill, increase generation potential, reduce total dissolved gas.

Work Plan for Design and Implementation

- *Strategy for design, implementation, and assessment (continued)*
  - Undertake radio and/or acoustic tag studies to support prototype evaluations and to determine route-specific survival and combined passage route survival to assess achievement of the fish passage objective
  - Assess, design and implement other Tier 1 or Tier 2 non-turbine passage alternatives identified in the 2003 Fish Passage Alternatives Study until the fish passage objective is met.

Work Plan for Design and Implementation

- *Implement a plan for developing a design for a non-turbine fish passage route*

Design guidelines

√ Concept development, modeling and assessment

√ Selection and advancement of preferred design

√ Prototype testing and evaluation

→Final design and implementation

– Field testing and evaluation

TOOLS USED IN DESIGN AND EVALUATION

Acoustic tagged fish

- Fish passage routes and survival
- Fish behavioral characteristics

CFD models of forebay and tailrace

- Flow patterns
- Velocities and accelerations
- Zones of influence

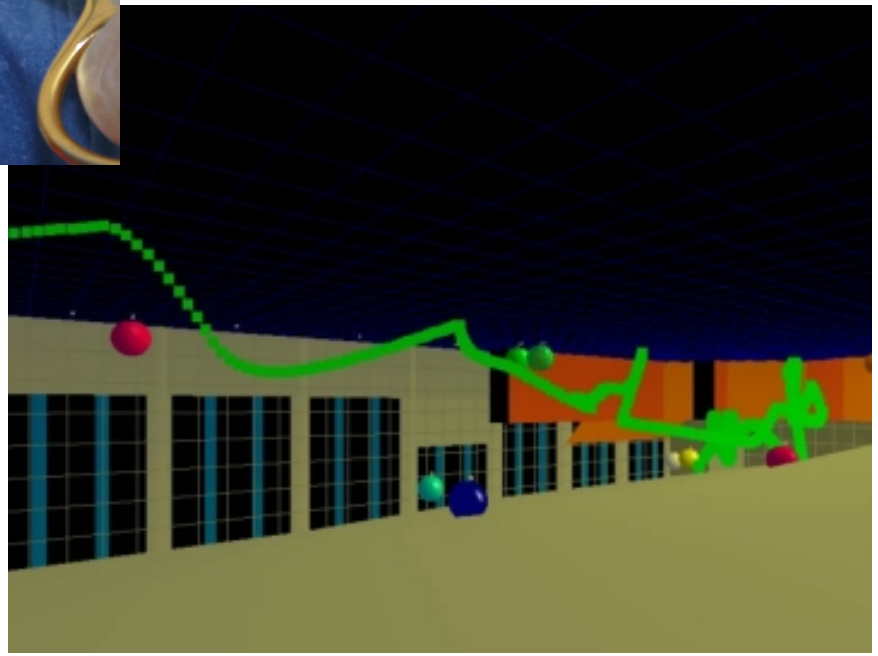
1:64 scale hydraulic (physical) models of forebay and tailrace

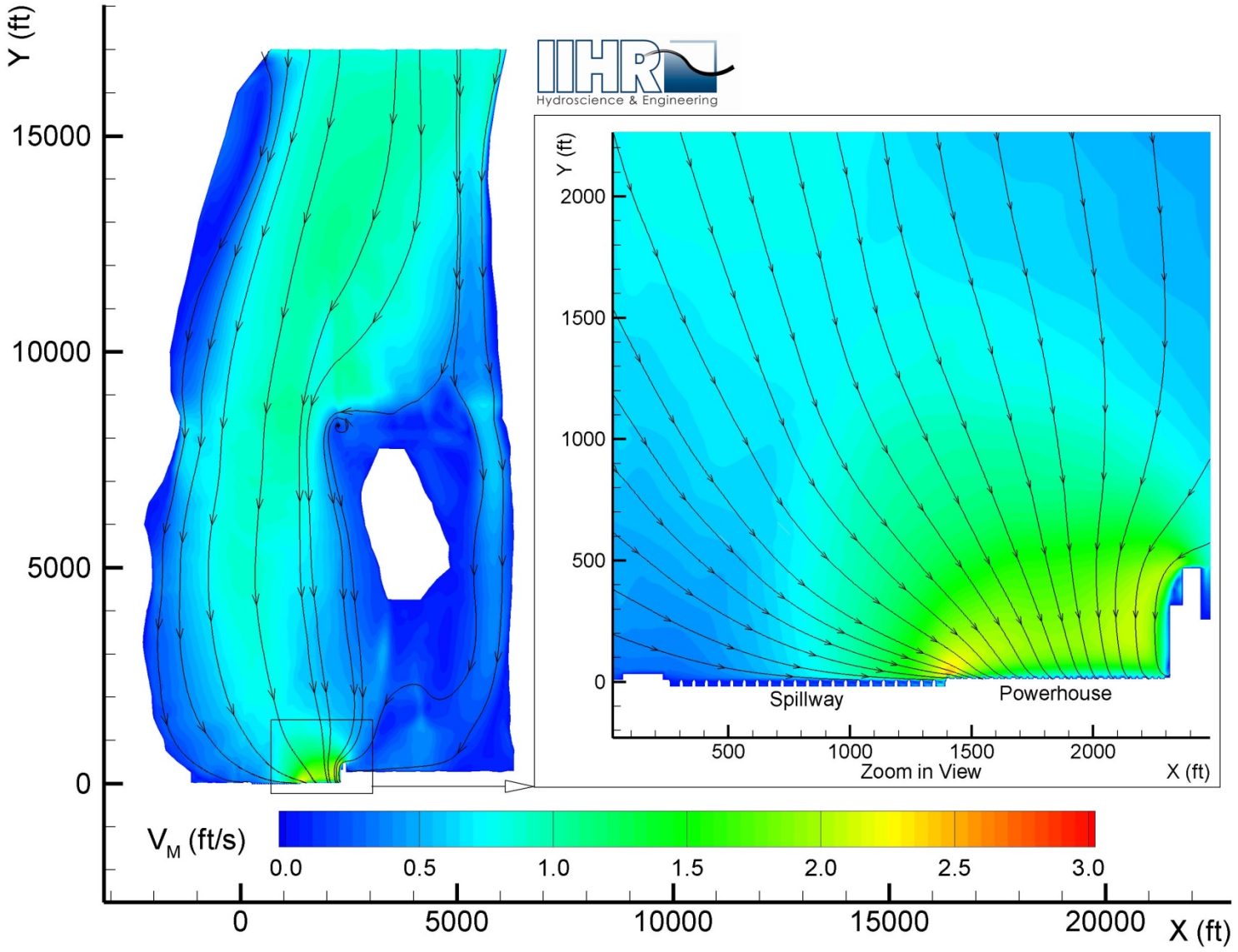
- Flow observations

Numerical fish surrogate (NFS) model

- Estimate of fish passage routes

Acoustic Tags for Tracking

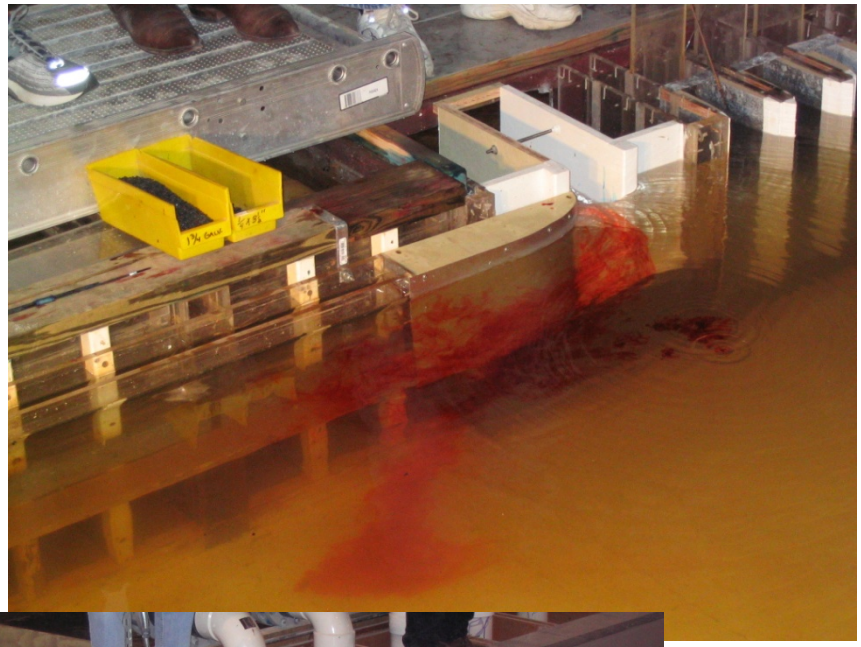


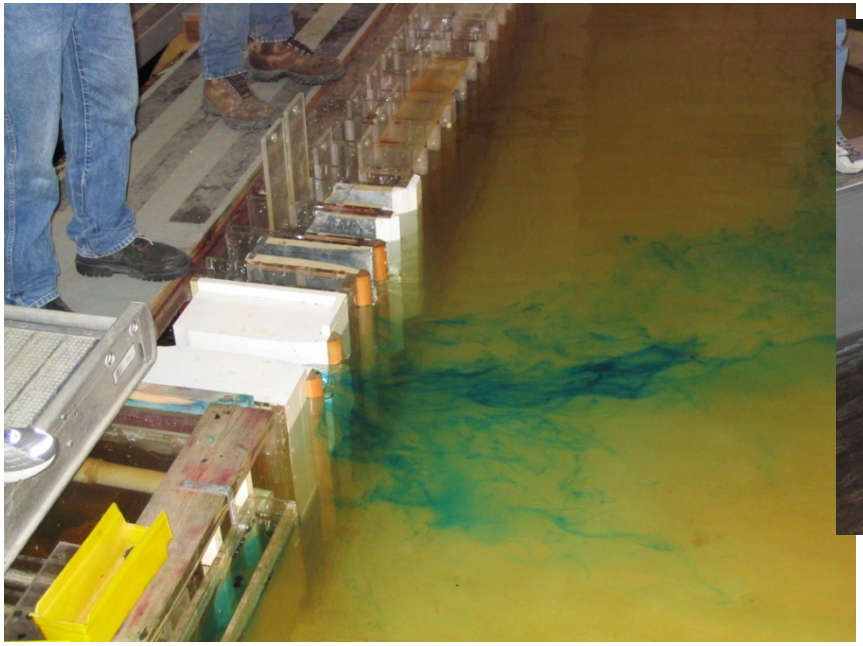


Priest Rapids Dam Forebay Velocities and Streamlines
Powerhouse Units 1 to 10 at 16 Kcfs each
Total Flow 160 Kcfs

Modeling Work

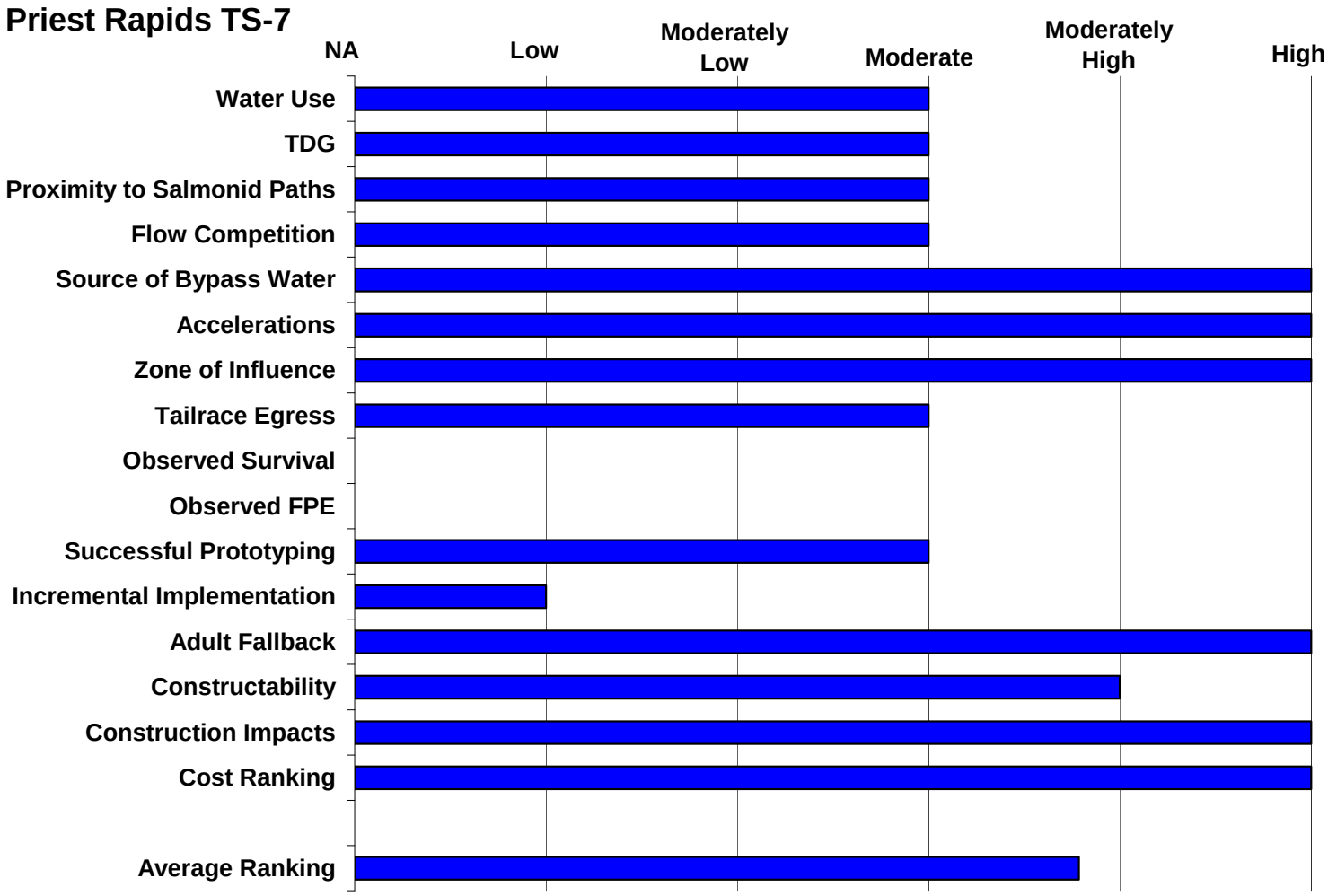
- *Approach patterns*
- *Entrance shaping*
- *Entrance location*



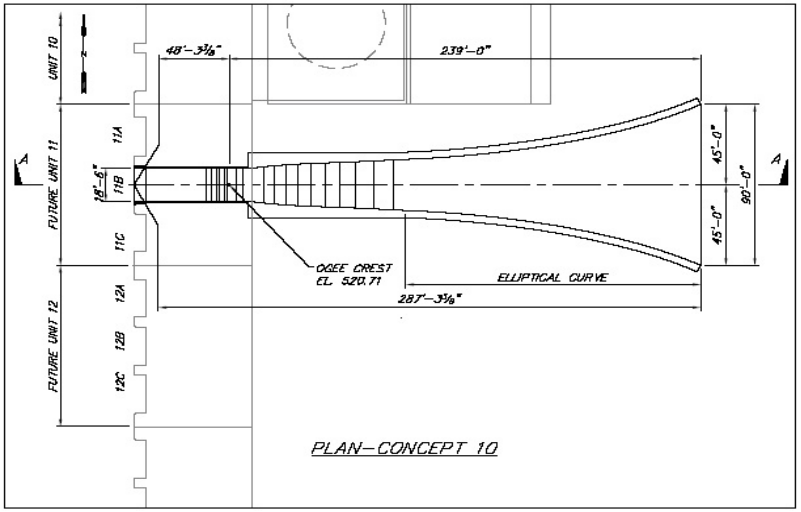


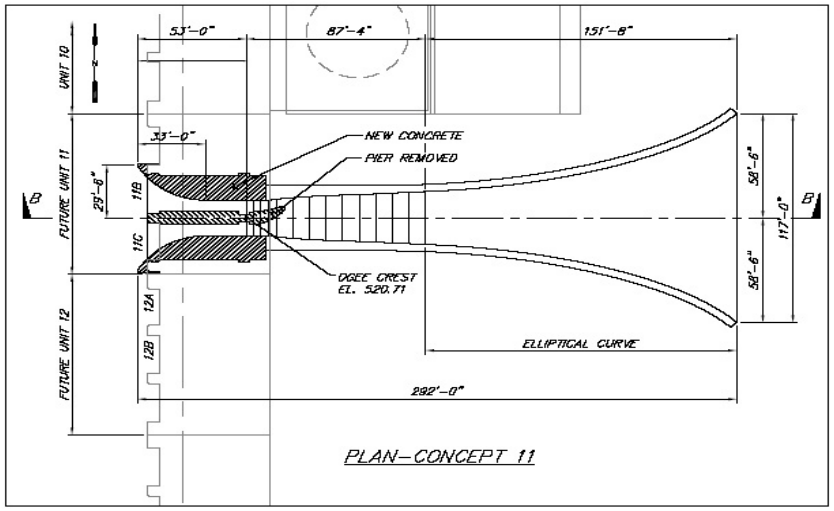
Spreader design

SUMMARY OF 2003 FISH PASSAGE ALTERNATIVES STUDY REPORT



Status of Design
Concept 10 and Concept 11





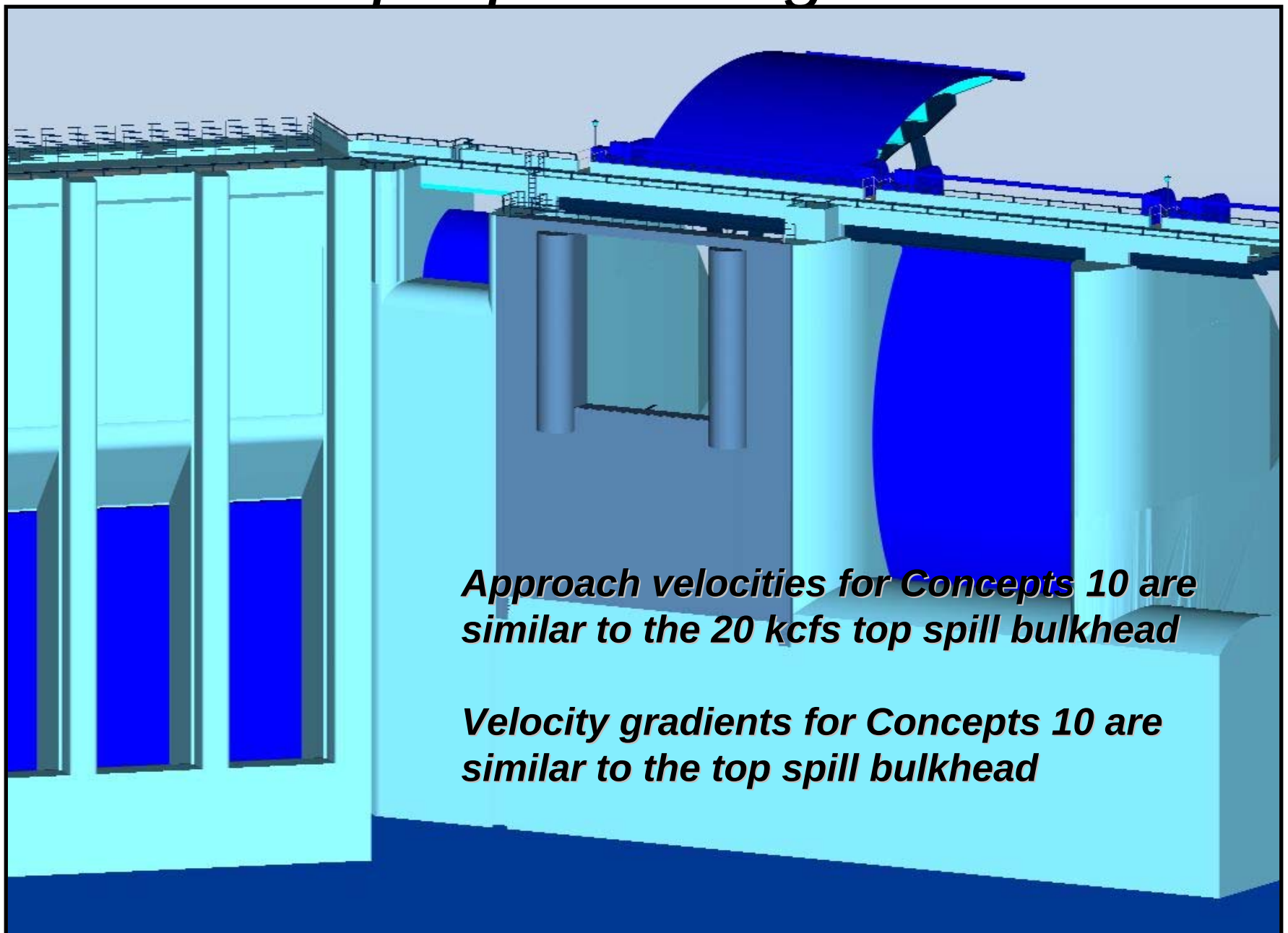
Concept 10

- Located in Future Unit 11
- 20,000 cfs
- Opening 18.5 feet by 84.8 feet
- Entrance velocity at dam face 12.75 fps
- Exit velocity about 65 to 70 fps
- Exit width of 90 feet

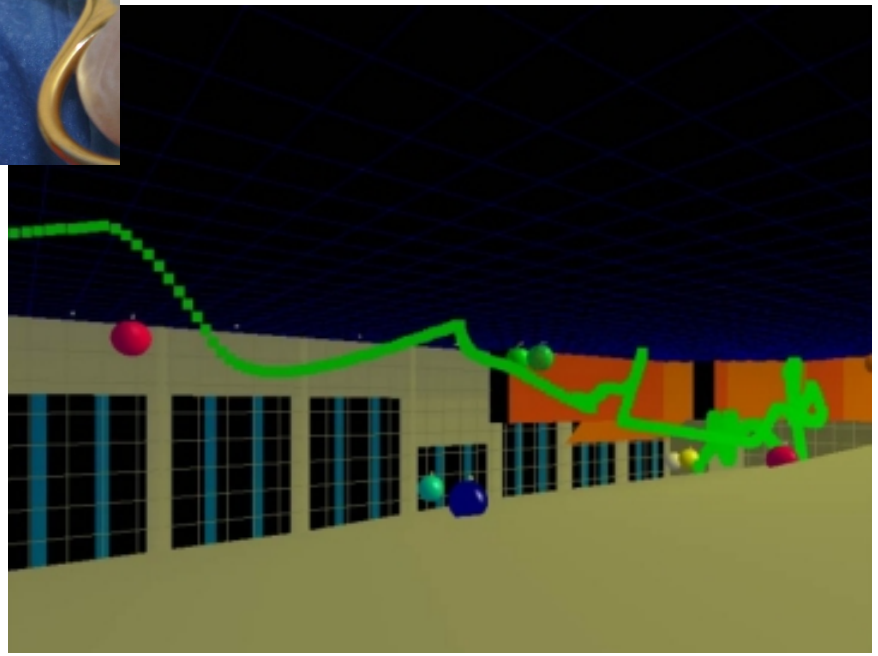
Concept 11

- Located in Future Unit 11
- 20,000 cfs
- Opening 59.0 feet by 83.2 feet
- Entrance velocity at dam face 4.1 fps
- Exit conditions similar to Concept 10
- Exit width of 117 feet

Top Spill Configuration

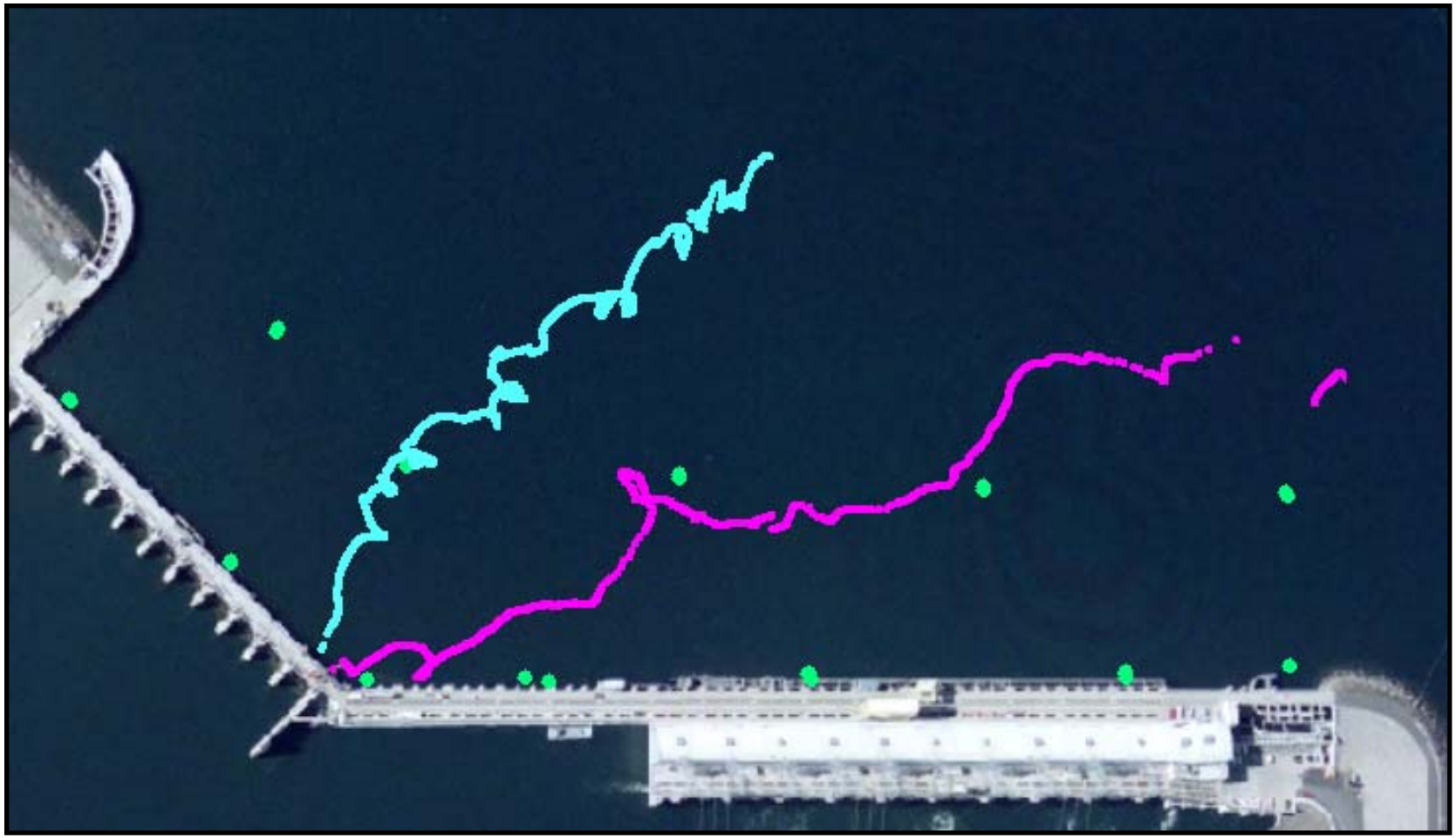


Acoustic Tags for Tracking



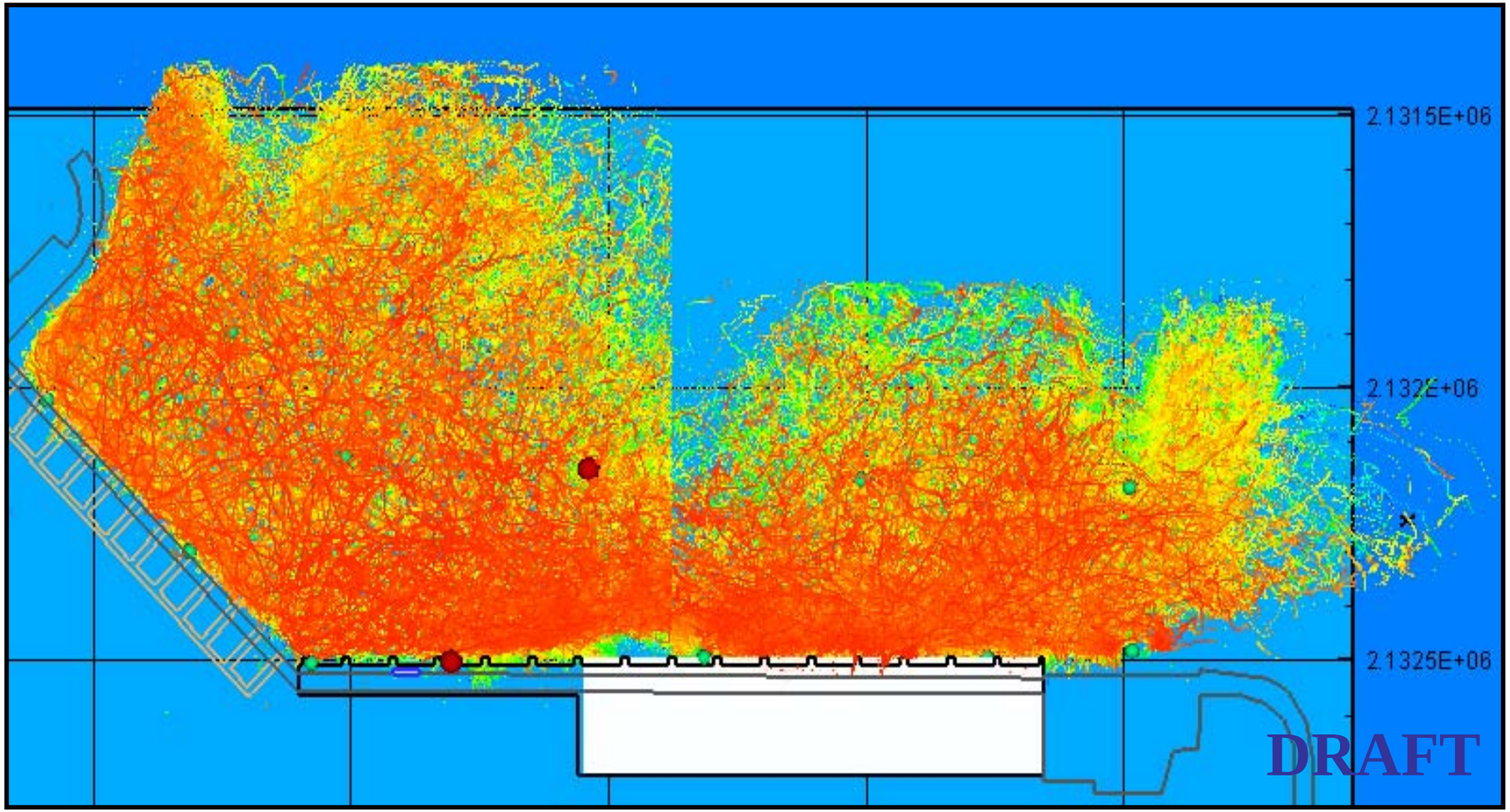

N40729
RESTRICTED

2004 Acoustic Tag Study



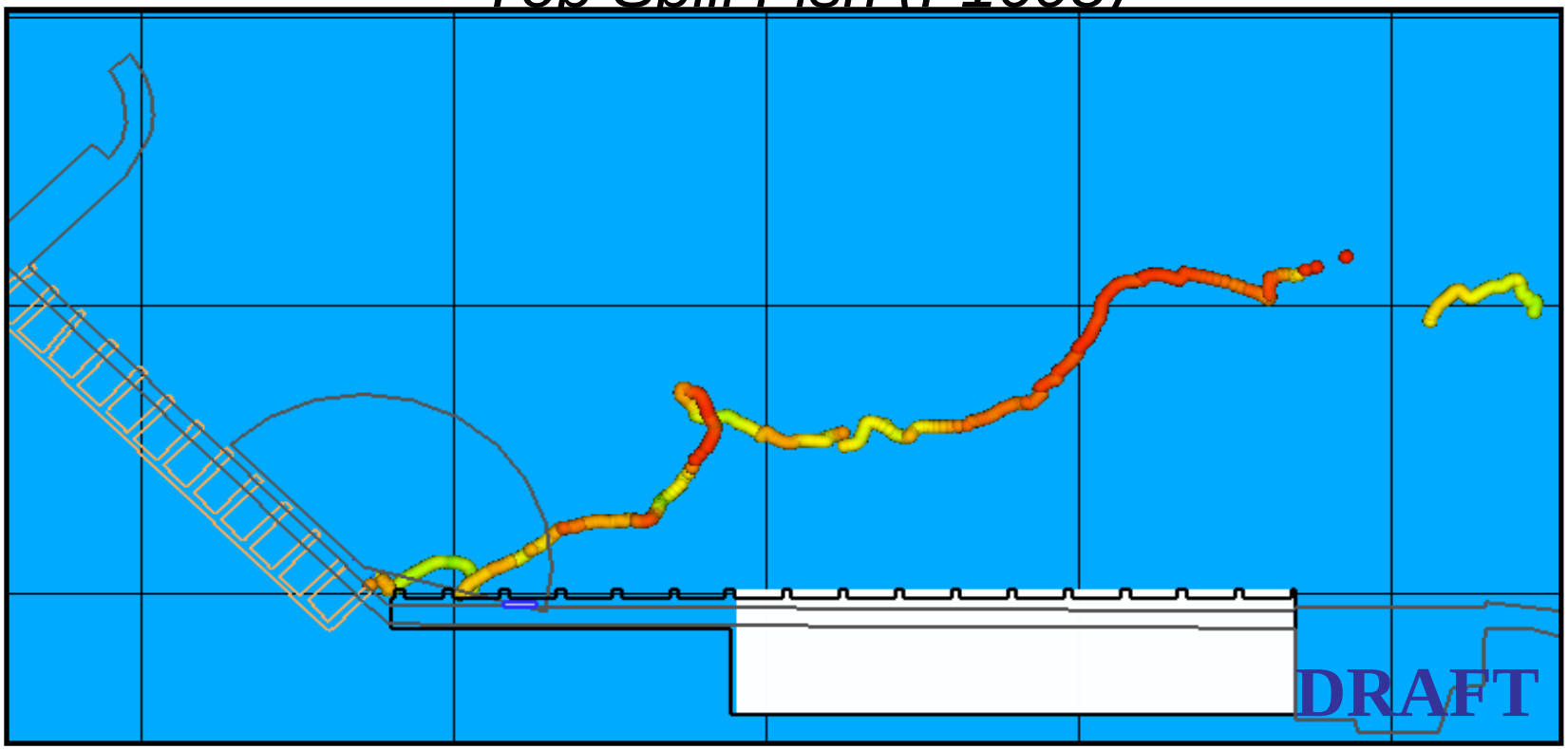
2004 Acoustic Tag Study

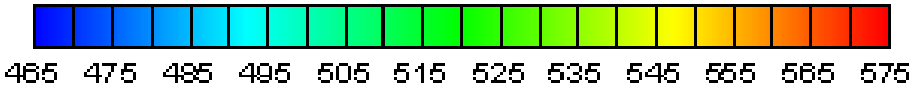
All 3D Echos



2004 Acoustic Tag Study

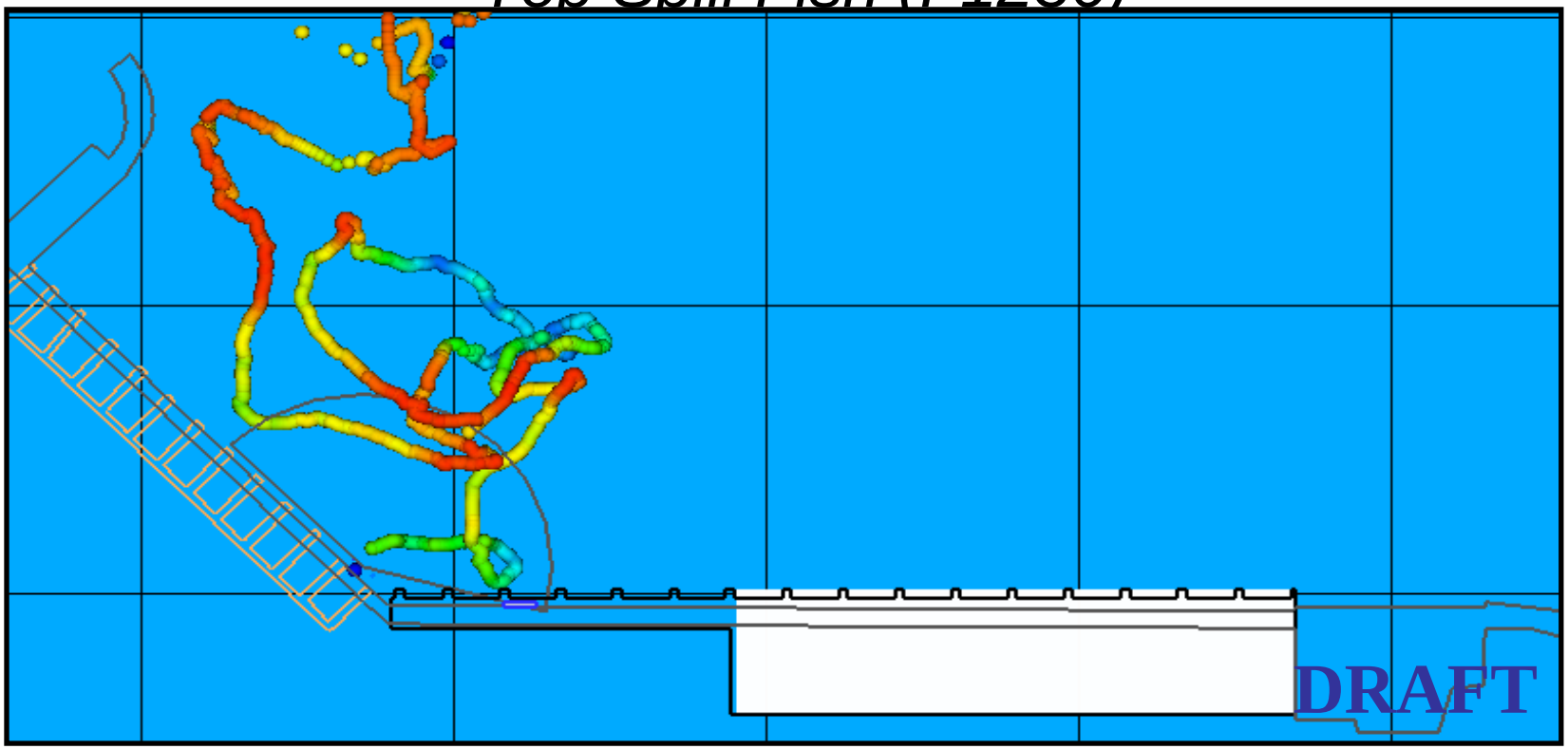
Top Spill Fish (F1608)

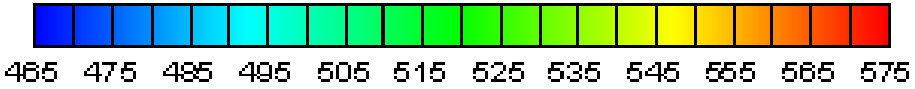




2004 Acoustic Tag Study

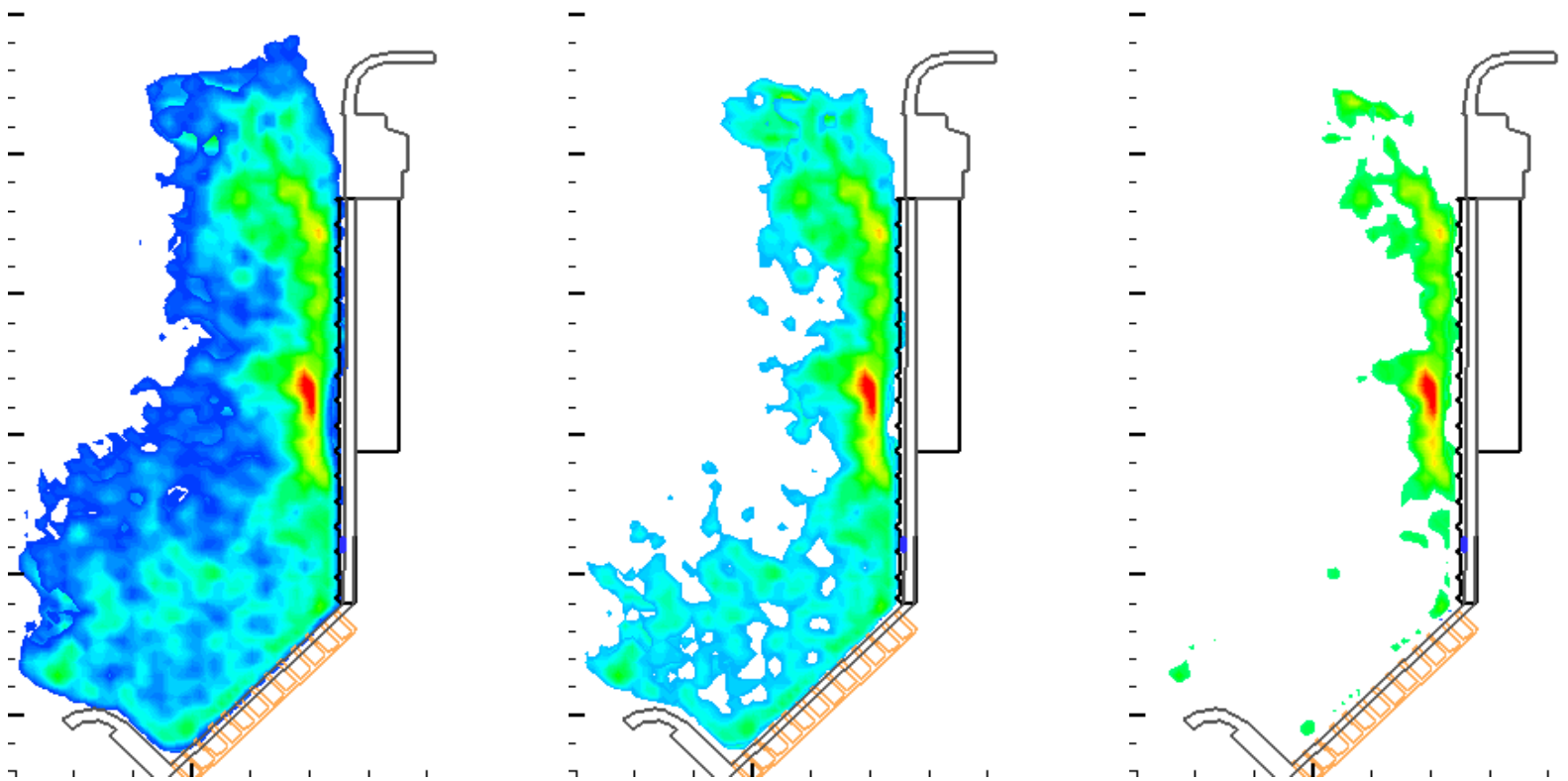
Top Spill Fish (F1236)





2004 Acoustic Tag Study

Powerhouse Only

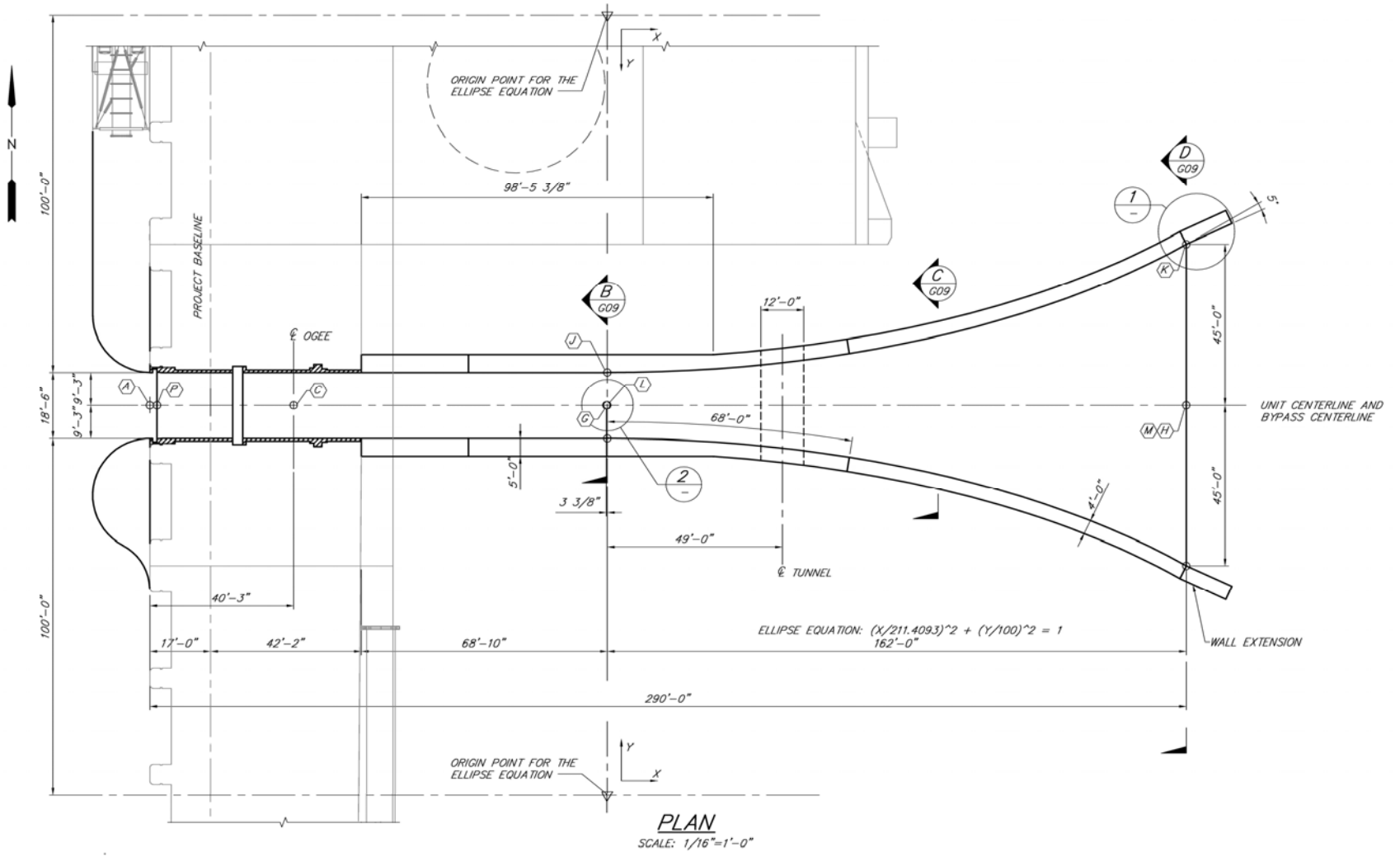


DRAFT

2004 Acoustic Tag Study Preliminary Conclusions

- *No apparent rejection of the top spill opening based on hydraulic conditions*
- *Rejection at 50 feet was less than 1 percent*
- *Fish Passage Efficiency (FPE) was 25.6 percent*
- *Fish Collection Efficiency (FCE) at 300 feet was 86 percent*
- *Major approach path was along face of future units*

Plan View


N
ORIGIN POINT FOR THE ELLIPSE EQUATION
X
Y
98'-5 3/8"
PROJECT BASELINE
℄ OGEE
B G09
C G09
D G09
1
5°
K
12'-0"
45'-0"
100'-0"
18'-6"
9'-3"
9'-3"
A
P
C
J
L
G
68'-0"
UNIT CENTERLINE AND BYPASS CENTERLINE
M
H
5'-0"
3 3/8"
2
4'-0"
49'-0"
℄ TUNNEL
40'-3"
17'-0"
42'-2"
68'-10"
ELLIPSE EQUATION: (X/211.4093)^2 + (Y/100)^2 = 1
162'-0"
WALL EXTENSION
290'-0"
ORIGIN POINT FOR THE ELLIPSE EQUATION
PLAN
SCALE: 1/16"=1'-0"

GOAL: 95% fish survival past the concrete

2006 Steelhead Study Results

Total Dam Passage Survival = 87.9%

What do we have to work with?

Year	Powerhouse	Surface Spill	Spillway	**Total Dam Passage**
2006	45% pass. 83% surv.	9% pass. 98% surv.	46% pass. 90% surv.	87.6%

Design work started in 2003 with a “Team Approach” of the PRCC and Grant PUD

Project Objective

- The objective of the project was to assist Grant PUD in meetings the requirements of the NMFS 2008 BIOP, which were included in the FERC License Order

- Reduce spill, increase generation potential, reduce total dissolved gas.

MODELS USED

- HYDRAULIC MODELS (Iowa)
  - 1:50 Scale Forebay Model
  - 1:52 Scale Tailrace Model
  - 1:24 Scale ‘Sectional’ Model
- CFD MODELS
  - Forebay
  - Tailrace
  - Bypass Structure

Agencies & Tribes (PRCC) at IIHR

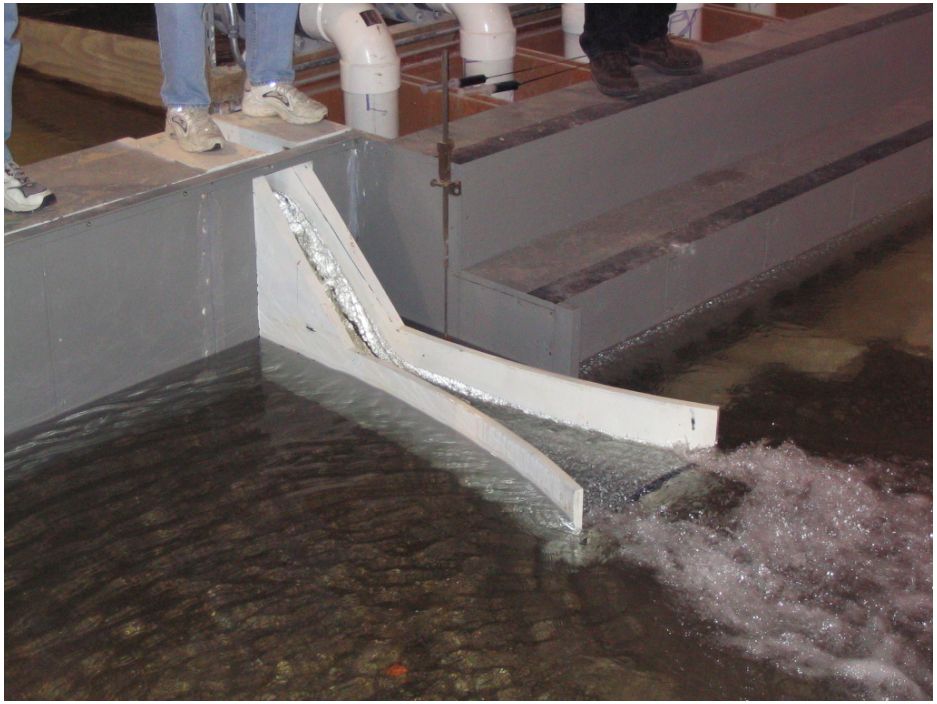
Modeling Work
Sectional Model

- *Gate design*

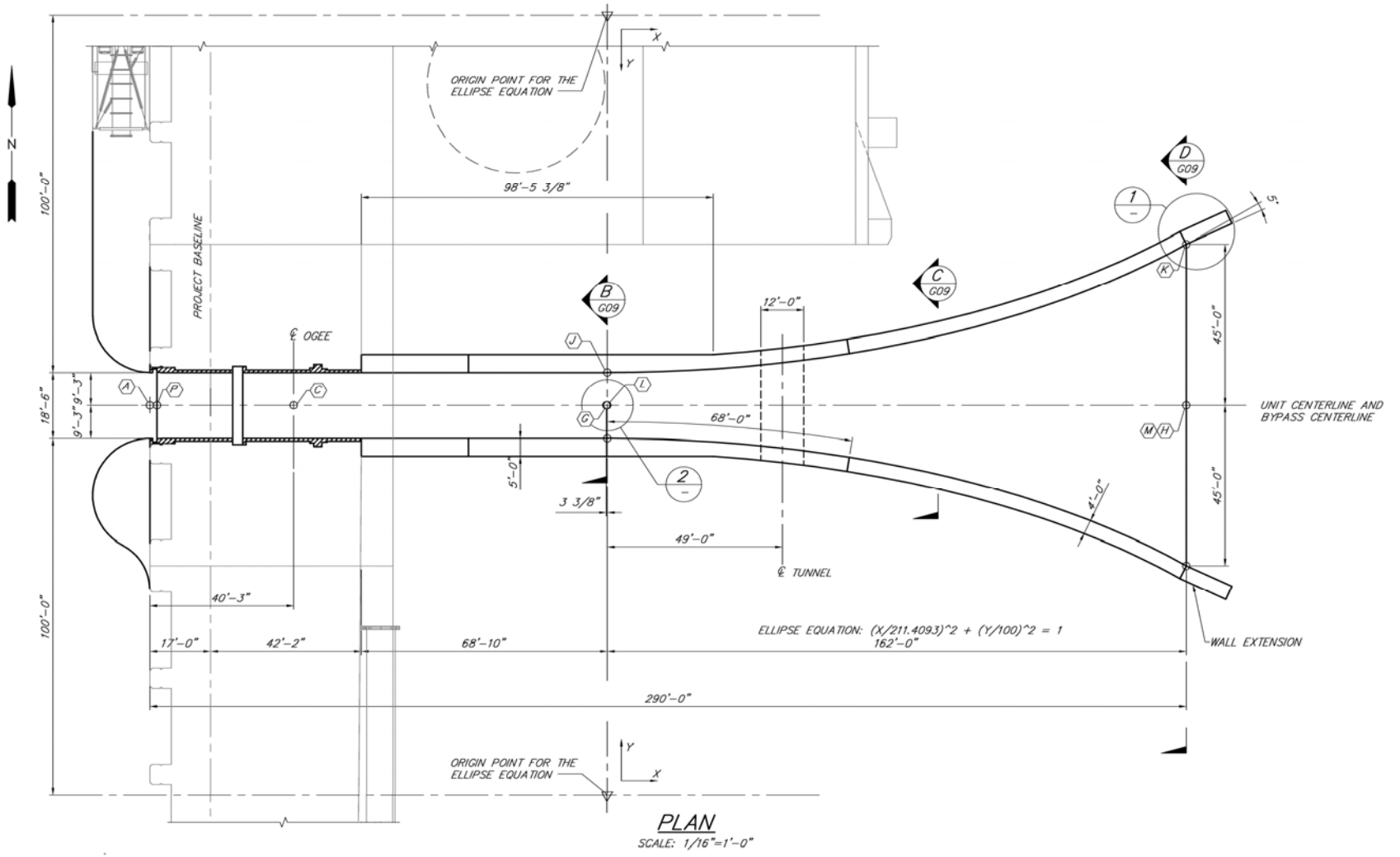
- *Spreader design*

Modeling Work
Tailrace Model

- *Review of egress patterns*
- *Erosion assessment*
- *Spreader design*



Plan View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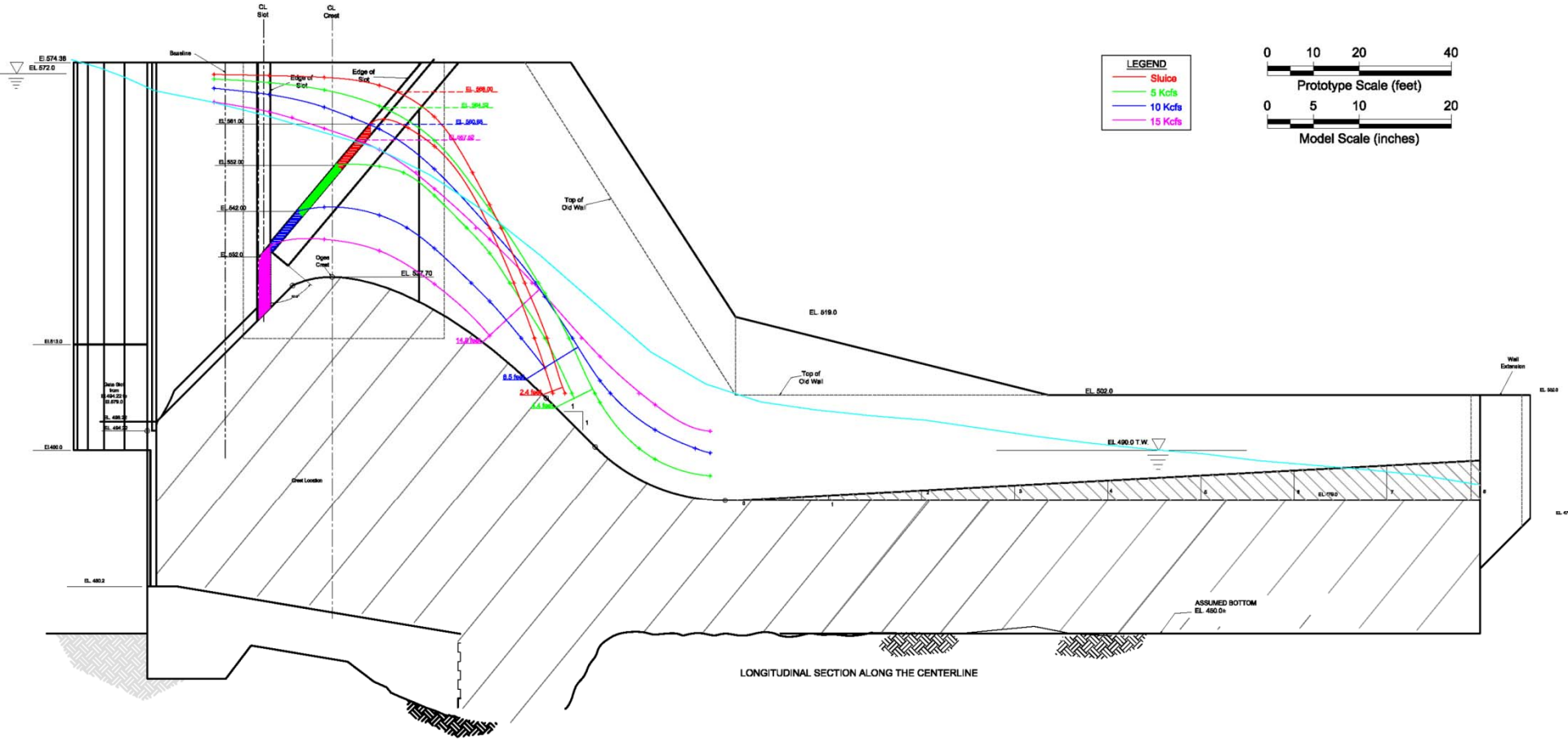
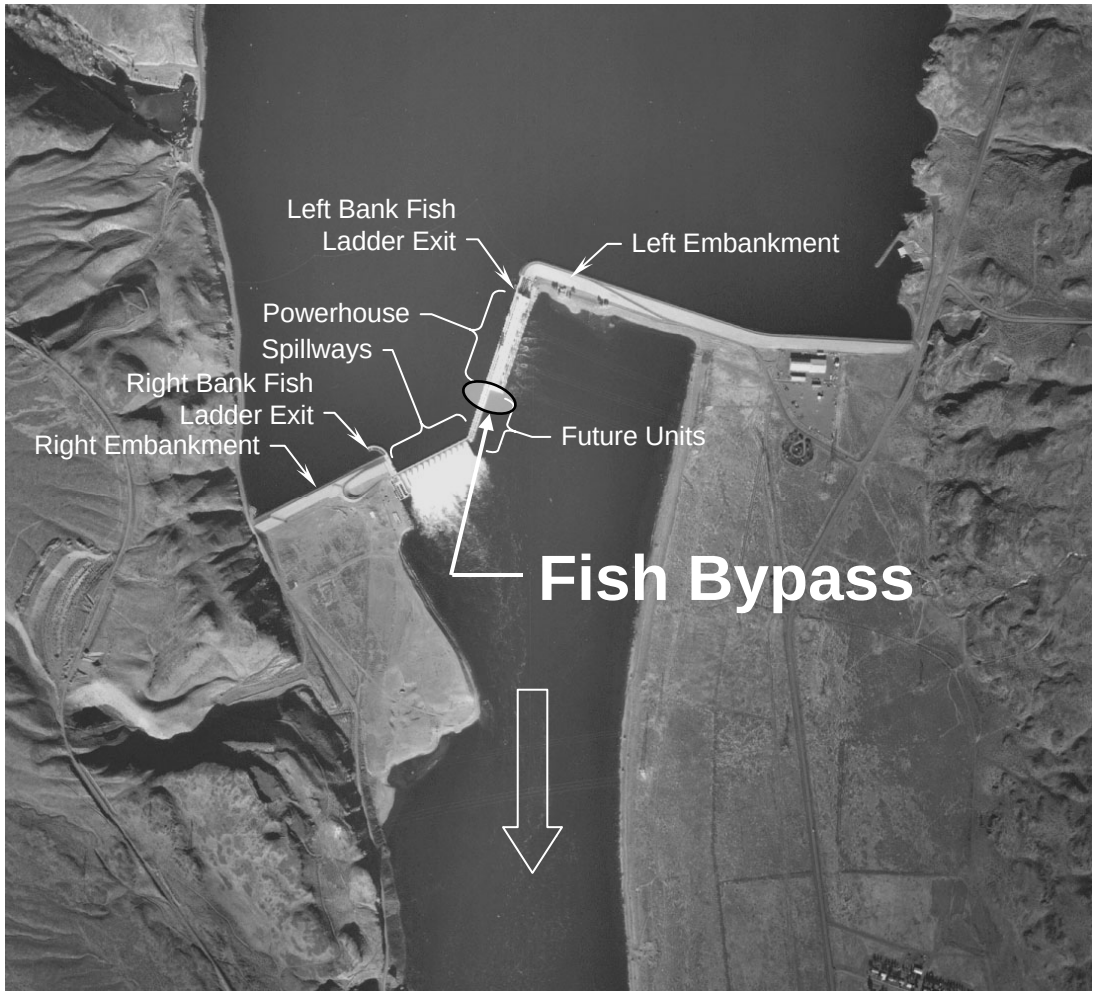
Gate Operation



Project Features

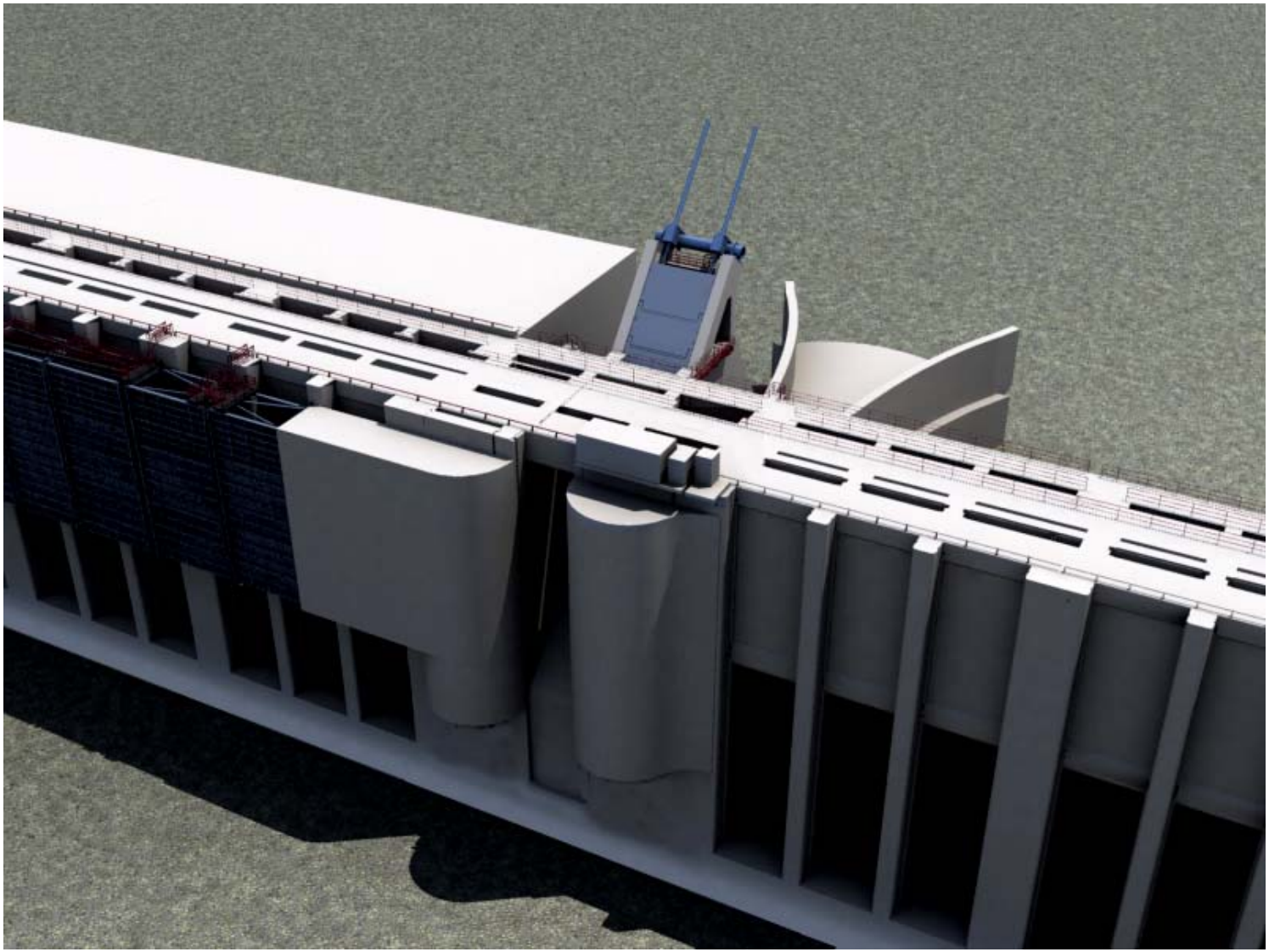
- Nominal full bypass flow of 20,000 cfs
- Vertical and inclined gates to set lower flow rates (15 kcfs, 10 kcfs, 5 kcfs and Sluice)
- Finished opening through concrete for water passage is 18.5 feet wide and 83 feet deep
- Length of 290 feet upstream/downstream
- Exit chute width of 90 feet
- Discharge flow spread and elevated to minimize total dissolved gas (TDG) and tailrace scour

Wanapum Dam

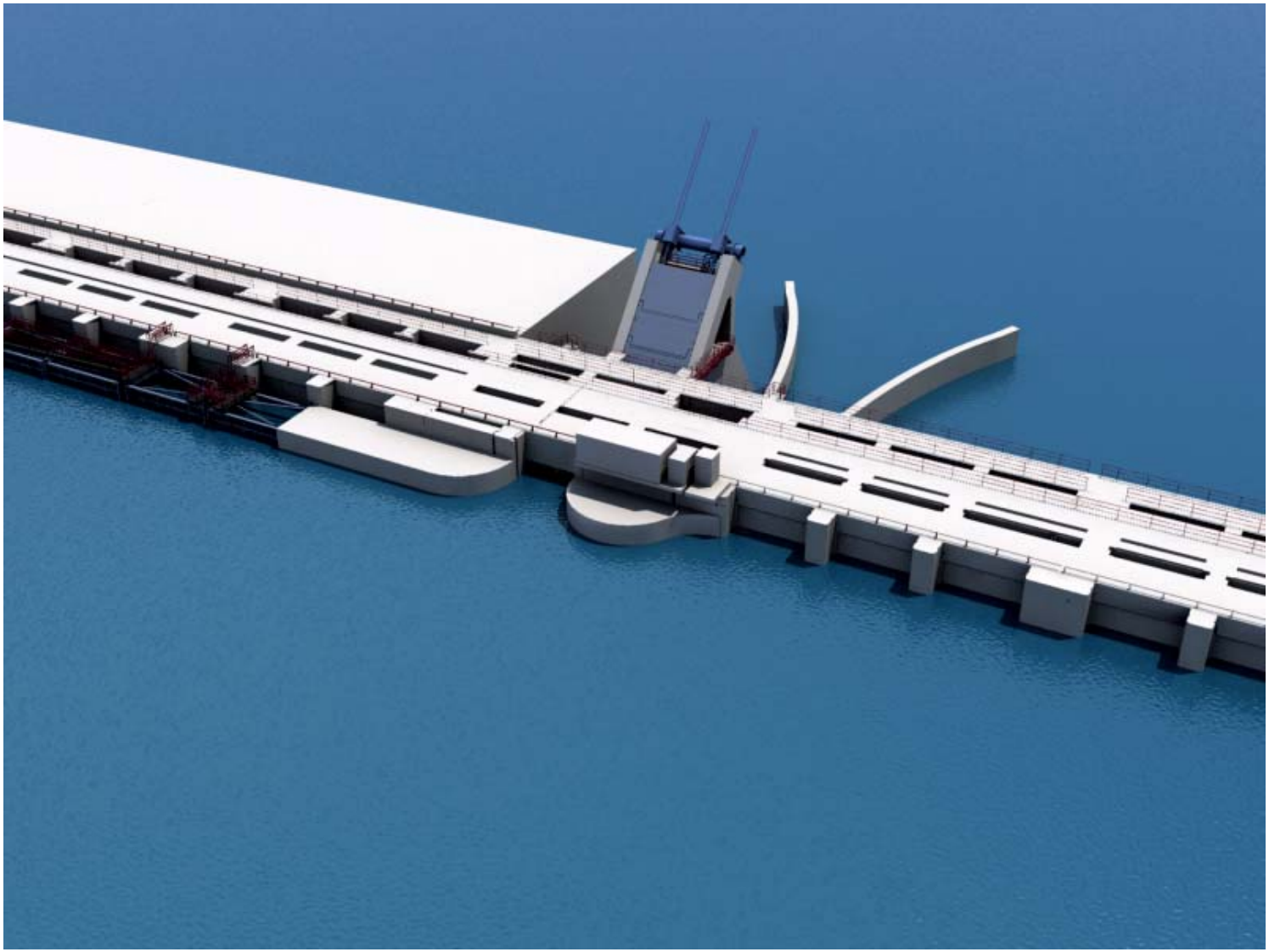

Left Bank Fish
Ladder Exit
Left Embankment
Powerhouse
Spillways
Right Bank Fish
Ladder Exit
Right Embankment
Future Units
Fish Bypass

Downstream View – No Water

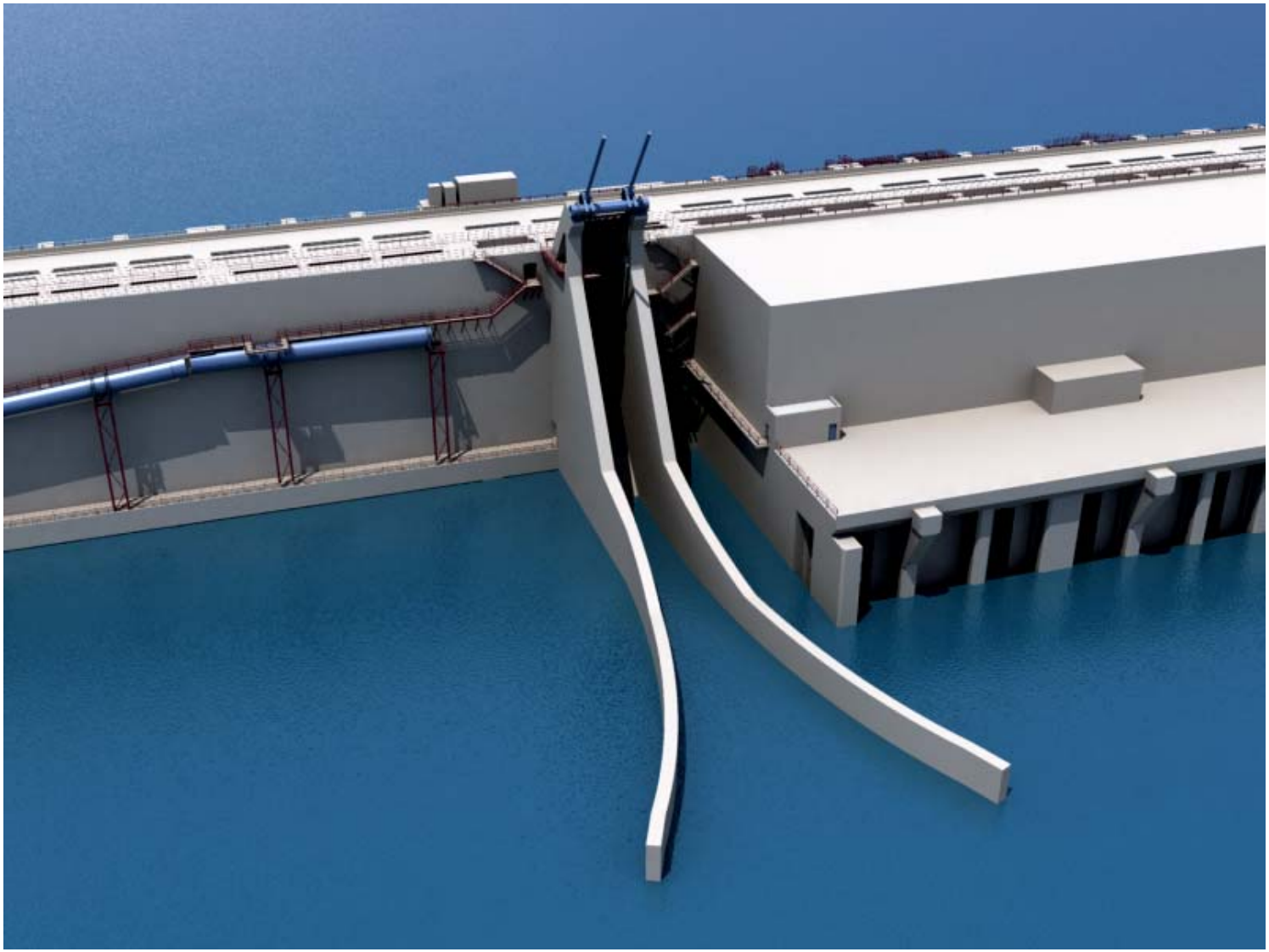
Upstream View – No Water



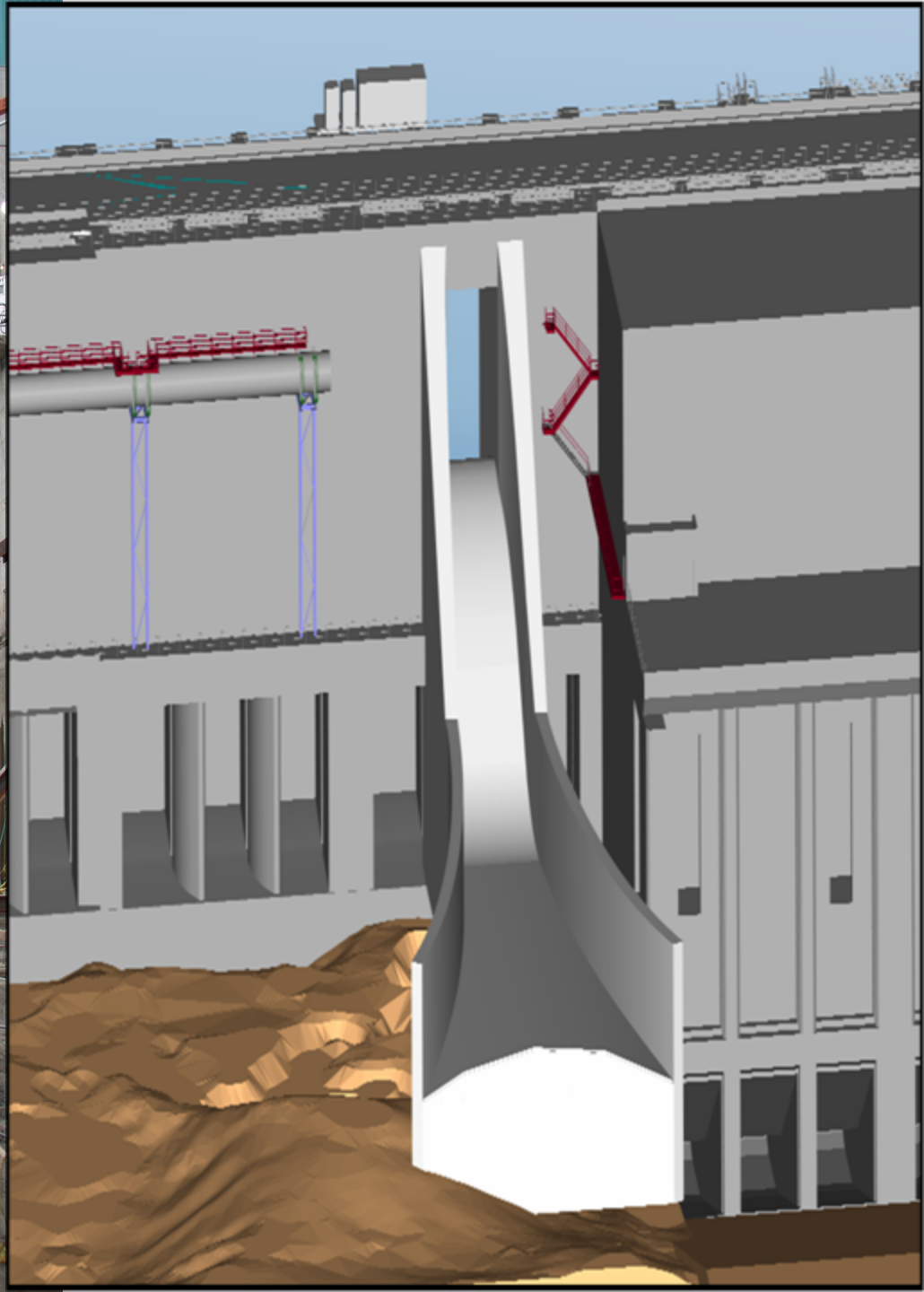
Upstream View



Downstream View




SPILL
KIT




185
BULLAIR