

RECLAMATION

Managing Water in the West

Cle Elum Dam Fish Passage Final Design

Yakima Basin Science & Management Conference

June 17, 2015

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U.S. Department of the Interior
Bureau of Reclamation

Cle Elum Fish Passage Design



Adult Collection Facility

Cle Elum River

Downstream Passage Conduit

Spillway

Flow

Helix Conduit Structure

Inlet Structure

Cle Elum Dam

Cle Elum Reservoir
Forebay

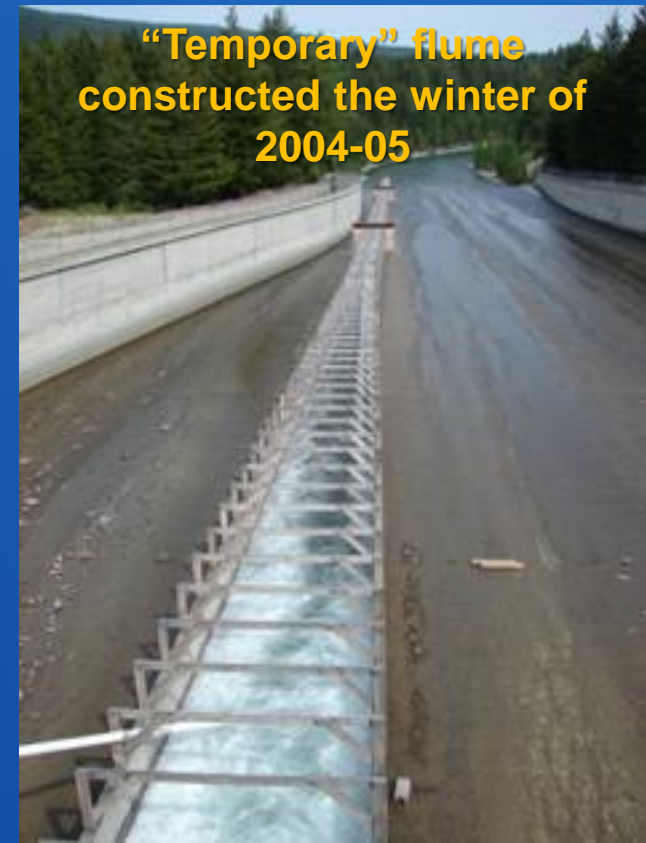


Downstream Passage

- Most Challenging due to the large swing in annual pool elevation (approx. 100 ft)



Came "unglued" June 7th at 9 pm



"Temporary" flume
constructed the winter of
2004-05

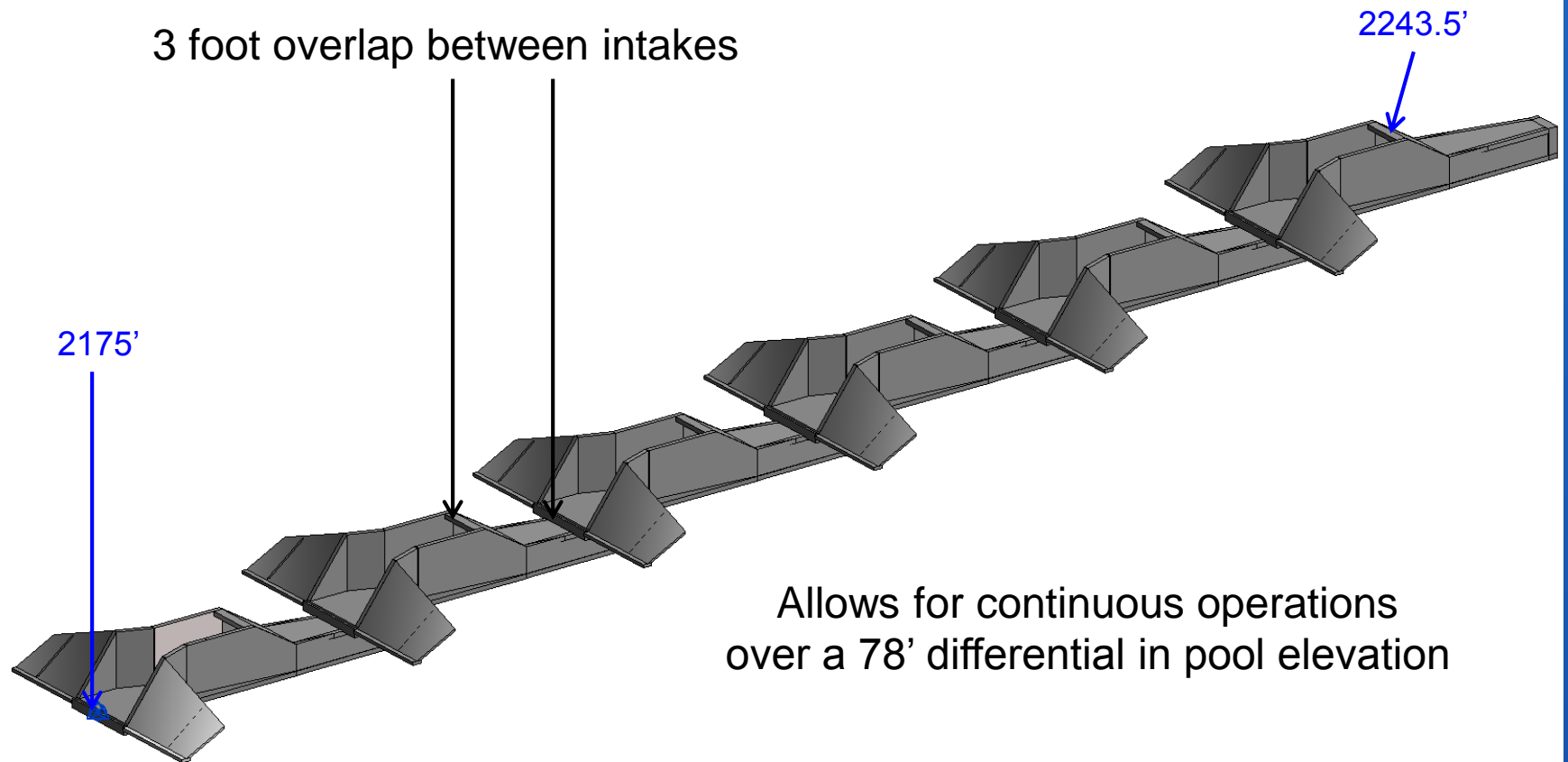
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Original Design = "DOA"



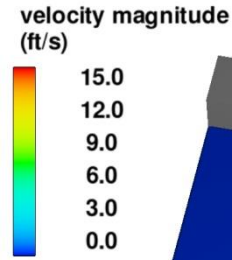
New Downstream Design

Intakes

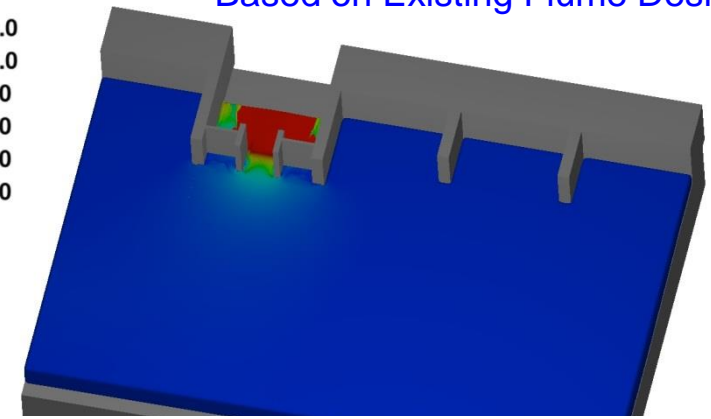


Obermeyer Weir Modeling

4 foot weir profile, $Q = 320\text{ft}^3/\text{s}$

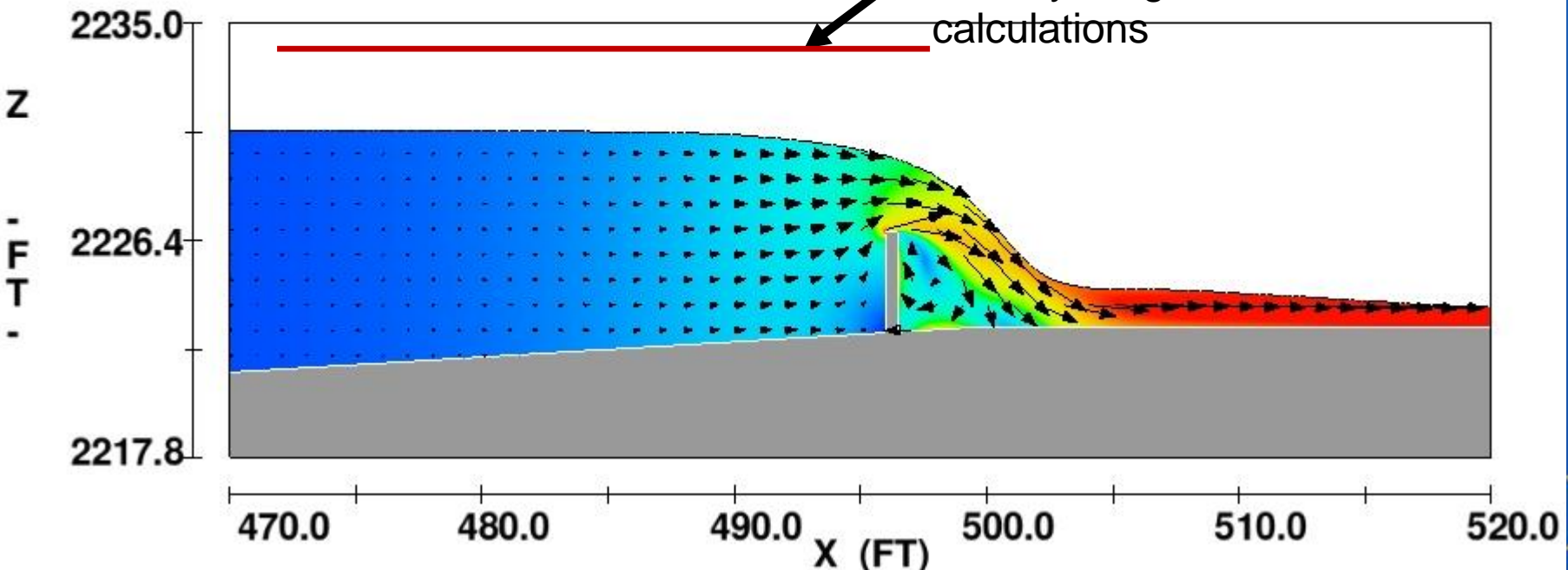
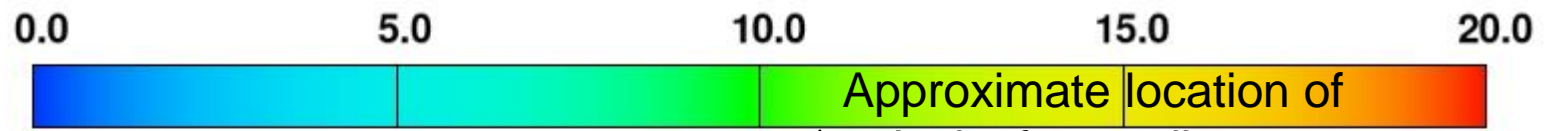


Based on Existing Flume Design



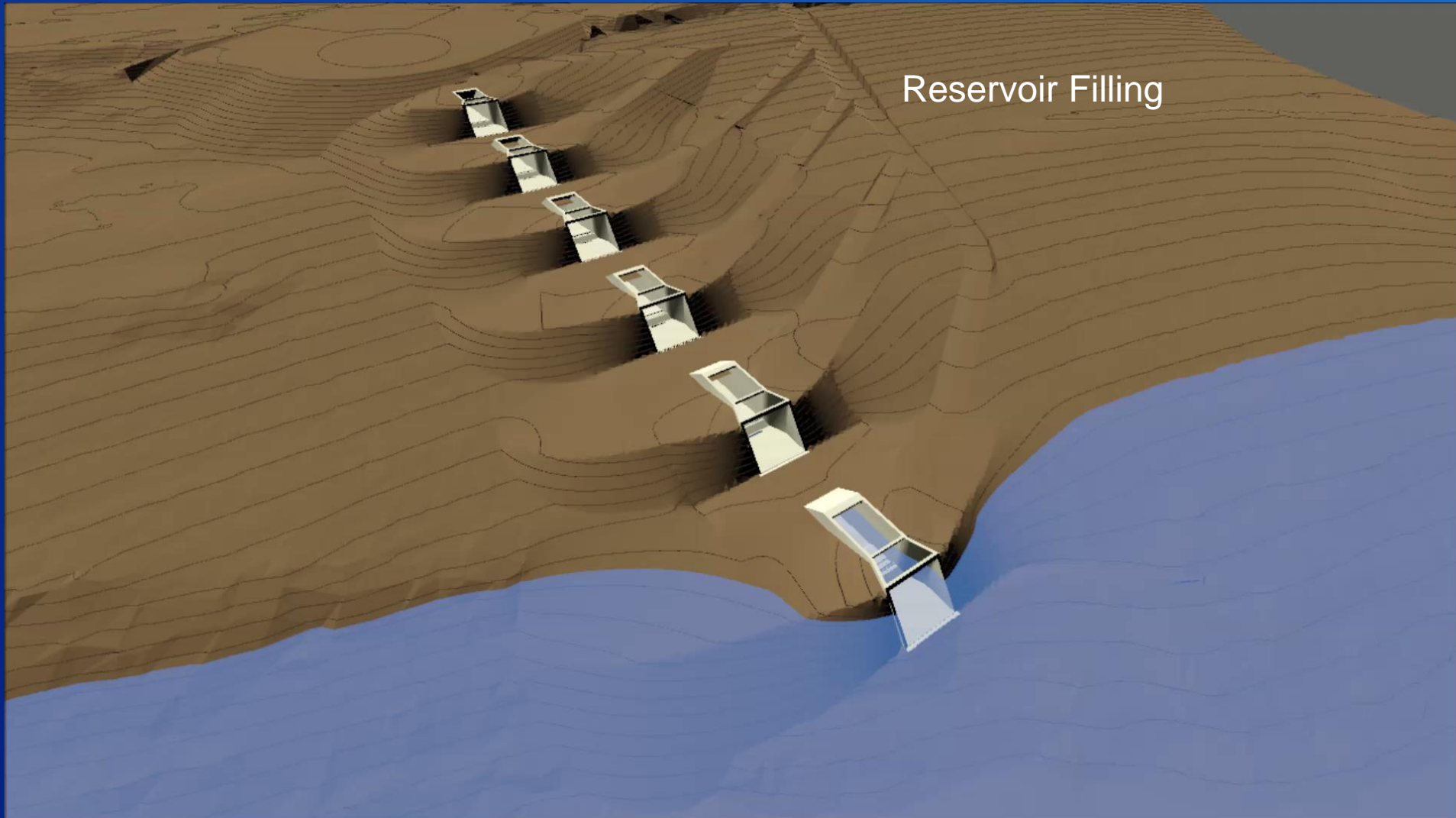
velocity magnitude (ft/s)

max = $2.41\text{E}+01$



New Downstream Design

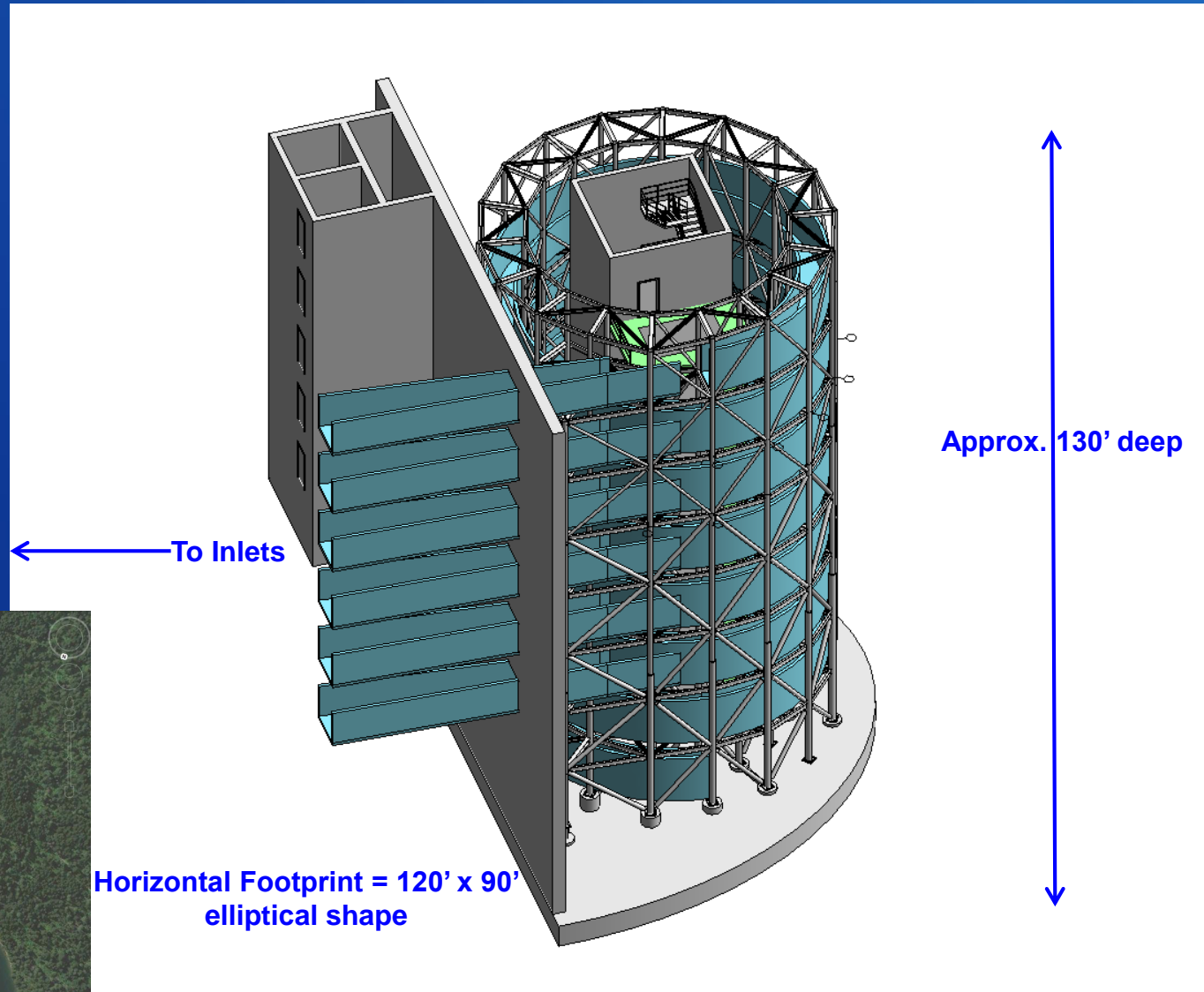
Intakes



New Downstream Design

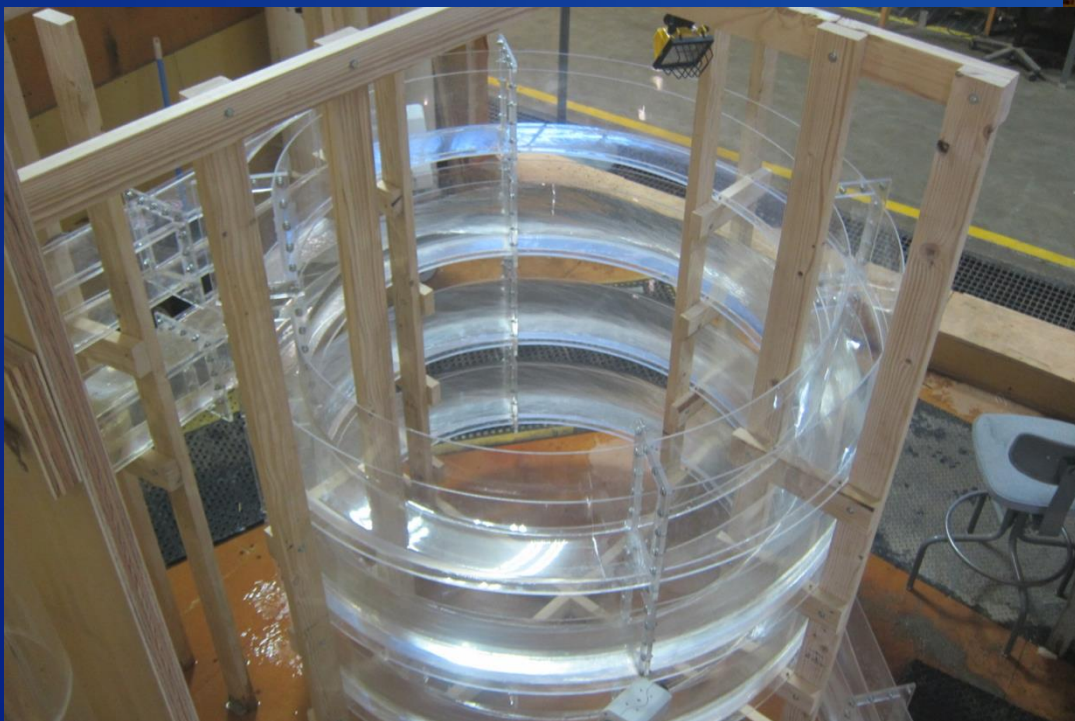
Helix

located on the right
abutment



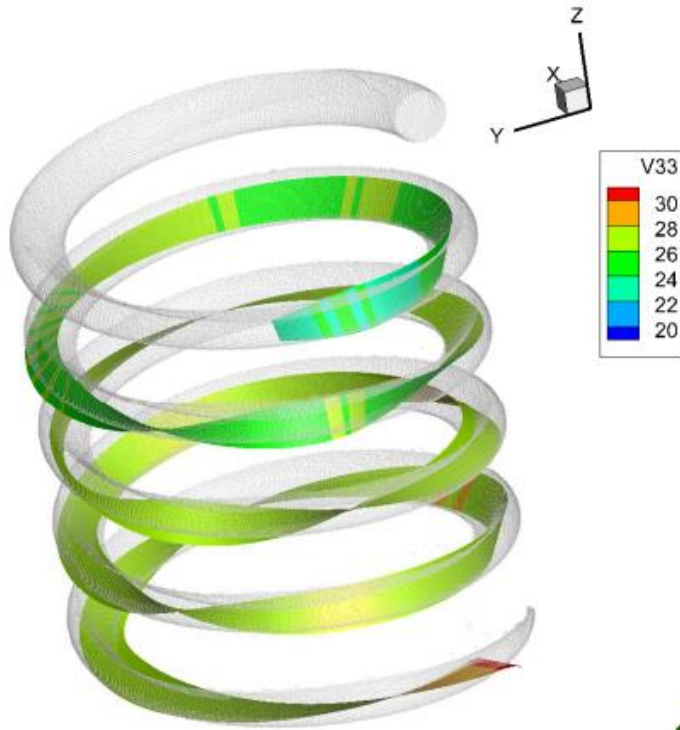
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Helix Physical Model

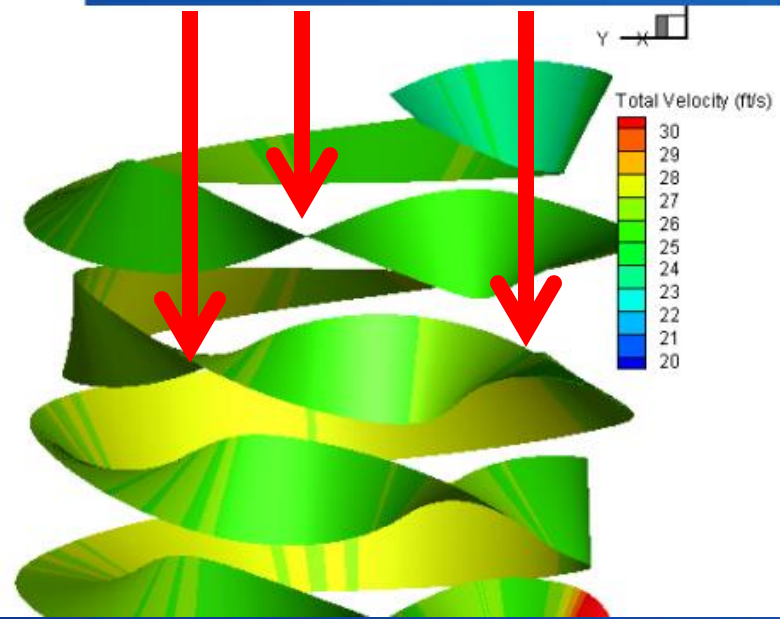


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Observed Severe “Corkscrew” Water Movement Down the Helix



Corkscrew Flow Pattern =
Unhappy Fish

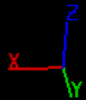
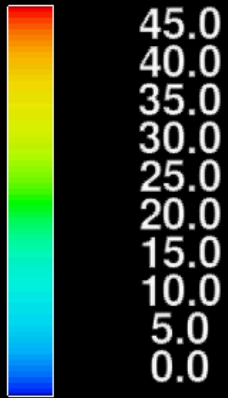


1st CFD video (4th concept)

Time Frame: 0.00000

Case #1, 400 cfs, RWS Elevation 2243 ft

velocity magnitude
(ft/s)

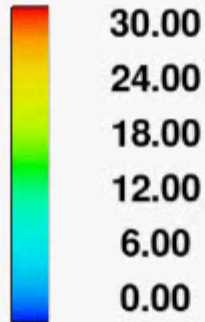


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8th concept; at least the 20th design iteration

Time Frame: 0.00

velocity magnitude
(ft/s)



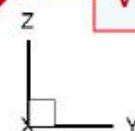
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Sensitivity Analysis (from fish's perspective)

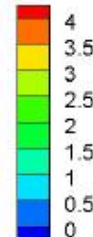
Rollover Parameter
(ROP)

Difference in Max
and Min vertical
velocity

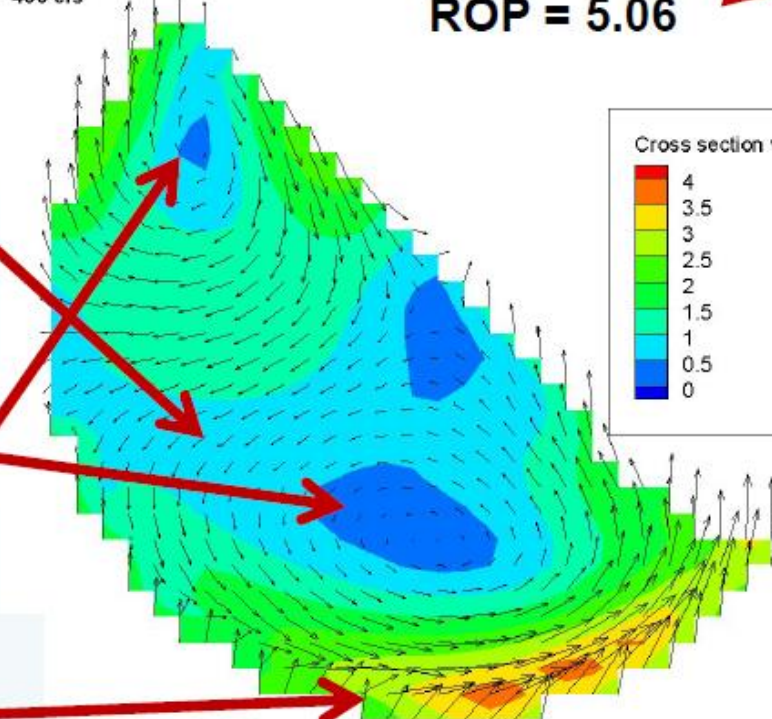
ROP = 5.06



Cross section velocity (ft/s)



52 ft diameter helix
6 ft diameter pipe
400 cfs



Total area with velocity less than 1 ft/s cross-velocity (blue shades indicate a more favorable condition).

Tightness of rotational flows.

Maximum sweeping velocity.

Helix Hydraulic Model Video



MVI_2898.MOV

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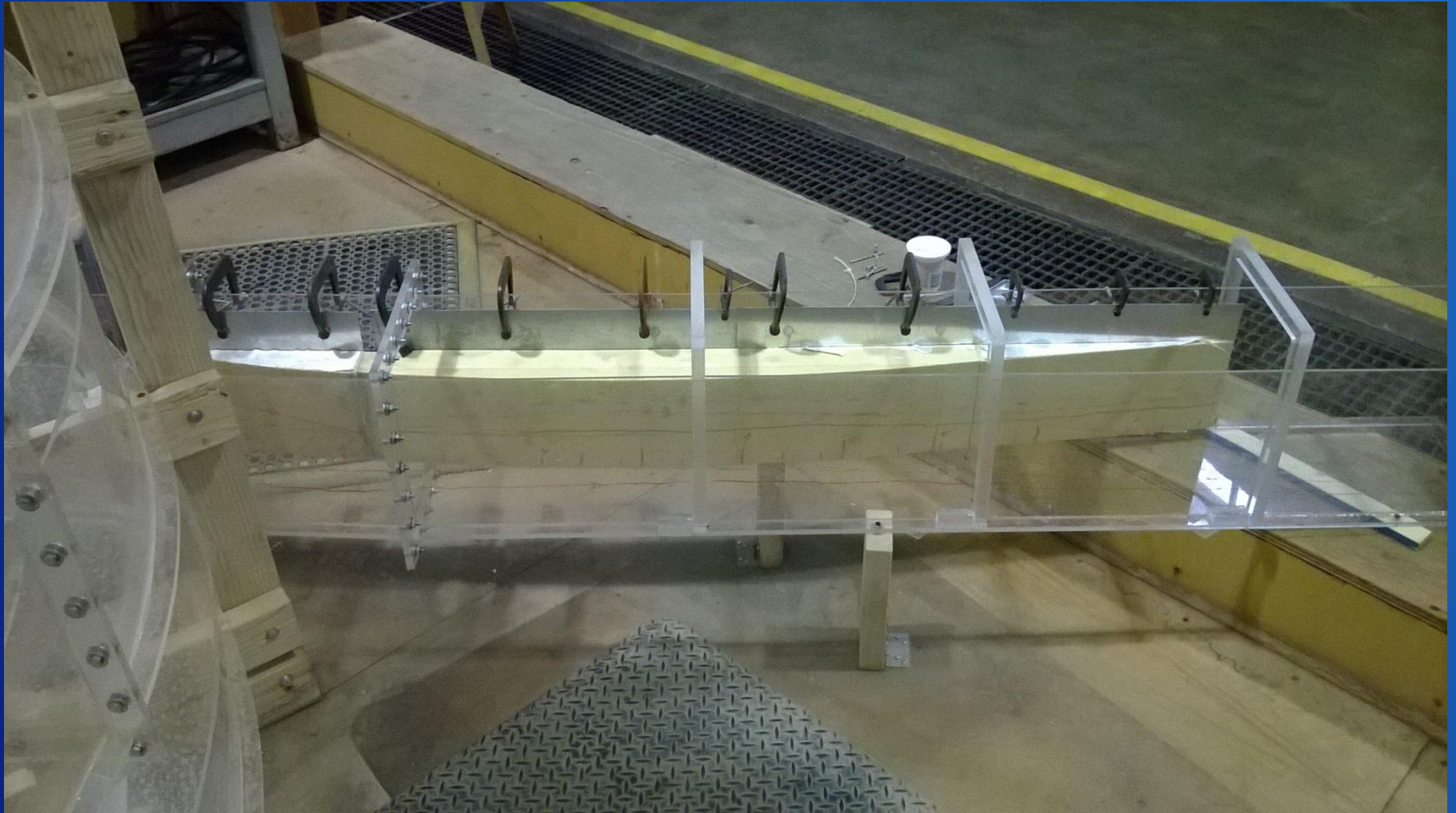
New Downstream Design

Tunnel/Outfall



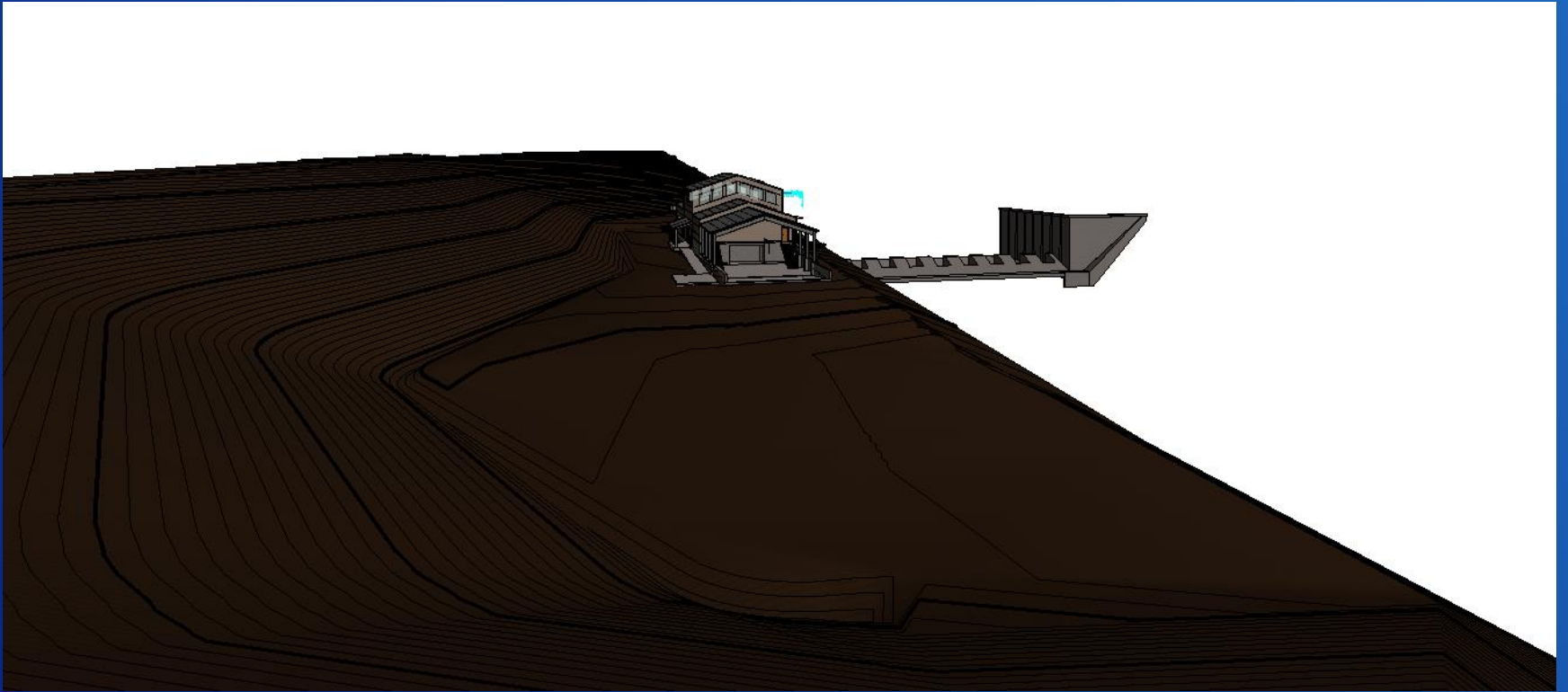
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Tunnel / Outfall



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Adult Collection Facility



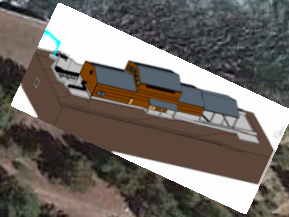
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2nd Upstream Passage

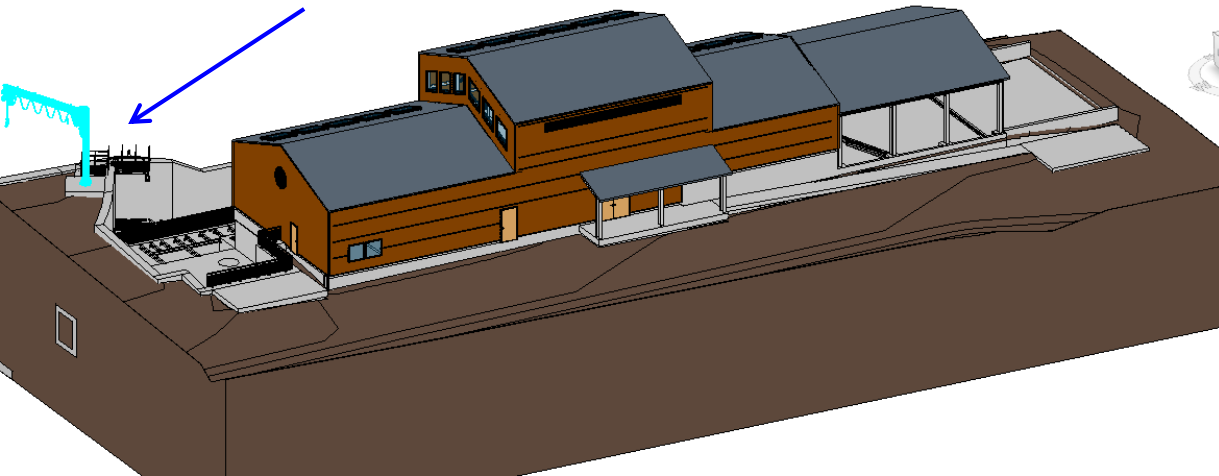


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Adult Trap & Haul Facility



← Dam & Stilling Basin River Flow →

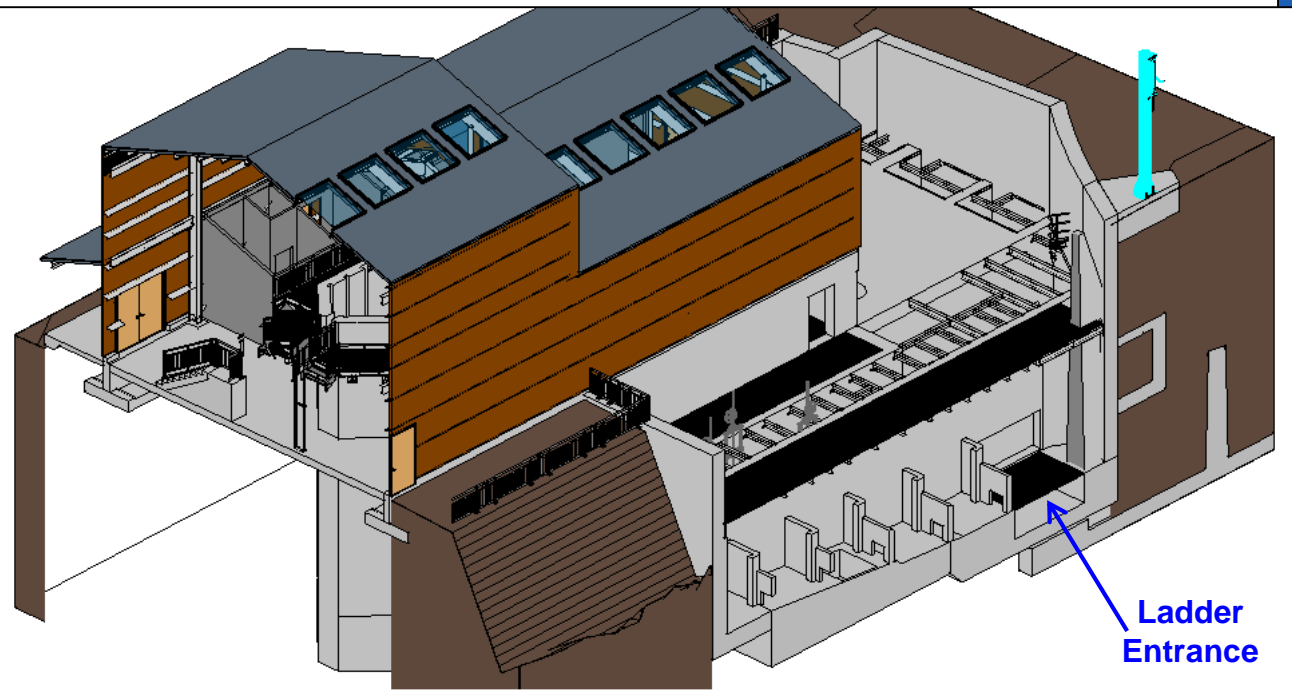
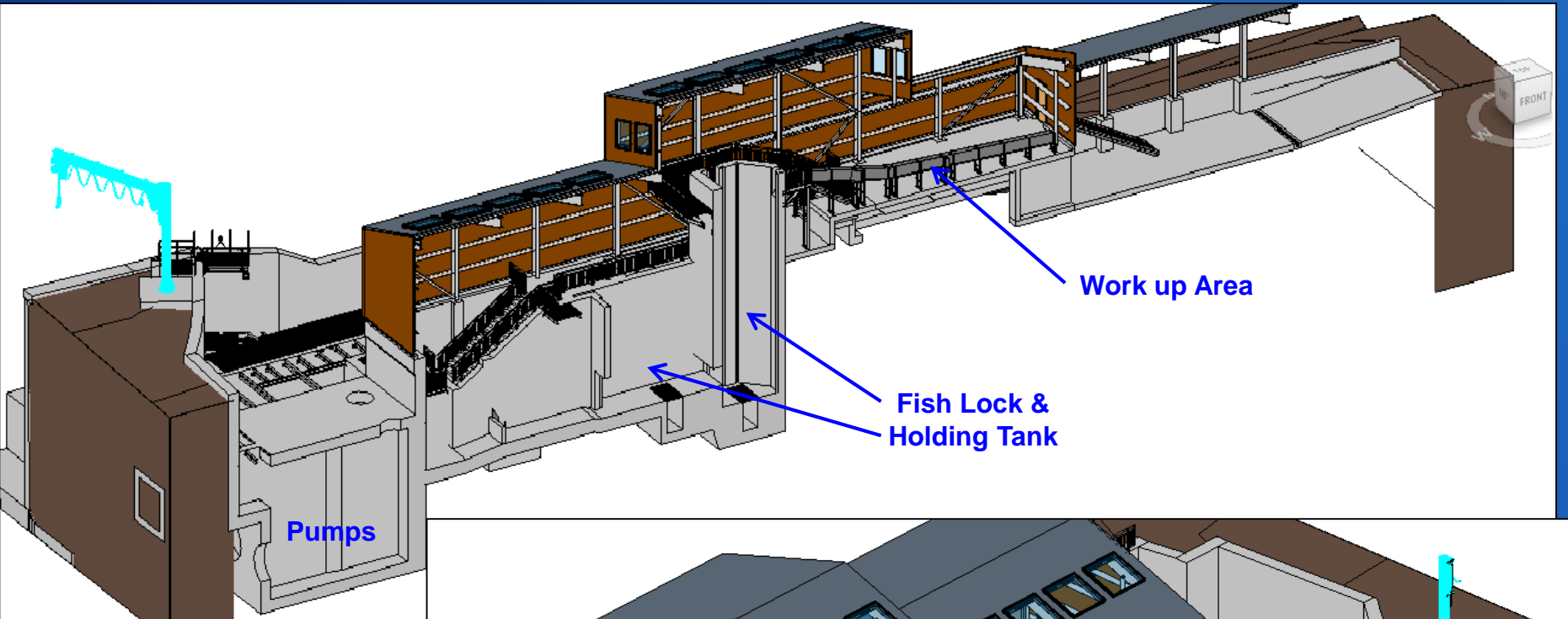


Google earth

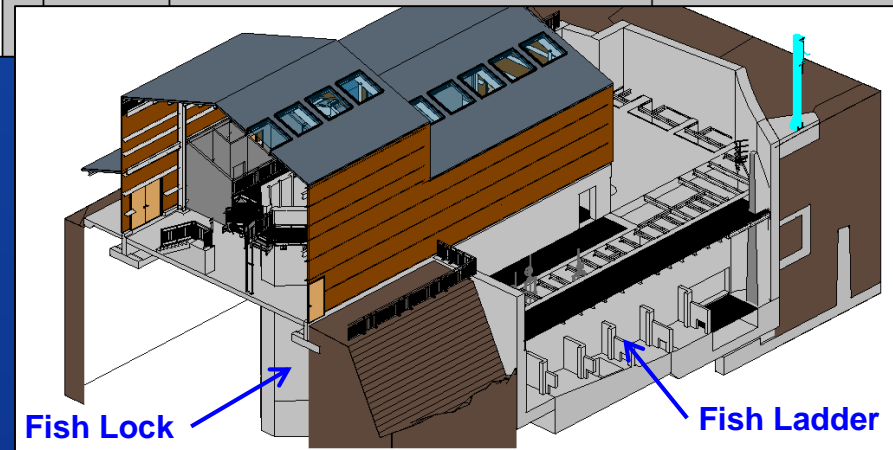
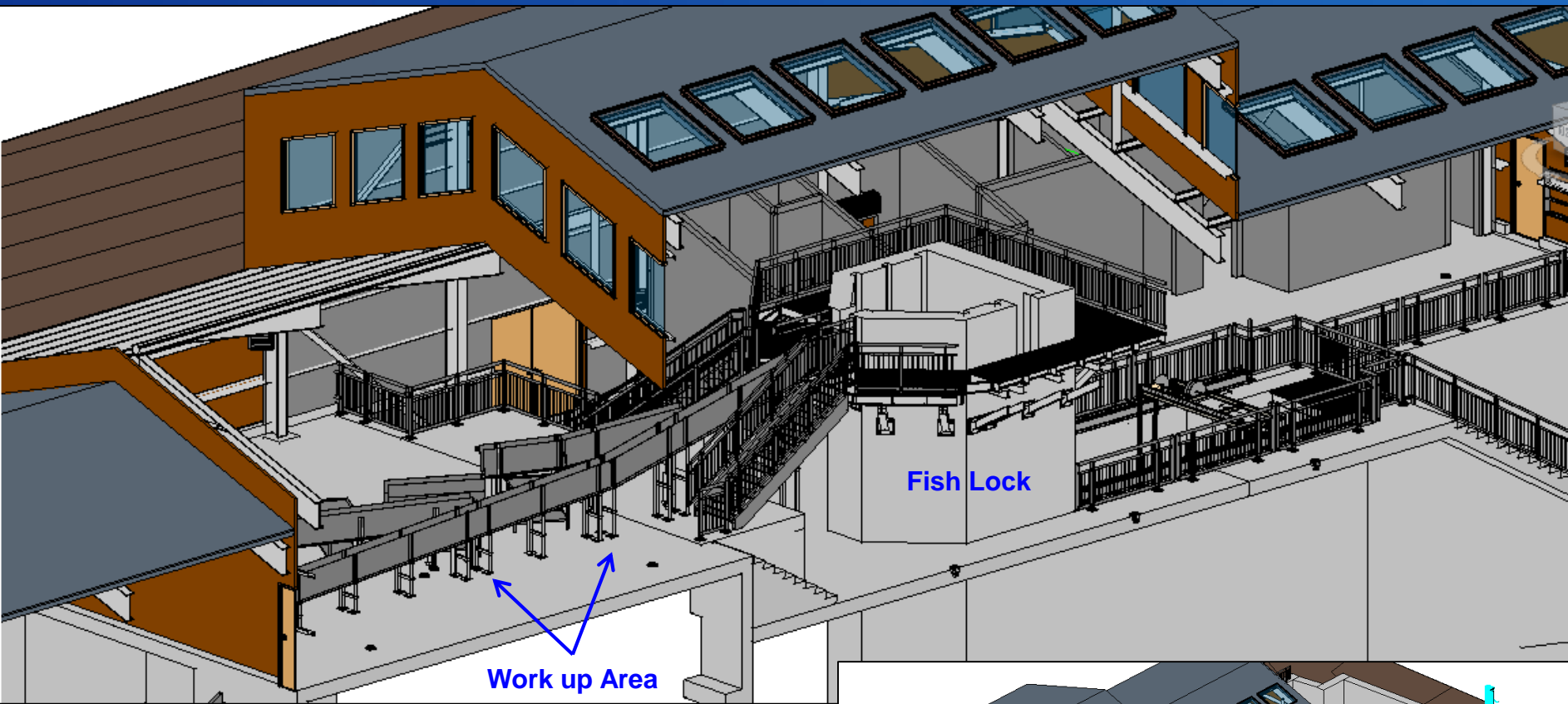
1°04'17.51" W elev 2202 ft eye alt 3199 ft

ION

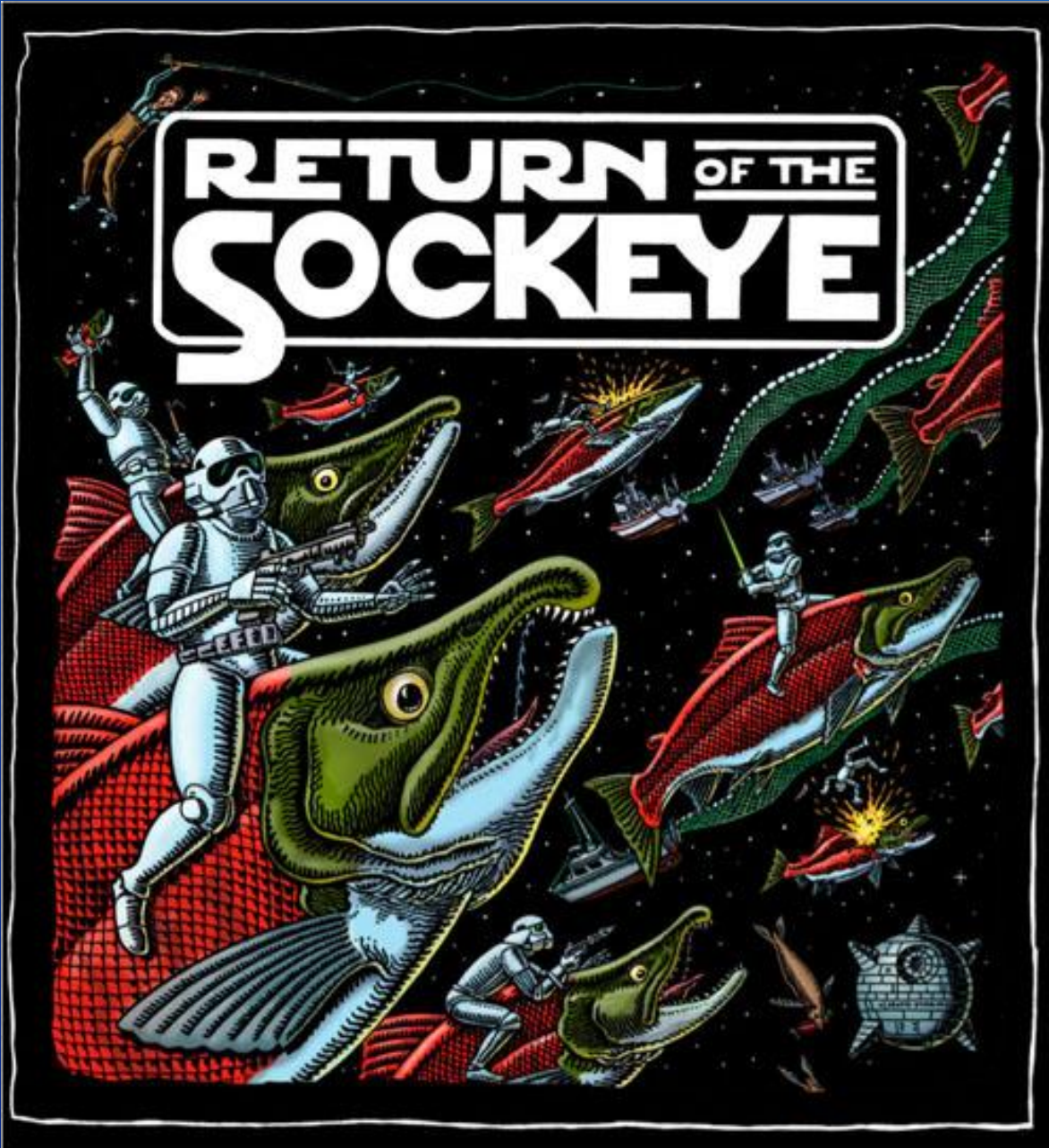
Adult Trap & Haul Facility



Adult Trap & Haul Facility



RETURN OF THE SOCKEYE



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