RECLAMATION

Managing Water in the West

TR-2009-03

Travel to Cle Elum Dam Fish Passage Facility, Yakima Project; Washington

Dates of Travel: August 19-20, 2009

U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Hydraulic Investigations and Laboratory Services Group
Denver, Colorado

BUREAU OF RECLAMATION
Technical Service Center
Denver, Colorado

TRAVEL REPORT

Code : 86-68460 Date: September 24, 2009

To : Manager, Hydraulic Investigations and Laboratory Services Group

From : Brent W. Mefford and Kathleen H. Frizell

Subject : Travel to Cle Elum Dam

1. Travel period: August 19-20, 2009

2. Places or offices visited: Seattle, and Cle Elum Dam, Washington and vicinity.

3. Purpose of trip: Attend a meeting on proposed fish passage options for the Cle Elum storage reservoir.

4. Synopsis of trip: We traveled to Seattle, Washington on August 19, 2009. The next morning we meet Steve Montague (Pacific Northwest Regional Office) and traveled together to Cle Elum Dam. At the dam we meet with Wendy Christensen (Technical Projects manager for the Columbia-Cascades Area Office), Duane Dobbs (Cle Elum dam tender), Mark Johnston and Brian Saluskin, fisheries biologists from the Yakama Nation Fisheries Resource Management Program, and Steve Rainey, (GEI consultant). The meeting was organized to discuss the proposed baseline concepts for upstream and downstream passage facilities and a proposed Value Planning Study modification to the baseline passage concept. A description of the baseline concept and the proposed modification (Proposal 1) are presented in the Value Planning (VP) Final Report, Cle Elum Dam Fish Passage Facility (July 6, 2009), Yakima Project, Washington.

Wendy started off the meeting by describing the major components of the baseline design. This was followed by a discussion on the downstream juvenile passage multi-level intake structure, figure 1. The discussion focused on three issues; the potential for excessive turbulence in the downwell plunge pools, the location and orientation of the structure, and the operating range of the structure. Concerns were expressed that the turbulence in the downwells could be strong enough to cause fish disorientation and elevated stress levels if fish do not pass through the facility relatively quickly. Steve Rainey cited studies on downstream passage on the Columbia River Dams showing prolonged exposure of smolts to high turbulence was harmful and should be avoided. The group agreed this was an issue that requires further investigation prior to final design. We proposed physical modeling of the structure should include a large sectional model in which juvenile salmon or trout could be passed through the model to develop a better understanding of their behavior when exposed to turbulence levels and flow patterns associated with the proposed design. An overall model of the intake structure has been planned for

FY2011, but this did not include the fish behavioral modeling proposed during this meeting. The second issue discussed the Value Planning (VP) proposal to move the intake adjacent to the shore at the right abutment. The group thought that this would be more acceptable because the sockeye smolts tend to move downstream adjacent to the shoreline, and would more likely encounter the intake tower entrance than if it was located in the middle of the pool. The orientation of the intake tower might be investigated first with a numerical model that could provide guidance on approach flow patterns prior to physical modeling. The third issue discussed was the operational range of the intake tower. Steve provided the reservoir stage exceedance plot shown in figure 2. In dry years the plot indicates that the juvenile bypass system will not be operable due to low reservoir conditions until April and for very dry years until late May. Mark Johnston commented that the smolts generally want to move downstream starting in February. In dry years they would be delayed several months before reservoir levels were high enough to operate the downstream bypass. Mark and Brian did not think the downstream passage delay that will occur in dry years is a significant issue.

Wendy and Steve M. then presented an overview of the VP proposal that moved the upstream trap and haul facility to the right bank of the river. Steve M. had prepared preliminary drawings of a possible layout showing the elements needed as proposed by the VP team, figure 3.

The major components of the VP proposal were:

- Eliminate the fish barrier weir.
- Move the upstream passage fish collection facility from the left bank to the right bank where the downstream passage outfall was located.
- Use downstream fish bypass water to supplement upstream fish attraction to the fishway and collection facility.
- Add a dewatering system and juvenile sampling/PIT tag detection facility to the downstream bypass.
- Secondary component for downstream passage was to move the intake to the shoreline as stated above.

The main issues raised concerning the proposal were attraction to the upstream fishway especially during high summer outlet releases from the reservoir, screening of the juvenile bypass flow, and the additional handling of juveniles that the tagging facility would impose on the fish. Prior to discussing the VP proposal, the group walked to the toe of the spillway at the right bank to witness flow conditions in the stilling basin and downstream river channel during a high outlet works discharge. At the time of our site visit the outlet works was passing about 3,000-3200 ft^3/s flow downstream at reservoir El. 2167 ft. Photograph 1 shows flow released from the outlet works tunnel. Photographs 2 and 3 show the downstream extent of flow turbulence in the spillway stilling basin and downstream river. Photograph 4 shows flow conditions along the downstream right bank. The area on the right bank near the spillway terminus, where photograph 4 was taken, is a raised flat fill area supported by the right spillway wall and a downstream cutoff wall anchored into the right bank. The available drawings do not show topography in this area or downstream. Obtaining additional topography along the right bank and river bathymetry downstream of the spillway was identified as a project data need. (Upon return to Denver, a map of available Lidar data was sent that should be adequate for early design. Bathymetry of the river channel may wait until final design. Data files, after confirming datums, may be obtained from Edwardo Lopez in the Regional Office). In addition, tailwater information needs to be verified prior to final design as it seems at initial glance that the values used in the previous designs might be a little high. After viewing the downstream river, outlet works flow and the right bank area, the group returned to the maintenance building to continue discussions on the VP proposal. For upstream attraction the group agreed that upstream migrating adult fish would require cold water releases from the fishway and attraction flow. The reservoir mixes thermally quite quickly, but the surface is warmer than the bottom. With the downstream juvenile passage providing surface withdrawal, exclusive use of that in the upstream facilities might become an issue in the summer if it is still operating then. An option to tap into and use the 14-in diameter bypass pipe in the 14-ft diameter outlet works tunnel for cold water was discussed and will be looked at to determine its feasibility. Assuming the auxiliary and ladder flow is of comparable temperature to outlet releases, fish would likely find the fishway entrance fairly quickly given the approximate 200 ft width of the river and the relatively straight downstream alignment. The elements of the upstream facility will include:

- Ladder (1 or 2) with auxiliary flow at entrance,
- Trap and haul facility similar to that proposed in the draft Cle Elum and Bumping Lake Dams Fish Passage Facilities Planning Report,
- Jetted auxiliary flow to draw fish from the outlet works turbulence zone over to the right side,
- Screened pumped flow during certain operational periods for the ladder and auxiliary flow,
- Potential screened juvenile passage flow where overlap occurs during the upstream passage period,
- Juvenile outfall relocated,
- Pit tag detection could be worked into downstream flume section, if determined desirable at a later date.

There were some basic discussions regarding the location of these elements. It was felt that the juvenile bypass should be located near the downstream end of the stilling basin. The ladder should be located upstream from the auxiliary flows, but close to them. The screened pump facility may be accomplished with multiple low-head pumps. The reservoir ice cover is minimal and the river has no ice. Therefore, the screens could be left in the water or possibly removed.

We discussed the probable operating conditions that would impact fish attraction to the upstream fishway. The seasons for upstream and downstream fish passage may be affected by water year (drought, normal, and wet) and water temperature. The maximum time period for passage of downstream juveniles was discussed as lasting from February to June. The maximum upstream passage window was discussed as lasting from February to December with more likely April through September. Overlap in seasons could potentially occur or not. The reservoir level fluctuates tremendously, filling in the spring and draining during the summer. "Flip-flop" operation between the Tieton and Yakima basins occurs producing minimum flows of 180-230 ft^3/s and maximum flows of about 3,200 ft^3/s in August. Spillway flows are rare, but allowance for upstream passage during spillway flows or survival of facility features should be ensured during that time. The conditions are summarized in table 1 for potential flow amounts and where the flow might be obtained.

Table 1. - Potential operating conditions during various times of the year and how the flow might be obtained for fish passage facilities.*

	Downstream Juvenile Passage Flow ft^3/s	Outlet Releases ft^3/s	Upstream Fishway (pumped or from outlet) ft^3/s	Pumped Attraction Jet ft^3/s	Auxiliary flow through diffuser at fishway entrance (ft^3/s)
Jan – Apr High Reservoir	200 to ~ 400	200 to ~ 4000	6	~ 50	0 to ~180
Jan- Apr Low Reservoir	No Releases	200 to ~ 3000	6	~ 50	0 to ~180
May – Aug High Reservoir	200 to ~ 400	200 to ~ 3000	6	0 to 50	0 to ~180
May – Aug Low Reservoir	100 to ~ 400	0 to ~200	6	0	0
Sept – Dec High Reservoir	0 to 400	200 to ~ 3000	6	0 to 50	0 to ~180
Sept – Dec Low Reservoir	No Releases	180 to ~230	6	0 to 50	0 to ~50

*The flow volumes will be reevaluated based upon findings from the hydraulic model study and more analysis of seasonal flow availability.

The elements of the facility will be laid out based upon the flow volumes needed during various seasons of operation, the flow patterns observed during the visit, and the expected fish behavior.

The general overall project schedule was provided by Wendy as follows:

- Draft EIS; 2010
- Final EIS; 2011
- Design data collection and physical hydraulic modeling; 2011
- Final design; 2012-2013

The immediate need is for a maximum footprint/layout of the proposed facility for the EIS that includes the basic components and a cost estimate that would rely on the existing cost estimate in the Design and Estimate Appendix at the January 2008 cost level.

5. Conclusions: All parties concurred that the VP proposal to move the trap and haul facility to the right bank was acceptable and perhaps even preferred because it offers more flexibility with operation. Attraction should be adequate if enough flow is provided to draw the fish from the left

side to the right side of the basin during outlet works operation. It was thought that attraction flow could be provided by pumping, use of screened downstream passage flow, or use of flow from the outlet works bypass pipe. Planned physical hydraulic modeling of the spillway stilling basin, with interaction of flows between the outlet works, juvenile bypass outfall, and adult upstream facility, will verify or provide adjustment to the preliminary layout, as needed. In addition, it was agreed that the juvenile tagging facility that had been incorporated into the right bank facility was not needed. It was felt that the additional stress caused to the juveniles would not be warranted and there were other opportunities for tagging at the Roza and Chandler juvenile monitoring facilities. Figure 5 shows a preliminary layout of the right bank facility without the juvenile tagging facility. It was also felt that the elimination of the juvenile facility would realize a significant cost savings.

The TSC agreed to provide a statement of work to modify the existing agreement with the Columbia-Cascades Area Office to do the work necessary in FY2010 to develop a layout of the right bank facilities up to the level of the other proposal and for the EIS.

6. Action correspondence initiated or required: None.

7. Client feedback received: None.

cc: CCA-1100 (Christensen); CCA-1121 (Hubble); 86-68460 (Mefford, Frizell, Hanna);
86-68130 (Cohen); 86-68460 (files)

SIGNATURES AND SURNAMES FOR:

Travel to: Cle Elum Dam

Date or Dates of Travel: August 19-20, 2009

Names and Codes of Travelers: Brent W. Mefford, 86-68460; Kathleen H. Frizell, 86-68460

Traveler	**Date**	**Traveler**	**Date**
Brent W. Mefford Brent W. Mefford	9/22/09		
Kathleen H. Frizell Kathleen H. Frizell	9/22/09		

Noted and Dated by:

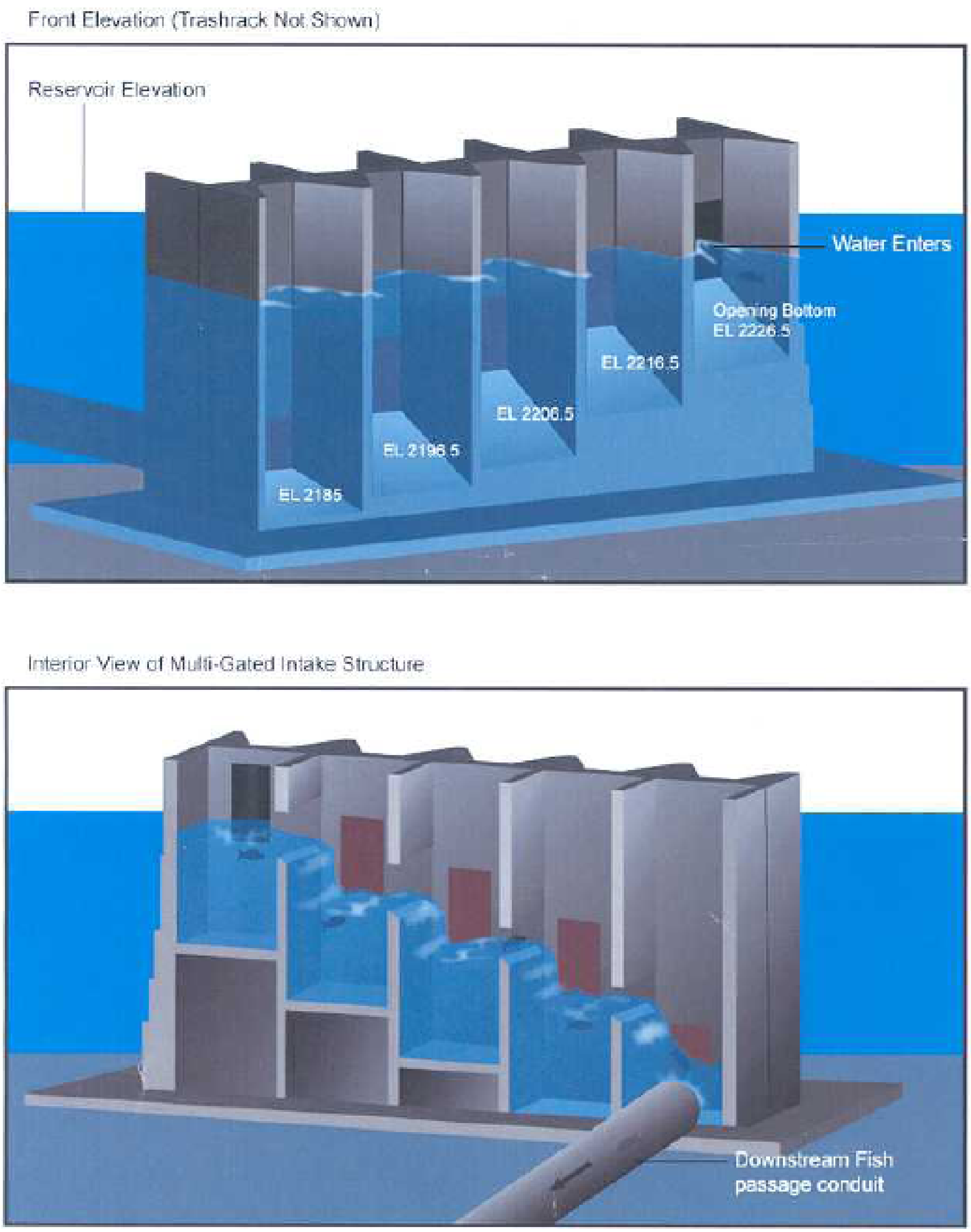

Figure 1 - Schematic of multi-level juvenile intake structure proposed for downstream passage.

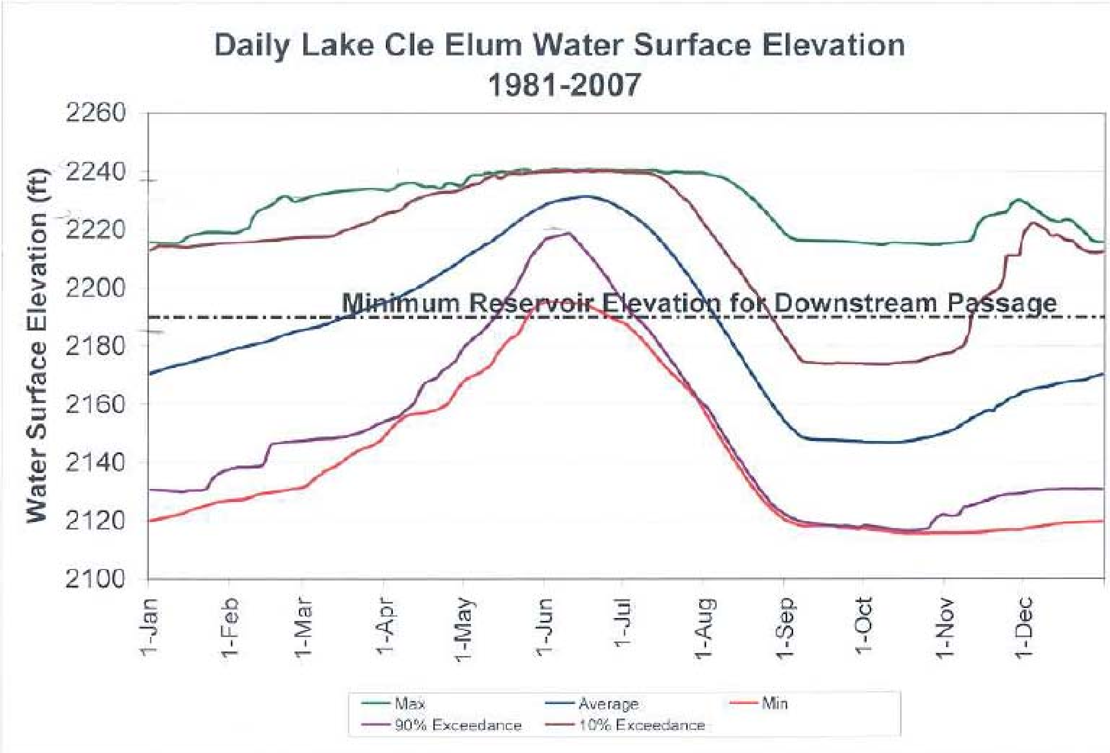

Figure 2 – Exceedence plot of reservoir elevation for the year. The bottom intake is at El. 2185 ft and the maximum reservoir water surface elevation is 2240 ft.

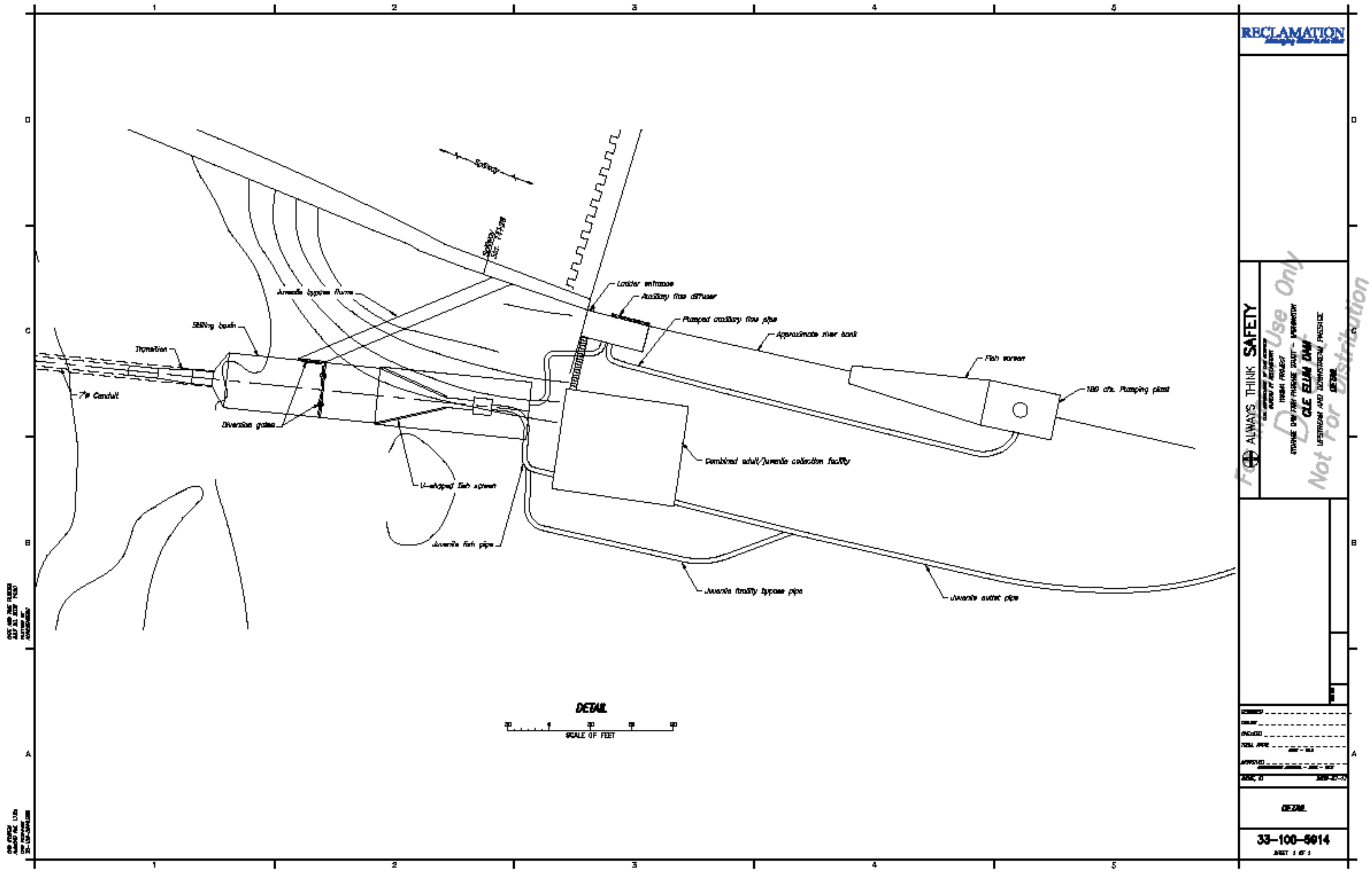

Figure 3. - Preliminary rough layout of the VP proposal for the right bank upstream trap and haul facilities and downstream passage exit with juvenile tagging facility included.

Photograph 1 - View of 3,200 ft^3/s flow discharging from the outlet works tunnel. Note that it appears the water surface in the stilling basin is above the invert of the outlet works tunnel.

Photograph 2 - View from the right bank of spillway stilling basin and downstream river with high outlet works flow.

Photograph 3– Close up view of the downstream extent of the whitewater resulting from a outlet works discharge of 3,200 ft^3/s. The view is from the right bank looking downstream toward the left bank.

Photograph 4 – View looking downstream at right bank from the end of the spillway stilling basin.

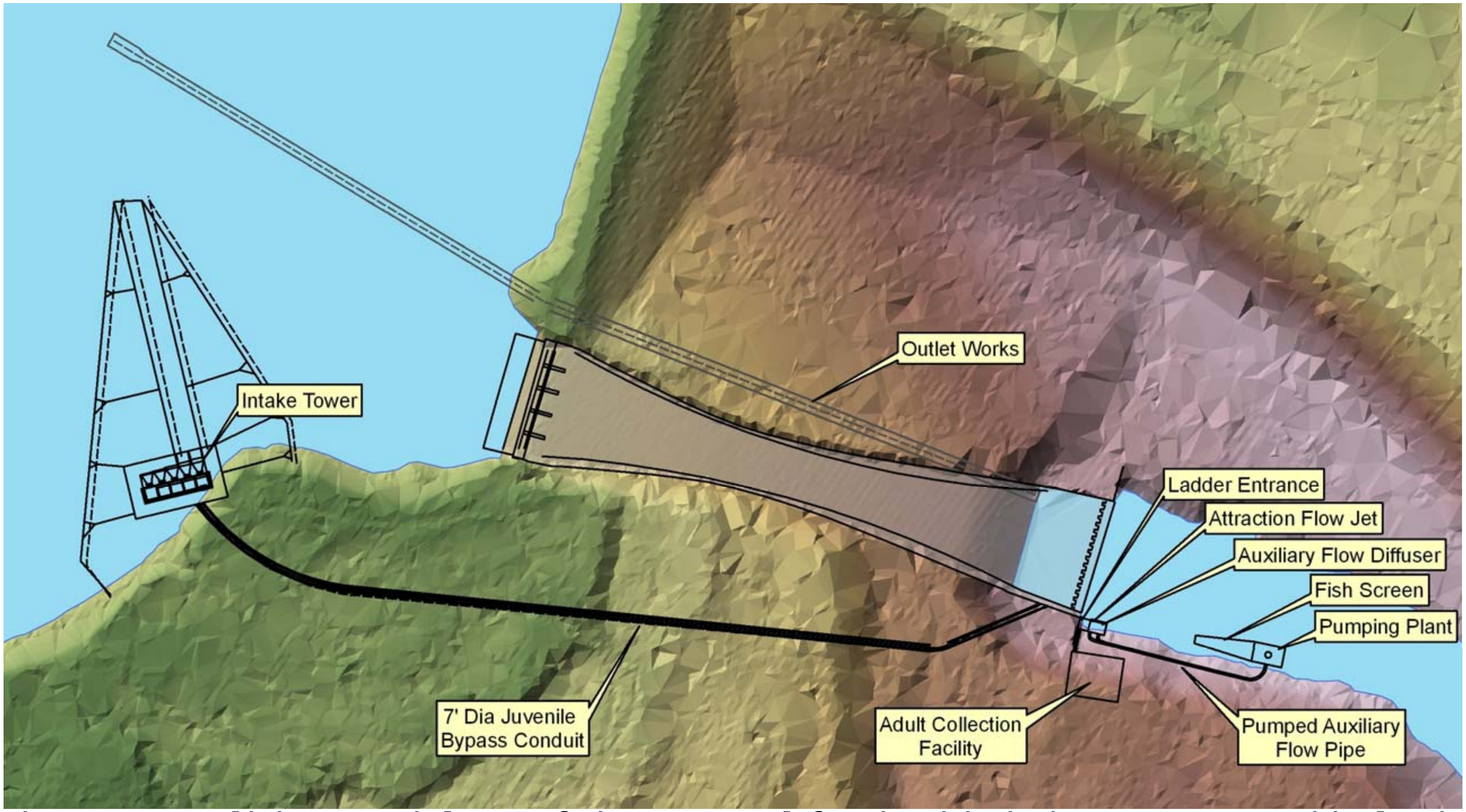

Figure 4. - Preliminary rough layout of the VP proposal for the right bank upstream trap and haul and downstream passage exit facility with the removal of the juvenile tagging facility.