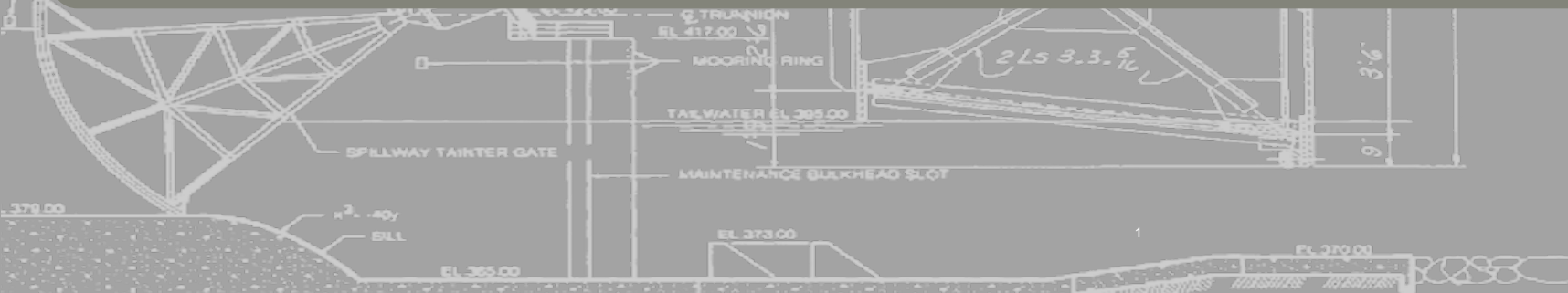


FOSTER DOWNSTREAM FISH PASSAGE FOLLOW-ON IMPROVEMENTS WFFDWG PRESENTATION

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05 March 2019



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NOTE:
TAMPER GATE

AGENDA

- The New Fish Weir Delivery
- RM&E results
- Alternatives for design improvements
- Questions and Discussion



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NEW FISH WEIR

- The New Fish Weir was delivered and installed early March 2018
- Initiated post construction evaluation in March 2018
- Preliminary results indicate the collection efficiency increased substantially compared to the old weir
- However, high rates of injury and mortality were observed after passage



LOCATIONS IDENTIFIED TO BE CAUSING INJURY

- Majority of the injuries were strikes on the concrete spillway (sensor fish data)
- Additional injuries were scrapes and bruises as fish traveling down the spillway (sensor fish data)



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ALTERNATIVES FOR IMPROVEMENTS

1. Modification to Fish Weir Shape or Location
2. Concrete Retaining Piers on Spillway
3. Pipe from Fish Weir Outlet to Spillway Surface
4. Inflatable C-Shaped Water Catch
5. Non-Movable Angled Stream Catch on Spillway
6. Movable Shell-Shaped Stream Catch on Spillway
7. Inflated Flume Mounted to the Fish Weir
8. Landing Pool (two options)
 - i. Static Removable Slide Gate
 - ii. Pneumatic Bottom Hinged Weir Gate



ALTERNATIVES FOR IMPROVEMENTS

1. Modification to Fish Weir Shape or Location

- This alternative would involve changes to the current weir to increase the velocity water stream. This would reduce the impact angle of the water stream, increasing the angle of the point of impact on the spillway.
- Modifications to the current weir are restricted by the size of the opening in the road deck, limiting changes to the dimensions of the weir. The PDT do not envision any changes that would significantly increase downstream travel of the stream.
- The option of lowering the weir to submerge the entrance and create a larger head differential on the opening was also reevaluated. This option was considered in the original EDR and found to be unsafe and ineffective for fish passage. The PDT determined this design will not be considered for design evaluation and analysis.



ALTERNATIVES FOR IMPROVEMENTS

2. Concrete Retaining Piers on Spillway

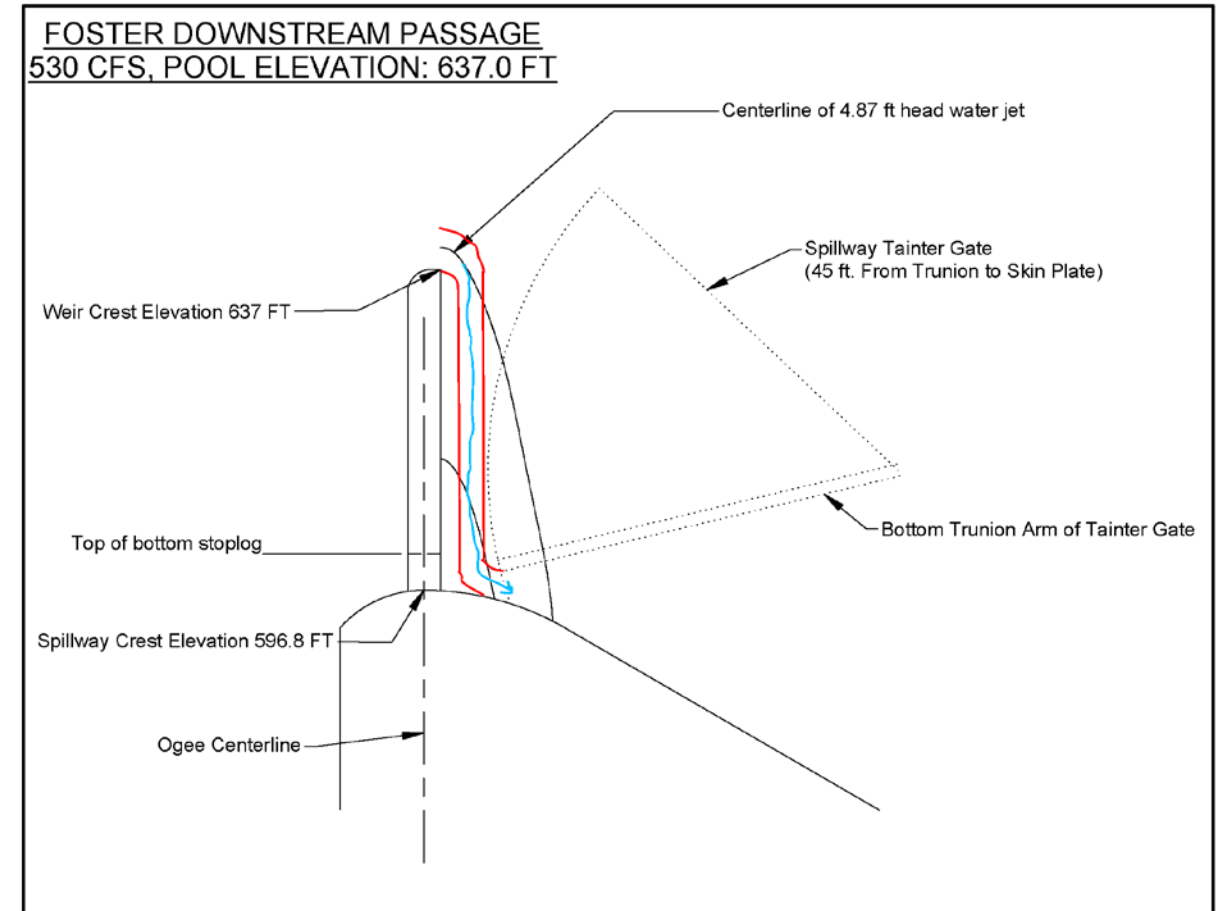
- This option is the placement of concrete walls on the spillway around the landing area of the water stream to prevent water from spreading on the chute.
- This alternative is untenable from a dam safety perspective and would significantly affect the current spillway capacity.
- This alternative will not be carried forward for design evaluation and analysis.



ALTERNATIVES FOR IMPROVEMENTS

3. PIPE FROM FISH WEIR OUTLET TO SPILLWAY SURFACE

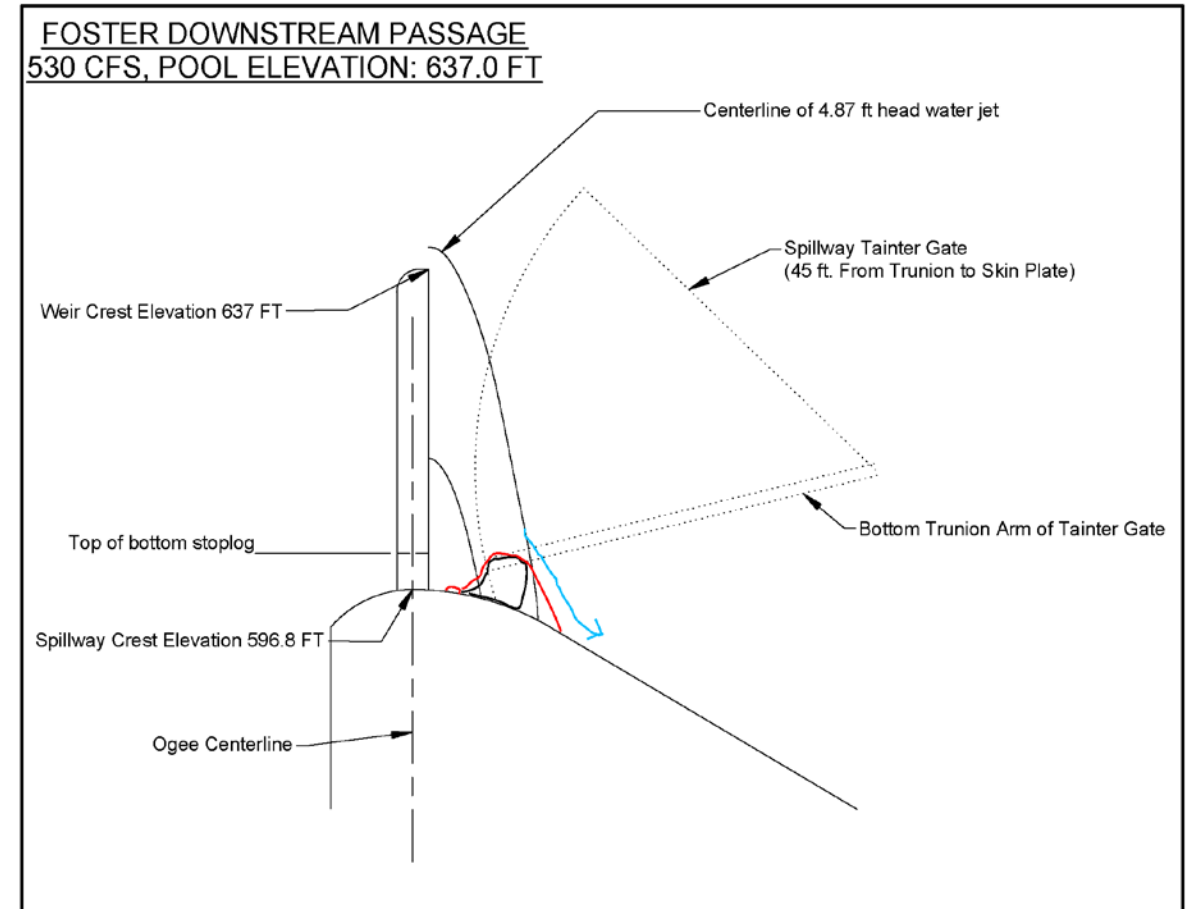
- This option involves the installation of a rigid pipe from the downstream side of the weir, vertically traveling down to the spillway face and releasing out onto the spillway chute.
- The pipe would be supported through attaching it to the weir and to the spillway piers.
- Multiple pipes would be needed for the different pool levels, or a pipe that could change length would be required.
- The PDT determined this design will not be carried forward for design evaluation and analysis because of the lack of clearance between the downstream side of the stoplogs and the tainter gate, concerns of loads applied to the stoplogs to support the pipe, and debris inside the pipe.



ALTERNATIVES FOR IMPROVEMENTS

4. Inflatable C-Shaped Water Catch

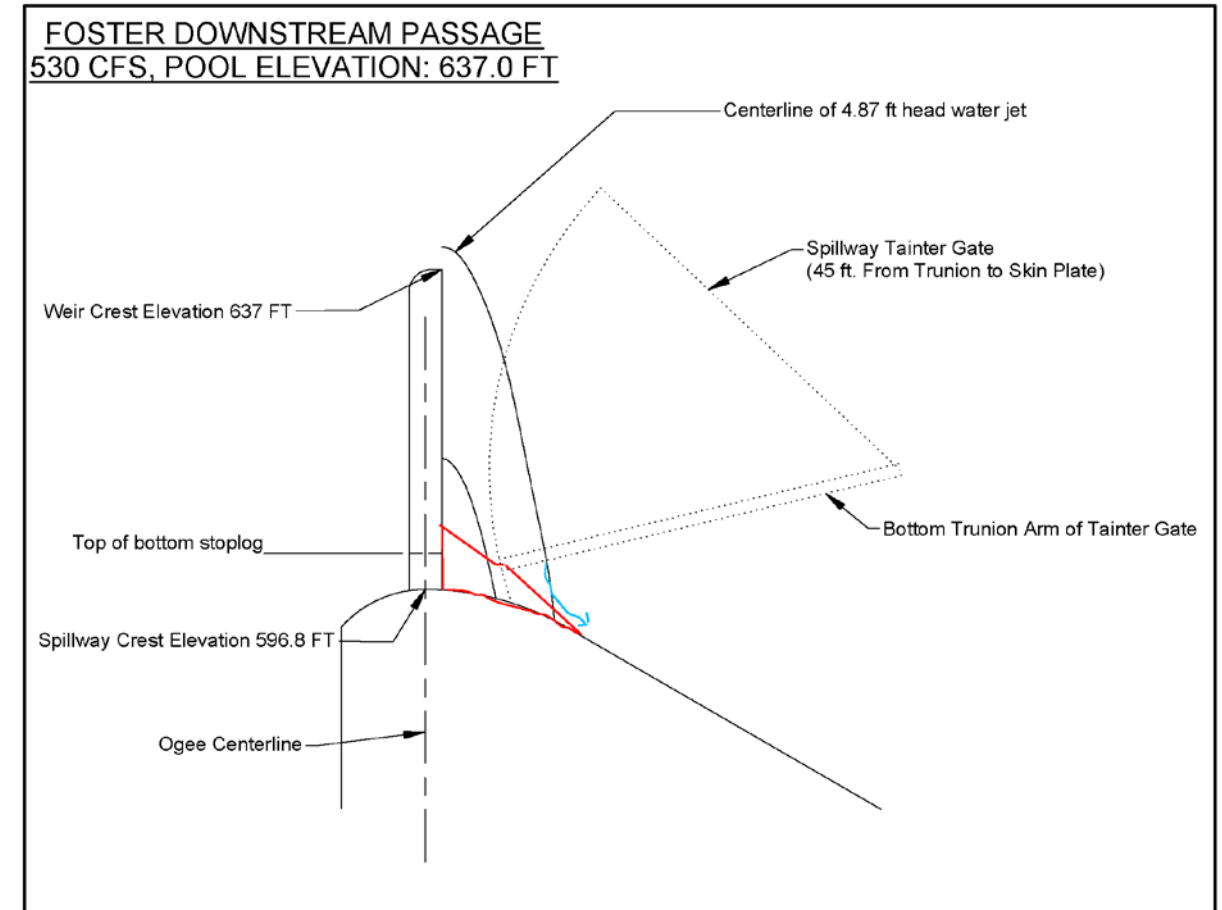
- This option would mount a large inflatable “C”-shaped rubber tube on the spillway. The downstream edge of the center of the “C” shape would have a rubber flap to the spillway surface to act as an angled catch for the water stream. The points of the “C” shape would act as sidewalls to restrict the stream from flowing towards the pier faces and direct the flow down the spillway.
- The inflatable tube would be mounted to the spillway using brackets and bolts. The entire tube section could be deflated to return the spillway to normal spill operations.
- The PDT determined this design will not be considered for design evaluation and analysis because of concerns about the modification to the spillway required to mount such a large amount of rubber. This is a dam safety concern.



ALTERNATIVES FOR IMPROVEMENTS

5. NON-MOVEABLE ANGLED STREAM CATCH ON SPILLWAY

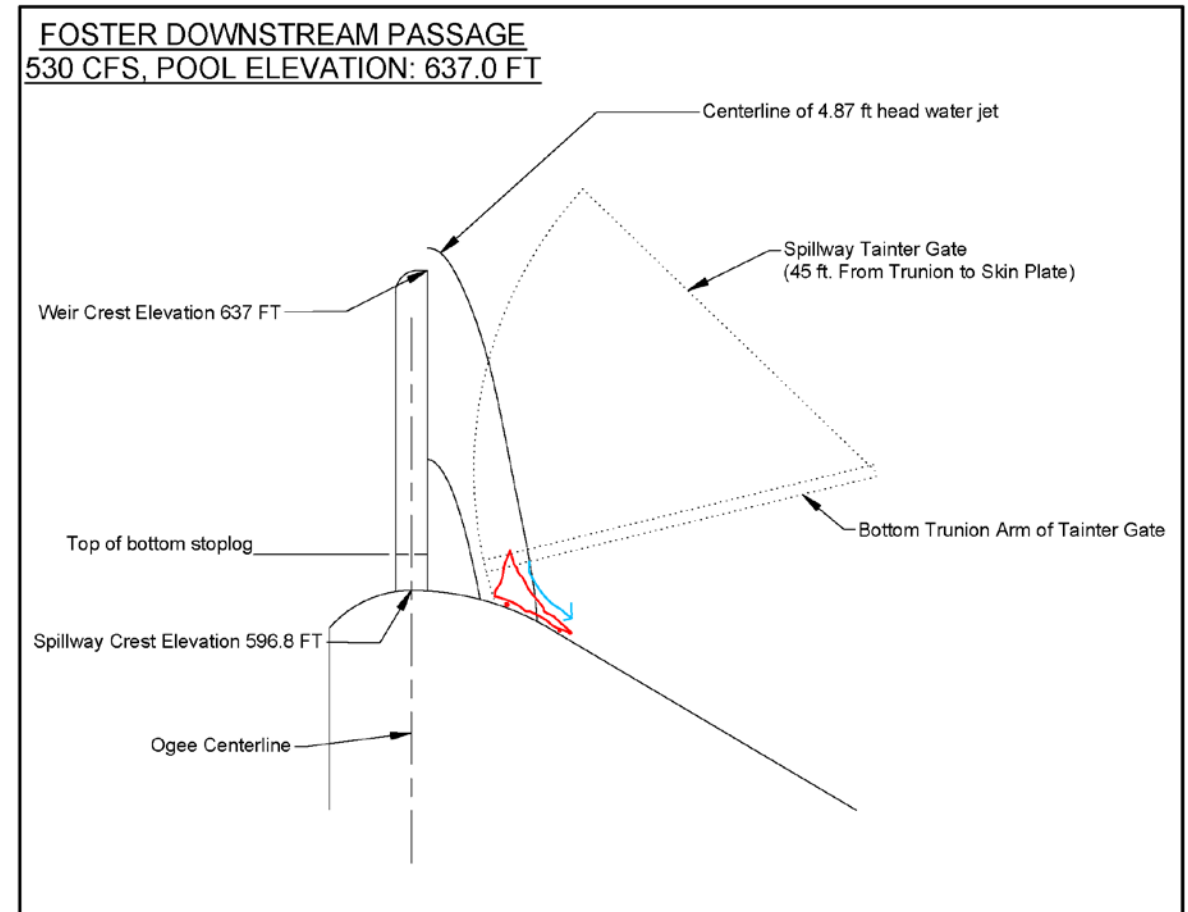
- This option involves the placement of an angled water catch of approximately 45 degrees covering the entire spillway face from pier face to pier face that would catch water and direct it down the spillway.
- The location of the high pool, high flow impact point, the tainter gate seal line, and the non-moveable solution would require that the tainter gate seal on the device.
- The large device would require significant changes to the spillway for installation and would have to be removed to return the spillway to original condition for spill when necessary.
- This design will not be considered for evaluation and analysis because of constructability and dam safety concerns.



ALTERNATIVES FOR IMPROVEMENTS

6. MOVEABLE SHELL-SHAPED STREAM CATCH ON SPILLWAY SURFACE

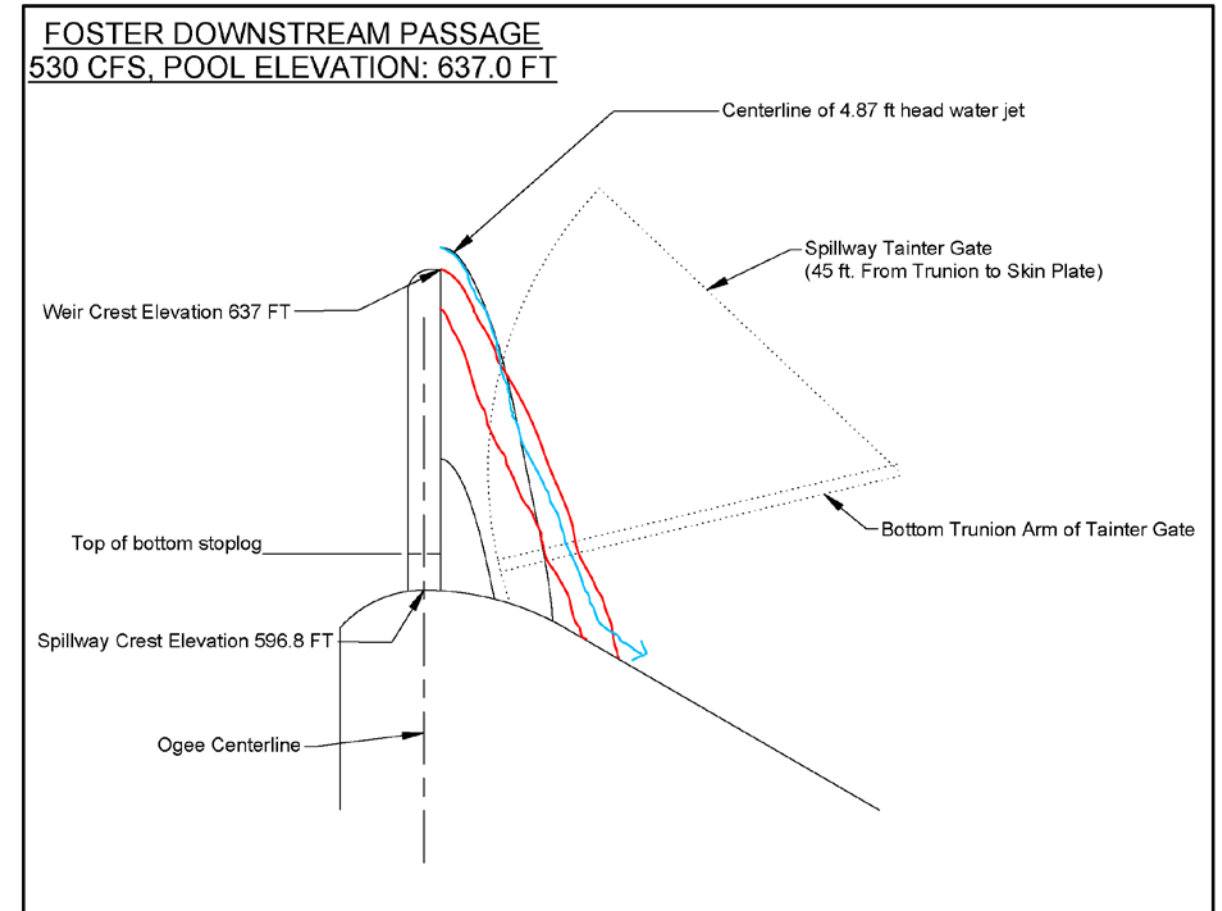
- This option is a 20 foot wide shell shaped moveable water catch on the spillway surface constructed of HDPE and/or steel.
- This device would catch the water stream and direct it downstream through its curved shape. The shell shape would keep the water stream from spreading towards the pier faces and direct constricted flow down the spillway.
- The device would move on wheels and be held in place by cables connected to the upper deck through a pulley system. The device would be lowered down the spillway to close the tainter gate and would have to be removed to return the spillway to regular service.
- This design will not be carried forward for evaluation and analysis because of the size, constructability, and dam safety concerns.



ALTERNATIVES FOR IMPROVEMENTS

7. INFLATED FLUME MOUNTED TO THE WEIR

- This option is an inflated flume attached to the downstream side of the weir that would catch the water stream and carry it to spillway, approximately 40 feet down the spillway face with at least 5 foot high sidewalls to provide a channel for water.
- This device would be released from the weir and floated downstream if the spillway has to be returned to regular spill operation.
- Concerns were raised about the ability of an inflated flume to maintain shape and resist damage under load from the water stream and debris. Additionally, the weight of the flume mounted to the back of the current weirs or stoplog would add significant loads to the stoplogs.
- This design will not be carried forward for evaluation and analysis because of the size, constructability, and dam safety concerns.



ALTERNATIVES FOR IMPROVEMENTS

8. LANDING POOL

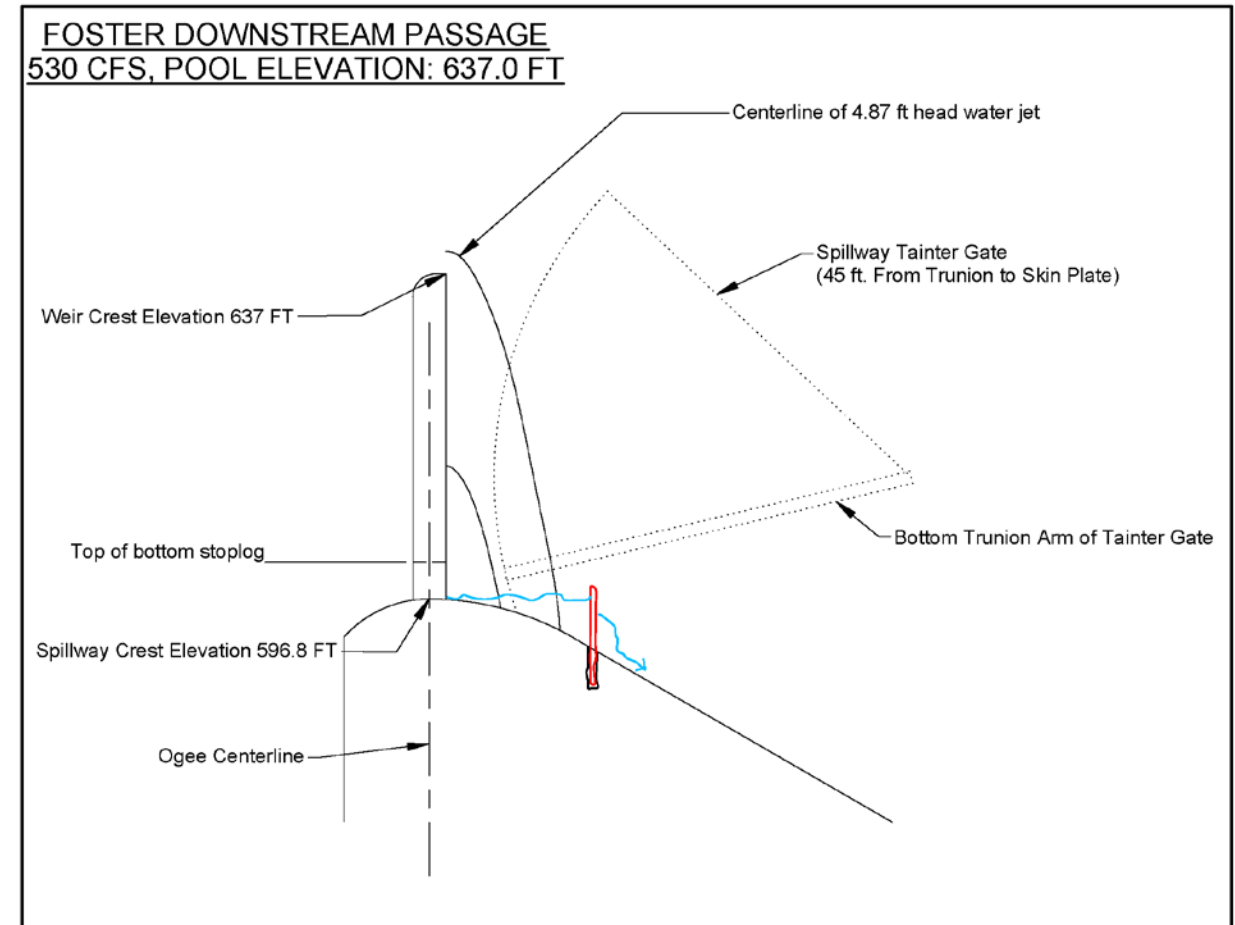
- This option has two different gate designs that would create a landing (plunge) pool for the weir stream to dissipate the energy of the fall and provide a safe landing for the fish on the spillway.
- The pool would be created by a gate located approximately x feet downstream from the spillway crest and approximately x feet downstream from the landing point of the maximum flow and weir height water stream. This pool would extend from pier face to face and from the downstream side of the stop logs to the proposed gate.
- This requires a gate height of approximately x feet at the chosen location on the spillway, with the height of the water against the stoplogs of x feet. Fish would pass over the gate and fall a short and safe distance onto the spillway.



ALTERNATIVES FOR IMPROVEMENTS

8. LANDING POOL - STATIC REMOVABLE SLIDE GATE

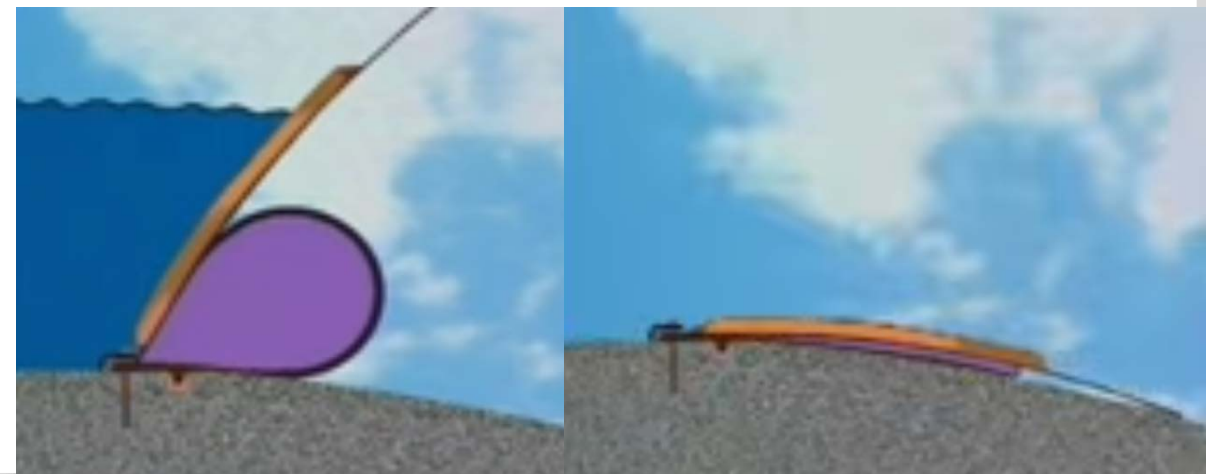
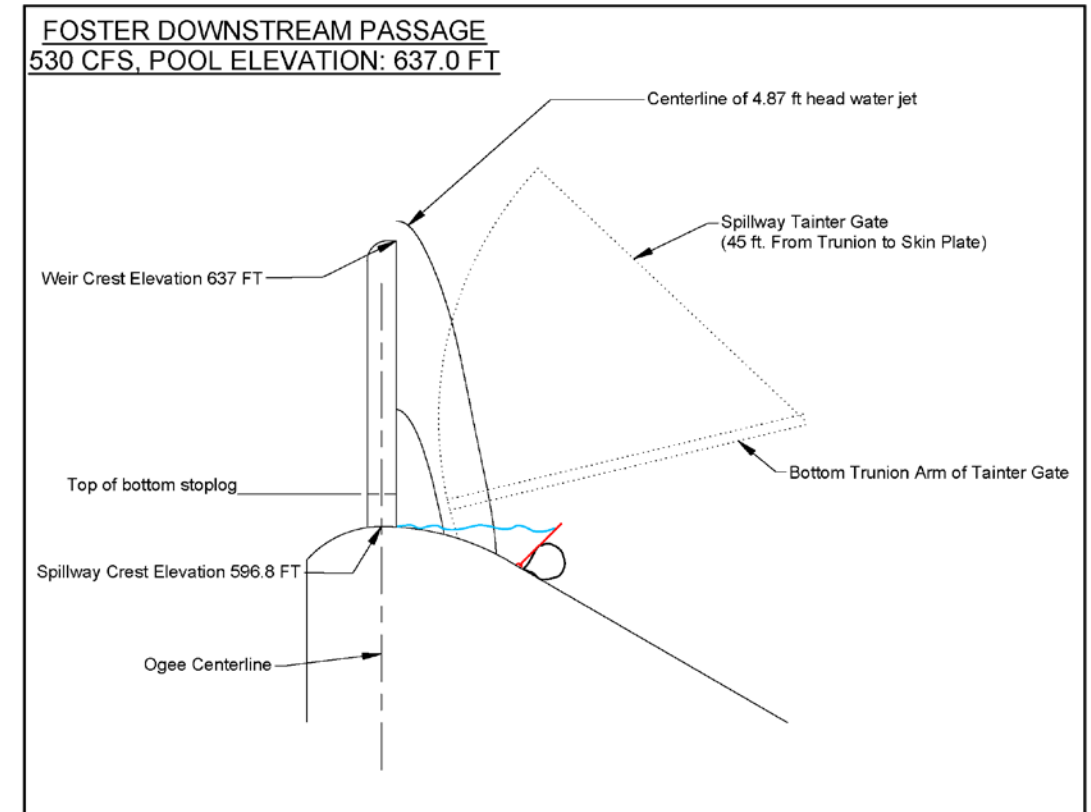
- This option has several segmented bulkhead style gates across the spillway. Each section of gate would be supported by a removable bollard style I-beam slide gate slot.
- One gate would be shorter than the others to create a localized weir for fish passage.
- To return the spillway to regular spill ops, the gates and bollards would be craned out of the spillway and the remaining slot holes would be filled.
- This design offers a promising combination of versatility and a well-established product, and will be carried forward for evaluation.



ALTERNATIVES FOR IMPROVEMENTS

8. LANDING POOL - PNEUMATIC BOTTOM HINGED WEIR GATE

- A pneumatically actuated bottom hinged gates similar to Obermeyer Hydro would be installed across the spillway at the chosen location. Each hinged gate would be supported by a pneumatic bag.
- Passage down the spillway would be accomplished by lowering one segment of the gate to act as the secondary weir.
- To return the spillway to normal operation the entire gate would be lowered to parallel with the spillway surface.
- This design offers a promising combination of versatility and a well-established product, and will be carried forward for evaluation.



QUESTIONS / DISCUSSION

