United States Department of the Interior

FISH AND WILDLIFE SERVICE

300 Westgate Center Drive
Hadley, MA 01035-9589

November 11, 2015

MEMORANDUM

To: Susquehanna River Coordinator, Maryland Fishery Resources Office, Annapolis, MD
Attention: Sheila Eyler, Fish and Wildlife Biologist

From: Jesus Morales, Hydraulic Engineer, Fish Passage Engineering

Subject: Inspection of fishways at Holtwood Hydroelectric Project (FERC #1881)

A seasonal inspection of the fish passage facilities at the Holtwood Hydroelectric Project (Project) was performed at 1:30 pm on Wednesday, 05/06/2015. The Project is owned and operated by the PPL Electric Utilities. The USFWS (Service) review team was led by Sheila Eyler. Consultants from Normandeau Associates, Inc., and personnel from the Maryland Department of Natural Resources and from the Pennsylvania Fish and Boat Commission were also present.

This site review included the newly retrofitted upstream passage facilities. From the top floor of the fish lift, the group observed a lift cycle in process for each one of the two hoppers. The first hopper serves the entrance channel that catches fish from the tailrace, and the second hopper serves the channel that catches fish from the spillway side. PPL typically operates their fishway from the beginning of April until early June. PPL also operates the fishway through the summer and fall for resident fish.

Based on this review, the salient passage issues appear to center on safety concerns at the exit channel, excessive debris accumulation at the exit of the fishway, mechanical issues at the entrance gate, and high velocity barriers at the tailrace of the Project:

Exit channel:

- Fish transfer - The first hopper, which catches fish from the tailrace, sluices fish out of the hopper and into the exit channel through a chute. This chute forces the fish against one of the exit channel sidewalls. To minimize risk of injuries to the fish, once again, the Service suggests that a pipe or curved extension with a smooth bend could be added at the end of the chute to guide the fish safely into the center of the channel.

- Debris issue – Same as the previous year, significant debris was observed at the waterway upstream from the exit channel, stacked against the trash rack. The amount of debris material was enough to be considered a potential cause of delay and possible source of injury for migrating fish trying to exit the lift.

Entrance gates:

- Mechanical issues - While on-site, the fishway operators informed the Service personnel that the adjustable entrance gate at the spillway area was in-operable for most of the migratory season because of mechanical difficulties, and had to be kept fully opened. This fully-opened position resulted in no head differential between the water surface elevations of the entrance channel and the tailrace (the Service recommends to maintain a head differential of 4 to 6 inches at the entrance of any fishway). The ability of an entrance gate to properly track the tailwater elevations is crucial to the effective performance of a fishway to attract and guide migratory fish. The Service recommends that the operators run the fish lift prior to the start of the fish migration season to check that all mechanical elements are working properly.

Tailrace bathymetry:

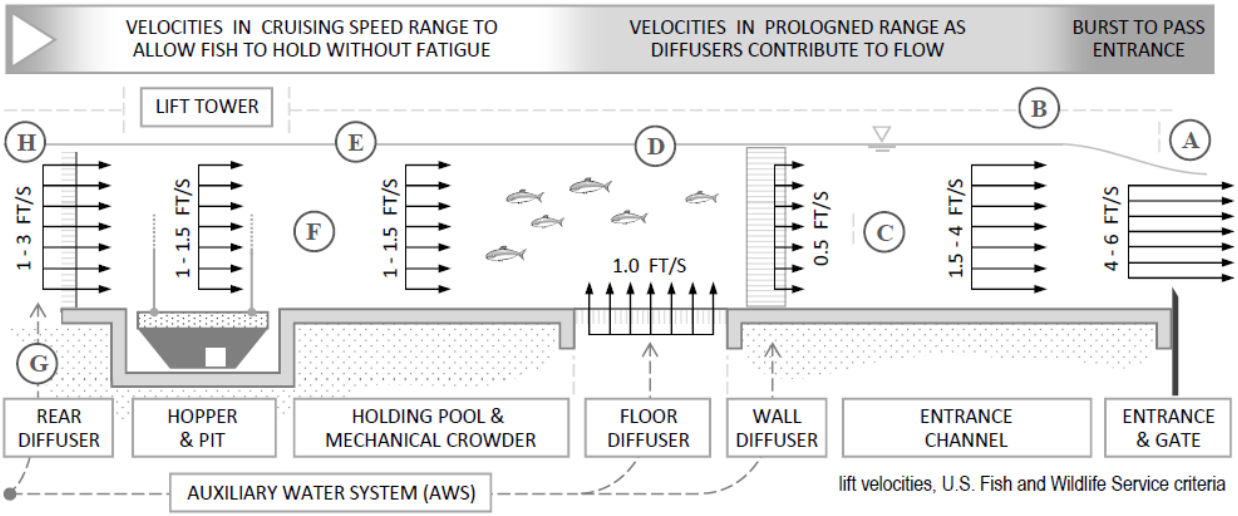
- High velocity barriers - After extensive stream work in the tailrace to provide target migratory fish with a continuous and accessible low velocity zone of passage all the way into the fishway, the Licensee and its consultants have identified that undesired high velocity areas still remain. The Licensee informed the Service that they intend to go back into the tailrace sometime in the next year, prior to the 2016 migration season, to work on these and confirm that hydraulic conditions within the Project are adequate for the safe and timely passage of all target migratory species.

Additional observations made during this review:

- The new Obermeyer Pneumatically Actuated Spillway Gates were being installed this year with the goal of enhancing fish passage performance for the entrance located below the spillway.
- There was no attraction water supply (AWS) diffuser operating at the fishway channel from the spillway side. All of the fish passage flow was coming from behind the hopper. This could potentially result in water velocities at the crowding pool higher than the recommended by the Service (1 to 1.5 feet per seconds). Velocities at the different stages of the fish lift should be verified and compared with the Service's criteria for hydraulic conditions at a fish lift (see appendix for a *Fish Lift Reference Card*).
- Personnel from Normandeau Associates currently operate the fish lift at Holtwood based on an operation scheme matrix that was produced by Kleinschmidt. The Service respectfully requests to have access to this matrix for our own review.

Thank you for the opportunity to participate in this review. We look forward to supporting your efforts to restore the Susquehanna River ecosystem. For questions please contact Jesus Morales at 413-253-8206.

Appendix



lift velocities, U.S. Fish and Wildlife Service criteria

BIOLOGICAL LIFT CAPACITY

$$n_H = V\left(\frac{60\ min}{1\ hr}\right)\frac{r}{w_f \forall_c [1 + C_n]}$$

n_H is the lift biological capacity in fish per hour
V is the volume of the component in ft^3
r is the cycle time in lifts per minute
w_f is the nominal weight of the target species in lbs
C_n is the non-target species allowance
$\forall_c$ is the crowding limit: hopper = 0.10 ft^3/lb †
holding pool = 0.25 ft^3/lb

† crowding limit is valid for lift cycle times of 15 m or less

A. Attraction jet is created by acceleration due to entrance (lift) gate operations; jet typically results in 0.5 – 2.0 foot hydraulic drop into TW.
B. Flood walls and other lift components should be designed to protect against a 50-year flood event.
C. Flow in the entrance channel, downstream of the diffusers, should be streamlined and free of eddies and aeration.
D. Diffuser velocities are maximum point velocities; upwelling and aeration from the AWS should be minimal.
E. Depth in lower flume should be greater than 4 feet at all times.
F. Flow above hopper and in holding pool should be free of aeration.
G. As much AWS flow as possible should be discharged behind the hopper.
H. AWS dissipators should be designed to remove excess energy from flow.

USFWS Northeast Region (R5)
Fisheries, Fish Passage Engineering
B. Towler, 07/29/2014

FISH LIFT