Jun 19th, 2:30 PM - 2:50 PM

Design and Development of Fish Passage Facilities for Shortnose Sturgeon at a Northeast Hydropower Project

Jesse Waldrip
Kleinschmidt

Steve Amaral
Alden

Follow this and additional works at: https://scholarworks.umass.edu/fishpassage_conference

https://scholarworks.umass.edu/fishpassage_conference/2017/June19/14

This Event is brought to you for free and open access by the Fish Passage Community at UMass Amherst at ScholarWorks@UMass Amherst. It has been accepted for inclusion in International Conference on Engineering and Ecohydrology for Fish Passage by an authorized administrator of ScholarWorks@UMass Amherst. For more information, please contact scholarworks.library.umass.edu.
Design and Development of Fish Passage Facilities for Shortnose Sturgeon at a Northeast Hydropower Project
Hadley Falls Dam

- 30-ft high, 985-ft long dam
- Located at RK 129
- 18-mile long impoundment
- Hadley Unit 1 installed in 1950, replaced in 2015
  - 15 MW Kaplan turbine
  - Hydraulic capacity of 4,520 cfs
- Hadley Unit 2 was installed in 1983
  - 15 MW fixed blade propeller turbine
  - Hydraulic capacity of 3,750 cfs
- Five 3.5 ft high automated Rubber Dam sections on the spillway crest
- Canal – Hydraulic capacity of 3,000 - 6,000 cfs
Existing Fish Passage

- Two Fish Lifts with entrances in the spillway and tailrace
- Bascule gate and rubber dam used as surface bypasses
- Louver guidance array in canal with bypass discharge into tailrace
Existing Fish Passage

Fish Lift Entrance

Downstream Bypass

Fish Lift Entrance
Downstream Fish Passage Background

- Holyoke Hydroelectric Project - New license 1999
- ESA-listed shortnose sturgeon
- Diadromous species (blueback herring, American shad, sea lamprey, and American eel)
- Settlement Agreement - March 12, 2004
- Cooperative Consultation Team - Multi-year program of research and analysis to address a permanent solution for downstream passage
- This research has included:
  1. 5 years of flume studies - Conte and Alden Labs;
  2. 4 years of sturgeon radio tracking studies;
  3. Effectiveness testing of the 2-inch spaced full depth louvers;
  4. Analysis of the total river flows and desk-top I/E estimates;
  5. CFD analysis of flows that fish would experience with proposed enhancements.
Components of Conceptual Design

- Angled bar rack – 2-inch clear bar spacing; 2-3 ft/s approach velocity
- Surface bypass – modified version of existing uniform acceleration weir
- Submerged bypass – 5 ft/s entrance velocity
Bypass Details

- Surface bypass - bascule gate bay modified with new 12 ft wide uniform acceleration weir
- Submerged bypass - comprised of 3 ft wide by 18 ft high entrance with a 2 ft rounded partition at mid-height separating flow/fish into two separate 3 ft by 3 ft conduits
Bypass Discharge Details

- A new flow deflector was built at the downstream end of the apron below the Bascule Gate to direct the bypass discharge up and over the upstream entrance.
- A new plunge pool was built 2-ft from the flood wall and 24-ft from the dam apron.
- Plunge pool has sloped sides, bottom length of 35-ft, and bottom width average 15-ft.
- Plunge pool depth at the normal tailwater elevation is 16-ft.
- Plunge pool is lined with concrete to provide scour protection.
A 3D Computational Fluid Dynamics (CFD) model was used to evaluate hydraulic conditions with respect to agency criteria and develop the final design of the fish passage facilities.
CFD Modeling – Rack and Bypasses

Approach velocities 0.5 ft upstream of angled bar rack
CFD Modeling – Flow Streamlines Surface Bypass
CFD Modeling – Flow Streamlines Submerged Bypass
CFD Modeling – Bypass Discharge
Construction
Construction
Angled Bar Rack Construction
Fish Lift Entrance Enhancements
Plunge Pool Construction
CFD Model and Post-Installation
CFD Model and Post-Installation
Results to Date

- Studies to determine downstream passage efficiency are ongoing.
- In 2016, 94 shortnose sturgeon were lifted before being returned downstream.
  - 79 unique shortnose sturgeon entered the fish lift (15 repeats).
  - 11 previously tagged shortnose sturgeon
  - There were 5 times more shortnose sturgeon entering the fish lift in 2016 than any previous year (Maximum number lifted was 16 in 1996).
- In 2016, 385,930 adult American shad were lifted upstream at Holyoke Dam.
  - This was higher than the 60-year (1955 to 2015) annual mean of 309,119 shad.
  - It was the eighth highest annual count during the 60-year period.
Design and Development of Fish Passage Facilities for Shortnose Sturgeon at a Northeast Hydropower Project

Jesse Waldrip, P.E.
Jesse.Waldrip@kleinschmidtgroup.com
(207) 416-1256

Steve Amaral
amaral@aldenlab.com
(508) 829-6000 ext. 6415

Thank you!