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Passage of aquatic species

Puntledge Power Station, Canada

A novel penstock screen design on the Puntledge Power Station intake, in Canada, separates juvenile anadromous fish from power station inflows and returns them safely to the river below, vastly reducing fish mortality during downstream migration.

Overview

In 1913, Canadian Collieries Ltd. completed the construction of a hydroelectric facility on the Puntledge River to supply power to local coalmines. The facility consisted of an impoundment dam on Comox Lake, a low diversion dam, an intake structure 4 km downstream of Comox Dam, and a flume and penstock system conveying the water to a powerhouse a further 7 km downstream.

In 1953, the British Columbia Power Commission initiated a project to expand the facility, a project completed in 1956. The new facility included a 5.1 km long penstock from the diversion dam to a 24 MW powerhouse located on the right bank of the Puntledge River.

The facility was acquired by BC Hydro in 1962.

Dam name

Scheme operator
BC Hydro

Country
Canada

River
Puntledge

Construction years
1913 (completion of original facility)
1953 (upgraded facility)

Size of scheme (MW)
24

Catchment area
450 km^2

Effective reservoir capacity

Reservoir size

1993 (retrofitting of screens)

External recognition

Association of Professional Engineers and Geoscientists 1995 Environmental Award Competition Design, Construction and Monitoring Phase, presented for design and construction of Eicher penstock fish screens.

Electric Power Research Institute (EPRI) contribution to the Electrical Industry and Customer in the development of new technology

Electrical Power Research Institute (EPRI) 1994 Generation and Storage Product Champion, presented to Mr. H.A. Smith at BC Hydro

Details

Historically, the Puntledge River supported significant salmon and steelhead trout populations and was considered to be one of the more important salmon fisheries on the east coast of Vancouver Island. Construction of the impoundment dam on Comox Lake in 1913 affected production of coho salmon, summer chinook salmon and steelhead trout, all of which had historically spawned in tributaries of Comox Lake.

The expansion project provided for upstream migration of adult fish at both dams. However, juvenile fish migrating downstream were forced to migrate through the turbines and the estimated 60% morality rate resulted in immediate and drastic declines in salmon stocks.

Initial studies for facilitating downstream migration of juvenile fish considered the use of louvers, drum screens and vertical screens to prevent fish from entering the turbines. These studies concluded that screens of the type patented by George Eicher, would provide an economical solution if placed over the capped penstocks at the Puntledge Diversion Dam. The screens consist of a wedge-wire partition installed in a steel penstock at a low angle to the flow, and pass fish through a bypass pipe branching from the top of the penstock. The design is unique in two ways; it uses much higher approach velocities at the screen than conventional screens, and the travel time along the screen is very short.

Retrofitting of the screens required excellence in engineering design, careful flow velocity modeling and significant modification of the existing infrastructure. However, the success of the fish screening project is clearly evident in the outcomes of extensive post-installation monitoring. Mortality of downstream migrating juvenile salmonids has been reduced from an estimated 60% to less than 1%.

Other Aspects

Siting & design
Few precedents existed for the use of Eicher screens on power station intakes. Designing screens that could be successfully retrofitted into the existing intake structures at Puntledge Power Station was a challenging task worthy of a number of design awards.

Multiple Use Benefits
The original hydropower facilities at Puntledge Dam were having a significant impact on the health of the salmonid fishery in the river and in Puntledge Lake. Retrofitting of fish screens has alleviated one of the principal causes of fishery decline, and is expected to significantly improve recreational and commercial fisheries in years to come.

Further information

Source: Hydropower Good Practices Workshop, Annex VIII - Examples for Good Practice Report, Villach, Austria, October 2005. International Energy Agency.

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