REEFTON HYDRO POWER FISH SCREEN CONCEPT REPORT

Engineers and Geologists

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1.0 Introduction

Riley Consultants Ltd (RILEY) has been commissioned by Reefton Hydro Power House Trust (RHPT) to prepare an engineering report for the construction of the proposed fish screen at Reefton Hydro Electric Power Scheme (RHEPS).

This document describes the concept design of the proposed fish screen for the intake on the Inangahu River.

2.0 Background

The RHEPS was first constructed in 1888 and was decommissioned in 1946. The scheme is of significant historical value given its age and some of the infrastructure associated with parts of the intake race and foundations of the power station is still visible. There is a community initiative to reinstate the power scheme with a peak flow of 3.5m^3/s and as much as possible to be constructed in the same location as the original scheme.

There are two recent reports prepared for the proposed scheme which are relevant to the fish screen which are:

- Reefton Hydro-electric Power Project Assessment of Aquatic Effects. Freshwater Solutions Ltd (April 2014).
- Proposed Hydro-electric Project Inangahua River: Assessment of Hydrological and Environmental Effects. Jowett Consulting Ltd (May 2013).

These reports provide suggested design criteria for a fish screen and we understand that from consultation with key stakeholders these criteria have been agreed.

3.0 Basis for Design of Fish Screen

The proposed scheme is to take a minimum of 1.4m^3/s and maximum of 3.5m^3/s of from the river while maintaining a minimum flow of 2m^3/s in the river between the intake and powerhouse. It is estimated that the scheme will operate for approximately 70% of the time.

The key species to be considered for the fish screening are Brown Trout and Longfin Eels. Given the low head and use of a Kaplan turbine fish smaller than 100mm long are considered to have a high survival rate of swimming through the turbine (Refer Jowett Consulting Ltd Report). The design criteria agreed with Fish & Game West Coast is a fish screen with bar/mesh size of 10mm and an approach velocity of less than 0.3m/s.

4.0 Fish Screen Options

The key aspects of the design of a fish screen are:

- Velocity of the flow into the screen (approach velocity), measured in front of the screen.

- Velocity of the flow past the screen (sweep velocity).
- Mesh size of screen.
- Fish bypass geometry and design.

These key factors need to be considered in determining the fish screen location and fish screen type. The other considerations in the selection relate to sediment, ease of operation/maintenance, construction costs and operating costs.

4.1 Location of Fish Screen

We have considered the following potential locations for a new fish screen:

- At the river intake.
- Between the river intake and the sluice structure.
- Immediately downstream of the sluice structure.
- At the power house.

4.1.1 At the River Intake

At this location the screens would be exposed to the river and the debris it conveys. During large floods there would be risk of blockage and also potential for significant damage to the infrastructure and therefore, we have concluded there are no obvious feasible options for a fish screen at the river intake

4.1.2 Between the River Intake and Sluice Structure

The fish screen could be located immediately upstream of the sluice structure or utilise the sluice structure for the fish bypass back to the river.

At this location the control of water levels and flows will be limited. There will also be issues with debris and sediment. This location is better than at the intake but likely to require significant maintenance to keep the fish screen clean particularly during higher river flows.

4.1.3 Immediately Downstream of the Sluice Structure

Locating the fish screen after the sluice structure will ensure the screen is within a controlled environment for flows/water levels and will reduce the maintenance issues associated with debris and sediment blocking the screen.

In additional to the fish screen, the sluice structure could be designed to provide four functions which are:

- A debris screen for larger debris.
- A sluice function for sediment back to the river from initial section of intake and race.
- Flow control gate to control flow downstream to the powerhouse.
- Flood gate which could be fully closed in very high flows to avoid significant quantities of sediment and debris downstream in race.

This is considered the best location for the fish screen.

4.1.4 At the Intake to the Power House

A fish screen could be constructed upstream of the intake to the proposed power house. This would be similar in concept to the screen immediately downstream of the sluice structure. The main issue with this location is that it is a significant distance downstream from the river intake and would require longer bypass back to the river.

4.2 Fish Screen Type

There are a number of different types of fish screen that have been considered. The screens considered as potentially appropriate for the RHEPS based on the design criteria are:

- Flat screen without automatic cleaner (manual cleaning required).
- Rotary cylinder screen.
- Travelling flat screen.

A fish screen located upstream of the sluice will need to be suitable for a much higher sediment and debris load and therefore would likely require a cleaning system built-in. If the screen is located downstream of the sluice then a screen with a manual cleaning system is considered suitable.

From discussions with RHPT it is understood that a flat screen with manual cleaning is preferred option.

4.3 Proposed Fish Screen Location and Type

From an assessment of the different options, RHPT have decided to proceed with a flat screen located just downstream of the sluice structure. This is deemed to be the best location and screen type for the design. Figure 1 shows the location of the proposed fish screen immediately downstream of the existing sluice structure.

Figure 1: Location of proposed new fish screen

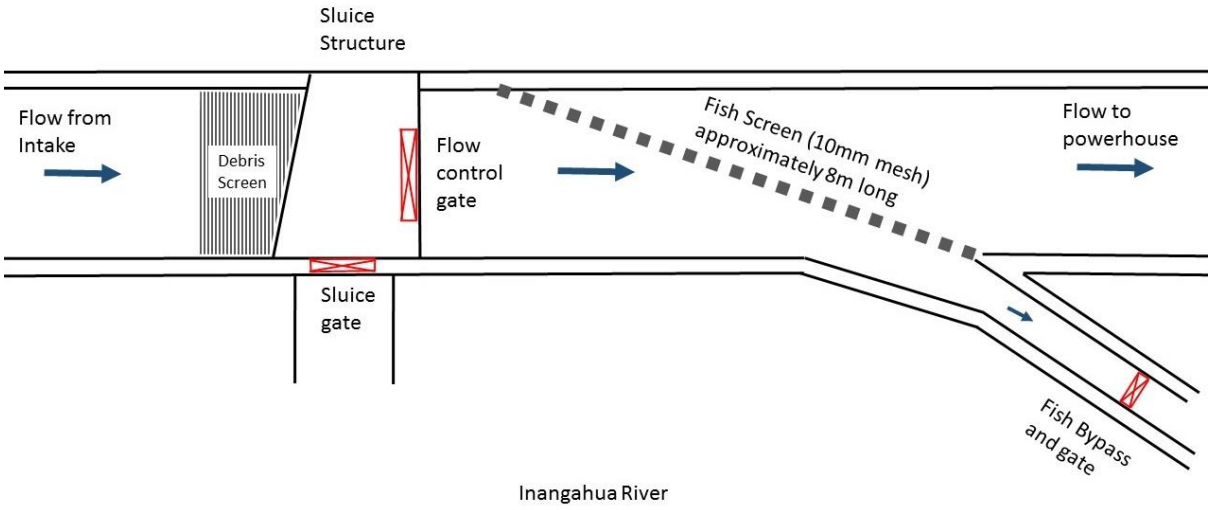
5.0 Fish Screen Design

Figure 2 shows a schematic of the proposed fish screen located immediately downstream of the existing sluice structure. A debris screen with large spacing will be located upstream of the sluice structure for larger debris. This will require manual cleaning following any significant rivers flows.

The sluice structure will include a main flow control gate or stop log system to control flows downstream and could be used to close off the flow during maintenance or extreme flood events.

The fish screen will be located immediately downstream of the sluice and will be designed to meet the criteria of 10mm mesh/bar spacing and 0.3m/s approach velocity. The screen will be angled across the race to achieve the approach velocity requirements with a sweep velocity towards a fish bypass back to the river. The fish bypass will have a gate or stop log system to control flows in the bypass back to the river. The fish screen will need to be manually cleaned but the sluice gate and debris screen upstream will reduce the quantities of sediment and debris at the fish screen.

Figure 2: Layout of fish screen and bypass channel



6.0 Limitation

This report has been prepared solely for the benefit of Reefton Hydro Power House Trust as our client with respect to the brief. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such parties' sole risk.

The hydraulic analyses and recommendations contained in this report are based on our understanding and interpretation of the available information. The recommendations are therefore subject to the accuracy and completeness of the information available at the time of the study. Should any further information become available, the analyses and findings of this report should be reviewed accordingly.

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