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Woundale Beck Hydro

Flood Risk Assessment

September 2018

Hydropower Consultancy & Development

Document Control

Scheme Name: **Woundale Beck**
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Document Control			
File Name:	NTWD-DOC-Flood Risk Assessment-B-100918-DM		
	Original Rev A	**Revision B**	**Revision C**
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Approved by:	A. Cropper	S. Phillips	
Date:	07.09.18	10.09.18	
Status:	Client Review	Approved	
Comments:			

CONTENTS

1. INTRODUCTION

This document presents a flood risk assessment of the site of a proposed new hydro scheme on Woundale Beck, Windermere, Cumbria. Woundale Beck is located on National Trust land, with a proposed abstraction (intake) location of 341371 506386, and a proposed discharge point of 341905 505832.

2. FLOOD FLOWS

The Low Flows Enterprise Model was used to calculate flood flows. The Q0.1 figure is 1.719m^3/s. This represents the flow that occurs 0.1% of the year, or a 1 in 1000 flow event. It is not the peak flood flow which we can expect during exceptional climate change events and is based upon historic data. The historic rainfall data used for these flood flow figures reflect less extreme weather than the future is likely to entail. Therefore this project has been designed with flood flows of as much as 10m^3/s in mind.

3. FLOOD ZONE

The reach is subject to flooding however the area is constrained by the natural banks formed by these events. Whilst the intake weir will be located in the flow of the river and contained wholly within in the 'flood' zone; the pipeline and powerhouse will be located outside of the flood zone as seen in Figure 1 (Selected location shows the powerhouse location).

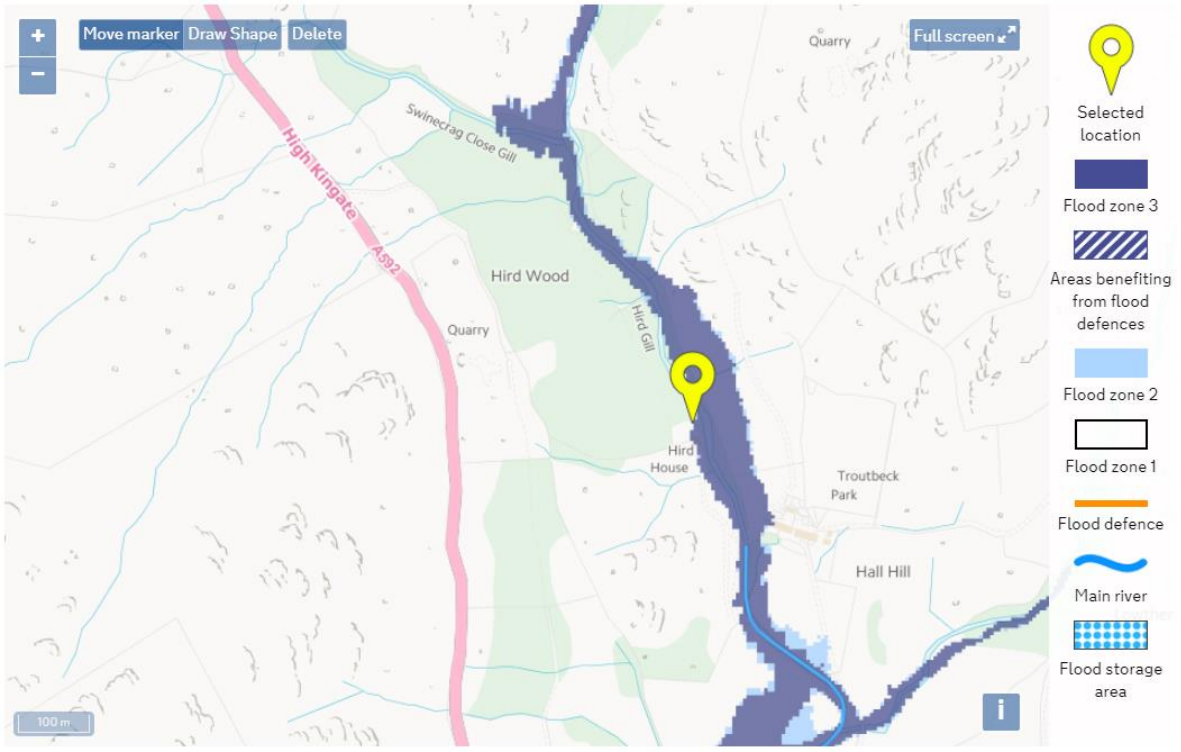

Figure 1: EA Flood Map

4. INTAKE WEIR

The new weir is to have an elevation (i.e. crest level of Coanda screen) of 266 mAOD. The wing walls joining the northeast and southwest banks are both to be at an elevation of 266.4mAOD. The crest level replaces the natural crest level of the waterfall immediately upstream while the wing walls tie in to natural bedrock banks on either side. These levels allow flood flows to pass over within the bounds of the weir without causing any increased flood risk upstream of the weir. Backfilling of bed material immediately upstream of the intake weir will further offset the risk of a build-up of flood waters behind the structure.

In the event of full weir failure, no rush of water would be in occurrence, the material held back being gravel rather than water as no significant weir pool will be present given the size of the structure. All ancillary equipment has been located in the bank area, resulting in a low-profile structure that matches the existing topography as far as possible.

5. FLOOD PROTECTION

The intake structure can be completely submerged without adverse effect. The structure has a very low profile and is structurally reinforced to ensure that high waters will not cause damage to the structure or the integrity of the weir.

The powerhouse will be located above the extent of the flood area and further flood protection for the turbine house will be provided by the use of flood resistant construction methods and materials. The floor is entirely concrete and building materials for the turbine house walls comprise of breeze blocks. The turbine house floor drains at its lowest point into a drain which is discharged to the river via the turbine outflow pipe. The floor level of the turbine house will be 150mAOD. All electrical equipment is to be a minimum of 1m above floor level and as per standard design the control system shuts down automatically during an electrical malfunction.

There is a section of the penstock that will cross Woundale beck. To protect the penstock from flood flows the pipe will be raised above the watercourse to an extent that is significantly above the flood flow. The penstock will also be protected by supported each end in concrete..

In the very long term, if climate change affects both sea levels and the frequency of ‘tropical’ storms, then there may be a risk from storm surges, however this is likely to be beyond the lifetime of the scheme as proposed at this location. The powerhouse access area will be made up from permeable material (gravel) with the surrounding area having good vegetation. Local drainage from around the powerhouse will be discharged via the outfall directly into the river, and surrounding land which falls towards the river naturally.

6. CONCLUSION

Given the above information, the development of the proposed scheme on Woundale Beck is unlikely to alter flood risks in any manner; and floods are unlikely to pose a risk to the project's infrastructure.