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Hazelford Weir Hydroelectric Project

Flood Risk Assessment

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Introduction

1.1 This assessment is associated with planning and Environment Agency consent applications for a hydropower scheme and associated infrastructure at Hazelford Weir. Please see the relevant supporting statement for general background information on the site and proposed development.

1.2 The applicant for this project is the Canal and River Trust, which is also the landowner and navigation authority at the site.

1.3 This site-specific assessment follows guidance set out the Communities and Local Government Guidance on Flood Risk Assessment for Developments Planning Policy Strategy 25 (2010). It also makes reference to EA Product 7 Flood Data and Newark and Sherwood District Council Strategic Flood Risk Assessment (SRFA).

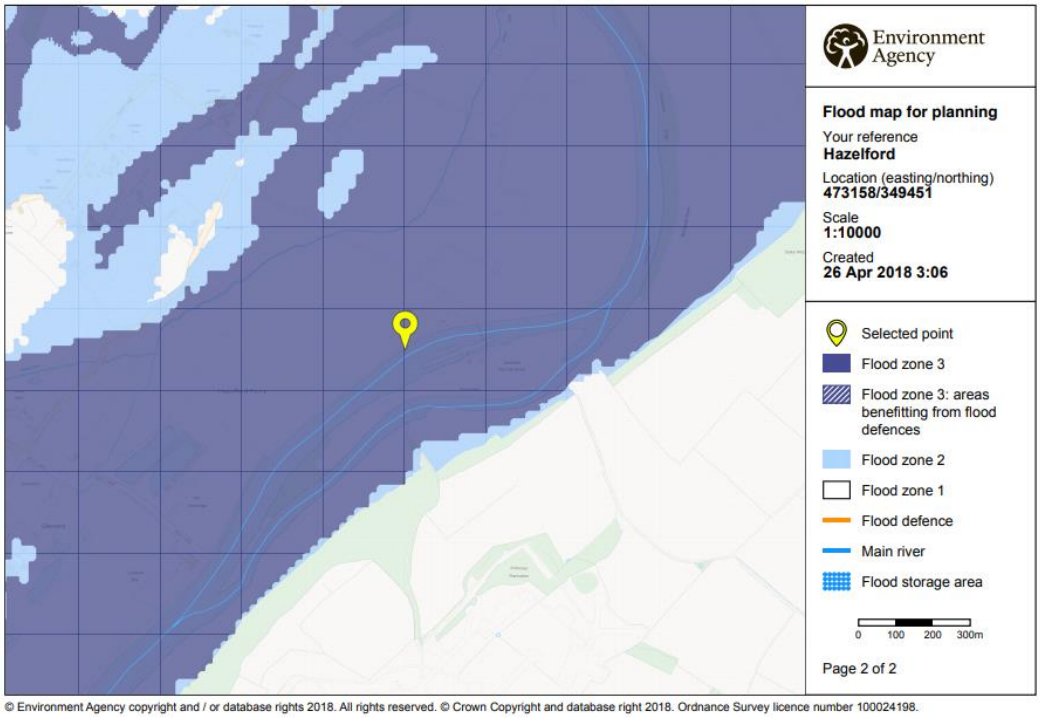
1.4 The development is water compatible, with reference to the vulnerability classification (table D.2, annex D, PPS25).

1.5 The development site is located in the functional floodplain of the River Trent. The River Trent is tidally influenced however the predominant risk of flooding within Nottinghamshire is fluvial flooding.

1.6 Figure 1 below shows that the development is located in Flood Zone 3, which is appropriate for its function (table D.1, annex D, PPS25). An exception is appropriate under the Exception Test because the development is water compatible and it is infrastructure (table D.3, annex D, PPS25).

1.7 The latest relevant flood data for the site were obtained from the Environment Agency.

Figure 1 – Environment Agency Flood Map



Definition of the flood hazard

1.8 Appraising the sources of possible flood water, the SFRA signals surface water, sewers, groundwater and reservoirs/canal sources. The river Trent has a residual flood risk in a 1 in 100 year flood event.

Proposal description

1.9 The River Trent at this point flows along two channels separated by an island and canal lock. The two channels diverge around 1 km upstream of the site and re-converge around 350 m downstream. Separate weirs are located within each channel. The weirs serve the purpose of maintaining navigation levels between Hazelford and Gunthorpe.

1.10 The proposal comprises a Kaplan turbine, adjustable weir crests along both weirs, two new multi-species fish passes, two new eel passes, a turbine house, hydraulic channels, fish screening, access improvements, an electrical substation and underground cabling.

1.11 The proposal will not result in any changes in water level outside the range normally experienced at the site. However it will slightly alter the frequency at which certain water levels occur as described below.

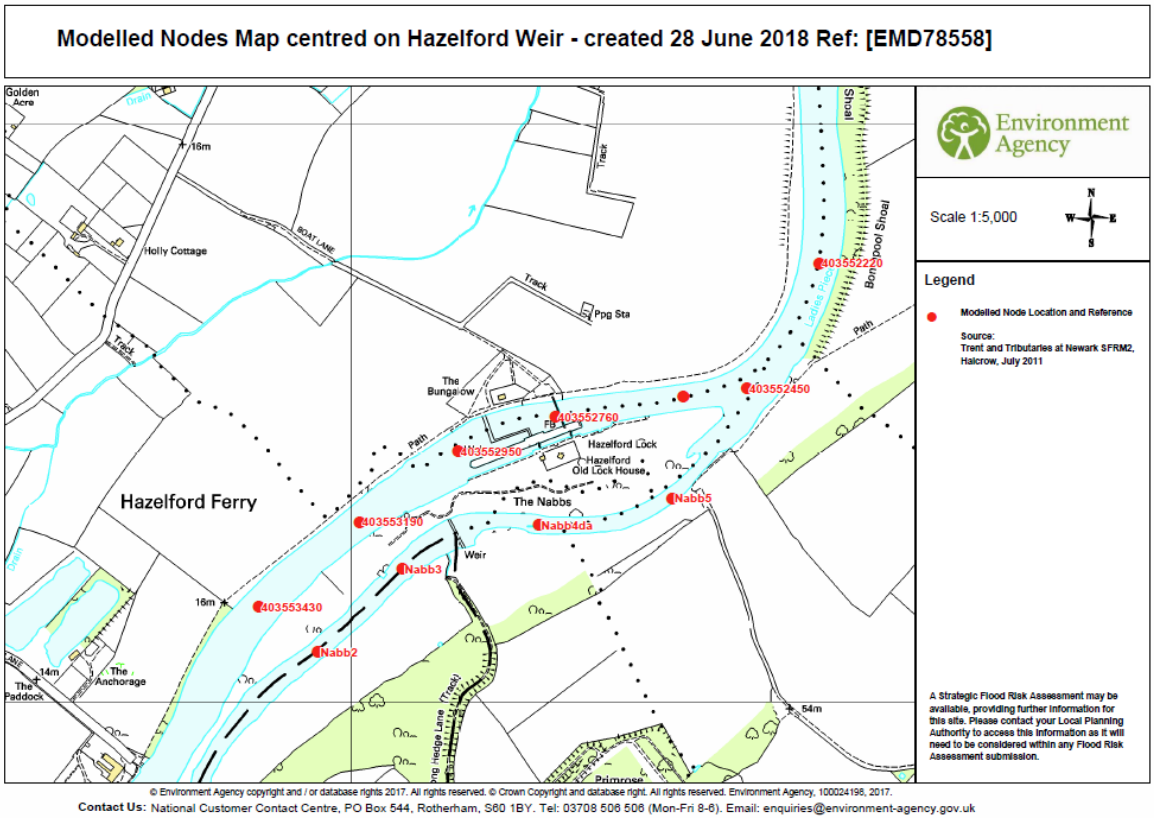
1.12 The proposed main weir crest will have a maximum crest level of 13.10 mAOD during low flows, which is 0.60 m above its existing level. The secondary weir crest will be marginally lower at 13.07 mAOD, which is 0.57 m above its existing level, to provide a higher hands-off flow in this channel. As flow increases the secondary weir crest will gradually lowered to maintain, as far as possible, a water level equal to approximately 13.3 mAOD, which is the existing mean level plus 0.3 m. This water level currently occurs during a flow condition of around Q10. Once the secondary weir crest has returned to its existing level, the main crest will be gradually lowered in the same manner. The secondary weir will be lowered first, to maximise. During high flows the weir crest levels will be as existing.

1.13 The weir crests will include a fail-safe mechanism to ensure that they automatically lower, in a controlled manner, during loss of power or communications.

1.14 The adjustable weir crests allow operation of a hydropower scheme without resulting in unacceptable 'drawdown' of water levels, and provides greater control over the navigational waters between Hazelford and Gunthorpe.

Summary of Flood Levels from Product 7 data at node point reference 403552950 *source: Trent and Tributaries at Newark SFRM2, Halcrow, July 2011	
Typical bank level	15.0 mAOD
Weir crest level	12.50 mAOD
Flood levels	
100 year flood 1% AEP	15.29 mAOD
100 year flood + Climate Change	15.49 mAOD
1000 year flood 0.1% AEP	15.79 mAOD

Figure 1 – Environment Agency Node Map



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Historic flood events

1.15 The River Trent at Hazelford is a large river with a catchment area of 7,675 km^2. The hydropower scheme and associated infrastructure are located in the functional floodplain of the River Trent.

1.16 The River Trent has a long history of significant flooding in this area. Flood defences were built in 1947 after flooding affected 28 miles of road, 3000 properties and 86 factories in the city centre. Following another flood event from 2000, the Environment Agency worked with partner organisations to study the flood risk over the entire length of the River Trent and its main tributaries. The Nottingham Left Bank Flood Alleviation Scheme (FAS) was subsequently developed by the Environment Agency.

Probability

1.17 From the Environment Agency's flood data, the flood level immediately upstream of the weir during the 1 % Annual Exceedance Probability (AEP) is modelled to be 15.29 mAOD; with 0.1% Annual Exceedance Probability (AEP) the level is 15.79 mAOD. These levels are well above the typical bank level, which is around 15.0 mAOD.

Climate change

1.18 The EA flood data includes 1 in 100 year levels with a 20% climate change allowance. This increases the levels from 15.29 mAOD to 15.49 mAOD.

Flood risk management measures

1.19 The hydropower scheme will not be operational during times of extreme flood. Therefore, providing access to and from the building in times of flood has not been considered necessary.

1.20 Water level sensors will be installed on both sides of the weir to allow automation of the hydropower scheme and adjustable weir crests. During very high flows, the weir crests will be lowered to the existing crest level and as such the flood conveyance area will be as existing. As a result, the adjustable weir crests will not increase flood risk.

1.21 The weir crests will include a fail-safe mechanism to ensure that they automatically lower, in a controlled manner, during loss of power or communications.

1.22 No maintenance of the hydropower scheme or weir crests will be carried out during high flow conditions.

1.23 All electrical equipment will be protected against flood damage to at least the 1 in 100 year (+ climate change) flood level, which is 15.49 mAOD.

Off-site impacts

1.24 Building on the floodplain increases the risk of flooding to upstream property as well as the proposed development. However, at only around 200m², the turbine house represents a small fraction of overall floodplain and as such makes a negligible contribution to flood risk.

1.25 The run-off from the proposed development will not greatly change due to the small footprint of impermeable surfaces and additional capacity of the hydropower channels.

1.26 A number of minor tributaries and other discharges are present upstream of Hazelford Weir. These discharges may experience a change in water levels to the same extent as the main channel. However as the weir will return to its existing level during flood conditions, there will be no increase in flood risk associated with any of the discharges.

1.27 As the adjustable weir crests will be fully lowered during flood conditions, the flood conveyance capacity of the channel will remain as existing.

Residual risks & mitigation measures

1.28 During construction, all excavated material will be moved off-site, away from the canal bank. The appointed contractor will be required to provide appropriate method statements, risk assessments and mitigation measures under the EA environmental permitting process. Appropriate cofferdam structures will be used.

1.29 The hydropower scheme includes steel screens to exclude fish and debris from the hydropower channels. These will be cleaned very regularly, to avoid loss of energy generation due to head losses.

1.30 All minor ancillary equipment will be stored inside the turbine house or off-site to prevent it being lost during a flood event.

1.31 There is potential during the construction phase to temporarily dewater very small sections of the river channel. The construction method statement will include site-specific requirements to ensure no further drainage of existing wet areas, or diversion of existing drainage channels, occurs.

1.32 Operatives will be able to monitor operating conditions, including upstream water levels remotely. The associated risks and compliance enforcement will be managed by the operator.

1.33 Frequent routine inspections of the HEP scheme will be carried out. Planned maintenance is dependent upon the specific requirements of the individual items of equipment but maintenance will be in line with the manufacturer's recommendations to ensure smooth and reliable operation.

1.34 Any weir crest maintenance operations will only be carried out after consultation with the Environment Agency, CRT and any other affected parties.

Environmental permit

1.35 An application for a new bespoke environmental permit (flood risk activities) will be submitted to the Environment Agency. This will include a risk assessment and management system.

Conclusions

1.36 The hydropower scheme will automatically shut down and the adjustable weir crest will return to existing crest levels during times of high flows. The scheme will not impede flows and the flood conveyance area will be unchanged.

1.37 The adjustable weir crest features a fail-safe mechanism to ensure that it lowers, in a controlled manner, during loss of power or communications.

1.38 The turbine house presents a negligible additional flood risk due to its small size within the floodplain.

1.39 All electrical equipment will be protected to a suitable flood level and the hydropower scheme has been designed to exclude debris.

1.40 Construction and maintenance works will only be carried out during relatively low flow conditions.

1.41 Environmental Permits will be obtained for both temporary and permanent works.

1.42 Overall the proposal is considered to be adequately protected against flood damage and will not present any additional flood risk to others.

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