

Beeston Weir Weir Modifications

Water Framework Directive Assessment

Document Control

| Version | Date of Issue | Author(s) |
|---------|---------------|--------------------------------|
| 01 | April 2019 | Richard Spurr Will Houghton |

Renewables First – Company

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Contents

| | | |
|----------|---|-----------|
| 1 | INTRODUCTION | 1 |
| | INTRODUCTION TO ASSESSMENT | 1 |
| | PURPOSE OF ASSESSMENT | 2 |
| | SITE DESCRIPTION | 2 |
| | CURRENT WFD STATUS | 3 |
| | PROPOSAL SUMMARY | 4 |
| | INTERACTION WITH OTHER HYDROPOWER SCHEMES | 5 |
| 2 | IMPACT ON WFD OBJECTIVES..... | 6 |
| 3 | DETAILED REVIEW..... | 8 |
| | CATCHMENT STATUS | 8 |
| | GEOMORPHOLOGY | 9 |
| | SITE DESIGNATIONS | 9 |
| | TERRESTRIAL ECOLOGY | 10 |
| | FISH PASSAGE | 12 |
| 4 | CONCLUSIONS | 13 |

1 Introduction

Introduction to assessment

- 1.1 This document has been produced in connection with an impoundment licence application for Beeston Weir crest adjustments on the River Trent.
- 1.2 The Environment Agency's Guidance for run-of-river hydropower: the Water Framework Directive, nature conservation and heritage dated December 2013 has been followed as part of this assessment.
- 1.3 The assessment will review the potential effects arising from the proposed scheme in relation to flow patterns and sediment availability.
- 1.4 The Water Framework Directive (2000/60/EC) (WFD) was passed by the European Union in 2000. It became part of UK law in 2003 with the issue of The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003.
- 1.5 The WFD is implemented regionally by river basins. Each river basin has a River Basin Management Plan (RBMP) which is updated every six years. The RBMP documents the current status of the water bodies and the pressures affecting them. It outlines the improvements that can be made within the current management period and the programme of investigations to be carried out.
- 1.6 The fundamental objectives of the WFD that apply to surface water bodies are:
 - Prevent deterioration of the status of water bodies
 - Achieve at least good ecological status and good surface water chemical status by a set date
 - Reduce pollution from priority substances and eliminate priority hazardous substances as defined by the European Commission
- 1.7 In addition to the objectives above there are further standards and measures to be met in areas defined as protected areas. These areas are listed in the RBMPs.
- 1.8 Artificial or Heavily Modified Water Bodies (AWB, HMWB) cannot achieve good ecological status as they are unable to get close enough to the required natural conditions. Instead the aim is to achieve good ecological potential.

- 1.9 The RBMPs detail the Environment Agency (EA) objectives specific to each water body that are designed to meet the WFD objectives. The proposed measures to meet the objectives are also given.

Purpose of assessment

- 1.10 This assessment has been undertaken to fulfil the requirements under the Water Framework Directive.
- 1.11 The EU Water Framework Directive requires environmental objectives be set for all surface and ground waters to enable them to achieve good status or potential for heavily modified water bodies by a defined date. One objective is to prevent further deterioration which can include changes to flow pattern, width and depth of channel, sediment availability/transport and ecology and biology.
- 1.12 This assessment looks at the current status of the water bodies that may be affected by the proposed hydropower system and discusses whether or not the proposal will deteriorate the ecological quality of the water bodies or prevent the water bodies from achieving good ecological status.
- 1.13 Any EA defined objectives and measures that are specific to the water body will be considered to determine if the proposed hydropower system will prevent these objectives and measures from being realised.
- 1.14 The assessment includes any cumulative or in-combination effects.

Site description

- 1.15 The application site is located at Beeston Weir, on the River Trent. The main weir consists of a masonry crest perpendicular to river flow, there is also a concrete side weir. The side weir faces an operational hydropower station and vertical slot fish pass.
- 1.16 The weir serves the purpose of maintaining levels for navigation upstream of the weir.

Current WFD status

| | |
|---------------------------------------|---------------------------------|
| Site Name | Beeston Weir |
| Location | Beeston Weir, River Trent |
| Post code | NG9 1NH |
| OS Grid Reference | SK 53566 35260 / SK 53513 35247 |
| Watercourse | River Trent |
| Water body name | Trent from Soar to The Beck |
| Water body ID | GB104028053110 |
| Management Catchment | Trent Lower and Erewash |
| River Basin District | Humber |
| Hydromorphological Designation | Heavily Modified |
| Current Ecological Quality | Moderate |
| Current Chemical Quality | Good |

| Classification Item | 2013 | 2014 | 2015 | 2016 |
|--|---------------|-----------------|---------------|---------------|
| Overall Water Body | Moderate | Moderate | Moderate | Moderate |
| Ecological | Moderate | Moderate | Moderate | Moderate |
| Supporting elements (Surface Water) | Moderate | Moderate | Moderate | Moderate |
| Biological quality elements | Good | Moderate | Moderate | Moderate |
| Macrophytes and Phytobenthos Combined | Good | <u>Moderate</u> | Moderate | Moderate |
| Invertebrates | Good | Good | Good | High |
| Hydromorphological Supporting Elements | Supports Good | Supports Good | Supports Good | Supports Good |
| Hydrological Regime | Supports Good | Supports Good | Supports Good | Supports Good |
| Physico-chemical quality elements | Moderate | Moderate | Moderate | Moderate |
| Acid Neutralising Capacity | - | High | High | High |
| Ammonia (Phys-Chem) | Good | High | High | High |
| Biochemical Oxygen Demand (BOD) | High | High | Good | Good |
| Dissolved oxygen | High | High | Good | Good |
| pH | High | High | High | High |
| Phosphate | Poor | <u>Poor</u> | Poor | Poor |
| Temperature | High | High | Moderate | Good |
| Specific pollutants | High | High | High | High |
| Chemical | Good | Good | Good | Good |

1.17 Pressures listed in the Mitigation Measures Assessment are:

- Navigation – Navigation including ports
- Local and Central Government – Flood protection
- Urban and transport – Urbanisation

1.18 Other probable reasons listed for not achieving good status are:

- Water industry – Sewage discharge
- Urban and transport – Transport Drainage

Proposal summary

1.19 Weir modifications are proposed to address navigational issues, whilst also increasing HEP energy production and reducing flood risk. Flow splits are designed to remain as-existing during normal flow conditions, ensuring that there are no significant changes to the weir pool environment or passability of the site for migratory fish.

1.20 The proposal includes the following works:

- Main weir
 - Removal of existing 300 mm beam
 - Installation of adjustable weir crest system
 - Creation of fish easement at left bank
- Side weir
 - Increase crest level by 200 mm
- Temporary works as required to construct the above

Interaction with other hydropower schemes

1.21 There are a number of proposed, consented and operational hydropower schemes and fish passes along the River Trent. Details of those within approximately 50 km are shown below:

| Site name | Distance from Beeston (km) | Fish pass | HEP |
|--|----------------------------|---|--------------------------|
| Burton Weirs | 45 | Rock ramp | Small scheme operational |
| River Dove (mouth) | 40 | n/a | n/a |
| River Derwent (mouth) | 12 | n/a | n/a |
| Sawley Weir | 11 | - | - |
| River Soar (mouth) | 8 | n/a | n/a |
| Thrumpton Weir | 8 | Partial barrier only | - |
| Beeston Weir | - | Vertical slot | Operational |
| Holme Sluices | 11 | Canoe slalom; Further passes planned | Operational |
| Stoke Weir | 16 | Possible alongside HEP | Under consideration |
| Gunthorpe Weir | 24 | Consented with HEP | Consented |
| Hazelford Weirs | 32 | Consented with HEP & at secondary weir | Consented |
| Averham (Staythorpe) Weir | 42 | Partial barrier only | - |
| <i>Newark Weir and Nether Weir may be bypassed via Averham Weir. Of these, Nether Weir has a consented HEP scheme.</i> | | | |
| Cromwell Weir | 54 | Consented with HEP | Consented |
| <i>Tidal reaches leading to Humber Estuary</i> | | | |

1.22 As shown below, the proposals will not result in any adverse impacts for each of the WFD classification elements. Any in-combination effects will be neutral or positive.

1.23 The proposals result in a small positive impact on fish passage and dissolved oxygen, which when combined with other improvements along the Trent will have an increased value.

2 Impact on WFD Objectives

2.1 The following table reviews the RBMP plan for the relevant Trent Lower and Erewash section:

| CATEGORY / Subcategory / element | Current status | Objective | Potential impact | Assessment |
|---|-----------------------|------------------|-------------------------|---|
| OVERALL WATER BODY | Moderate | - | | See subcategories below |
| ECOLOGICAL | Moderate | - | | See subcategories below |
| Supporting elements | Moderate | Good by 2027 | - | Details of pressures identified in Mitigation Measures Assessment are provided below |
| Biological quality elements | Moderate | Good by 2027 | - | The proposals will slightly improve fish passage, although the 'Fish' element is not currently assessed for this water body |
| Macrophytes and Phytobenthos Combined | Moderate | Good by 2027 | No impact | There will be no significant hydromorphological impacts of the proposal. Changes in water level will be within the range currently experienced. Overall, as there is no adverse impact on other related elements such as water quality, there will be no significant impact on macrophytes or phytobenthos. |
| Invertebrates | High | - | No impact | There will be no significant hydromorphological impacts of the proposal. Overall, as there is no adverse impact on other related elements such as water quality, there will be no significant impact on invertebrates. |
| Hydromorphological supporting elements | Supports Good | - | No impact | Please see the main text below for further detail on geomorphological impacts. There is no significant impact. |
| Hydrological regime | Supports Good | - | No impact | Flow splits will remain as-existing for the vast majority of flow conditions. Water level changes are minor and within the range normally experienced. |

| <u>CATEGORY / Subcategory / element</u> | <u>Current status</u> | <u>Objective</u> | <u>Potential impact</u> | <u>Assessment</u> |
|--|-----------------------|------------------|-------------------------|---|
| Physico-chemical quality elements | Moderate | - | No impact | See individual elements below |
| Biochemical oxygen demand (BOD) | Good | - | No impact | There will be no significant impacts on aquatic species that contribute to BOD, nor any significant impact due to changes in DO, see below. |
| Dissolved oxygen | Good | - | Positive impact | During all flow conditions (except flood events) there will be a slight increase in dissolved oxygen, as the flow splits will remain unchanged and the head at the weir will increase slightly. As a result, the proposals will provide a small contribution towards meeting WFD objectives for this element. |
| Temperature | Good | - | No impact | There will be no impact on water temperature due to the proposals. |

2.2 All other WFD elements not listed in the table above, such as physico-chemical and chemical elements, will not be affected by this proposal.

2.3 All conditions summarised above provide either positive benefit or no impact on the WFD elements assessed.

3 Detailed review

Catchment status

- 3.1 Beeston Weir is located within the 'Trent from Soar to The Beck' section of Nottingham Urban Operational Catchment Area. The Management catchment area is Trent and Lower Erewash within the Humber River Basin District.
- 3.2 The Lower Trent and Erewash catchment covers an area of approximately 2054 km² extending from the River Dove confluence with the River Trent south west of the city of Derby and finishing at Alkborough Flats where the Trent flows into the Humber Estuary. Within this area the River Trent is 174 km long with its main tributaries including the rivers Derwent, Soar, Erewash, Leen, Greet, Devon, Idle, Torne and Eau and the Dover Beck.
- 3.3 The Humber RBMP cites that it may not be possible to achieve good ecological quality target due to it being 'disproportionately expensive'.
- 3.4 The Trent Lower and Erewash Catchment Management Plan shows that the reason for not achieving 'good' status is due to the catchment is failing on Ecological Status and that after water companies, rural land management is a large contributor to the reasons for failure.
- 3.5 Within the Trent and Erewash management catchment area there is an ongoing legacy of issues relating to urban runoff, pollution incidents, and effluent dilution from sewage treatment, industry and coal mining. Historically, these issues resulted in a considerable deterioration in the water quality of both the Trent and its tributaries. This is a result of less populated rural areas being offset by a number of large urbanised conurbations in the upper reaches of the Trent or its tributaries.¹
- 3.6 The priority river basin management issues to tackle in the catchment are:
 - Diffuse pollution from rural and urban areas
 - Fish passage
 - Channel modification.²

¹ <http://environment.data.gov.uk/catchment-planning/ManagementCatchment/3052/Summary>

² Humber_RBD_Part_1_river_basin_management_plan

Geomorphology

- 3.7 Geomorphological change associated with the proposals is limited as existing flow splits are maintained across the vast majority of flow conditions.
- 3.8 Upstream of the weir, the frequency that water levels occur will be altered slightly. During low and moderate flow conditions, the water level will increase by up to 425 mm, however this is considered very minor given the scale of the Trent at Beeston. During flood events, the water level may be marginally lower. Any associated impacts, for example on flow speed and sediment transport, are considered negligible.
- 3.9 The proposed changes to the weir crest (side weir +200 mm, main weir -300 to +425 mm) are also small within the context of the site. Bedload transport over the main weir may increase marginally, however this is considered negligible.
- 3.10 Flow splits will remain as-existing during most flow conditions. Above Q10, the main weir flow will be slightly higher, whilst the side weir flow will be slightly lower. However, these changes reduce again as the flow increases beyond Q3; as the upstream water level increases further, the weir crest modifications become less significant.
- 3.11 Downstream of the weir, the depth and overall flow rate will be unchanged. Some minor changes to the flow split will occur during high flow conditions, however as described above these changes reduce during higher flows.
- 3.12 Overall the geomorphological impact of the proposals is considered very minor.

Site designations

3.13 Desktop ecological surveys were undertaken using the following available online resources:

- MAGiC (Multi Agency Geographical Information Centre)
- National Biodiversity Network (NBN) Gateway
- Environment Agency
- Nottinghamshire Insight Mapping

3.14 A number of ecological designated sites are relevant to this application:

- 59 km upstream: mouth of River Mease SSSI/SAC, primary reasons for designation are spined loach and bullhead

- 400 m to 4 km upstream: Attenborough Nature Reserve & Attenborough Gravel Pits SSSI, this is a large site situated along the left bank. The reasons for citation include its aquatic plants, floodplain woodland and breeding birds
- 700 m south, with hydraulic connection 500 m downstream:
 - Holme Pit SSSI, designated for wetland plant species and breeding birds
 - Clifton Grove, Clifton Woods and Holme Pit Pond LNR
- ~110 km downstream: Humber Estuary (SAC, SPA, SSSI, Ramsar), designated species include river lamprey, sea lamprey, breeding birds

3.15 Local Wildlife Sites close to the site and/or with a direct hydraulic connection to the impounded reach are summarised as an Appendix at the end of this document.

3.16 National Biodiversity Network (NBN) records in the area show sightings of spined loach (*cobitis taenia*), recognised by Annex 2 of the EC Habitats Directive, and brown/sea trout (*salmo trutta*) and eel (*anguilla anguilla*), both priority species listed within the UK Biodiversity Action Plan (BAP). There was one sighting of freshwater crayfish (*austropotamobius pallipes*) in 2012.

3.17 A phase 1 habitat survey has not been commissioned for this project as the existing access routes for the hydropower scheme will be used during construction.

Terrestrial ecology

3.18 The impact on Local Wildlife Sites (LWS) in the surrounding area is assessed below. Those situated downstream of the weir will not be affected by the proposals, as the downstream water level will remain as-existing. Those situated upstream of the weir may experience a slight change in the frequency that certain water levels occur, in line with the main river channel. However, water levels will remain within the range that is currently experienced.

2/57 Beeston Canal

The LWS area is downstream of the lock gates (height approx. 28.000 mAOD) and therefore will be unaffected by the proposals.

1/24 Attenborough Gravel Pits

The site is hydraulically linked to the Trent via weirs with a crest level of 25.450 mAOD; the LWS will be unaffected by the proposals.

5/2251 River Trent – Attenborough

This area will experience a slight increase in water levels during low and moderate river flow conditions. This will in turn result in a marginally larger wetted area during those conditions. However, any associated impacts (positive or negative) will be insignificant given the modest water level increase of up to 425 mm.

2/354 Barton Flash

This is predominantly a terrestrial site; water level changes will have a negligible impact on the LWS.

2/56 Barton in Fabis Fishing Pools

These pools are hydraulically linked to the Trent, however LIDAR data show that when the water level in the Trent is 24.900 mAOD, the water levels within the LWS are at least 25.300 mAOD, therefore the water bodies within the LWS are elevated above the main river and will be unaffected by the proposals.

5/2299 Thrumpton Bank

This bank is a gradual slope reaching to approx. 28.000 mAOD, therefore any associated impacts (positive or negative) will be very minor given the modest water level increase of up to 425 mm.

5/266 Thrumpton Park

This large (78 ha) site includes two ponds that are hydraulically linked to the Trent, however LIDAR data show that when the water level in the Trent is 24.900 mAOD, the water levels within the LWS are 26.100 mAOD (east pond) and 26.400 mAOD (west pond), therefore the LWS will be unaffected by the proposals.

3.19 The EA pre-application response advised that water vole and otter may be impacted upon as a result of the change in water level within the impounded reach. However, entrances to water vole burrows are situated below low water level, with internal chambers extending up above flood water level (Water Vole Species Action Plan, 2000). The slight increase in low water level will therefore not adversely impact the burrow entrances, whilst the slight decrease in flood levels would reduce the risk of flooding within the internal chambers. Similarly, otter holts are predominantly dry environments, positioned above flood levels (Chanin, 2003) and so would also not be adversely impacted.

Fish passage

3.20 As the flow splits remain as-existing during the vast majority of flow conditions and there is no significant geomorphological change, there will be no adverse impact on fish habitats.

3.21 During all flow conditions (except flood events) there will be a slight increase in dissolved oxygen, as the flow splits will remain unchanged and the head at the weir will increase slightly. As a result, the proposals will provide a small contribution towards meeting WFD objectives for this element.

3.22 Fish migration barriers along this region of the River Trent are summarised earlier in this report, as part of the Introduction section.

3.23 The Environment Agency (Matthew Buck) has advised that, in addition to the vertical slot fish pass, fish also migrate past Beeston Weir using a standing wave that occurs near the north bank during high flows. To ensure that this migration route is not made worse, the application includes creation of a fish easement in this area. This will be created by installation of timber baffles, mounted diagonally on the weir face, which will concentrate flow in this area and provide a greater flow depth. This will both make it easier for fish to ascend this section and also create a more focused attraction flow.

3.24 Pre-application advice has confirmed that there is no evidence of lamprey at Beeston however, due to lamprey passage improvements further downstream it is possible lamprey will arrive at Beeston in future. However, the Environment Agency has confirmed that the existing vertical slot fish pass will provide very good lamprey passage, and that no modifications to the pass would be required.

3.25 Due to the increase in upstream water levels, flow through the existing fish pass would increase during all migration flow conditions, particularly during low and moderate flow conditions. This would therefore improve its attraction for upstream-migrating fish.

3.26 Yellow eels are present at Beeston, however the weir is currently impassable to upstream-migrating eels. This will not be affected by the weir modifications. Downstream passage is possible through the existing fish pass, and this would be maintained following the weir modifications. Overall, there will be no obstruction to eel passage due to this proposal and therefore installation of an eel pass is not required by the Eels Regulations 2009.

3.27 The project and its construction will not release, generate or disturb any elements or substances not currently present in the river body. There would be no impact on the current Good chemical status of the river.

4 Conclusions

- 4.1 The proposed development will not impact negatively on the current status of the water body and will not have an adverse impact on meeting future WFD objectives.
- 4.2 The creation of a fish easement will ensure that fish passage at Beeston Weir is not adversely affected by the weir modifications. In addition, the increased flow through the existing fish pass will improve fish passage, including for lamprey. These provisions will facilitate future improvement of the WFD ecological status of the water body.
- 4.3 Overall, the proposed development will have no impact or a positive impact on each individual element of the relevant WFD classifications. Accordingly, any in-combination effects will have a neutral or positive impact on the WFD elements.