

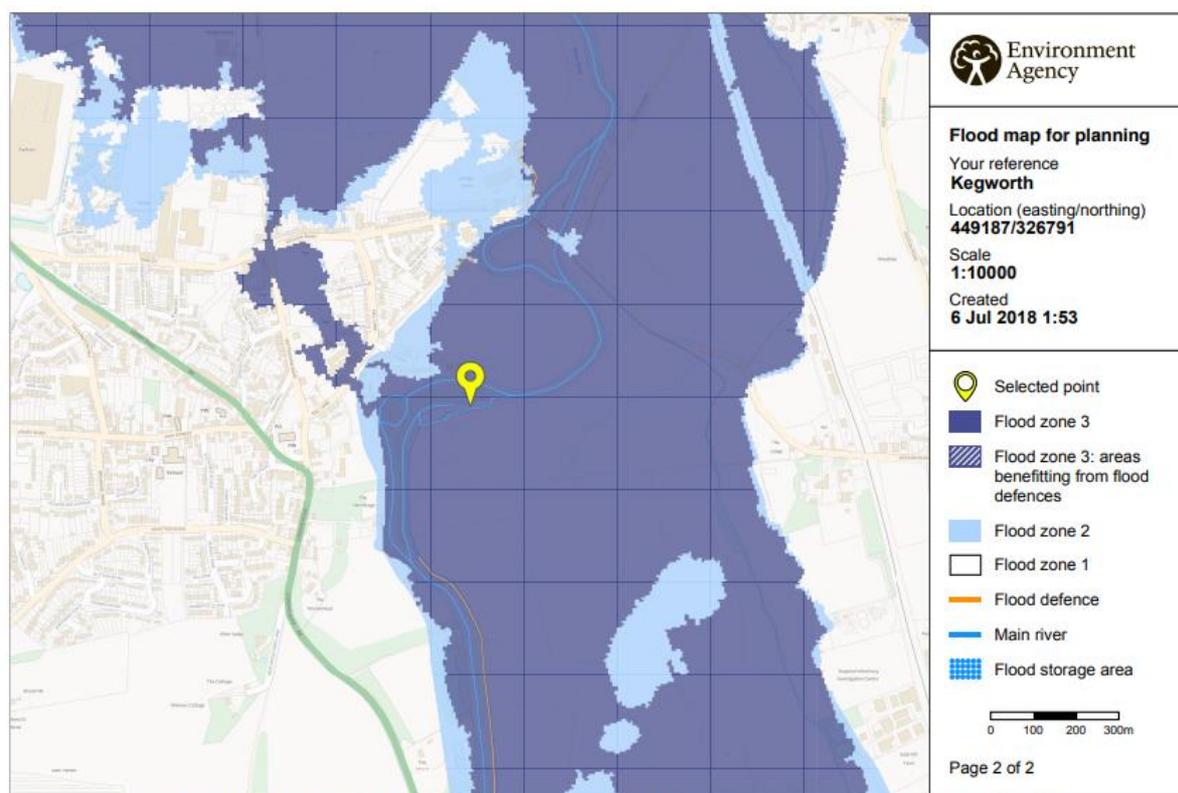
Kegworth Lock Hydroelectric Project

Flood Risk Assessment

Introduction

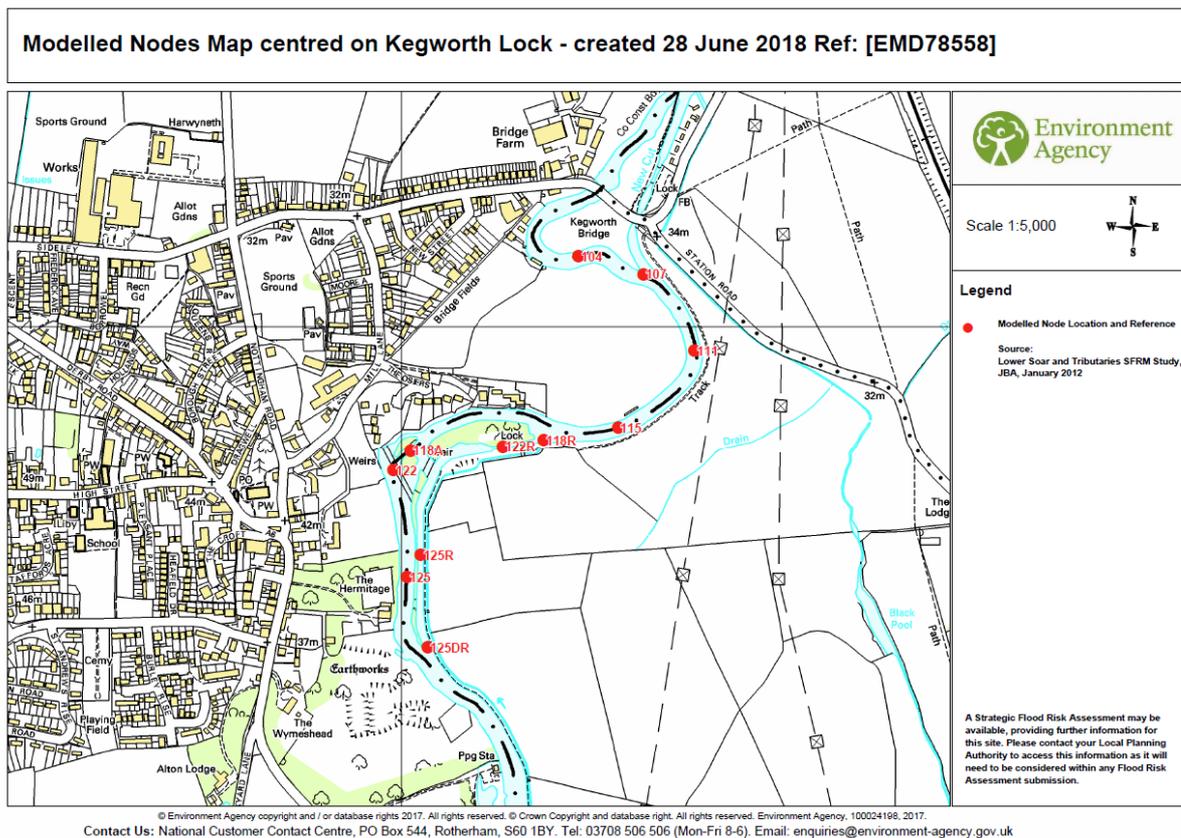
- 1.1 This assessment is associated with planning and Environment Agency consent applications for a hydropower scheme and associated infrastructure at Kegworth Lock. Please see the relevant supporting statement for general background information on the site and proposed development.
- 1.2 The applicant 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) [[link](#)]. It also makes reference to EA Product 7 Flood Data, and the North West Lincolnshire SFRA (2015 Update) [[link](#)].
- 1.4 The development is water-compatible, with reference to the vulnerability classification (table D.2, annex D, PPS25).
- 1.5 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 is infrastructure (table D.3, annex D, PPS25).
- 1.6 The latest relevant flood data for the site were obtained from the Environment Agency.

Figure 1 – Environment Agency Flood Map



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Summary of Flood Levels from EA flood data at node 122R	
*Source: Trent and Tributaries at Newark SFRM2, Halcrow, July 2011	
Approximate bank level	32.9 mAOD
Flood Levels	
1 in 100 year flood (1%)	32.96 mAOD
1 in 100 year flood + Climate Change (1% + 20%)	32.97 mAOD
1 in 200 year flood (0.5%)	32.96 mAOD
1 in 1000 year flood (0.1%)	32.98 mAOD



Definition of the flood hazard

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

Existing hydraulic structures

- 1.8 The main weir is a concrete structure that spans the channel diagonally, situated around 270 m downstream of the bifurcation and with a breadth of 104 m. The weir maintains navigational water levels upstream. On the downstream side, the channel continues for around 260 m before converging with the navigational channel.
- 1.9 The narrower navigational channel – also known as the ‘Old Cut’ – extends for around 300 m before reaching the side weir, which has a breadth of 26 m and spills into the main channel just downstream of the main weir. The navigational channel continues for a further 120 m before reaching Kegworth Lock, following which it converges with the main channel.
- 1.10 Approximately 500 m further downstream, the river splits again to provide a navigational channel through Kegworth Flood Lock.

Proposal description

- 1.11 The proposal comprises a single Archimedes screw turbine, a new multi-species fish pass, a turbine house building, below-ground hydraulic channels, trash screening, access improvements, an electrical substation and underground cabling.
- 1.12 The weirs have a relatively even crest level of approximately 32.36 - 32.39 mAOD. No changes to the weirs are proposed and no new weirs are proposed.
- 1.13 During most flow conditions, the hydropower scheme will be operated to maintain a specific ‘hands-off’ upstream water level, to ensure sufficient flow passes through the fish pass and over the weirs.

Historic flood events

- 1.14 The primary source of flood risk in North West Leicestershire is fluvial flooding. The north and east of the district is vulnerable from the River Trent and the River Soar, both independently and, in wider flood events, concurrently.
- 1.15 The catchment of the River Soar covers an area of approximately 1,380 km², covering much of the county of Leicestershire. The hydropower proposal is located in the functional floodplain of the River Soar.
- 1.16 Significant flood events affecting the whole of the River Trent basin have occurred in 1932, 1947, 1960, 1998 and 2000. The 2000 event remains the highest recorded at several locations on the River Soar and lower River Trent.
- 1.17 Notable flood events within the Soar valley include those in 1932 and 1954, which led to the subsequent construction of a flood alleviation scheme. The village of Kegworth is now protected by flood defences consisting mostly of earth embankments.
- 1.18 The River Soar experienced another significant flood event in 1998 when the River Soar overtopped the defences at Kegworth that offer protection during the 1 in 10 annual probability

(10%) flood event. However, the defences at Ratcliffe on Soar, which offer protection during the 1 in 100 annual probability (1%) event were not breached or overtopped.

1.19 The 2000 floods had a widespread impact throughout the River Trent catchment with an approximate annual probability of between 1 in 25 (4%) and 1 in 50 (2%). The worst affected areas were the lower reaches of the River Soar and the middle reaches of the River Trent from upstream of Nottingham to Newark, both affecting property within North West Leicestershire. Environment Agency defences failed or were overtopped along the River Soar. No properties flooded between Kegworth and the River Trent confluence from the River Soar.

Probability

1.20 From the Environment Agency's Product 7 data, the flood height behind the weir during the 1 % Annual Exceedance Probability (AEP) is modelled to be 32.96 mAOD, with 0.1% Annual Exceedance Probability (AEP) modelled at 32.98 mAOD. These levels are approximately 0.1 m above the bank level of 32.9 mAOD. The floor level of the turbine house will be at 33.9 mAOD, one metre above the typical bank level of 32.9 mAOD.

Climate change

1.21 The EA Product 7 dataset includes 1 in 100 year levels with a 20% climate change allowance. However the flood level increases only marginally, from 32.96 mAOD to 32.97 mAOD.

Flood risk management measures

1.22 Water level sensors will be installed immediately upstream and immediately downstream of the proposed hydropower development. This will allow automation of the hydropower scheme.

1.23 The hydropower scheme will include remote access, including external webcams. As a result, providing access to and from the building in times of flood has not been considered necessary.

1.24 All electrical equipment will be protected against flood damage to at least the 1 in 100 year (+ climate change) flood level, which is 32.97 mAOD. The turbine house floor level is 33.9 mAOD.

Off-site impacts

1.25 Building on the floodplain increases the risk of flooding to upstream property as well as the proposed development. However, at only 30 m², the turbine house represents a small fraction of overall floodplain. Based on the typical bank level of 32.9 mAOD and 1 in 100 year (+ climate change) flood level of 32.97 mAOD, the loss of flood storage volume due to the turbine house structure is therefore approximately 2 m³.

1.26 The new intake channel has an average invert level of approximately 30.3 mAOD and dimensions in plan view of approximately 60 x 5.3 metres. Based on the 1 in 100 year (+ climate change)

flood level of 32.97 mAOD, the gain of flood storage volume due to the hydraulic channels is therefore approximately 849 m³. As such the overall net impact on flood storage volumes is a gain (improvement) of approximately 847 m³.

- 1.27 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.

Residual risks & mitigation measures

- 1.28 During construction, all material scraped back 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 a trash rack to exclude debris from the hydropower channels. This 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 hydropower 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 manufacturer's recommendations to ensure smooth and reliable operation.

Environmental permit

- 1.34 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

- 1.35 The main structures associated with the development are a small turbine house with footprint 30 m² and below-ground hydraulic channels. The proposal does not include any new weirs or other structural changes that may impede flood flows.

- 1.36 The turbine house will reduce flood storage at the site by approximately 2 m³ only, whilst the new hydraulic channels will provide a much larger increase in flood storage of approximately 849 m³, giving an overall net increase of 847 m³.
- 1.37 The floor level of the turbine house is designed as 33.9 mAOD, which is more than 0.9 m above the 1 in 100 year (+ climate change) flood level of 32.97 mAOD. As such, all electrical equipment will be suitably protected. The hydropower scheme has been designed to exclude debris and will be regularly maintained.
- 1.38 Construction and maintenance works will not be carried out during flood conditions.
- 1.39 Environmental Permits will be obtained for both temporary and permanent works.
- 1.40 Overall the proposal is considered to be adequately protected against flood damage and will not present any additional flood risk to others.