

ZOUCH BRIDGE

Proof of Evidence of

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For Leicestershire County Council

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Prepared for:

Leicestershire County Council

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1. Witness Details

NAME: Fay Bull

OCCUPATION: Flood Risk Specialist and Chartered Scientist

JOB TITLE: Regional Director, Water, AECOM

QUALIFICATIONS: BSc, MSc, MCIWEM, C.WEM, CSci

1.1 Please see outlined below my career history and a brief summary of the relevance of each role to this Proof of Evidence.

1.2 2015 to Present: Principal Consultant / Associate / Regional Director, AECOM

- Overseeing a team of 25 scientists and engineers delivering flood and water consultancy projects for a variety of clients, including Local Authorities, the Environment Agency, Highways England and developers.
- Project Director for numerous Flood Risk Assessments, Strategic Flood Risk Assessments, Outline Business Cases for flood alleviation schemes and flood modelling studies.
- Lead Supplier for Capita AECOM in the Environment Agency's Programme Delivery Unit in the Midlands, responsible for delivering a portfolio of projects, including a large flood alleviation scheme on the River Soar through Leicester city centre.
- I had a five month break in my employment with AECOM between February and July 2017 where I worked for Waterman Aspen as an Associate Director, before returning to AECOM in July 2017.

1.3 2012 to 2015: Flood Mitigation Manager, Nottingham City Council

- Established the Lead Local Flood Authority (LLFA) function within the City Council under the Flood & Water Management Act (2010).
- Established the statutory consultee role for the LLFA function, which required the LLFA to be consulted on all Major planning applications. Developed a draft Supplementary Planning Document for Sustainable Drainage Systems.
- Provided pre-application and application advice to the planning team, developers, architects and consultants on all aspects of flood risk.
- Led on assessment and consultation for large scale planning applications, including the Nottingham Enterprise Zone and sites at high or complex risk of flooding.

1.4 2011 to 2012: Infrastructure Capacity Strategist, Severn Trent Water

- Established a new function for outsourcing Development Impact Assessments to framework consultants, including establishing new procedures and guidance.
- Advised Local Planning Authorities on strategic waste water infrastructure requirements to ensure that new development did not increase flood or pollution risk.
- Compiled business cases to promote schemes into the capital investment programme that increase waste water infrastructure capacity to accommodate development and growth.

1.5 2006 to 2011: Scott Wilson Limited: Progressed from Graduate to Senior Flood Risk Consultant

- Compilation of Flood Risk Assessments (FRAs) under Planning Policy Statement 25: Development & Flood Risk and later the National Planning Policy Framework. FRAs ranged from large sites in areas of high flood risk, such as Lower Broughton regeneration in Salford, to localised flooding issues.
- Development of hydrological and hydraulic models using industry standard software (Flood Estimation Handbook, ReFH, ISIS, Tuflow, MicroDrainage) to assess flood risk to and from new development for private developer clients.
- Development of hydraulic models for the Environment Agency, in line with Environment Agency specifications.
- Development of Strategic Flood Risk Assessments for Local Planning Authorities, including Northamptonshire, Greater Manchester and Oxfordshire.

2. Instructions given by Client

- 2.1 I was approached by AECOM's Highways team in February 2016 regarding the Zouch Bridge replacement scheme. At this time, Leicestershire County Council (LCC) had been advised by the Environment Agency (EA) that a Flood Risk Assessment (FRA) would be required for the proposed bridge replacement. LCC had previously been advised by the EA that no FRA would be required. However, the requirement for the Council to obtain planning permission triggered the need for an FRA under the National Planning Policy Framework (NPPF) because the development is located in the functional floodplain (Flood Zone 3b) of the River Soar.
- 2.2 I led the development of a proposal to fulfil the FRA requirement in accordance with the NPPF and the accompanying Planning Practice Guidance (PPG). In line with the NPPF requirements and the potential for the scheme to impact flood risk, I recommended a Level 3 FRA be undertaken. A Level 3 FRA involves a detailed analysis of flood risk, including hydraulic modelling. The proposal for the FRA was submitted to LCC as part of a wider package of environmental assessments including noise and air quality. AECOM was appointed by LCC in March 2016.
- 2.3 Once appointed, my role on the project was as Delivery Manager for the FRA, supporting the Project Manager for the package of environmental assessments. I oversaw the technical delivery of the FRA with support from a small team who undertook the majority of technical work and reporting under my direction. I also performed quality assurance tasks by checking the draft report before submission.
- 2.4 In this Proof of Evidence, I will outline the work that was undertaken under my direction to assess the impacts of the proposed Zouch Bridge replacement on flood risk and the process that was followed to ensure that appropriate mitigation measures were incorporated into the bridge design to ensure that the proposals meet the legislative requirements outlined in the NPPF. The Zouch Bridge Level 3 Flood Risk Assessment (AECOM, March 2017) has been referred to extensively in the preparation of the Proof of Evidence. The Assessment is available as an inquiry document within the planning application documentation.

3. Scheme Description & Mitigation Features

3.1 Under my direction, the team undertook the following activities to inform the FRA:

- One site visit was undertaken to familiarise the hydraulic modeller with the local conditions;
- Existing site data was obtained from the EA, including the existing hydraulic model for the River Soar.
- Scheme proposals and data relevant to the FRA, such as topographic survey, were obtained from the AECOM Transportation Team.
- Relevant local flood risk policy was obtained, including the Strategic Flood Risk Assessments.
- The EA was engaged to outline and agree requirements for the site-specific FRA.

3.2 The above data and information were used to assess the risk of flooding to and from the proposed development from all sources of flood risk, including fluvial (river), pluvial (surface water), groundwater, sewers and infrastructure failure (e.g. canals). Based on the assessment it was identified that the proposed bridge had the following potential impacts:

- Fluvial flood risk: The bridge is located in the functional floodplain (Flood Zone 3b) according to the EA's Flood Map and has the potential to impact on channel conveyance and flood flow routes. Fluvial flood risk was investigated in the FRA to ensure that the proposals were acceptable on the grounds of the NPPF and is summarised in this Proof of Evidence.
- Pluvial flood risk: Parts of the bridge are at 'Medium' to 'High' pluvial flood risk and an increase in impermeable area as a result of the bridge replacement has the potential to increase pluvial flood risk to surrounding areas. A Drainage Strategy developed by the highway design team has been incorporated into the design and referenced in the FRA. The drainage design was developed in accordance with national best practice by providing attenuating surface water flows to 5l/s.
- Groundwater: The bridge is located in an area of groundwater emergence according to the EA's Area Susceptible to Groundwater Flooding due to the proximity to the river. The bridge replacement is unlikely to have a positive or negative impact on groundwater flooding.
- Sewers: There are no sewers in the immediate vicinity of the bridge and therefore the bridge replacement is unlikely to have a positive or negative impact on sewer flooding.
- Infrastructure: The Zouch Cut canal is located within the vicinity of the bridge. Providing that the fluvial impacts of the bridge replacement are adequately mitigated, the proposal is unlikely to affect flooding to or from the canal. No other significant infrastructure has been identified.

3.3 A hydraulic modelling exercise was undertaken to quantify the impacts of the bridge replacement on fluvial flood risk and investigate mitigation options to inform the design.

Baseline hydraulic modelling of proposed bridge

3.4 The EA's 'Lower Lower Soar' hydraulic model (2012) was used as a starting point for the hydraulic modelling assessment and was used to define the hydrology for both the baseline

and proposed model scenarios. In line with the climate change guidelines for flood risk issued by the EA, a 30% increase to the 1% AEP (1 in 100 year) fluvial flow was applied to the hydrology for the baseline and proposed scenarios. This represents the 'Higher Central' climate change scenario allowance for the Humber River Basin District over the next 100 years (the likely minimum life-span of the proposed development). After consultation with the EA, a 50% increase in flows was also modelled as a sensitivity test on the 1% AEP (1 in 100 year) event. This represents the 'Upper End' climate change scenario allowance.

3.5 The following updates were made to the 'Lower Lower Soar' model to form a baseline hydraulic model for the FRA:

- Topographic survey provided by LCC was used to improve the representation of the banks on the upstream side of the bridge.
- Existing road levels in the model were compared against the topographic survey and amended where necessary.
- LiDAR data was used to facilitate the representation of a series of land drains within the baseline model.

3.6 The amendments to the hydraulic model provided a localised improvement to the representation of flood risk to establish existing baseline conditions and a basis upon which to determine the impacts of the proposed bridge design. The EA undertook a peer review of the updated baseline hydraulic model and confirmed that the updated model was adequate and acceptable.

3.7 The baseline model shows a significant flood flow route across the floodplain on the left (southern) bank of the River Soar, as shown in Figure 1. This flow route passes over the A6006 in the vicinity of the Marina to the south west of Zouch Bridge as annotated in Figure 1.

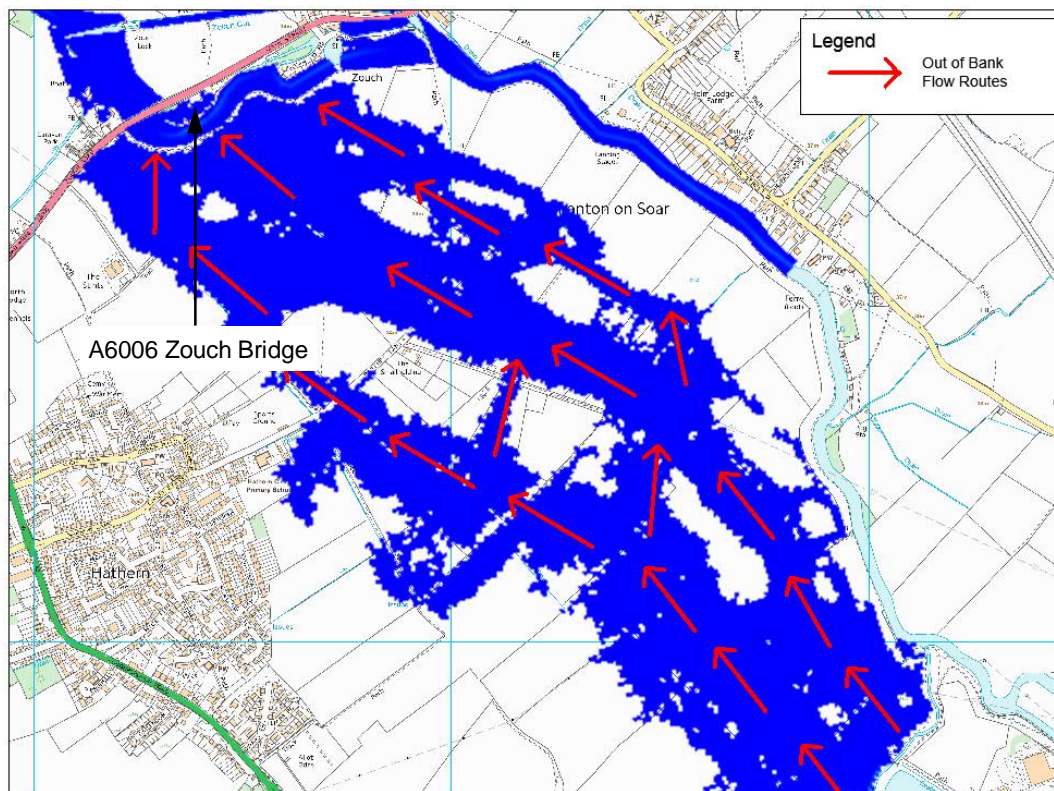


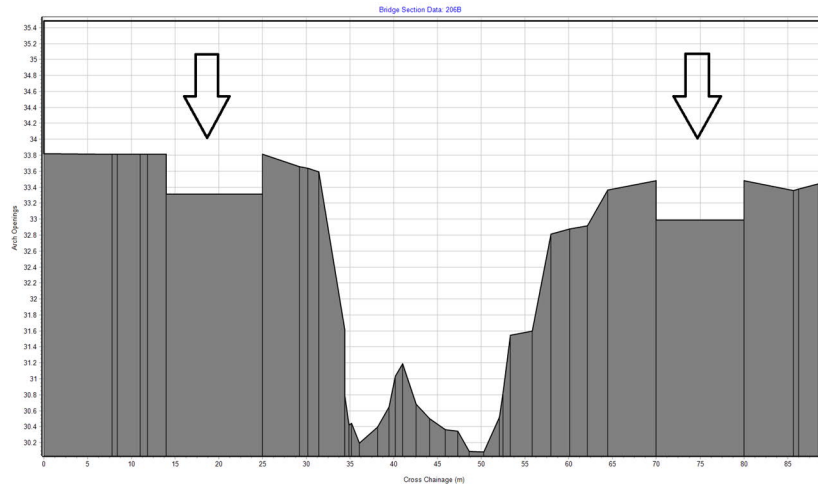
Figure 1. Out of bank flow route on the left (southern) bank in baseline model

Hydraulic modelling of the proposed bridge

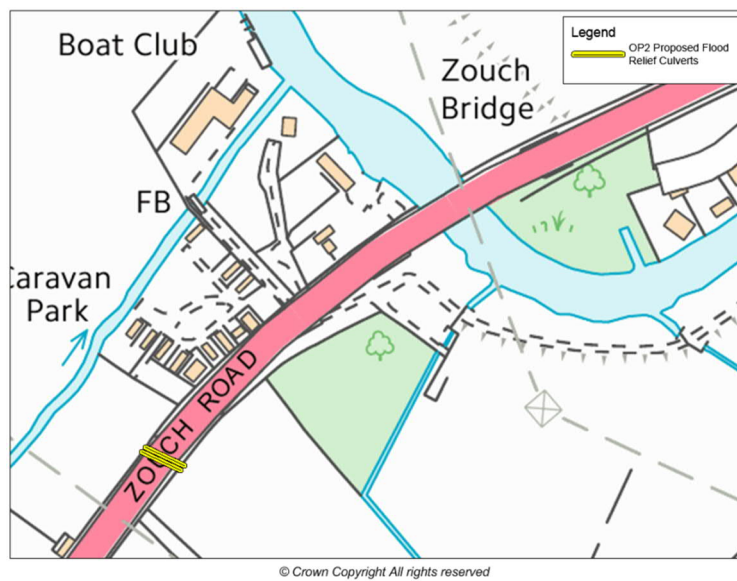
- 3.8 The proposed bridge was inserted into the hydraulic model to test the impacts. The initial proposal was found to result in unacceptable changes to flood risk. This is because the proposals included raising of the A6006 on the approach to Zouch Bridge in the vicinity of the Marina (Area A shown in Figure 1), which affected the existing flood flow route. Whilst this had a beneficial impact on flood risk at the Marina downstream of the bridge, with a reduction in flood levels of 0.08m in the 1% AEP (1 in 100 year) event, the proposals caused an increase in flood depths upstream of the bridge of 0.07m in the 1% AEP (1 in 100 year) event. This increase in flood depth as a result of the bridge was not considered acceptable and would not meet the requirements of the NPPF. At this point, I called a meeting, held on 14 September 2016, with the client the Environment Agency, AECOM water and highways teams to discuss changes to the bridge design.

Bridge Design: Flood Risk Mitigation

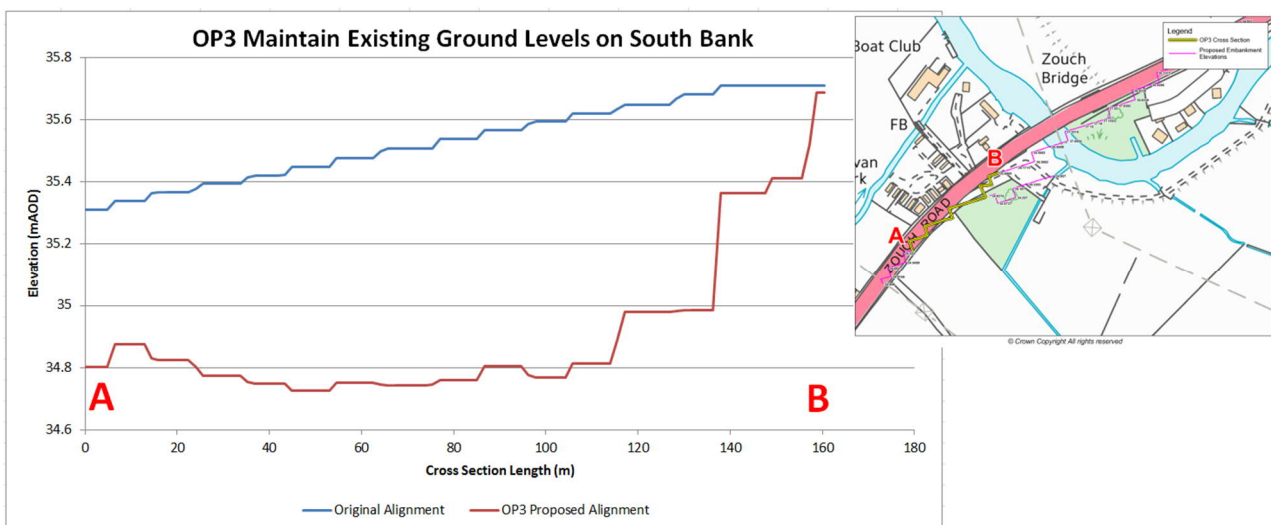
- 3.9 During the meeting on 14 September 2016, the adverse flood risk impacts of the initial design were explained and a 'long list' of potential mitigation options to reduce the impacts were identified and discussed. A 'short list' of mitigation measures to be tested in the hydraulic model were selected according to the likelihood of minimising the impacts of the bridge on flood risk, whilst also ensuring that highway and bridge design standards could be achieved. The mitigation options that were tested included:
- Option 1: The inclusion of 'scrapes' to lower the ground levels beneath the spans of the bridge on the left and right banks. This option was selected as it may sufficiently improve conveyance through the structure, reducing flood risk on the upstream side of the bridge.
 - Option 2: The inclusion of flood relief culverts beneath the sections of elevated highway on the approach to the bridge. This option was selected as it may reduce the impact of the raising of ground levels on the approach to Zouch Bridge, thus reducing flood risk on the upstream side of the bridge.
 - Option 3: Maintaining existing ground levels on the approach to the bridge on the left (south) bank of the river. This option was selected as it may maintain the existing flood flow route over the A6006 on the approach to the bridge.
- 3.10 Schematic representations of these options are shown in Figure 2.



Option 1 – Channel cross section, location of scrapes indicated by arrows



Option 2 – Plan showing location of flood relief culverts



Option 3 – Amendment to ground levels (inset shows cross section location A-B)

Figure 2. Schematics showing the short list mitigation options that were tested using hydraulic modelling (Options described in paragraph 3.9)

- 3.11 Based on the hydraulic modelling undertaken, the most effective mitigation option was Option 3 and was selected as the preferred option. This option was found to maintain existing flood levels upstream and downstream of the bridge and was therefore deemed appropriate and in line with the requirements of the NPPF. Working with AECOM's highway and bridge design teams, the preferred option design was refined using hydraulic modelling.
- 3.12 The resulting impacts of the bridge, including the mitigation measures, were demonstrated to be negligible using hydraulic modelling. The existing flow route across the A6006 has been maintained within the left bank (southern) floodplain, but is partially impeded in the right bank (western) floodplain. However, as shown in Figure 3 there is a negligible impact on flood extents and minimal differences in water levels upstream and downstream of the site (≤ 20 mm, considered negligible and within the confidence tolerance limits of the modelling). There is no detrimental change in flood hazard classification at any of the properties in Zouch as a result of the proposed bridge alignment.
- 3.13 The EA, as statutory consultee, undertook a peer review of the hydraulic model including the preferred option and confirmed that the modelling approach and mitigation measures were acceptable. The EA also reviewed the FRA and raised no objections to the proposals providing that the measures detailed in the FRA were implemented (Appendix A).



Prepared for: Leicestershire County Council LCC

4. Responding to Objections

- 4.1 Mr & Mrs Mee have made objections to the proposals. Whilst these have been withdrawn, the following objection was in relation to flood risk and is addressed below:
- Provision for the escape of livestock in times of flood have not been addressed.
- 4.2 Whilst this objection is primarily in relation to access, from a flood risk perspective, land that is currently in the floodplain will remain in the floodplain post-development. Hydraulic modelling has demonstrated that the bridge design will have a negligible impact on the frequency, depth and rate of onset of flooding to land and property adjacent to the River Soar in the vicinity of Zouch Bridge. The design philosophy to reduce the number of bridge abutments from 10No. to 3No. will improve conveyance and reduce the risk of blockage during times of flood, which may benefit landowners adjacent to the watercourse. Business and home owners at risk of flooding from the River Soar in the Zouch area are able to sign up to the EA's Flood Warning Service to receive timely alerts in the likely event of a flood. The bridge replacement will not affect the EA's ability to offer flood warnings.
- 4.3 Mr Farrow has made objections to the proposals. None of the objections are directly in relation to flood risk. The following objection would require flood risk considerations:
- The Alternative suggestion will be cheaper.
- 4.4 The potential flood risk considerations for the alternative route are considered in the Alternative Assessment Document.

5. Summary & Conclusions

- 5.1 In summary, through the development of the FRA it was determined that the initial bridge and highway design resulted in adverse flood risk impacts immediately upstream of the proposed bridge. Mitigation measures were considered in consultation with LCC, the EA and the AECOM highway and bridge design teams. Based on the outcome of the hydraulic modelling, I recommended to LCC that the bridge design be amended to minimise the impacts of the proposed bridge on flood risk and to meet the requirements of the NPPF. This amendment involved lowering the proposed road levels on the approach to Zouch Bridge to maintain existing ground and road levels and therefore maintain the existing flood flow route. This recommendation was accepted by LCC and incorporated into the design by AECOM's highway and bridge design teams.
- 5.2 On balance, as a result of the work undertaken during the FRA and the recommendations that I made to LCC, the proposed bridge and highway design will have a minimal impact on flood risk to people, property and land. The proposals meet the requirements of the NPPF and accompanying PPG. The Environment Agency, as statutory consultee, has confirmed that they have no objections to the on the grounds of flood risk (Appendix A).

Appendix A Environment Agency Correspondence

- Letter from the Environment Agency to Leicestershire County Council confirming that there are no objections to the proposed development.

Mr Peter Bond
Leicestershire County Council
Planning Department
County Hall
Leicester Road
Glenfield
Leicester
LE3 8RJ

Our ref: LT/2017/122246/01-L01
Your ref: 2017/Reg3Ma/0097/LCC
Date: 04 July 2017

Dear Mr Bond

PROPOSED REPLACEMENT OF EXISTING BRIDGE

ZOUCH BRIDGE

I refer to the above application which was received on 5 June 2017.

Thank you for providing us more time to review this application following the receipt of the revised Flood Risk Assessment which was received on 30 June 2017.

Based upon the information provided, we have no objection to the application if the measures as detailed in the revised Flood Risk Assessment titled "Zouch Bridge Level 3 Flood Risk Assessment" prepared by AECOM Infrastructure and Environment UK Ltd, dated June 2017 are implemented, and subject to all recommendations of Section 6 - Replacement of Zouch Bridge (LCC 303) Habitat Scoping Survey are followed accordingly.

Informative

An environmental permit for a flood risk activity will be required for any proposed works or structures in, under over or within 8 metres of the top of the bank of main river or the landward toe of flood defence.

Yours sincerely

Miss Lydia Bond
Planning Advisor

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Direct e-mail lydia.bond@environment-agency.gov.uk

cc Leicestershire County Council: Planning & Transportation