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The Cambourne to Cambridge Order

Cambridgeshire County Council

Transport and Works Act 1992
Transport and Works (Inquiries Procedure) Rules 2004
Inquiry into:
THE CAMBOURNE TO CAMBRIDGE ORDER

PROOF OF EVIDENCE

of

Jack Southon

of WSP

On behalf of Cambridgeshire County Council

09th August 2025

Planning Inspectorate Reference: DPI/E0535/25/1

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1. INTRODUCTION

1.1 Qualifications and Experience

Academic qualification

- 1.1.1 My name is Jack Southon. I am a Technical Director in the Sustainable Water Management Team at WSP. I hold a BSc (Honours) in Physical Geography from the University of Wales Aberystwyth and an MSc in Geographical Information Systems and Remote Sensing from Aberystwyth University. I am a Chartered Member of the Chartered Institute of Water and Environmental Management and a Fellow of the Royal Geographical Society. I am a Chartered Environmentalist, Chartered Scientist, Chartered Water and Environmental Manager and Chartered Geographer (GIS).

Professional career

- 1.1.2 I have over 17 years' experience in flood risk consultancy work including modelling and assessment of flood risk for major infrastructure projects. I have managed the flood risk input to schemes through all stages of the project lifecycle including strategic constraints mapping and route corridor studies, alternatives appraisals, Environmental Statement preparation, public inquiries / examinations, permitting and construction.

Key project experience

- 1.1.3 I have managed or co-ordinated 100s of flood risk modelling and flood risk assessment studies predominantly across England and Wales. I have acted as expert witness in relation to flood risk matters for Local Plan examination, planning appeals and transport infrastructure schemes in England and Wales. Most recently I acted as flood risk expert witness for a planning appeal for a residential development in East Riding of Yorkshire and this followed my work as an expert witness in relation to the East Riding SFRA at Local Plan examination. I have experience in the development of flood modelling and flood risk assessment to support the assessment of a wide range of Infrastructure types including linear Infrastructure including recent road (Carlisle Southern Linik Road), rail (HS2 and East West Rail) and energy Infrastructure (Eastern Green Link 2).

- 1.1.4 Previously, whilst under different employment, I have undertaken commissions for the Environment Agency to prepare catchment modelling of the Bin Brook and St John's College to undertake flood modelling and prepare a Flood Risk Assessment in regard to the amendments to their playing fields adjacent to the Bin Brook. These commissions were all completed well before my work on this project and there is no conflict of interest with my role in preparing this evidence.

1.2 Scope of Evidence

- 1.2.1 The scope of my evidence is in relation to the flooding effects at Bin Brook and focuses on the preparation of flood risk modelling and those parts of the flood risk assessment of the Scheme related to the Bin Brook. The wider Water (including flooding) topic as reporting within the ES, with the exception of flooding modelling of the Bin Brook (which is discussed here in), are dealt with in the Proof of Evidence of Mr Andy Saunders (Ref CD26-01-APP-W3-1).

1.3 Summary of Evidence

- 1.3.1 Section 2 sets out key flood risk matters (in relation to the Bin Brook) that, in my professional opinion, are relevant to the public inquiry for the Inspector.
- 1.3.2 Section 3 covers the flood risk modelling of the Bin Brook including how the modelling used to inform the FRA (CD1-11.13.02) and ES have been developed, used and the results of the assessment as well as the Key Stakeholder Engagement (in relation to Bin Brook) focusing on engagement with the Environment Agency.
- 1.3.3 Section 4 deals with objections and representations made relevant to my Proof of Evidence. I address specific matters raised in the Statements of Case in relation to the following 2 objections:
- The Environment Agency (OBJ301) in relation to flood risk modelling for Bin Brook; and
 - Clare Hall (OBJ213) in relation to the flood risk modelling for the Bin Brook.
- 1.3.4 Section 5 deals with other issues raised by third parties.
- 1.3.5 In section 6 I provide an overall conclusion on the matters covered by my Proof of Evidence.
- 1.3.6 Section 7 provides my Statement of Truth.
- 1.3.7 A range of correspondence that I refer to within the proof are included in the separate Appendix (Ref CD26-01-APP-W9-2).
- 1.3.8 A summary of my evidence is provided separately (Ref CD26-01-APP-W9-3).

1.4 Professional Declaration

- 1.4.1 I confirm that the opinions expressed in this evidence are my true and professional opinions, given independently in accordance with the Chartered Institution of Water and Environmental Management and Royal Geographical Society Codes of Conduct.

2. MAIN ISSUES FOR THE INSPECTOR RELEVANT TO MY EVIDENCE

2.1 Introduction

- 2.1.1 In this section, I identify the key flood risk matters (in relation to the Bin Brook) that, in my professional opinion, are relevant to the public inquiry. These matters have been informed by the issues raised in representations by interested parties.
- 2.1.2 The main issues of relevance to my evidence are:
- (a) The baseline flood risk modelling of the Bin Brook and its surrounds.
 - (b) The proposed scheme flood risk modelling of the Bin Brook and its surrounds.
 - (c) The assessment and reporting of forecast flood risk impact arising from the proposed scheme to the Bin Brook and its surrounds.
- 2.1.3 I address each of these matters in turn in the following sections of my Proof of Evidence

3. FLOOD RISK (BIN BROOK)

3.1 Introduction

- 3.1.1 The Cambourne to Cambridge Scheme is a proposed new 13.6km long public transport route linking Cambourne and Cambridge. It will include a dedicated busway serving communities in Cambourne and the proposed Bourn Airfield development, as well as in Hardwick, Coton and the West Cambridge campus.
- 3.1.2 Along the proposed route the busway crosses the Bin Brook. The Bin Brook is a Statutory Main River that rises in Hardwick to the west of Cambridge and runs in a generally easterly direction towards the River Cam, of which it is a tributary.
- 3.1.3 Upstream of the area of interest the Bin Brook runs around the Gough Way estate before crossing an area of open fields and entering the grounds of Clare Hall adjacent to West Court. The Bin Brook continues to flow in a generally north-east direction through the grounds of the Needham Research institute and latterly Robinson College before meeting the River Cam Adjacent to St John's College between the Bridge of Sighs and Magdalene Bridge.
- 3.1.4 The proposed Cambourne to Cambridge scheme works would remove an existing access bridge that crosses the Bin Brook near the southern edge of the grounds of Clare Hall (West Court) and replace it with a larger bridge and associated embankment running approximately perpendicular to the watercourse.
- 3.1.5 My evidence focuses on the assessment of the existing flood risk to and from the Bin Brook and how this may be impacted by the proposed works. Detailed information about Bin Brook Flood Risk effects associated with the Scheme and a description of the likely significant effects of the proposals is provided the relevant sections of in ES Technical Report 13: Water (CD1-11.13.01) and includes Appendix TR13.1 Flood Risk Assessment (CD1-11.13.02).

3.2 Assessment Methodology

- 3.2.1 In order to evaluate the impacts of the proposed works on flood risk from the Bin Brook a baseline flood model was prepared to assess the current and future flood risk under existing conditions. The following section sets out the relevant development history of the modelling evidence base.

- 3.2.2 Hydraulic modelling of the Bin Brook crossing area was prepared based on baseline models provided by the Environment Agency – principally the 2017 Gough Way Model prepared by CH2M Hill (now part of Jacobs) which was the latest modelling undertaken by the Environment Agency at the time of the assessment¹. For clarity in this proof I will refer to the supplied 2017 Gough Way Model herein as the as the ‘CH2M Hill 2017 model’.
- 3.2.3 Various adaptations were made to the CH2M Hill 2017 model and the associated hydrology to make it suitable for scheme assessment and in response to comments from the Environment Agency to produce our baseline model (which represents present day topographic conditions in the catchment). These adaptations included:
- (a) reduce model extent to focus on area of interest (shorten to approximately 1.8km),
 - (b) prepare updated upstream and downstream boundaries to reflect updated extent and changes in hydrology data and approach,
 - (c) updating channel cross section data based on topographic survey of the watercourse collected in May 2022,
 - (d) use of 1m LIDAR data downloaded May 2022 to update floodplain representation (used to inform a 2m resolution grid size)
 - (e) use of updated (May 2022) MasterMap Ordinance Survey data to reflect land use in the flood plain
- 3.2.4 For clarity in this proof I will refer to the adapted model herein as the ‘applicant baseline model’.
- 3.2.5 The applicant baseline model was used to establish flood levels up and down stream of the proposed Bin Brook crossing for a range of present day return flood events as well as flood events including an allowance for Climate Change.
- 3.2.6 An alternative version of the applicant baseline model was created to include representation of the proposed works – namely the removal of the existing access bridge, the introduction of the busway embankment and inclusion of the proposed bridge embankments. The proposed bridge deck was not included in the model as this was above the design flood level and not material to the assessment. For clarity in this proof I will refer to this version of the model herein as the ‘applicant as-proposed model’.
- 3.2.7 The applicant baseline model and the applicant as-proposed model were submitted in September / October 2023 to the Environment Agency for review as part of pre-application discussions for the Scheme.
- 3.2.8 In November 2023, the Environment Agency provided a detailed response (a copy of which can be found in the Appendix to this proof of evidence ref CD26-01-APP-W9-2 Item 1) listing areas of concern with the applicant baseline model and applicant as-proposed model where amendments or clarifications were required. The area of concern included:
- (a) queries relating to the 1D model, 2D model and 1D2D linking
 - (b) the representation of the bank lines and structures

¹ It should be noted that subsequent to the supply of the 2017 Gough Way Model to the applicant the Environment Agency (and their delivery partner JBA Consulting) completed a separate model dated in August 2023. This is discussed further in 3.2.20.

- (c) glass walling against the model boundary in the 0.1% AEP event including climate change.
- 3.2.9 The Environment Agency subsequently confirmed, in December 2023 (found in the Appendix to this proof of evidence ref CD26-01-APP-W9-2, pdf page 11, Item 3), that addressing the core points raised (those potentially affecting the outcome of the study identified as red and yellow items in their review RAG sheet) should resolve their concerns regarding the applicant baseline model and applicant as-proposed model.
- 3.2.10 Revisions were made to the applicant baseline model and applicant as-proposed model to address the core concerns raised by the Environment Agency and the outputs from the updated modelling (both applicant baseline and applicant as-proposed models) was used to inform the Flood Risk Assessment (CD1-11.13.02) which has been submitted in support of the Application.
- 3.2.11 In response to the submission of the TWAO Application the Environment Agency submitted an objection (OBJ301) (CD2-OBJ-301). This was submitted as a holding objection pending the Environment Agency's review of the updated model to ensure it had addressed their previous concerns. The modelling and associated reporting were provided to the Environment Agency in February 2025.
- 3.2.12 The Environment Agency provided updated review comments on the applicant baseline and applicant as-proposed models in March 2025 (found in the Appendix to this proof of evidence ref CD26-01-APP-W9-2 pdf page 14, Item 4). There were continued areas of concern including:
 - (a) use of storm duration in hydrology
 - (b) use of most recent versions of hydrology and hydraulic model software and data sources
 - (c) omission of specific small foot bridges from the model
 - (d) continued concern regarding glass walling in the 0.1% AEP event including climate change.
- 3.2.13 Clarifications to the concerns raised by the Environment Agency in March 2025 in regard to the applicant baseline and applicant as-proposed models were provided in April 2025 (found in the Appendix to this proof of evidence ref CD26-01-APP-W9-2 pdf page 71, Item 5) and a further technical note to address sensitivity testing to storm duration, software and data versions was issued in May 2025 (found in the Appendix to this proof of evidence ref CD26-01-APP-W9-2 pdf page 115, Item 6). Other matters were clarified within the review documentation.
- 3.2.14 As outlined in 3.2.11-3.2.13 above, subsequent to their objection the Environment Agency have undertaken a review of the hydraulic modelling and flow estimation (Hydrology) in March 2025 and clarification was provided in April and May 2025.
- 3.2.15 Further feedback was received from the Environment Agency in July 2025 (found in the Appendix to this proof of evidence ref CD26-01-APP-W9-2 pdf page 124, Item 7) based on the May submission. This noted the following areas of concern:
 - (a) the left bank downstream boundary application
 - (b) application of zlines associated with 1d-2d link
 - (c) lack of commentary in the modelling report comparing the results of the applicant baseline and applicant as-proposed models with other sources of information, namely NAFRA2

- (d) the provision of tabularised full results, and model structures log
 - (e) the representation of the channel as it passes under the Robinson College building
 - (f) the delivery of the roughness sensitivity test
 - (g) provision of raw simulation files (xmdf files) for the March 2025 submission
 - (h) suggested 'significant' difference resulting from the use of FEH13 rainfall in place of FEH22 rainfall
 - (i) presentation of updated FEH Statistical method estimates using National River Flow Archive Peak Flood dataset version 13 and latest release of WINFAP software
 - (j) approach to consideration of urbanisation in each catchment and pooling group and growth curve fittings (for the abandoned FEH Statistical method estimates)
 - (k) provision of ReFH2 rural flow estimates
 - (l) use of critical storm duration in ReFH2 across different sub-catchments.
- 3.2.16 A further response was provided to the Environment Agency in July 2025 in respect to these points (found in the Appendix to this proof of evidence ref CD26-01-APP-W9-2 pdf page 179, Item 8).
- 3.2.17 Following review of the July 2025 and previous documentation, the Environment Agency have indicated (see CD26-01-APP-W9-2 pdf page 191, Item 9) that they consider the applicant baseline and as-proposed models used for the Cambourne to Cambridge busway FRA and ES acceptable for assessing flood risk in the area of interest. They note that although the model is suitable for supporting the TWA Order and Flood Risk Assessment, it would not meet internal Environment Agency standards for updating the flood map without addressing the issues highlighted in the review. However, for planning purposes the Environment Agency have indicated that they consider it is acceptable.
- 3.2.18 Furthermore the Environment Agency have indicated (see CD26-01-APP-W9-2 pdf page 191, Item 9) that they consider the increases in flood depths in already inundated open fields to be 'minor' and that they do not appear to materially affect the flood risk evaluation. They also note modest reductions in flood depths in built-up areas downstream of the proposed bridge. The Environment Agency have stated that post-development modelling will need to demonstrate that any increase in flood risk remains within the red line boundary of the application and, where possible, that the structure delivers an overall improvement in flood risk. On this basis it is expected that the Environment Agency will write to the Inspector directly by the 19th August 2025 to withdraw their objection on flood risk grounds.
- 3.2.19 Other comments from the Environment Agency (as listed in CD2-OBJ-301) in regard to groundwater, aquifers, water quality, contaminated land and water voles are addressed in other proofs of Evidence or it is expected that these will be addressed satisfactorily at detailed design stage.
- 3.2.20 In parallel to the work outlined above the Environment Agency have commissioned and undertaken an update of the Bin Brook independently. This was prepared by JBA Consulting and is dated as August 2023. This model covers a larger extent and is based on a mix of survey retained from the 2017 model (survey dating from 2002) with areas updated to use survey from 2018 and 2021. The model uses LIDAR from 2019 and MasterMap from 2020. The model is supported by an updated hydrology

assessment undertaken between 2021 and 2023. For clarity in this proof I will refer to this model herein as the as the 'JBA 2023 model'.

- 3.2.21 Notwithstanding the different input data as summarised in Table 3-1 below the modelling approach in the applicant baseline model and the JBA 2023 model are generally similar and it is considered that the applicant baseline model (and subsequent applicant as-proposed model are appropriate to base the impact assessment of the proposed scheme upon.

Table 3-1 Comparison of input data between JBA 2023 model and Applicant baseline model

	JBA 2023 Model	Applicant baseline model
LIDAR	Download September 2020 (based on data flown in 2019)	Downloaded in May 2022 (based on data flown in 2019) It is noted that additional LIDAR data is now available flown in February 2023
MasterMap	September 2020	May 2022
Survey	Various up to 2021	Various up to 2022
Hydrology	Assessment undertaken between 2021 and 2023	Assessment undertaken 2023

- 3.2.22 The JBA 2023 model has been run for a range of scenarios. The most comparable scenario to compare to the applicant baseline model is the ER17_XX_2m_Q100CC19_NOL run (Existing Risk, 1% AEP +19% Climate change, Normal Operating Level on the River Cam). Selected in-channel water level results for this model are quoted in Table 3-2 below for reference.
- 3.2.23 The results from Table 3.2 below show that the applicant baseline model generally provides a more conservative estimate of flood depth than the JBA 2023 model for the area of interest therefore it is considered appropriate to continue to use the applicant baseline model to inform the proposed bridge deck height.
- 3.2.24 The following section will consider the potential for impact of the proposed development on flood risk to and from the Bin Brook as well as the proposed embedded mitigation based upon assessment using the applicant baseline model and applicant as-proposed model.

3.3 Modelling results - predicted impacts and likely significant effects

- 3.3.1 A comparison of modelled water levels, depths and flood extents was made between the June 2025 applicant baseline and applicant as-proposed models
- 3.3.2 Plates TR13.1-1-2 and TR13.1-1-3 from the FRA (CD1-11.13.02 pdf page 52, section 3.2) reproduced below shows the areas of change in modelled flood extent and peak flood water level respectively for the 1% AEP with 19% climate change allowance from the baseline flood risk as a result of the proposed 10m span bridge and embankment with existing footbridge removed. On plate TR13.1-1-2 the areas in orange show where the flood extent for proposed scheme is greater than the baseline. On plate TR13.1-1-3 positive value show where out of bank water levels increase as a result of

the proposed scheme, negative values show where water levels decrease. Note that changes less than 0.01m (10mm) have not been shown as these are not considered to be significant and are beyond the confidence limits of the assessment.

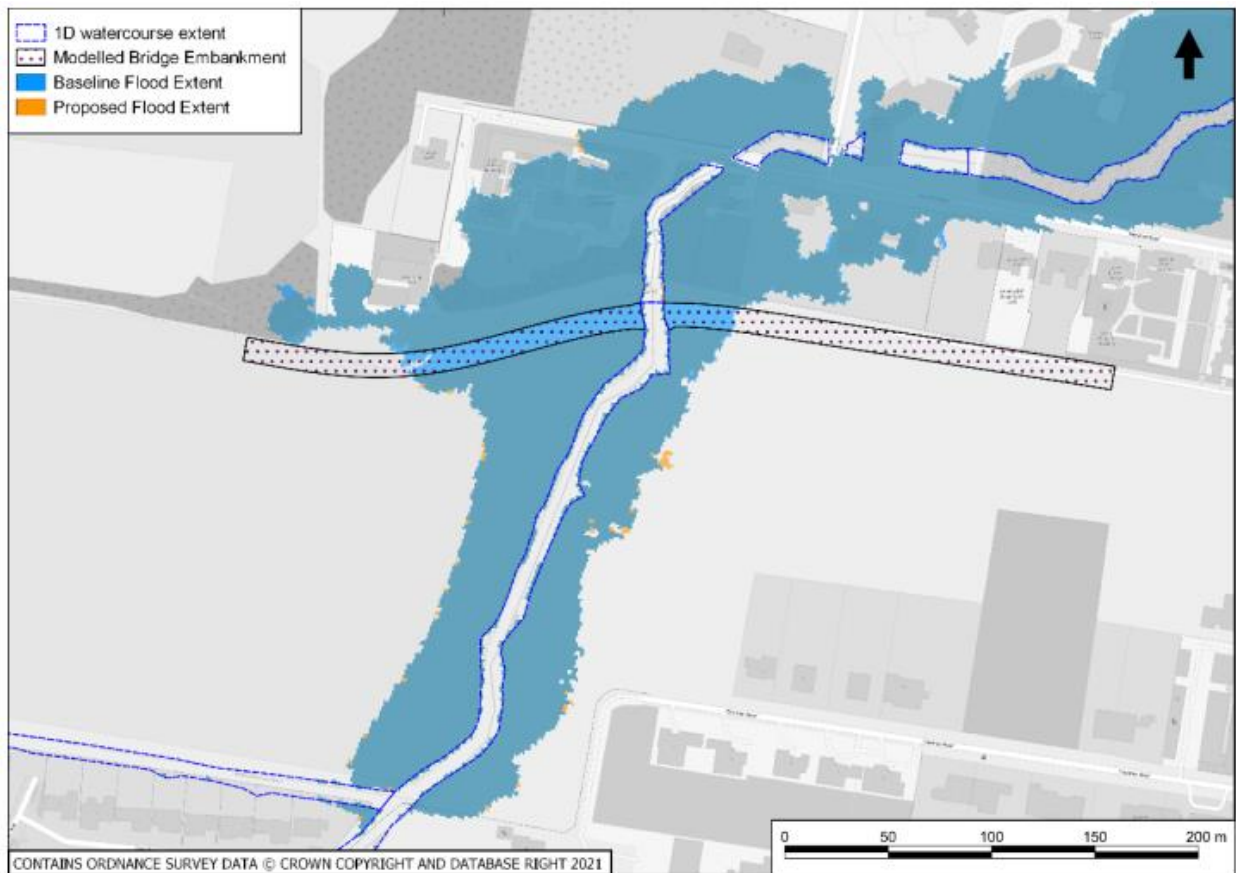


Figure 1- Reproduction of Plate TR13.1-1-2 from the FRA (CD1-11.13.02 pdf page 52, section 3.2) showing the comparison in modelled flood extent between the Applicant Baseline and Proposed models for the 1% AEP event with 19% climate change allowance

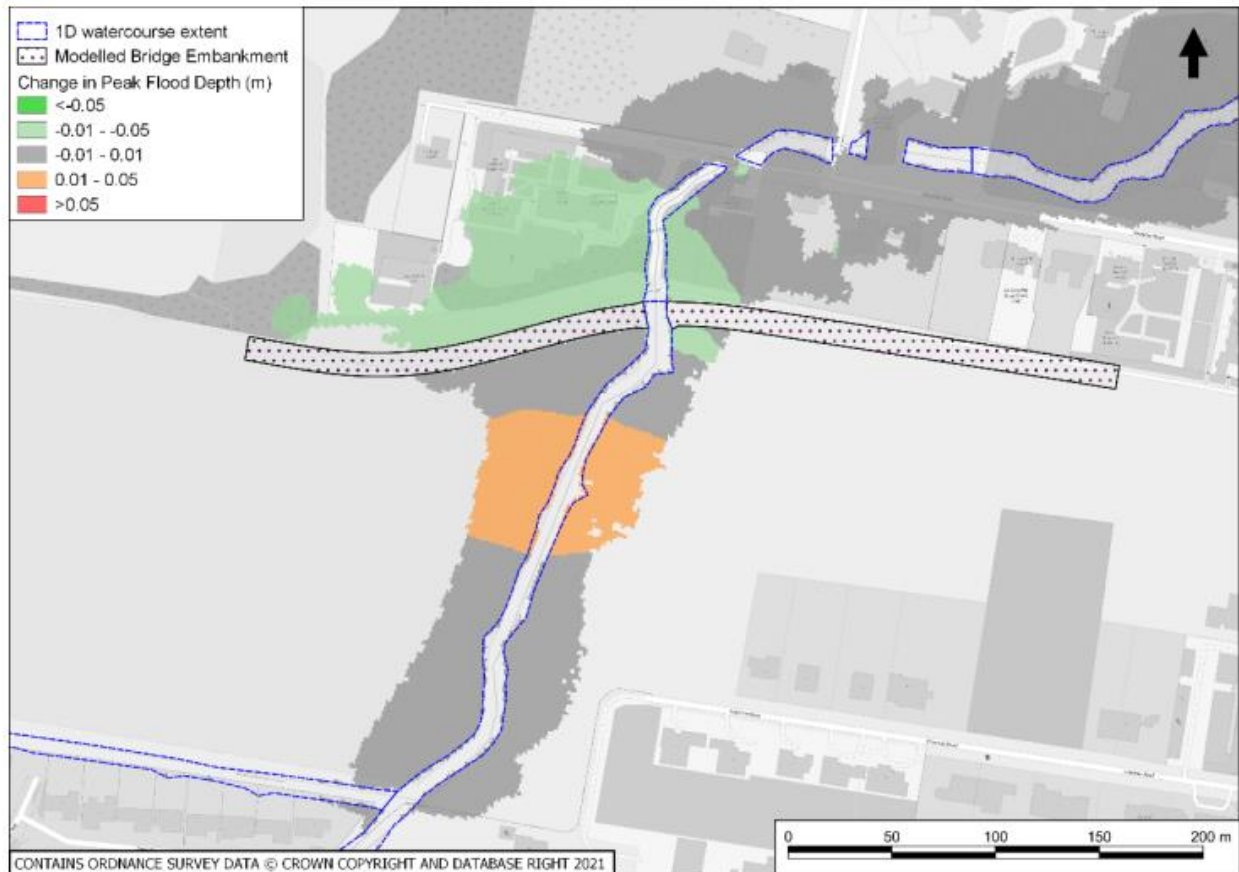


Figure 2- Reproduction of Plate TR13.1-1-3 from the FRA (CD1-11.13.02 pdf page 52, section 3.2) showing the comparison in modelled peak flood water level between the Applicant Baseline and Proposed models for the 1% AEP event with 19% climate change allowance

- 3.3.3 The table below shows the in channel modelled water levels for the 1% AEP event including 19% allowance for climate change for the JBA 2023 model, the applicant baseline model and the applicant as-proposed model.

Table 3-1 In channel modelled water levels for the 1% AEP event including 19% allowance for climate change from different models

Node ID ²	Chainage from proposed bridge	(a) JBA 2023 model maximum modelled water level (mAOD)	(b) Applicant baseline model maximum modelled water level (mAOD)	(c) Applicant as-proposed model maximum modelled water level (mAOD)	Difference between JBA 2023 model and Applicant baseline model ³ (a-b) (m)	Difference between Applicant baseline and proposed model ⁴ (c-b) (m)
BB01_1189 (BB2323u)	-648m (South of Gough Way estate)	10.105	10.103	10.103	0.002	0.000
BB01_0796 (BB1907d)	-255m (north of Gough Way estate)	9.147	9.416	9.424	-0.269	0.008
BB01_0628 (BB1709)	-87m	9.113	9.361	9.387	-0.248	0.026
BB01_0541 (BB1624u)	0m (location of proposed crossing)	9.111	9.374	9.357	-0.263	-0.017
BB01_0461 (BB1548u)	+80m (Hersel Road crossing in the ground of Clare Hall)	9.09	9.373	9.371	-0.283	-0.002
BB01_0403 (BB1489u)	+138m (Sylvester Road crossing)	8.994	9.346	9.344	-0.352	-0.002
BB01_329 (BB1416u)	+191m (Robbinston College access road crossing)	8.807	9.196	9.194	-0.389	-0.002
BB01_0049 (BB1142u)	+471m (Grange Road crossing)	7.95	7.722	7.721	0.228	-0.001

3.3.4 Note that modelled in-channel peak water levels are quoted to three decimal places for illustration of model sensitivity only as this reflects the level of precision reported in the model results. They should not be relied upon to be millimetre accurate absolute values as this is beyond the confidence limits of the modelling approach and results.

3.3.5 This showed that the proposed scheme has a minimal impact on in-channel and flood risk when compared to the baseline flood risk for the same event. The largest impacts are seen upstream of the proposed crossing where maximum modelled water levels in the 1% AEP event plus 19% climate change increase by 26mm. For context the in-

² Node ID is taken from the Applicant baseline model and the Applicant as-proposed model. The equivalent Node ID from the JBA 2023 model is shown in brackets. Where an exact change match can not be found in the JBA 2023 model the nearest equivalent node is listed (e.g. BB1907d is 282m upstream of the proposed crossing)

³ Positive values indicate that JBA 2023 model maximum modelled water level is higher than the Applicant baseline model maximum modelled water level. Negative values indicate the Applicant baseline model maximum modelled water level is higher than the JBA 2023 model.

⁴ Positive values indicate that Applicant as-proposed model maximum modelled water level is higher than the Applicant baseline model maximum modelled water level. Negative values indicate the Applicant baseline model maximum modelled water level is higher than the Applicant as-proposed model.

channel depth is approximately 2.9m (2,900mm) in this location and this represents a 0.8% increase in in-channel modelled depth.

- 3.3.6 Figures 1 and 2 above show a similar pattern with out of bank maximum modelled water level for the 1% AEP event plus 19% climate change, with a small area of increased maximum modelled water level between 10mm to 50mm in peak flood depth over an existing flood depth of approximately 900mm⁵ within the Order Limits to the south (upstream) of the proposed crossing but not extending to the Gough Way estate.
- 3.3.7 Outside of the Order Limits, water levels decrease along the Bin Brook downstream of the proposed route including a small area of reduced maximum modelled water level between 10mm and 50mm in the area to the north (downstream) of the proposed crossing around the Clare Hall estate, so reducing flood risk to third parties. Water levels along Bin Brook upstream of the crossing point would be similar to the baseline, with minimal 8mm increases in depth over a short reach of the watercourse. These increases are within areas already inundated by up to 900mm, and the flood extent is not increased such that it would affect any additional buildings or assets.
- 3.3.8 The above in tables and figures show that the introduction of the new Bin Brook crossing will have little impact on the flood risk, showing minimal change in predicted flood extents for the 1% AEP event with 19% climate change allowance, with the majority of the change within the Order Limits and within areas already expected to be inundated in a flood event.

3.4 Embedded Mitigation

- 3.4.1 Impact on flood risk will be mitigated through use of a clear span bridge over Bin Brook, designed with a bridge soffit above the 1% annual exceedance probability event plus 19% climate change allowance with an additional 300mm freeboard. By replacing the existing small opening bridge with a wider (10m) clear span bridge with a deck raised above the 1% AEP plus climate change event there significantly reduced risk of surcharging of the structure at this location (as is currently shown in the 1% annual exceedance probability event plus 19% climate change allowance for the existing structure).
- 3.4.2 It is not proposed to include flood plain compensation equal to that of the introduced embankment as it was found that by removing the to-be redundant downstream existing access bridge in conjunction with introduction of the scheme embankment and bridge that, as shown in section 3.3, there was no significant impact on flood levels outside of the order limits to compensate. Additionally due to the generally very flat topography of the catchment there is limited opportunity for level for level floodplain compensation local to the area of the works.
- 3.4.3 It has been proposed by an objector (Clare Hall) in their statement of case (reference CD23-17 OBJ-213 SoC, pdf page 99, Section 8.0), to excavate areas of the floodplain within the Order Limits to create additional floodplain storage. The objector's modelling results show this will result in increased flood plain flood depths in broadly the same location within the Order Limits as model results show increased depth in the applicant as-proposed model but the objectors proposal results in much greater increases in floodplain flood depth (of approximately 1m in the objector's illustrative proposal) over much larger extent (up to 14,900m² in the objector's illustrative proposal). The excised areas are likely to be harder to make productive use of following the proposed works due to the prospect of being more regularly inundated or waterlogged. The objector's proposals do show a small (negligible) betterment over a large area; however this is in the order of a 5mm reduction in flood depths and therefore considered negligible. Consequently the objector's proposals are considered to be disproportionate to the scale of the impact identified in the flood risk assessment. The significant increase in

⁵ Out of bank water depth queried from model results and shown in Plate TR13.1-4-6 from the FRA (CD1-11.13.02)

flood risk that would be created by the objector's proposals for the negligible impact offsite is not considered viable

3.5 Conclusions

- 3.5.1 In conclusion, no likely significant effects on flood risk from the Bin Brook are predicted as a result of the proposed development. Mitigation in the form of a large, clear span bridge with deck soffit set above the 1% AEP plus 19% climate change level incorporating 300mm of freeboard has been included. It is not proposed include additional floodplain compensation storage as it is observed to be ineffective and non-viable in this location.

4. REPRESENTATIONS MADE IN CONNECTION WITH BIN BROOK FLOOD RISK (OBJ213)

- 4.1.1 This part of my Proof of Evidence is concerned with the Clare Hall objection (CD2-OBJ-213) and subsequent correspondence) and specifically the Bin Brook flood risk impact of the scheme.

Summary of points made and impact of the scheme on flood risk from the Bin Brook (OBJ 213)

- 4.1.2 Section 2.3 of the Clare Hall objection (CD2-OBJ-213 pdf page 3 section 2.3) state that “(2.3.1) The information provided by the Applicant in support of the Scheme is wholly insufficient as it relates to flooding and does not yet demonstrate that the objectives of the National Planning Policy Framework (2024) have been complied with, in respect of Planning and flood risk. (2.3.2) Clare Hall believes that, based on detailed flood modelling and mitigation reporting commissioned by the college, there is significant increased flood risk associated with the Scheme and that these risks have been inadequately assessed as part of the proposed route. (2.3.3) The current Scheme has a material impact on increasing flow rates and water levels, which can cause scour, bank instability, damage to bridges, the mobilisation of debris, and potential negative outcomes on buildings at Clare Hall (increasing risk to life across the site)”.
- 4.1.3 Subsequent correspondence dated 17/02/25 and 25/03/25 from Clare Hall requests clarification in regard to the assessment of flood risk which the applicant has sort to address.
- 4.1.4 It is noted that this correspondence also references other points in regard to the sustainable drainage treatment train and the flood storage areas drain down time and Transport / Route Alignment but they are not within the scope of evidence presented in this proof and are therefore not discussed further here.

The main issues raised (OBJ213)

- 4.1.5 In terms of Bin Brook Risk impact the main issues raised by this objector along with my response are set out in Table 4-1 below:

Table 4-1 – the main issues raised by Clare Hall (OBJ213) and my response

Ref	Main issues raised by this objector	My response
a)	the status of the Environment Agency's formal review and approval of the flood risk modelling used to inform the draft TWAO	Addressed in Section 3 of this document. Specifically as noted in 3.2.18 "As set out in correspondence in April and May 2025 (ref CD26-01-APP-W9-2 Items 5 and 6) and the July 2025 further response (ref CD26-01-APP-W9-2 Item 8) it is believed that the Environment Agency comments in relation to flood risk modelling have been suitably addressed and any residual matters are not material to the conclusions of the FRA". It is expected that a short addendum will be added to this proof to present the conclusion of the Environment Agency review of the applicant baseline and applicant as-proposed models.
b)	The exact model used in the assessment	The DAT file name is BB01_010.DAT for the applicant baseline model, and BB01_Prop_010.DAT for the applicant as-proposed model. However, it should be noted that the file name of the model used in the assessment is not material to the outcome of the assessment; the approach to developing the model and undertaking the assessment are well documented within the relevant reports and technical appendices. The exact model used in the assessment is reported in the Environment Agency review record will be circulated to upon their acceptance of the model and associated work.
c)	Revised zoomed out version of figures used in the report	Full raw model results files have been provided to the Environment Agency and Clare Hall to allow them to undertake their own assessment of the model results in lieu of revised report figures. This was noted as acceptable by the objector.
d)	Additional figures showing differences in flood depth classified into 1mm increments	Raw model results have been provided. I maintain that it is still not appropriate to quote differences in modelled water levels or depths to 1mm accuracy as requested by the objector as the confidence levels of model representation of natural and engineered systems are well beyond this. The Objector references EA guidance stating that 'tolerances in the software should not be accounted for when reviewing impacts so that trends of impact can be identified and mitigated'. However I would challenge the application of this guidance (assumed to be the Environment Agency and Defra Guidance Using modelling for flood risk

		<p>assessments⁶. As I understand it the guidance is suggesting that a 'relative' change approach be employed when comparing baseline and proposed scenario results. This is what has been undertaken to inform the TWAO as document in the FRA and ES (CD1-11.13.02) with trends in results specifically discussed. Moreover, many hydraulic modelling packages quote values to the nearest millimetre or even smaller, however it is important to recognise that model resolution / precision is not the same as model confidence / accuracy. I would understand the confidence level in the schematisation of the bridge into a 1D-2D depth averaged flood model to be beyond what I would consider to be the 'tolerances in software' and is not a consistent source of uncertainty between the two scenarios.</p> <p>I would caution against quoting or relying upon the assessment results to a 1mm level of precision as this is well beyond the model confidence.</p> <p>As per the guidance we have carried out this analysis using raw results, without including any allowance for model calculation error ('modelling tolerance'). The results of this assessment are shown to an appropriate level of precision (2 decimal places).</p>
e)	Confirmation of how the bridge has been represented in the model	Confirmation of how the bridge has been represented in the model is included in the well documented within the relevant reports and technical appendices (CD1-11.13.02 - Annex TR13.1.1, section 2.3.2) and is reported in the Environment Agency review record (the Appendix to this proof of evidence ref CD26-01-APP-W9-2).
f)	Confirmation of the impact on peak flows passing from the subject site onto Clare Hall as a result of the proposal	Confirmation of the impact on peak flows passing from the subject site onto Clare Hall as a result of the proposal have been produced and are shown in Table 4-2 below. As can be seen there is negligible change in in-channel flow or cross-sectionally averaged velocity other than for section BB01_0541 (the site of the proposed crossing) where flow increase from 3.339 m ³ /s in the applicant baseline model up to 9.485 m ³ /s in the applicant as-proposed model as a result of more flow passing in the 1D element under the proposed scenario than compared to the baseline as expected by the increase in

⁶ <https://www.gov.uk/guidance/using-modelling-for-flood-risk-assessments>

		bridge opening size and removal of the undersized crossing at Rifle Range track. The changes in cross sectionally averaged velocity are generally very small up to 0.02 m/s and negligible compared to the baseline cross sectionally averaged velocity which are in the order of 0.4-1.1 m/s
g)	The risk of blockage from the new structure	<p>Following the Environment Agency's Blockage Management Guidance⁷ the source, pathway and receptor model has been used to screen-out the need for a modelling assessment of blockage of the proposed scheme.</p> <p>The Source in this context is the presence, prevalence and type of potential debris to form the blockage in the upstream catchment. Given the large number of smaller culverts upstream of the site of interest including around Gough Way it is considered that the debris catchment would be the area downstream of Gough Way and upstream of the proposed structure. This area has currently maintained through agricultural use. There is low potential for larger debris due to the limited contributing area.</p> <p>Pathway in this context is the mechanism of the blockage – how the debris would form a blockage. No trash screen is proposed on the structure; the proposed bridge is a 10m clear span structure with abutments set back from the channel top of bank. It would take a considerable out of bank flow event with flows and velocities capable of mobilising 10m+ long debris to create a blockage of the structure the potential for this is considered to be very low.</p> <p>Receptor in this context is the asset that would suffer detriment as a result of the blockage – this can be from increased flood damages, scour or other impact. Due to the lack of notable source of debris and low potential for pathway to result in a blockage it was not considered that the local receptors would be at any greater risk as a result of the development than the current situation. Moreover as part of CtoC proposals involve removal of the existing much smaller opening bridge at this location, it is expected that the Scheme will reduce the risk of blockage in this location.</p>

⁷ <https://www.gov.uk/flood-and-coastal-erosion-risk-management-research-reports/blockage-management-guide>

h)	The final flow rates used in the assessment and why these differ from previous studies	The final flow rates used in the assessment are well documented within the relevant reports and technical appendices (CD1-11.13.02) and have been subject to formal review by the Environment Agency (see the Appendix to this proof of evidence ref CD26-01-APP-W9-2).
i)	Request for provision of copies of the approved models	Copies of the models provided to the Environment Agency have been made available to the objector. At the time of writing the Environment Agency approval was pending and will be captured in an addendum to this proof.
j)	Confirmation of the source data used in the assessment – specifically the version of National River Flow Archive Peak Flood data set (referred to as HiFlows in correspondence).	As per point h above the source data used in the assessment – specifically the version of National River Flow Archive Peak Flood data set (referred to as HiFlows in correspondence) is well documented within the relevant reports and technical appendices (CD1-11.13.02) and have been subject to formal review by the Environment Agency. This is discussed in greater depth in the Appendix to this proof of evidence ref CD26-01-APP-W9-2 Item 6.
k)	The approach to calculating attenuation requirements for the proposed scheme.	The approach to attenuation has been well documented within the technical reports and associated appendices (CD1-11.13.02) as in reiterated above in section 3.4.

Table 4-2 In channel modelled maximum flow and cross-sectionally averaged velocity for the 1% AEP event including 19% allowance for climate change from different models

Node ID	Chainage from proposed bridge	(a) Applicant baseline model maximum in-channel flow (m ³ /s)	(b) Applicant as-proposed model maximum in-channel flow (m ³ /s)	Difference between Applicant baseline and proposed model in channel flow ⁸ (b-a) (m ³ /s)	(c) Applicant baseline model maximum in-channel cross sectionally averaged velocity (m/s)	(d) Applicant as-proposed model maximum in-channel cross sectionally averaged velocity (m/s)	Difference between Applicant baseline and proposed model in channel cross sectionally averaged velocity ⁹ (d-c) (m/s)
BB01_1189	-648m (South of Gough Way estate)	2.697	2.736	0.039	0.409	0.413	0.004
BB01_0796	-255m (north of Gough Way estate)	2.097	2.12	0.023	0.731	0.753	0.022
BB01_0628	-87m	7.142	5.388	-1.754	0.624	0.633	0.009
BB01_0541	0m (location of proposed crossing)	3.339	9.485	6.146	0.483	0.502	0.019
BB01_0461	+80m (Hersel Road crossing in the ground of Clare Hall)	5.772	5.731	-0.041	0.591	0.593	0.002
BB01_0403	+138m (Sylvester Road crossing)	7.387	7.385	-0.002	0.599	0.601	0.002
BB01_329	+191m (Robbinson College access road crossing)	7.048	7.052	0.004	0.517	0.52	0.003
BB01_0049	+471m (Grange Road crossing)	10.399	10.347	-0.052	1.101	1.097	-0.004

4.1.6 Clare Hall have commissioned their own flood risk modelling from Create and presented results from their assessment in a technical note (supplied as part of CD23-17 OBJ-213 SoC (inc Supporting Documents) pdf pages 182-227). The modelling undertaken was based on the September 2023 Environment Agency model prepared by JBA with various amendments.

My Responses (OBJ213)

4.1.7 In respect to the modelling undertaken by Create (documented in CD23-17 OBJ-213 SoC (inc Supporting Documents) pdf pages 182-227), I note that the model used to support this note has not been provided so I am unable to comment on the execution of the assessment or the representation of the baseline and proposed scenarios. Similarly to my knowledge any amendments to the model used in the Create

⁸ Positive values indicate that Applicant as-proposed model maximum modelled in-channel flow is higher than the Applicant baseline model maximum modelled water level. Negative values indicate the Applicant baseline model maximum modelled in-channel flow is higher than the Applicant as-proposed model.

⁹ Positive values indicate that Applicant as-proposed model maximum modelled in-channel cross sectionally averaged velocity is higher than the Applicant baseline model maximum modelled water level. Negative values indicate the Applicant baseline model maximum modelled in-channel cross sectionally averaged velocity is higher than the Applicant as-proposed model.

assessment have not been subject to formal review and approval by the Environment Agency which appears to be one of the main criticisms of the work undertaken to support the ES of the draft TWAO.

Conclusions on Representations by Clare Hall (OBJ213)

- 4.1.8 I conclude that the provided responses along with the appended correspondence with the Environment Agency address points a, b, e, h, and j. Point d, g and k are discussed above and elsewhere in this document. Points c, f, and i are request for additional information that are superseded by the provision of the fully hydraulic model and raw results files to the applicant.

5. OTHER ISSUES RAISED BY THIRD PARTIES

- 5.1.1 It is noted that flood risk is referenced in the following objections. These have not been specifically referenced in Section 4 above as the references to flood risk are either more generic or where specific to Bin Brook less detailed than the Clare Hall and initial Environment Agency responses and it is anticipated that the evidence and discussion provided above in Section 4 is suitable to address these points as well.

Objection reference	Correspondent
OBJ285	The Needham Research Institute
REP 04	St John's College / University of Cambridge
OBJ225	A Curtis
OBJ35	E Khmelnitski
OBJ36	M Stewart
OBJ68	S Nobbs (Bidwells)
OBJ69	J Discoll
OBJ72	R&S Moulton
OBJ73	P Landshoff
OBJ81	L Bonesi
OBJ85	A Wilson
OBJ87	I Newcome
OBJ88	C Newcome
OBJ92	J Davidson
OBJ95	K Driscoll
OBJ99	K Lea
OBJ103	K Jestice
OBJ107	Drs Smalley & Richards
OBJ108	K Fry
OBJ111	H Lintott
OBJ114	R Sewell (South Newnham Neighbourhood)
OBJ115	R Habibi
OBJ119	C Stone
OBJ122	DJ Eastham
OBJ124	R & S Davies
OBJ131	T C Rochford
OBJ132	M & R Baker
OBJ133	S & P Saxena & Kalra
OBJ139	A Fry
OBJ142	A Davidson
OBJ144	R & W Kirkpatrick

OBJ145	J & A Foy
OBJ151	K Glover
OBJ152	M & A Schluter
OBJ157	H Gibbens
OBJ162	L Habibi
OBJ163	P Holton
OBJ166	B J Hawking
OBJ169	R Hawkins
OBJ172	S Maclay
OBJ174	P Rutsaert
OBJ175	K Fry
OBJ180	P Landshoff
OBJ182	J Hawkins
OBJ184	K Doyle
OBJ186	J Nunns
OBJ201	A Warren
OBJ221	S & M Chopra
OBJ223	R Borthwick
OBJ228	S Rowe
OBJ239	V Schiffmann
OBJ240	D Moss
OBJ248	W Mullen
OBJ249	C Mullen
OBJ254	A Selby
OBJ265	A Chester
OBJ273	S C Chester
OBJ277	L Walker
OBJ285	J Mei (Needham Research Institute)

6. CONCLUSIONS

6.1 The main issues of relevance to my evidence are:

6.1.1 The baseline flood risk modelling of the Bin Brook and its surrounds.

6.1.2 The proposed scheme flood risk modelling of the Bin Brook and its surrounds.

6.1.3 The assessment and reporting of forecast flood risk impact arising from the proposed scheme to the Bin Brook and its surrounds.

6.2 As can be seen from the evidence I have presented there has been extensive review of the applicant models – both baseline and as-proposed. The approach to developing the models and the data sources used are comparable with other sources of modelled information. Following extensive independent review the Environment Agency have indicated that they accept the technical evidence base and the conclusions of the FRA and no longer have an objection to the scheme (see CD26-01-APP-W9-2 pdf page 191, Item 9).

6.3 It can clearly be seen that flood risk to the scheme has been mitigated by the use of a raised bridge deck and embankment height set above the 1% AEP event including 19% allowance for climate change and a 300mm freeboard allowance. The flood levels estimated at the site of interest in the applicant's baseline model are higher than the JBA 2023 model and therefore the design is based on the more conservative value.

- 6.4 Flood risk as a result of the scheme has been assessed and found that any changes over 10mm are limited to within the order limits (and those changes within the order limits are understood and accepted by the scheme promoter). There are limited areas outside of the order limits that see increased modelled flood depths of less than 10mm as a result of the scheme. There are some areas of reduced modelled flood depths as a result of the scheme. The risk of blockage to the site is reduced as a result of the scheme compared to the existing situation. Flows and velocities are largely not materially changed as a result of the scheme other than at the site of the proposed bridge structure where more flow is expected to remain in bank as a result of the works, where it would have previously surcharged the existing bridge and formed out of bank flow routes.

7. STATEMENT OF TRUTH

The evidence which I have prepared and provide in this Proof of Evidence is true and is given in accordance with the guidance of my professional institution. I confirm that the opinions expressed are my true and professional opinions.