TRANSPORT

LCC08

Scheme Name:
North Hykeham Relief Road

Promoting Authority:
Lincolnshire County Council

Orders:
The Lincolnshire County Council (A1461 North Hykeham Relief Road) Compulsory Purchase Order 2024; and **The Lincolnshire County Council (A1461 North Hykeham Relief Road) (Classified Road) (Side Roads) Order 2024.**

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Hydrology & Flooding
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NORTH HYKEHAM RELIEF ROAD

HYDROLOGY & FLOODING - PROOF OF EVIDENCE

Contents

1. Introduction

1.1 Author

1.1.1 I am Sarah Armit. I am an environmental consultant for Ramboll UK Ltd, referred to as Ramboll throughout this report. I have a master's degree in Environmental Engineering, and I am a Chartered Environmentalist and Chartered Member of the Chartered Institution of Water and Environmental Management (CIWEM). I have been working in the environmental management sector for over 13 years, specialising in flood risk and the water environment.

1.2 Scope and Objectives

1.2.1 At this Inquiry I am the expert witness addressing matters relating to the hydrological regime and flooding arising from and in relation to the proposed North Hykeham Relief Road (NHRR) Scheme, hereafter referred to as "the Scheme". Planning permission for the Scheme was granted in May 2024 **[CD1.1]** and Section 73 consent granted in January 2025 **[CD1.2]**.

1.2.2 This Proof of Evidence provides the following:

- An assessment of flood risk to the Scheme from watercourses classified as main rivers, referred to as fluvial flood risk;
- An assessment of the impact of the Scheme to the River Witham floodplain and the existing fluvial flooding mechanisms;
- An assessment of groundwater flood risk to the Scheme;
- An assessment of the impact of the Scheme on groundwater flood risk within the existing hydrogeological setting;
- An assessment of flood risk to the Scheme from artificial water sources; and
- An assessment of the impact of the Scheme on flood risk arising from artificial water sources in the surrounding area.

1.2.3 The opinions expressed within this report are my own unless I state otherwise. I have been assisted by colleagues from within the Ramboll NHRR project team with regards to the hydrology and flood risk analysis reported in this document. Where a topic is covered within the Proof of Evidence of another specialist, I have provided a cross reference to the relevant proof.

1.2.4 This Proof of Evidence addresses hydrology and flooding with the assessment of surface water flood risk both to and from the Scheme being addressed in the Proof of Evidence presented by Mr Munir. Assessment of the impact of the Scheme on water quality is also addressed within the Proof of Evidence presented by Mr Munir.

1.3 Data Sources

1.3.1 The following assessments have been undertaken in relation to hydrology and flooding to inform the design of the Scheme and the Scheme planning submission:

- A Hydraulic Modelling Report prepared by Ramboll (Report Reference: NHRR-RAM-EWE-HYKE-RP-LE-22003, August 2023) **[CD8.98]**;
- A Flood Risk Assessment prepared by Ramboll (Report Reference: RR-RAM-EWE-HYKE-RP-LE-22002, August 2023) **[CD8.99]**;
- A Hydromorphology Assessment prepared by Ramboll (Report Reference: NHRR-RAM-EWE-HYKE-RP-LE-22004) **[CD8.100]**;
- The NHRR Environmental Statement Volume 2 Chapter 14 Road Drainage and the Water Environment prepared by Ramboll (Report Reference: NHRR-RAM-EWE-HYKE-RP-LE-22001, October 2023) **[CD7.1]**;
- A Water Framework Directive Assessment prepared by Ramboll (Report Reference: NHRR-RAM-EWE-HYKE-RP-LE-22005, August 2023) **[CD8.101]**;

- An Initial Scour Assessment and Optioneering report prepared by Ramboll (Report Reference: NHRR-RAM-EWE-HYKE-RP-LE-22006, October 2023) **[CD8.102]**; and
- A Drainage Strategy Report prepared by Ramboll (Report Reference: NHRR-RAM-HDG-HYKE-RP-CD-05003, October 2024) **[CD8.79]**.

1.3.2 These assessments, combined with discussion with relevant design team members, have been used to inform this Proof of Evidence.

2. Scheme Setting

2.1 Hydrology

2.1.1 The Scheme is situated to the south of the City of Lincoln and runs in a broadly west to east direction, linking the A46 and A15 and crossing an escarpment. Along this route, hydrological interest primarily lies in the areas of lower ground to the west of the escarpment.

2.1.2 Within the area to the west of the escarpment, the Scheme crosses the River Witham, classified as a main river. At the point of intersection with the Scheme, the River Witham flows in a south-north direction and towards the City of Lincoln. No other main rivers are crossed by the Scheme. The Scheme comprises an earth embankment, however this is intersected with a wide-span bridge at the River Witham crossing. The proposed bridge structure is approximately 109m in length and 30m in width. The bridge is to be supported by two sets of four 2.25m diameter circular piers, positioned either side of the River Witham channel.

2.1.3 The River Brant, also classified as a main river, joins the River Witham approximately 300m south and upstream of the Scheme. A third main river known as 'The Beck' is situated downstream of the Scheme, approximately 100m north, and flows in a west-east direction to also join with the River Witham and therefore also flows towards the city of Lincoln.

2.1.4 Several Internal Drainage Board (IDB) watercourses are present throughout the agricultural floodplain to the east and west of the River Witham, through which the Scheme passes. These drains are part of the Upper Witham IDB drainage network. The IDB manages the drainage network within this floodplain.

2.1.5 A culvert is proposed through the Scheme embankment, to the west of the bridge structure, to allow continued passage of flows within the IDB Green Lane Drain

channel. In agreement with both the Environment Agency (EA) and IDB, IDB Hykeham Pump Drain South channel and IDB Waddington Dyke South channel will also be culverted as they pass under the proposed bridge structure to the west and east of the River Witham channel respectively. The extent of these culverts upstream and downstream of the bridge structure has been agreed with the IDB. The management and redirection of the IDB watercourses impacted by the Scheme is discussed within the Drainage Proof of Evidence.

2.2 Existing Flood Defences

2.2.1 Flooding within the River Witham floodplain is actively managed by the EA with a series of sluice gates, flood water storage areas and raised earth embankments. Discussion with the EA as part of the planning consultation for the Scheme has been undertaken to ensure that there is no conflict with the provision made by the EA in this respect. This is discussed further in section 3.

2.2.2 Raised earth-bund embankments line both sides of the main rivers within the surrounding area, including the River Witham, River Brant and The Beck. The embankments extend a significant distance upstream and downstream of the Scheme, beyond the study area, and provide varying levels of protection against flood events.

2.2.3 A set of sluice gates are located within the River Witham channel approximately 100m south and upstream of the Scheme. A corresponding flood water storage area, known as the Witham Washland, is present to the west of these sluice gates and stores floodwaters when the sluice gates are in operation. The Witham Washland features a grassed earth-bund embankment with a concrete capping beam on its northern edge, running broadly parallel to the Scheme. This is known as the Witham Washland Defence and is approximately 1.2km in length. The EA

has confirmed that the Witham Washland Defence provides storage for river flows of up to and including the present day 1 in 100-year flood event. This is defined as a flood event that statistically has a 1% probability of occurring in any given year.

2.2.4 Further upstream of the Witham Washland, there are further raised earth-bund embankments on either side of the River Witham and River Brant channel. These act to create an additional flood storage area, upstream of the Witham Washland, known as the Brant Washland. The Brant Washland is situated to the south of River Witham and to the west of the River Brant, prior to the confluence of these two watercourses. The Brant Washland operates in conjunction with sluice gates located on the west bank on the River Brant, approximately 85m upstream of Blackmoor Road, and stores floodwaters when these sluice gates are in operation.

2.2.5 Figure 2.1 below has been extracted from the Hydraulic Modelling Report **[CD8.98]**. This shows the Scheme location, the hydrological setting of the Scheme and the flood defences described above.

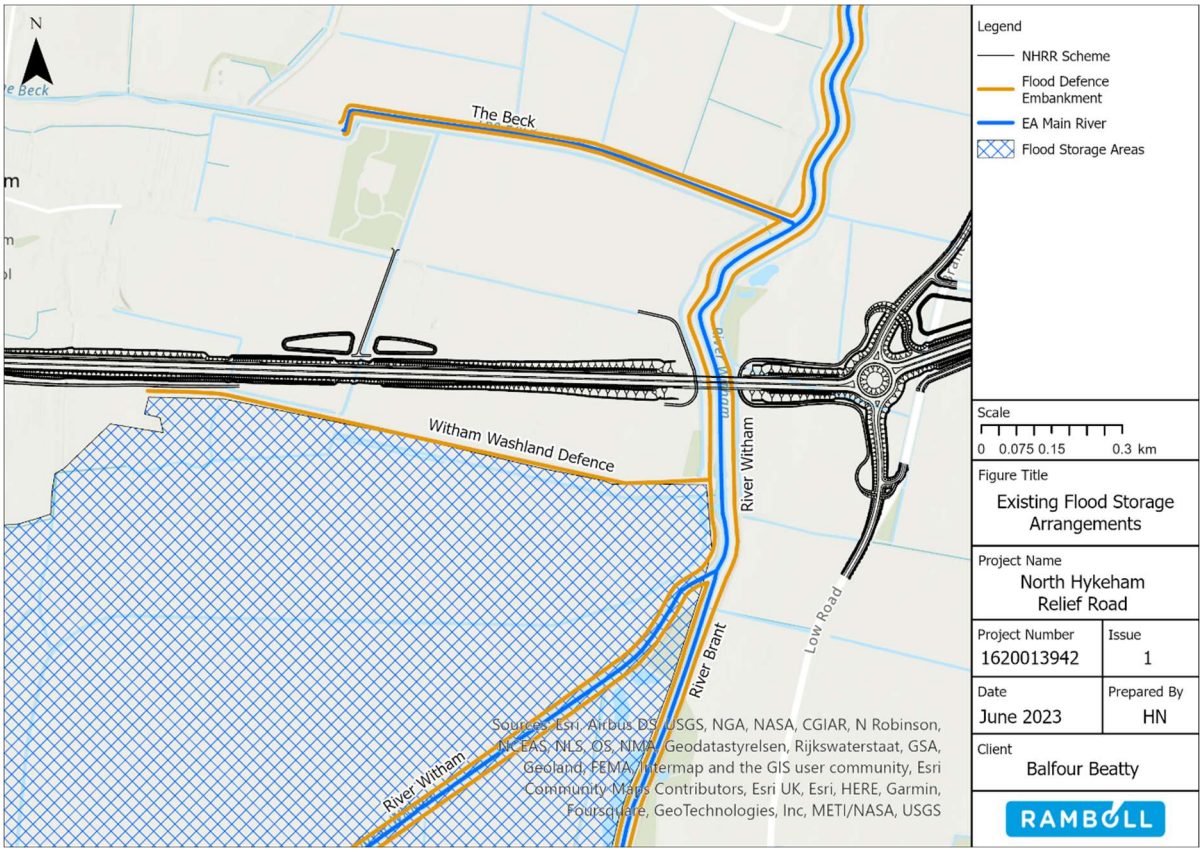

Figure 2.1: Hydrological Setting

2.2.6 Both the Witham Washland and Brant Washland sluice gates operate under the Lincoln Washlands Operating Procedures to protect the City of Lincoln from fluvial flooding. When a flood event is predicted during which the City of Lincoln is expected to flood, the River Witham main channel sluice gates are raised and the side sluice gates into the Witham Washland and Brant Washland areas are opened to allow water to flow into these flood storage areas. These operations are triggered by water levels recorded at Bracebridge, Hykeham Bridge and the River Witham main channel sluice gates.

2.2.7 Both the Brant Washland and the Witham Washland have a sufficient floodwater storage volume to be classified as reservoirs under the Reservoirs Safety Act **[CD2.9]**.

2.2.8 The Scheme location has been selected such that it is positioned downstream of the Brant Washland and the Witham Washland. This constraint on the Scheme

location ensures that the Scheme does not impact upon the operation of these flood storage areas.

2.3 Hydrogeology

2.3.1 The Scheme crosses two distinct groundwater units. These are the Lias Group to the west, comprising primarily of mudstone, and the Inferior Oolite Group to the east, comprising primarily of limestone. The escarpment discussed in Section 2.1 is situated between the two units, located just west of the A607, with topography falling westward towards the River Witham. Where the Scheme crosses this escarpment, a cutting into this is proposed to prevent excessive gradients for the Scheme structure.

2.3.2 A groundwater spring line is situated on the face of the escarpment. This line is disturbed by the proposed cutting. To maintain stability in the cutting through the escarpment at this location, counterfort drains are proposed to collect groundwater flow from the spring. These are proposed in the form of a series of shallow stone-filled trenches which tie into the proposed surface water drainage infrastructure at the base of the cutting slope. This drainage infrastructure will discharge to the IDB watercourse network and ultimately the River Witham.

3. Assessment of Fluvial Flood Risk

3.1 Fluvial Flood Risk Assessment Methodology

3.1.1 The Scheme is situated primarily in Flood Zone 1, defined by the EA to be at low risk of fluvial flooding, with the exception of the section which passes through the River Witham floodplain and falls within Flood Zones 2 and 3, where fluvial flooding is expected under certain conditions.

3.1.2 An existing EA hydraulic model, last updated in 2015, was used to determine the River Witham floodplain extents and corresponding flood zones within the EA flood mapping. At the time of the Scheme design, the EA were in the process of updating this model to account for changes in government guidance regarding the predicted future effects of climate change. This updated model was not available over the timescales required for the Scheme design. Therefore, it was agreed with the EA that Ramboll would complete their own model conversion of the existing model to assess the impacts of the Scheme, including the most up to date climate change guidance.

3.1.3 It was agreed between Ramboll, the EA and the IDB that two separate hydraulic models would be used to assess the impact of the Scheme: firstly, a model to assess fluvial flood risk relating to the River Witham and secondly, a model to assess the impact of the Scheme to the IDB drainage network. An assessment of the impact to the IDB drainage network has been undertaken by the drainage design team and this is covered within a separate Proof of Evidence.

3.1.4 The aims of the River Witham hydraulic modelling were to assess both fluvial flood risk to the Scheme and to assess the impact of the Scheme on existing fluvial flood risk within the River Witham floodplain. The methodology used to

undertake the River Witham hydraulic modelling has been formally agreed with by the EA.

3.1.5 As defined by the EA, the design flood event for the Scheme is the 1 in 100-year flood event including allowance for the future predicted effects of climate change over the lifetime of the Scheme. The climate change allowances included within the hydrological data for assessment have been formally agreed with the EA. To assist in assessing fluvial flood risk, the impact of both the present day 1 in 100-year flood event and the 1 in 1000-year flood event, defined as a flood event that statistically has a 0.1% probability of occurring in any given year, have also been assessed.

3.2 Fluvial Flood Risk to the Scheme

Analysis of Fluvial Flood Risk

3.2.1 The results of the hydraulic modelling **[CD8.98]** show that the road surface of the Scheme is situated above the floodwater levels of all fluvial flood events modelled. Therefore, the road surface is not predicted to flood and all flood waters are able to pass under the Scheme structure.

Impact of a Failure of the Flood Defences

3.2.2 In addition to the modelling of flood events with the existing flood defence systems acting as designed, the hydraulic modelling **[CD8.98]** also assessed flood events where the flood defence systems fail through a breach of the flood defences. In agreement with the EA, two breach scenarios were assessed;

- A breach of the Witham Washland Defence embankment; and
- A breach of the EA flood defence embankment situated on the western side of the River Witham channel, with the breach located between the River Witham sluice gates and the Scheme structure.

3.2.3 The results of the hydraulic modelling **[CD8.98]** show that even in the event of a failure of the flood defences at these locations, the road surface of the Scheme is situated above all of the fluvial flood levels modelled.

Proposed Mitigation Measures

3.2.4 The hydraulic modelling **[CD8.98]** assessed the impact of the presence of the Scheme on the velocity of floodwaters. During some flood events, the velocity of floodwaters is expected to increase as floodwaters pass underneath the proposed bridge structure compared to without the structure in place. This is discussed further in Section 3.3. To protect the bridge structure against erosion due to these higher velocities, scour protection is included in the bridge design in the form of a grasscrete apron around the bridge piers and at the base of the bridge abutments.

3.2.5 Scour protection is also proposed along the Scheme embankment in the form of a stone geomattress up to the height of floodwaters anticipated during the design flood event. This is to be designed to ensure the stability of the embankment and afford protection to the toe of the embankment during flood events where floodwaters are anticipated to reach the Scheme structure.

Conclusions

3.2.6 On the basis of the evidence presented above, the Scheme is not adversely impacted by fluvial flooding and no further mitigation measures are considered to be necessary.

3.3 Impact of the Scheme to the River Witham Floodplain

Analysis of Fluvial Flood Risk

3.3.1 The results of the hydraulic modelling **[CD8.98]** show that for the present day 1 in 100-year flood event all floodwaters are contained within the Witham Washland flood storage area. The floodplain extent, floodwater depths and floodwater velocities remain unchanged following inclusion of the Scheme within the hydraulic model.

3.3.2 When taking into consideration the future predicted effects of climate change, the 1 in 100-year flood event floodwaters are expected to increase. Floodwaters are expected to increase to such an extent that following closure of the River Witham sluice gates and entering of floodwaters into the Witham Washland, floodwaters will overtop the Witham Washland Defence embankment. Therefore, rather than all floodwaters upstream of the sluice gates remaining contained within the flood storage area until the sluice gates are reopened, some floodwater will flow over the top of the Witham Washland Defence embankment and enter the floodplain downstream. This is also anticipated for the 1 in 1000-year flood event.

Impact to Fluvial Flooding Mechanisms

3.3.3 When floodwaters overtop the Witham Washland Defence embankment, without the presence of the Scheme, overtopped floodwaters spread across the floodplain downstream of the embankment. With the presence of the Scheme, the proposed road structure acts as a barrier to the overtopped floodwaters, which are then funnelled underneath the Scheme bridge structure.

3.3.4 The hydraulic modelling **[CD8.98]** concludes that this will result in a reduction to the flood extents to the north of the Scheme and an increase to the flood extent to the south in the area between the Scheme structure and the Witham Washland

Defence embankment. Consultation with the EA has confirmed that no compensatory floodwater storage will be required to offset loss of floodplain volume due to the construction of the earth embankment as part of the Scheme structure.

3.3.5 The anticipated depth of flood waters varies across the River Witham floodplain, with depths of up to 3m within the floodplain to the north of the Witham Washland Defence embankment and to the south of the Scheme structure. At the proposed location of the Scheme structure adjacent to the River Witham channel, floodwater depths of approximately 0.5-2m are anticipated for the 1 in 100-year flood event including allowances for climate change.

3.3.6 When the Scheme is included within the hydraulic model **[CD8.98]**, there are decreases in floodwater depths to the north of the Scheme and increases of floodwater depths to the south of the Scheme. For the 1 in 100-year flood event including allowances for the predicted effects of climate change, downstream (north) of the Scheme these decreases range from approximately 20mm to 100mm and upstream (south) of the Scheme these increases range from approximately 50mm to 500mm.

3.3.7 In addition to changes in flood extent and floodwater depth, the concentration of floodwater flows under the bridge results in an increase in the velocity of floodwaters within the River Witham floodplain with the presence of the Scheme. For the 1 in 100-year flood event including allowances for the predicted effects of climate change, the hydraulic modelling results show increases in floodplain velocities on the southern edge of the Scheme embankment to the West of the River Witham, just before the opening to the wide span bridge crossing the river channel.

3.3.8 To mitigate the potential for erosion of the River Witham embankments due to an increase in floodwater velocities, scour protection in the form of a grasscrete apron is proposed along the embankments beneath the Scheme bridge structure as well as immediately upstream and downstream of the structure.

Impact to Fluvial Flows within IDB Watercourses

3.3.9 When the Witham Washland Defence embankment overtops, floodwaters also overtop the River Witham flood defence embankment on the western riverbank to the north of the River Witham sluice gates. A portion of the floodwater accumulating in this area of the floodplain enter the IDB Pump Drain South channel. With the Scheme included in the hydraulic model **[CD8.98]**, fluvial floodwaters fill the IDB Pump Drain South channel as far downstream as Meadow Lane, compared to the hydraulic model without the structure, where flood waters only fill the IDB Hykeham Pump Drain South channel as far downstream as The Beck. This is a result of the funnelling effect of the floodwaters under the Scheme wide span bridge, bringing additional floodwaters in closer proximity to the IDB Hykeham Pump Drain South.

3.3.10 With the presence of the Scheme, some increases in floodwater velocity are observed within the IDB Pump Drain South channel compared to the hydraulic model without the structure, however these increases remain isolated and localised. Due to the culverting of the IDB Pump Drain South channel at this location, scour protection is not required.

3.3.11 Changes to floodwaters within the IDB Green Lane Drain channel and IDB Waddington Dyke South channel during the modelled fluvial flood events are negligible.

Impact in the Event of a Failure of the Flood Defences

3.3.12 The flood event scenarios described above have been modelled with the sluice gates and corresponding flood storage areas acting as designed. As discussed in section 3.2, the hydraulic modelling **[CD8.98]** also assessed two breach scenarios: firstly, a breach of the Witham Washland Defence embankment and secondly, a breach of the earth embankment on the western side of the River Witham channel between the River Witham main channel sluice gates and the Scheme.

3.3.13 During the breach scenarios, no increase in floodwater velocities were observed within the River Witham channel. As a result of the breach, some increases in floodwater velocities were observed within the IDB Hykeham Pump Drain South channel between the Witham Washland and The Beck, however these velocity increases were the same for both the existing hydrological regime and with the inclusion of the Scheme. Therefore, the Scheme does not impact upon flow velocities during a breach scenario.

Conclusions

3.3.14 In summary, I consider the impact of the Scheme to the River Witham floodplain to be limited to small changes in flood extent, limited to the slight variations at the edges of the flood extents, and also small changes in floodwater depth and velocity. In the absence of people and buildings, these small increases in floodwater depth and floodwater velocities have a negligible impact on fluvial flood risk to downstream receptors. The impact of increases in floodwater velocities to structures is able to be managed through the inclusion of scour protection measures.

3.3.15 On the basis of the evidence presented above, the Scheme has no has adverse impact to the River Witham floodplain and fluvial flooding mechanisms.

4. Assessment of Groundwater Flood Risk

4.1 Groundwater Flood Risk to the Scheme

4.1.1 Groundwater flood events result from a rise in groundwater level sufficient enough for the water table to intersect the ground surface. Floodwaters may emerge from either point or diffuse locations and the elevated water table levels are typically longer in duration than fluvial or surface water flood events, developing over weeks or months and prevailing for days or weeks.

4.1.2 Given the relatively flat topography and presence of the IDB watercourses across the area surrounding the Scheme to the west of the escarpment, in the event of groundwater emerging at the ground surface, flows would most likely enter the IDB and highway drainage networks, via the same mechanisms as surface water would during a rainfall event.

4.1.3 As discussed in section 2.3, a groundwater spring line is situated on the face of the escarpment through which a cutting is proposed to accommodate the Scheme. To maintain stability in the cutting through the escarpment at this location, counterfort drains are proposed to collect groundwater flow from the spring and tie into the surface water drainage infrastructure. This drainage infrastructure will discharge to the IDB watercourse network and ultimately the River Witham.

4.1.4 Due to the local topography and the elevated nature of the Scheme structure, groundwater flows are highly unlikely to impact the road surface during a groundwater flood event. In the unlikely event that elevated groundwater at the road surface does occur, the presence of surface water drainage infrastructure to manage the flow of water upon the road surface would direct flows away from the carriageway via the same mechanisms as intended for surface water runoff. On

this basis further mitigation measures against groundwater flooding have not been considered necessary in the design of the Scheme.

4.1.5 On the basis of the evidence above, the risk of groundwater flooding to the Scheme is considered to be low.

4.2 Impact of the Scheme on Groundwater Flood Risk

4.2.1 The volume of groundwater emerging at the surface at the escarpment cutting is negligible compared to the overall groundwater volume in the unit. As discussed in section 2.3, groundwater flows will be directed into the proposed drainage infrastructure and westward towards the River Witham in line with the existing hydrogeological regime. Therefore, changes to the overall existing hydrogeological regime and groundwater quantities are negligible following introduction of the Scheme.

4.2.2 In addition to the escarpment drainage infrastructure discussed in section 2.3, the Scheme has been designed such that all proposed features below the ground surface, including structural foundations and surface water storage ponds, have taken into consideration groundwater levels. On this basis impact to groundwater levels arising from the Scheme are negligible. Consequently, changes to groundwater flood risk are also considered to be negligible.

4.2.3 On the basis of the evidence presented above, the Scheme has a negligible impact on existing groundwater flood risk to the surrounding area.

5. Flood Risk from Artificial Sources

5.1 Risk of Flooding to the Scheme from Artificial Sources

5.1.1 Reservoir flooding occurs when there is a failure of reservoir infrastructure. To minimise this risk, the integrity of reservoir infrastructure is regularly inspected by qualified engineers, however a residual risk of infrastructure failure remains.

5.1.2 As discussed in section 2.2, the Witham Washland and the Brant Washland flood storage areas are classified as reservoirs under the Reservoirs Act **[CD2.9]**. The Scheme is situated within an area anticipated to be impacted by flooding in the event of a failure of the infrastructure associated with these water storage areas. The risk to the Scheme because of a failure of the infrastructure associated with these has been assessed as part of the hydraulic modelling breach analysis detailed in section 3.3.

5.1.3 The results of the hydraulic modelling **[CD8.98]** show that in the event of a failure of the infrastructure associated with the Witham Washland and Brant Washland storage areas, the road surface of the Scheme is situated above all modelled flood levels. Scour protection has been incorporated into the design of the Scheme structure to provide project against floodwaters. Therefore, no further mitigation measures to protect the Scheme against reservoir flood risk are deemed to be necessary. There are no known other sources of artificial flood risk by which the Scheme may be impacted.

5.1.4 On the basis of the evidence presented above, the Scheme is not adversely impacted by artificial sources, including reservoir flooding, and no further mitigation measures are considered to be necessary.

5.2 Impact of the Scheme to Artificial Sources of Flood Risk

5.2.1 During consultation with the EA it was agreed that the Scheme does not interact with either the Witham Washland or the Brant Washland floodwater storage areas. During a flood event following failure of the infrastructure associated with these, floodwaters are able to pass beneath the proposed Scheme structure, and the Scheme does not impact upon the local hydrological regime or floodwater velocities. Therefore, the EA have confirmed that the Scheme will not be classified under the Reservoirs Act **[CD2.9]**. There are no other known artificial sources of flood risk which may be impacted by the Scheme.

5.2.2 On the basis of the evidence presented above, the Scheme does not adversely impact flood risk from artificial sources, including reservoir flood risk, to the surrounding area and no mitigation measures are considered to be necessary.

6. Summary and Conclusions

6.1.1 The Scheme crosses the River Witham, perpendicular to the direction of flow, via a wide-span bridge structure supported by two sets of four circular piers, positioned either side of the River Witham channel.

6.1.2 The hydraulic modelling analysis **[CD8.98]** of the interaction between the Scheme and the River Witham floodplain has been conducted in accordance with relevant legislation and professional guidance. The hydraulic modelling methodology has approved by the EA.

6.1.3 The hydraulic modelling analysis **[CD8.98]** demonstrates that the Scheme is not adversely impacted by fluvial flooding. The scour protection measures to be incorporated into the design of the Scheme structure are effective, justifiable and achievable. No further mitigation measures against fluvial flooding to the Scheme are considered to be necessary.

6.1.4 The impact of the Scheme to the River Witham floodplain is limited to slight variations at the edges of the flood extents, and also small changes in floodwater depth and velocity. In the absence of people and buildings, these small increases in floodwater depth and floodwater velocities have a negligible impact on fluvial flood risk to downstream and upstream receptors.

6.1.5 The impact of increases in floodwater velocities to the existing River Witham earth embankment flood defence structures is able to be managed through the inclusion of scour protection measures. The scour protection measures proposed are effective, justifiable and achievable. No further mitigation measures to the existing hydrological regime are considered to be necessary. On this basis the Scheme has no has adverse impact to the River Witham floodplain and fluvial flooding mechanisms.

6.1.6 Due to the local topography and the elevated nature of the Scheme structure, groundwater flows are highly unlikely to impact the road surface. In the unlikely event of elevated groundwater at the road surface, the presence of surface water drainage infrastructure would direct groundwater away from the carriageway via the same mechanisms as intended for surface water runoff.

6.1.7 Drainage infrastructure is included in the Scheme design to manage groundwater where the Scheme cuts through an escarpment. Furthermore the Scheme has been designed such that all proposed features below the ground surface, including structural foundations and surface water storage ponds, have taken into consideration groundwater levels. Therefore, impact to groundwater levels arising from the Scheme are considered to be negligible. Consequently changes to groundwater flood risk are also considered to be negligible.

6.1.8 The Scheme is not adversely impacted by artificial sources of flood risk, including reservoir flooding, and no further mitigation measures are considered to be necessary.

6.1.9 The Scheme does not adversely impact flood risk from artificial sources, including reservoir flood risk, to the surrounding area and no further mitigation measures are considered to be necessary.

6.1.10 My proof of evidence includes facts which I regard as being relevant to the opinions which I have expressed, and the Inquiry's attention has been drawn to any matter which would affect the validity of that opinion.

6.1.11 I believe the facts I have stated in my proof of evidence are true and that the opinions expressed are correct.

6.1.12 I understand my duty to the Inquiry to assist with matters within my expertise and believe that I have complied with that duty.