NORTH AND EAST MELTON MOWBRAY DISTRIBUTOR ROAD

Proof of Evidence LCC 07: Flooding

Prepared by: Dr. Ian Bentley

60542201- LCC -GEN-GEN_GEN_ZZ_Z-PE-HD-0700

Leicestershire County Council

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Quality information

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1 Table of Contents

1 Introduction

1.1 Qualifications

1.1.1 My name is Ian Bentley. I hold a Degree in Civil Engineering, a Master's Degree in Hydroinformatics and Hydraulic Engineering, and a Ph.D in Estuarine Morphodynamic Modelling. I have 12 years of experience in fluvial hydraulic modelling and flood risk analysis.

1.1.2 I am currently a Principal Engineer at AECOM and have held this post for over 6 years..

1.2 Relevant Experience

1.2.1 During my career I have been involved in the development of hydraulic models for the purposes of assessing flood risk, informing the design of flood alleviation schemes and assessing impacts to flood risk from proposed river crossings. My previous project work includes:

- **Didcot Garden Town HIF 1, Oxfordshire County Council (2021 – present):** development of hydraulic models for the purpose of assessing impacts to the River Thames and Moor Ditch watercourses near Didcot and Sutton Courtney.
- **LNA Modelling Programme (2020 – present):** technical lead for development of new Environment Agency hydraulic models for assessing flood risk from the River Bain and the River Steeping, in Lincolnshire.
- **AlUla Infrastructure Master Plan (2020):** development of broad scale 2D direct rainfall models for the purpose of flood risk mapping in Al Ula, Saudi Arabia, and the surrounding area (modelling lead).
- **EA Modelling and Mapping Framework secondment, Environment Agency, (2019/2020):** carried out model reviews using the Environment Agency's non-real time model review template and provided flood forecasting support to duty officers during flood events in February 2020.
- **Gilston Area FRA (2016 – 2019):** development of a hydraulic model for the purpose of assessing flood risk from the River Stort and impacts from two proposed river crossings in Harlow.
- **York Flood Alleviation Scheme, Water and Environment Management Framework, Lot 3, Environment Agency (2017 – 2019):** economic appraisal and hydraulic modelling to support the production of Options Appraisal Reports and OBCs for proposed flood alleviation schemes in York City Centre and the surrounding area.
- **York Initial Assessments, Water and Environment Management Framework, Lot 3, Environment Agency (2016):** lead the economic assessment of flood alleviation options for 32 flood cells within York City Centre and surrounding areas.
- **Water and Environment Management Framework, Lot 1, Environment Agency (2016 – 2017):** provided support and carried out internal reviews for 1D-2D models developed using Flood Modeller Pro and TUFLOW, for the Environment Agency.
- **Water and Environment Management Framework, Lot 3, Environment Agency (2015-2017):** lead a team to deliver modelling components for a series of flood risk assessment and feasibility studies. This included 1D-2D modelling using Flood Modeller-TUFLOW and detailed 2D river channel modelling using InfoWorks ICM.
- **Midyan Wind Farm Hydrology and Flood Risk Assessent, Saudi Aramco, Saudi Arabia (2015):** assisted with the hydrological and hydraulic modelling aspects of this Flood Risk assessment study.

- **Middlesbrough Flood Risk Modelling studies, Middlesbrough Council (2015):** lead a number of small scale modelling studies to assess the existing flood risk at sites in Middlesbrough and evaluate potential engineering solutions.
- **Irish National CFRAMS project, OPW Ireland (2013-2014):** development of 1D-2D linked models using ISIS-2D, for the purpose of flood risk and flood hazard mapping.

2 Involvement with the Scheme and Contribution Made

2.1 Included within this proof

2.1.1 This proof of evidence covers the site wide approach to flooding across the scheme at all watercourses. The assessment made includes all potential effects arising from Flooding and identifies that there is no unacceptable impact. Specific detail for the flood risk approach at the River Eye has also been included as Annex B to the Proof of Evidence LCC 06: River Eye diversion and Site of Special Scientific Interest prepared by Jonathon Simons.

2.2 Definitions

It would be helpful if from the start I define certain terms to ensure that my evidence can be followed:

Exception Test:	The Exception Test is set out in paragraph 160 of the NPPF. It is a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.
Main River:	Larger river or stream falling under the jurisdiction of the Environment Agency, as shown on the Main River Map[1]
NPPF:	National Planning Policy Framework; the 2021 version. The NPPF sets out government's planning policies for England and how these are expected to be applied.
Ordinary Watercourse:	All open watercourses not designated as Main River
PPG:	Planning Practice Guidance. The PPG sets the government's planning policies for England and how these are expected to be applied (in conjunction with the NPPF).

2.3 My involvement

2.3.1 My involvement with NEMMDR began in February 2018, primarily in the development of hydraulic models to assess the baseline flood risk from the River Eye and the Lag Lane watercourse and subsequently the impact of NEMMDR on flood risk from these watercourses. I have provided advice to the designers on suitable bridge dimensions for the River Eye and culvert dimensions for the Lag Lane Ordinary Watercourse and provided input to the preparation of the Flood Risk Assessment. Further details of the objectives and conclusion of the Flood Risk Assessment are provided in subsequent sections of this proof.

2.4 Work carried out by my colleagues at AECOM

Prior to my involvement, my colleagues at AECOM had undertaken the following:

2.4.1 Initial consultation was undertaken with the Environment Agency Partnership and Strategic Overview Team. This preliminary consultation was to get guidance on the two Eastern Distributor Road route options and to discuss requirements / restrictions on development in Flood Storage Areas (FSA) and compensatory floodplain storage. Based on the outcome of this consultation Option 1, which did not cross the Brentingby Dam's Flood Storage Area was chosen as the preferred option.

2.4.2 Following the scoping phase of the project, regular correspondence was maintained with the Environment Agency to:

a) Obtain the River Wreake hydraulic model (of which the River Eye is a part of) to be used to represent the pre-scheme i.e. baseline scenario at the River Eye crossing;

b) agree the River Eye hydraulic modelling approach;

[1] https://data.gov.uk/dataset/4ae8ba46-f9a4-47d0-8d93-0f93eb494540/statutory-main-river-map

c) to discuss the various River Eye crossing options;

d) discuss the proposed River Eye realignment in the vicinity of the proposed crossing;

2.4.3 In support of the NEMMDR planning application, a Flood Risk Assessment (FRA) was prepared in accordance with the National Planning Policy Framework (NPPF), its associated Planning Practice Guidance (PPG) and other relevant local policy in 2018. The guidance related to flood risk essentially remains the same as before in the latest NPPF published in 2021 and therefore, the Flood Risk Assessment is still in compliance with the latest planning policy.

2.4.4 The FRA has considered flood risk from all sources. Flood risk from the River Eye, which is classed as a Main River, has been supported by hydraulic modelling in consultation with the Environment Agency. This hydraulic modelling has been reviewed and approved by the Environment Agency.

2.5 The need for a Flood Risk Assessment

2.5.1 The proposed NEMMDR intersects one Main River - the River Eye, and five Ordinary Watercourses which are tributaries of the River Eye, and the former now disused Melton Mowbray Navigation and Oakham Canal. The five Ordinary Watercourses are two unnamed minor watercourses located near Sysonby Lodge Farm, Scalford Brook, Thorpe Brook and the unnamed watercourse located adjacent to Lag Lane which will be referred to as the Lag Lane watercourse here on. Please see map showing the watercourses that the proposed NEMMDR intersects along with associated flood zones 2 & 3 provided in Appendix A.

2.5.2 Table 2-1 Flood Zone Definition

Flood Zone	*Definition*
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3).
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding or land having a 1 in 200 or greater annual probability of sea flooding (Land shown in dark blue on the Flood Map).
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

2.5.3 As parts of the proposed NEMMDR are located in Flood Zones 2 & 3, a Flood Risk Assessment is required to assess the risks from all sources of flooding to and from a proposed development in order to comply with National Planning Policy Framework (NPPF). Section 14 of the newly updated (July 2021) NPPF provides national policy in relation to development and flood risk. In 2018, during the planning stage of this NEMMDR, in the previous version of NPPF, Section 10 provided the national policy in relation to development and flood risk. The NPPF is supported by the Planning Practice Guidance (PPG), an online resource published in March 2014.

2.6 The Exception Test

2.6.1 The NPPF considers the vulnerability of different forms of development to flooding and classifies proposed uses accordingly. Annex 3 of the updated NPPF identifies the vulnerability classifications of developments. Section 7, Paragraph 066 of the Planning Policy Guidance associated with the NPPF illustrates a matrix which identifies which vulnerability classifications are appropriate within each flood zone. This can be seen below in Table 2.2.

2.6.2 Table 2-2 Flood Risk Vulnerability and Flood Zone Compatibility

Flood risk Vulnerability classification	*Essential Infrastructure*	*Water Compatible*	*Highly Vulnerable*	*More Vulnerable*	*Less Vulnerable*
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception test required	✓	✓
Zone 3a	Exception test required	✓	×	Exception test required	✓
Zone 3b 'Functional Flood plain'	Exception test required	✓	×	×	×
Key *✓ Development is appropriate.* *× Development should not be permitted*					

2.6.3 The proposed NEMMDR is considered 'Essential Infrastructure' under the heading "Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk". The proposed scheme route crosses Flood Zone 3 at three locations in the vicinity of the proposed crossings of the River Eye, Scalford Brook and Thorpe Brook. As Table 2.2 above indicates, the Exception Test is required for the development.

2.6.4 However, the proposed NEMMDR alignment has been included in Melton Borough Council's latest Local Plan following a rigorous options appraisal process, which considered various factors including environmental impacts and long–term sustainability. It has been demonstrated that the proposed NEMMDR alignment would have the greatest positive long-term effects on traffic congestion within the town centre and offer best value for money. Therefore, the proposals will pass the Exception Test as long as flood risk is not increased.

3 Development of the NEMMDR Scheme

3.1 NEMMDR Option Selection

3.1.1 Prior to my involvement with NEMMDR, LCC had developed two potential routes for the eastern outer distributor road. Figure 3-1 shows the two options.

3.1.2 The assessment process suggested that Option 1 would more effectively deliver the aims of the distributor road and would do so with a lesser environmental impact than Option 2. Therefore Option 1 was taken forward for outline design and for planning submission. Some of the key environmental aspects where Option 1 fares better than Option 2 are as follows:

3.1.3 Option 2 is approximately 0.5km longer than Option 1, would have a greater journey time for users of the route and would require a larger amount of land. The increased length of the road would have additional environmental impacts.

3.1.4 Option 2 would take the road further from Melton Mowbray, extending the urban fringe of the town further into the surrounding rural area, although in doing so would take the road further from properties on the outskirts of the market town. Option 2 also passes through the Brentingby Flood Storage Area, with significant impacts on the flood storage capacity and environmental impacts on the area that may not be acceptable to the Environment Agency in the context of other options. Where the route of Option 2 crosses the Brentingby Flood Storage Area, a viaduct or multi-span structure would be required of approximately 700m in length. The scheme would pass through a larger amount of land in Flood Zones 2 and 3 than Option 1.

3.1.5 Option 2 would still require a crossing over the River Eye, although the crossing location would not be in close proximity to high voltage powerlines. The two routes diverge to the south east of Thorpe Arnold so the impact of NEMMDR on the village would be similar for the two options.

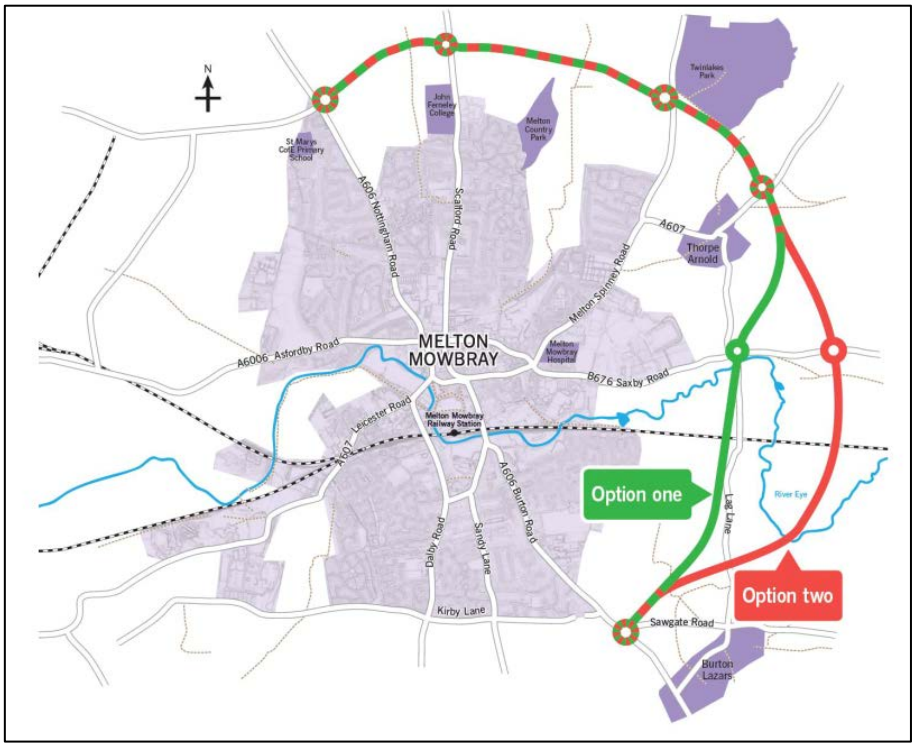


Figure 3-1 Options for Eastern Distributor Road

3.2 Planning Stage

3.2.1 At the planning stage, as stated in Section 2 above, a comprehensive Flood Risk Assessment was prepared in accordance with the NPPF with extensive consultation with the Environment Agency and Leicestershire County Council to support the planning application.

3.2.2 As a part of the FRA preparation the following objectives were met:

a) review of existing site data including Environment Agency (EA) flood risk data, ground conditions (if available), scheme proposals and reference to relevant Leicestershire County Council policy including Strategic Flood Risk Assessments, Preliminary Flood Risk Assessments, Surface Water Management Plans and Local Flood Risk Management Strategies;

b) liaison with the EA to outline and agree requirements regarding various flood related issues around the proposed River Eye crossing and River Eye hydraulic modelling;

c) liaison with LCC Flood team (Lead Local Flood Authority) to outline and agree requirements for the site-specific FRA;

d) liaison with the AECOM Highways and Infrastructure Teams to obtain scheme drawings, proposed drainage scheme drawings, topographical data etc.;

e) assessment and interpretation of available information to identify potential sources of flood risk. These include fluvial (River Eye and its tributaries), pluvial (surface water), groundwater, combined, foul or surface water sewers, and infrastructure failure (e.g. canals, reservoirs, pumped catchments) including any history of burst water mains, blocked sewers, canal breach events etc.);

f) hydraulic modelling to confirm baseline conditions and assess the fluvial flood risk impact of the proposed development in the vicinity of the proposed River Eye crossing. This included modelling of the existing baseline conditions and of the proposed scenario with the new bridge for a series of magnitude fluvial events;

g) identification of potential measures to mitigate the fluvial flood risk impacts of the proposed development;

h) a review of the surface water drainage design that has been prepared for the proposed development, and incorporation of the design calculations into the FRA; and

i) discussion and provision of recommendations for flood mitigation measures including fluvial volume compensatory storage and residual risk mitigation measures in line with the conclusions of the drainage strategy, where applicable.

3.2.3 Section 4 summarises the findings of the FRA. The FRA document is available for reference and is included in the NEMMDR Statement of Case documentation list.

3.3 FRA Approval and Grant of Planning Permission

3.3.1 The Flood Risk Assessment that accompanied the planning application which was submitted in September 2018 concluded that there will be no significant increase in fluvial flood risk to the neighbouring land uses, or an increase in surface water runoff as a result of the proposed development based on application of identified mitigation measures. The Flood Risk Assessment went through rigorous review by Leicestershire County Council's Flood team (Lead Local Flood Authority) and the Environment Agency and was accepted.

3.3.2 Planning permission was granted in May 2019 and detailed design of the NEMMDR has since been in progress. The planning permission was accompanied by planning conditions, some of which need to be discharged prior to commencement of construction. The following planning conditions related to flood risk are:

3.4 Planning Conditions – Flood Risk

3.4.1 The development shall be carried out in accordance with the submitted flood risk assessment (ref: MMDR – 60542201, dated September 2018, produced by AECOM) and the following mitigation measures it details:

- The soffit level of the River Eye bridge is to be set no lower than 76.18mAOD (section 3.1.1 page 23)

- The soffit level of any of the bridge spans are to be set no lower than 74.97mAOD (section 3.1.1 page 23)

3.4.2 These mitigation measures shall be fully implemented prior to first use of the development and then subsequently in accordance with the scheme's timing/phasing arrangements.

3.4.3 The development hereby permitted shall not be commenced until such time as a scheme to provide compensatory floodplain storage (as detailed in section 4.2, p36 of the submitted FRA) has been submitted to, and approved in writing by, the Country Planning Authority.

3.4.4 The scheme shall be fully implemented and subsequently maintained, in accordance with the scheme's timing/phasing arrangements, or within any other period as may subsequently be agreed, in writing, by the County Planning Authority.

3.4.5 The development hereby permitted shall not be commenced until the final designs for the scheme to provide [access for the] Environment Agency to the Brentingby Flood Storage Reservoir both during construction and post scheme completion (as detailed in Melton Mowbray Distributor Road – S5_GEN_ZZ_Z_SK-HD-002 Rev P01) has been submitted to, and approved in writing by the County Planning Authority. The scheme should include the following design details:

a) The distance of the field access gates from the road (east carriageway edge);

b) The width of the new access road;

c) The visibility splay distances;

d) The proposed new access pavement detail/proposal; and,

e) The proposed surface for the part of lag lane from the new access road to their reservoir site entrance.

3.4.6 The scheme shall be fully implemented and subsequently maintained, in accordance with the timing/phasing arrangements embodies within the scheme, or within any other period as many subsequently be agreed, in writing, by the County Planning Authority.

3.5 Development Since Planning Submission

3.5.1 The River Eye flood modelling has been updated to reflect changes to the scheme design that have occurred subsequent to the planning submission, including:

a) Minor changes to the road alignment and embankment crossing the River Eye floodplain.

b) Changes to the river diversion and restoration.

c) The addition of flood compensation areas to the east of the proposed crossing.

d) Changes to culvert dimensions on the Lag Lane tributary diversion.

3.5.2 It should be noted that these changes do not invalidate the planning permission. They are required because the detail of the design has developed further and, especially around the SSSI, progressed to identify the detail of land take. These updates to the model were necessary to finalise the flood compensation storage provision as required by planning condition 15.

3.5.3 In October 2019 flooding was observed in the area of the proposed crossing of the River Eye. The observed flooding appeared to be in excess of what the flood modelling predicted. According to the data provided by the Environment Agency, flooding in this area should be prevented by the Brentingby Dam Flood Storage Area, located approximately 1km upstream of the scheme crossing. Aerial photography taken during this event shows that the Brentingby Dam did function as intended and prevented flooding at the site of the proposed crossing. The observed flooding is therefore likely to have been caused by a release of stored flood water following the event. This explanation is also supported by rainfall and river level data provided by the Environment Agency, in particular:

a) Most of the rainfall fell on the 1st of October 2019 and levels in the flood storage area peaked at around 4pm on the 2nd of that month.

b) Aerial photos taken at around 4 – 5pm on the 2nd of October show flood water behind the dam but no flooding in the area of the proposed crossing.

c) At around 5pm on the 2nd of October, the downstream level record shows an increase in level and the water level behind the dam begins to decrease at the same time. This increase in downstream levels strongly suggests an increase in flow due to water being released from the dam. Water levels behind the dam do not appear to have been high enough for the dam to discharge via the spillway and in any case the subsequent decrease in level in the reservoir would have stopped any over-topping and this is not what the downstream level record shows.

d) The peak level in the reservoir roughly corresponds to a 1 in 20yr present day event.

e) Photos of flooding in the area of the proposed crossing were taken on the 3rd of October

3.5.4 The hydraulic modelling has considered a 1 in 100 year + 50% climate change event, a far more extreme event than the October 2019 event. This event has been shown to overwhelm the flood storage area to cause more severe flooding in the vicinity of the proposed crossing than was observed in 2019. Therefore, since the modelling has already considered a more severe flooding event than the October 2019 event, the findings from the modelling study can be considered robust.

3.5.5 In June 2020 AECOM prepared a proposal to investigate the causes of the October 2019 flood in detail; however, following discussion with the Environment Agency, it was agreed that this would not be required. It was agreed that the current model could continue to be used and would provide a robust representation of flood risk to scheme and the impact of the scheme on flood risk elsewhere.

4 Assessment of Scheme Proposals

4.1.1 The assessment of flood risk to the NEMMDR is set out in the Flood Risk Assessment (see core document SAD16). A summary of the FRA is provided below:

4.2 Scheme impact – Summary of the Flood Risk Assessment

4.2.1 The FRA that was prepared for the scheme in September 2018, in support of the planning application assessed flood risk from all sources, including fluvial, tidal, surface water, ground water, artificial sources (ponds, lakes, canals etc.) and artificial drainage systems. The following conclusions were drawn in the FRA:

4.3 Flood Risk from non-fluvial sources

4.3.1 The flood risk to the proposed scheme from tidal, surface water, artificial sources, drainage infrastructure and groundwater is considered to be low.

4.3.2 Tidal and surface water flood risk was assessed to be low based on distance from the coast and a review of existing Environment Agency Surface Water Flood Risk mapping.

4.3.3 Ground water flood risk was assessed to be low based on a review of Environment Agency Groundwater maps and the adoption of appropriate mitigation strategies.

4.3.4 Flooding from artificial sources was assessed to be low based on a review of OS maps and aerial imagery. Flooding from drainage systems was assessed to be low based on a review of Leicestershire County Council's Preliminary Flood Risk Assessment and the Melton Mowbray Strategic Flood Risk Assessment.

4.3.5 Ground investigation of the site and its vicinity have identified that ground conditions are unsuitable for infiltration SuDS, and that surface water runoff will need to outfall into the nearest watercourse. The runoff rate will be restricted from the site to greenfield rate using flow control devices. Attenuation will be provided in the form of ten balancing ponds; and

4.3.6 The drainage strategy demonstrates that it is possible to safely and sustainably manage surface water volumes from the site up to the 1% AEP + 40% for climate change flows.

4.4 Fluvial Flood Risk - River Eye and Lag Lane Watercourse

4.4.1 Hydraulic modelling of the River Eye was carried out using a computational model supplied by the Environment Agency. This model represents the River Wreake / Eye and a number of its tributaries. The model was updated to include an additional tributary crossed by the scheme and joining the river near the proposed scheme crossing of the River Eye (hereafter the Lag Lane tributary) and to incorporate newly available survey data in the vicinity of the River Eye crossing.

4.4.2 The updated hydraulic model was used to assess baseline flood risk from the River Eye and from the Lag Lane tributary. A proposed option model was then created to represent the scheme, including:

a) The proposed alignment of the river diversion, based on information supplied by AECOM's geomorphology team.

b) The proposed River Eye crossing based on information supplied by AECOM's highway design and bridge design teams.

c) The proposed Floodplain Compensation Areas, located to the east of the River Eye crossing.

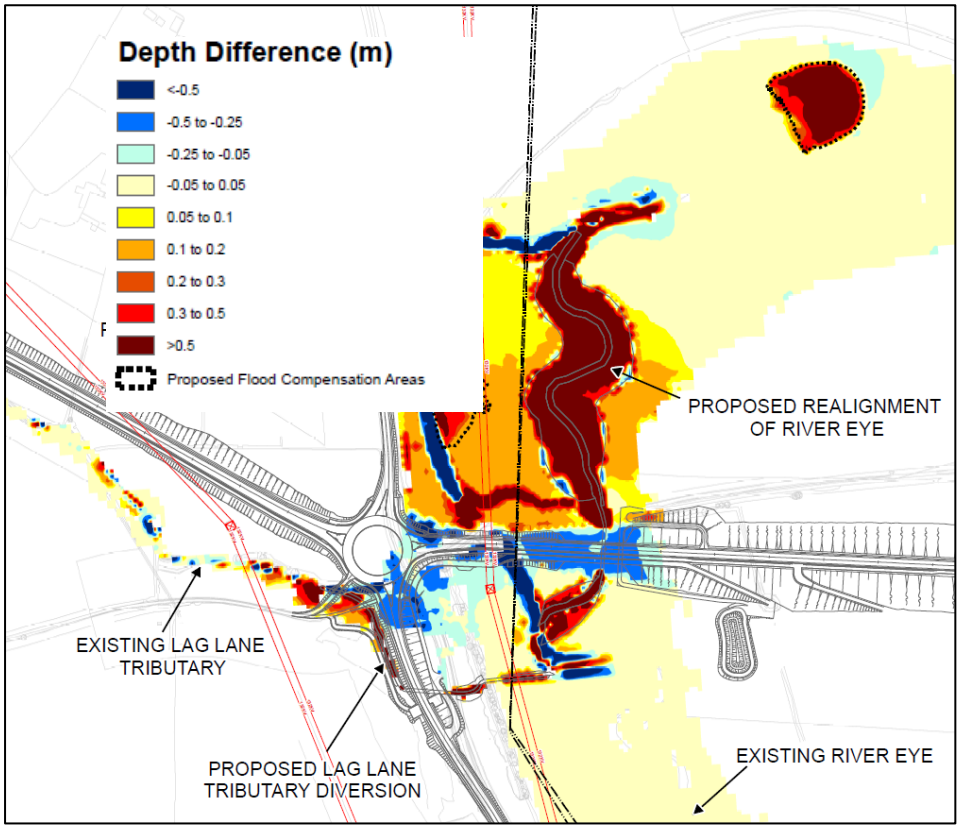
d) A proposed diversion of the Lag Lane tributary.

e) Proposed culvert sizes for crossings of the Lag Lane tributary by the scheme. New crossings under Saxby Road, a proposed bridleway and a realigned section Lag Lane were assessed for the diverted section of this watercourse.

4.4.3 Flood hydrology (peak river flows) was retained from the original Environment Agency model and modified to incorporate currently applicable climate change allowances. Flood flows in the River Eye at the site

of the proposed crossing, are controlled by the Environment Agency's Brentingby Dam Flood Storage Area, which largely prevents flooding for events up to and including the 1 in 100yr event.

4.4.4 The scheme was found to have a localised impact on flood levels upstream of the proposed River Eye crossing, with water levels increased by around 50 to 200mm during a 1 in 100 year flooding event, with a 50% climate change allowance. Larger increases to flood depths are limited to areas where ground levels are to be reduced, to form the realigned River Eye Channel and flood compensation areas. Increased flood depths extend approximately 200m upstream from the proposed crossing. The predicted changes to the peak flood depths are shown in Figure 4-1.



4.4.5 Figure 4-1: Depth difference map for a 1 in 100 year + 50% climate change event

4.4.6 Downstream of the of the proposed crossing, impacts to flood risk from the River Eye are confined to the area immediately adjacent to the diverted section of the channel, where ground level changes are part of the proposed channel design.

4.4.7 The scheme will reduce flood risk from the Lag Lane Tributary, which currently poses a risk of flooding to Saxby Road. The scheme proposals include diversion of this watercourse to a new culvert under Saxby Road, to the west of the existing crossing. Two new culverts under Lag Lane and an adjacent bridleway are at risk of overtopping during flood events, causing localised flooding to these accessways. This watercourse is also crossed by the scheme carriageway further to the north, where a minor, localised increase to the flood level is predicted upstream of the proposed culvert.

4.4.8 Flood risk to the NEMMDR has also been assessed for a breach of the upstream Brentingby Dam flood storage area. Since such an event is extremely unlikely this assessment was done to provide information for contingency planning only, and mitigation was not required as part of the present scheme. Breaching the dam would result in severe flooding to a large area. An event of this nature would be subject to contingency measures including temporary closure of the NEMMDR, along with many other roads.

In Conclusion:

4.4.9 Hydraulic modelling has shown very localised increases above 0.05m (which is considered a negligible increase within model tolerances) in flood levels immediately upstream of the proposed River Eye and Lag Lane Tributary crossings. However, it should be noted that no properties are located in the affected area, and there are minimal changes to the flood extents and depths. Therefore, these results show that the proposed scheme

does not significantly increase the flood risk to any properties in the vicinity of the proposed River Eye and Lag Lane Watercourse crossings;

4.4.10 Floodplain compensation storage will be provided on a level for level, volume for volume basis. The storage volumes have been calculated for the 1% AEP + 50% Climate Change event;

4.4.11 There is residual fluvial risk to the proposed development if a breach of Brentingby Dam were to occur. In the event that this extremely low-probability event did take place it is accepted that the proposed NEMMDR would be temporarily closed, along with many other roads (see para. 4.4.8).

4.5 Fluvial Flood Risk – Ordinary Watercourses

4.5.1 The impact of the proposed scheme on the fluvial flood risk from Thorpe Brook, Scalford Brook and the two Ordinary Watercourses adjacent to Sysonby Lodge Farm is considered to be low since the proposed crossing structures have been sized conservatively to accommodate peak flows in the 1% AEP + 50% Climate Change event.

4.6 Scheme Mitigation Measures

4.6.1 The scheme crosses the River Eye via a bridge spanning the diverted channel with three additional flood relief spans located in the floodplain, to maximise the conveyance of flood water. Soffit levels were set in accordance with freeboard requirements specified by the Environment Agency.

4.6.2 Three floodplain compensation areas are proposed to the east of the scheme to mitigate the infilling of floodplain storage by the scheme, providing an equivalent storage volume on a level-for-level basis.

5 Summary and Conclusion

5.1.1 As parts of the proposed NEMMDR are located in Flood Zones 2 & 3, a Flood Risk Assessment is required to assess the risks from all sources of flooding to and from a proposed development in order to comply with National Planning Policy Framework (NPPF).

5.1.2 As the proposed NEMMDR is considered 'Essential Infrastructure' the Exception Test is required. It has been demonstrated that the proposed NEMMDR alignment would have the greatest positive long-term effects on traffic congestion within the town centre and offer best value for money. Therefore, the proposals will pass the Exception Test as long as flood risk is not increased.

5.1.3 Flood risk from the non-fluvial sources tidal, surface water, ground water and artificial sources has been assessed to be low. The drainage strategy demonstrates that it is possible to safely and sustainably manage surface water volumes from the site up to the 1% AEP + 40% for climate change flows.

5.1.4 Hydraulic modelling has been carried out to assess flood risk to and from the NEMMDR associated with the River Eye and Lag Lane Tributary and this has shown very localised increases above 0.05m (which is considered a negligible increase within model tolerances) in flood levels immediately upstream of the proposed River Eye and Lag Lane Tributary crossings. No properties are located in the affected area, and there are minimal changes to the flood extents and depths. Therefore, these results show that the proposed scheme does not significantly increase the flood risk to any properties in the vicinity of the proposed River Eye and Lag Lane Watercourse crossings.

5.1.5 Floodplain compensation storage will be provided on a level for level, volume for volume basis. The storage volumes have been calculated for the 1% AEP + 50% Climate Change event.

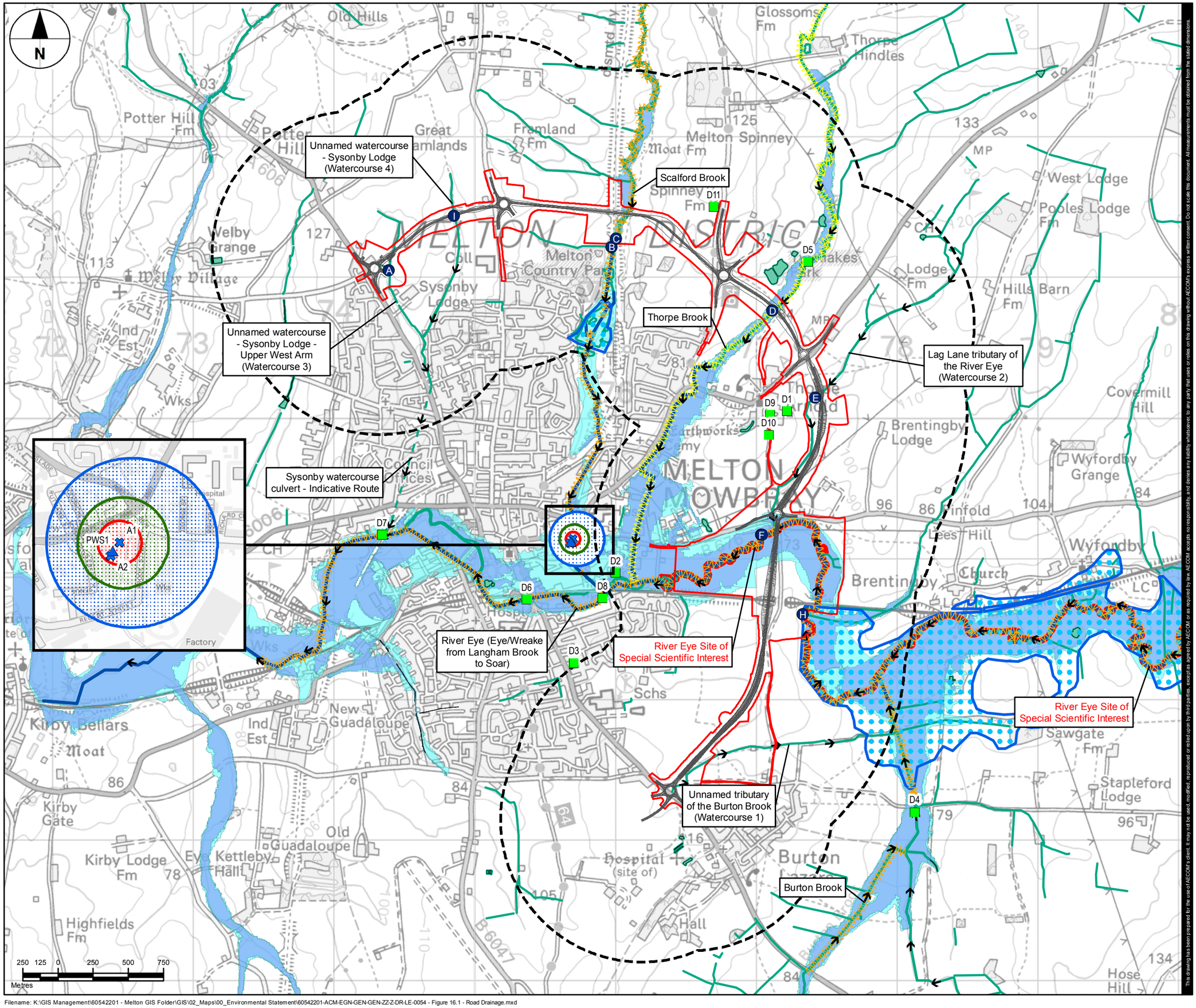
5.1.6 The impact of the proposed scheme on the fluvial flood risk from Thorpe Brook, Scalford Brook and the two Ordinary Watercourses adjacent to Sysonby Lodge Farm is considered to be low since the proposed crossing structures have been sized conservatively to accommodate peak flows in the 1% AEP + 50% Climate Change event.

5.1.7 Changes to the assessment carried out since the planning application do not invalidate the planning permission but are required because the detail of the design has developed further and, especially around the SSSI, progressed to identify the detail of land take. Updates to the hydraulic model were necessary to finalise the flood compensation storage provision as required by planning condition 15.

5.1.8 The Flood Risk Assessment has been through rigorous review by Leicestershire County Council's Flood team (Lead Local Flood Authority) and the Environment Agency and was accepted. The hydraulic modelling carried out to support the assessment of fluvial flood risk has also been independently reviewed by the Environment Agency, and approved.

5.1.9 Based on my professional judgement I can confirm that I concur with the findings of the Flood Risk Assessment that there will be no significant increase in fluvial flood risk to the neighbouring land uses, or an increase in surface water runoff as a result of the proposed development with the application of the identified mitigation measures.

Appendix A – Water body Features and Indicative Flood Zones



AECOM

PROJECT

NORTH AND EAST MMDR

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NOTES

1. ALL DIMENSIONS IN METRES UNLESS STATED OTHERWISE

KEY

- Proposed Scheme
- Red Line Boundary
- 1km Study Area
- River Eye Site of Special Scientific Interest (SSSI)
- Main River
- Ordinary Watercourse
- Ordinary Watercourse Culvert
- Waterbodies
- Approximate position of proposed new highway outfalls
- Active Water Activity (Discharge)
- Licenced Water Abstraction
- Private Water Supply
- Flood Storage Areas
- Flood Zone 3
- Flood Zone 2

Water Framework Directive Status

- WFD Moderate Ecological Status
- WFD Poor Ecological Status

Source Protection Zone

- Zone I - Inner Protection Zone
- Zone II - Outer Protection Zone
- Zone III - Total Catchment
- Zone of Special Interest

PROJECT MANAGEMENT DETAILS

DESIGNED: GB CHECKED: FB APPROVED: MS

INTERNAL PROJECT NUMBER	SCALE
60542201	1:25,000

STATUS	BS1192 SUITABLITY
FOR INFORMATION	S2

SHEET TITLE

FIGURE 16.1

WATER BODY FEATURES AND INDICATIVE FLOOD ZONES

DRAWING NUMBER	REV
60542201-ACM-EGN-GEN-GEN-ZZ-Z-DR-LE-0054	P01

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