East Midlands Gateway
Phase 2 (EMG2)

Document DCO 6.13G/MCO 6.13G

ENVIRONMENTAL STATEMENT

Technical Appendices

Appendix 13G

EMG2 Flood Risk Assessment

October 2025

13

The East Midlands Gateway Phase 2 and Highway Order 202X and The East Midlands Gateway Rail Freight and Highway (Amendment) Order 202X

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Notice

EXECUTIVE SUMMARY

This Flood Risk Assessment (FRA) has been prepared in accordance with the requirements set out in the National Policy Statement for National Networks (NPSNN). It has been produced on behalf of SEGRO (Properties) Ltd in respect of a Development Consent Order (DCO) for the proposed East Midlands Gateway Phase 2 (EMG2) and the East Midlands Gateway Rail Freight Interchange Material Change Order (MCO).

This report demonstrates that the EMG2 Project is not at significant flood risk, subject to the recommended flood mitigation strategies being implemented.

The Environment Agency (EA) Flood Map for Planning identifies that the EMG2 Project is located predominantly within Flood Zone 1. The Highway Works (No. 10, 11 and 12b) encroach into the Flood Zone 3 and 2, as mapped by the Environment Agency (EA). However, the works are limited to either signage alterations or works that are actually located above the floodplain upon existing embankments.

The village of Diseworth which neighbours the EMG2 Works has experienced a number of flood events between 2000 and 2024. Detailed hydraulic modelling has identified the potential for surface water overland flow pathways to form within the site of the EMG2 Works under the baseline conditions; these flow towards the local watercourses that pass through the village. It is proposed that the minor flood risk posed by the shallow surface water flow routes to the development will be addressed through the implementation of a surface water drainage strategy. The drainage strategy will be designed to intercept and store rainwater falling on the development, before discharging it to the local watercourse at a restricted rate, equivalent to a 39% reduction to the greenfield (pre-development) 1 in 1-year runoff rate. Therefore, the surface water discharge rate from the EMG2 Main Site will be less than the existing runoff rate, thereby offering a degree of downstream betterment. Additionally, the drainage strategy seeks to direct all surface water runoff from the EMG2 Main Site development to an outfall located downstream of Diseworth, thus reducing the volume and rate of surface water runoff directed towards the village.

The EMG2 Project has been reviewed against all potential sources of flood risk including coastal, fluvial, surface water, sewers, groundwater, canals, and reservoirs and large waterbodies. The overall risk posed by these sources has been identified as low.

Moreover, the EMG2 Project will not increase flood risk to the wider catchment area subject to suitable management of surface water runoff.

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APPENDICES

1. INTRODUCTION

1.1.1 This Flood Risk Assessment (FRA) has been prepared in accordance with the requirements set out in the National Policy Statement for National Networks (NPSNN). It has been produced on behalf of SEGRO (Properties) Ltd in respect of a Development Consent Order (DCO) for the proposed East Midlands Gateway Phase 2 (EMG2) and the East Midlands Gateway Rail Freight Interchange Material Change Order (MCO).

1.1.2 The proposed development comprises a number of interrelated component parts as follows, and collectively they are referred to as the EMG2 Project:

- **EMG2 Works:**
  - Construction of logistics and advanced manufacturing development and ancillary buildings (DCO, Works No. 1);
  - Construction of road infrastructure (DCO, Works No. 2);
  - Construction of bus interchange (DCO, Works No. 3);
  - Construction of HGV parking (DCO Works No. 4);
  - Provision of hard and soft landscaping (DCO Works No. 5);
  - Creation of a Community Park (DCO, Work No. 21); and
  - Modification and extension of the EMG1 substation (DCO, Work No. 20)[1].
- **Highways Works[2]**
  - A453 access junction works to the EMG2 Main Site (Works No. 6);
  - Hyam's Lane works (Works No. 7);
  - Works to the M1 northbound (Works No. 8);
  - Construction of link road from the M1 northbound to the A50 westbound (Works No. 9);
  - Works to the A50 westbound (Works No. 10);
  - Works to the link road from the M1 southbound and A50 eastbound to M1 Junction 24 (Works No. 11);
  - Works to the west side of the M1 Junction 24 roundabout and A453 northbound approach (Works No. 12a);
  - Works to the east side of the M1 Junction 24 roundabout and A453 southbound approach (Works No. 12b);
  - Improvements to the EMG1 access junction (Works No. 13);
  - Construction of the Active Travel Link between the EMG1 access junction and the A453 west of Finger Farm roundabout (Works No. 14);
  - Provision of an uncontrolled crossing of the A453 at the East Midland Airport signalised access junction (Works No. 15);
  - Works to M1 northbound signage on the approach to M1 Junction 23A (Works No. 16);

[1] Note – Due to its distance from the other EMG2 Works, for the purpose of assessing flood risk the extension of the EMG1 substation is assessed alongside the Highway Works.
[2] Note - Due to their geographical location for the purpose of assessing flood risk Works No. 6, 7, 15, 17, and 21 are assessed alongside the EMG2 Works).

- Works to Long Holden (Works No. 17);
- Works to the A42/A453 Finger Farm roundabout (Works No. 18); and
- Upgrade to public footpath L57 to a cycle track (Works No. 19).

- **EMG1 Works**
  - Construction of a new rail-served warehouse building on land adjacent to the rail-freight terminal referred to as Plot 16 (MCO, Works No. 3A) together with associated access (MCO, Works No. 5A) and landscaping (MCO, Works No. 6A).
  - Alterations to the maximum permitted height of gantry cranes at the rail freight interchange by 4m, to 24m overall;
  - An expansion of the EMG1 Management Suite by the EMG1 site entrance to cater for the additional demand on management facilities resulting from EMG1 (MCO, Works No. 3B);
  - Enhancements to the Public Transport Interchange by way of the installation of EV charging infrastructure for buses and provision of a drop-off layby adjacent to the transport hub (MCO, Works No. 5B and 5C); and
  - Provision of a signalised crossing over the EMG1 exit road approach to the access junction to EMG1 (MCO, Works No. 8A) connecting to the drop-off layby.

1.1.3 An illustrative site location plan is provided as **Figure 1.1** which also identities the approximate extent of the development component parts.

1.1.4 Due to the geographical distribution of the EMG2 Project, for the purpose of the FRA, the individual components have been grouped together for assessment based upon their location, as shown in **Figure 1.2**.

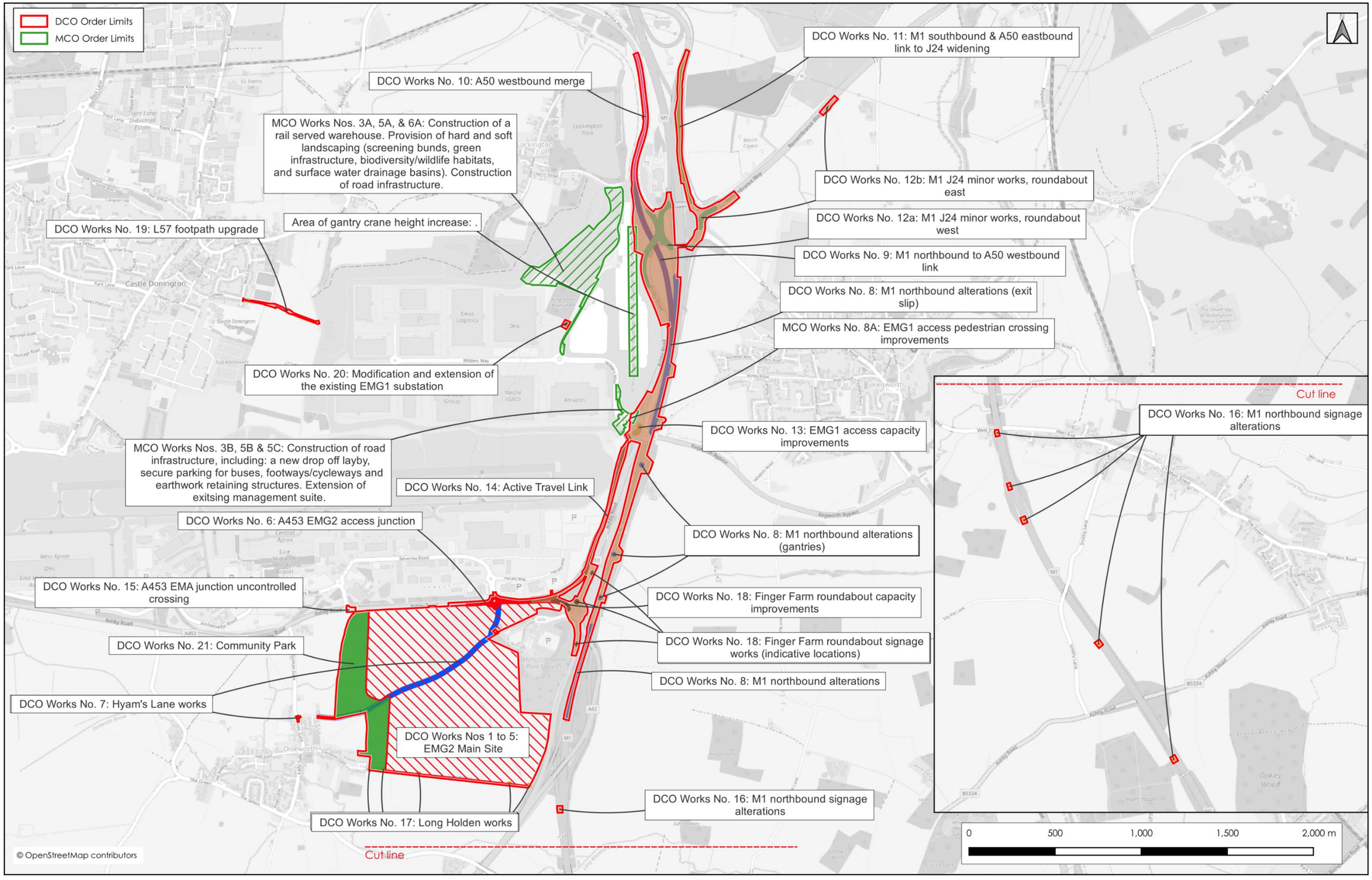

Figure 1.1: The EMG2 Project

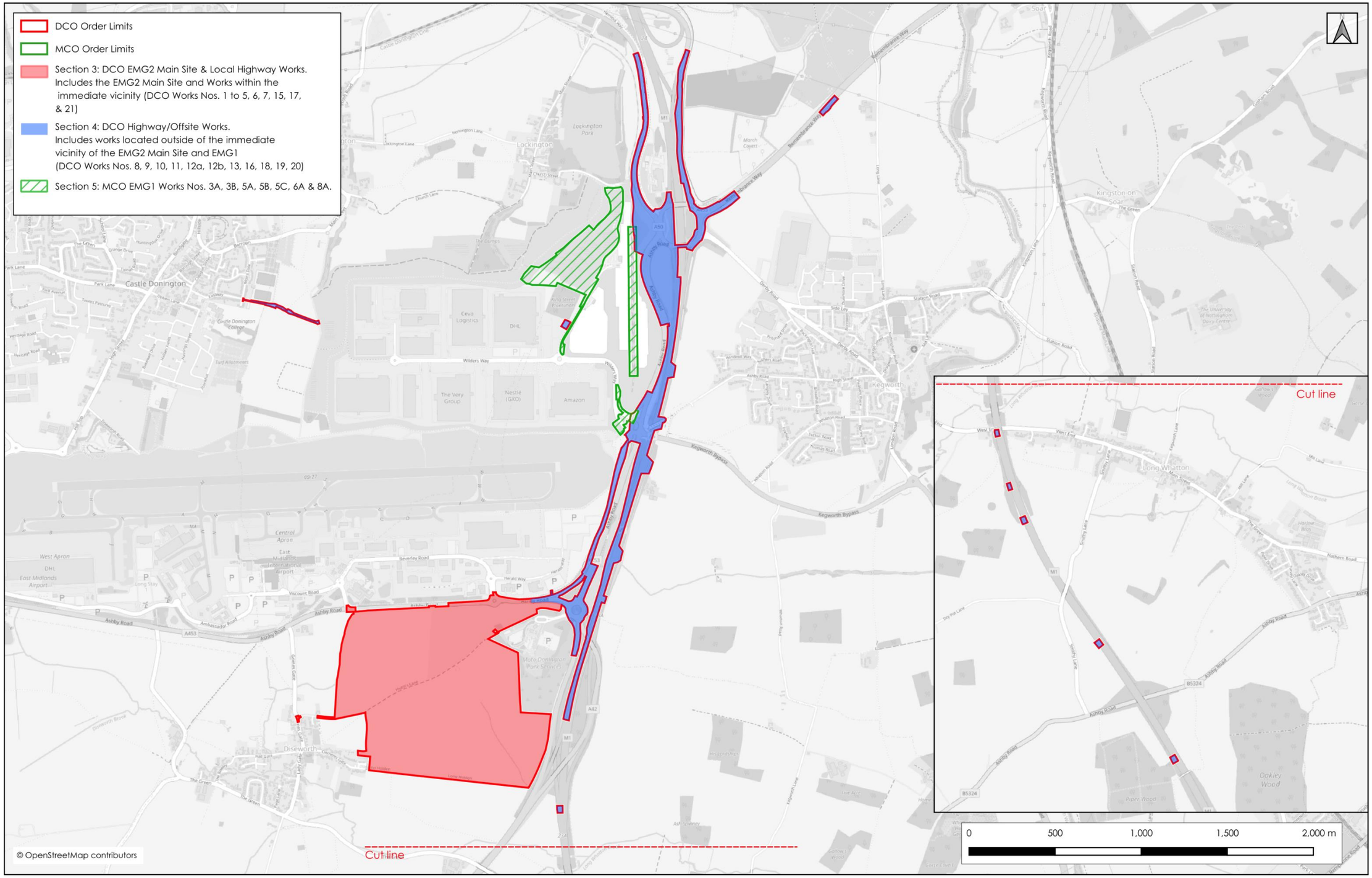

Figure 1.2: Grouping of EMG2 Project Components for the Purpose of the Flood Risk Assessment

Sources of Data

- Topographical Survey undertaken in April 2022 by Greenhatch Group (reference: 34529A_T_REV1)
- CCTV Survey of public sewer and piped watercourse (reference: 34529A_CCTV_REV1)
- Leicestershire County Council (LCC) Consultation and model information
- Environment Agency (EA) Risk of Flooding from Surface Water (RoFSW) Data
- EA Risk of Flooding from Rivers and Sea (RoFRS) Data
- EA Flood Map for Planning
- Ordnance Survey mapping
- 2022 EA 1m Light Detecting and Ranging (LiDAR) data
- North West Leicestershire 2015[3] and 2024[4] Strategic Flood Risk Assessments (SFRA) Updates
- Leicestershire County Council Preliminary Flood Risk Assessment[5] (PFRA)
- Greater Nottingham Strategic Flood Risk Assessment Addendum
- LCC Local Flood Risk Management Strategy
- LCC Flood Risk Management Strategy Action Plan
- Humber River Basin Flood Risk Management Plan
- North West Leicestershire Local Plan
- Diseworth and Long Whatton Catchment Study
- Long Whatton & Diseworth Flood Risk Mitigation & Resilience Study
- Site visit undertaken by BWB Consulting Ltd in June 2022
- Hydraulic modelling of the Diseworth Brook catchment undertaken by BWB Consulting in 2025, reference: EMG2-BWB-ZZ-XX-T-W-0002_HMR
- EA Hydraulic Model Information; 2022 Lockington Brook flood model, the 2021 Derbyshire Trent flood model and the 2012 Lower Soar flood model
- Hydraulic Assessment of an Unnamed Tributary of the River Soar (reference: EMG2-BWB-ZZ-XX-T-W-0005)
- Hydraulic Assessment of Hemmington Brook (reference: EMG2-BWB-ZZ-XX-T-W-0006)
- EA Hemington, Lockington, Castle Donington Brooks Modelling Study (2022) Information
- Factual GI Report undertaken by Fairhurst in 2023 (reference: 765514-01)
- EMG2 Works Sustainable Drainage Statement prepared by BWB Consulting (reference: EMG2-BWB-ZZ-XX-RP-CD-0001_SDS)

[3] Strategic Flood Risk Assessment 2015 Update (Atkins, June 2015)
[4] Strategic Flood Risk Assessment 2024 Update (Atkins, March 2024)
[5] Preliminary Flood Risk Assessment (URS Scott Wilson, June 2011)

- Highway Works Sustainable Drainage Statement prepared by BWB Consulting (reference: EMG2-BWB-ZZ-XX-RP-CD-0003_SDS)
- EMG1 Works Sustainable Drainage Statement prepared by BWB Consulting (reference: EMG2-BWB-ZZ-XX-RP-CD-0003_SDS)
- Severn Trent Water (STW) Sewer Records
- British Geological Survey (BGS) Drift & Geology Maps
- Site visits undertaken by BWB Consulting across 2024 and 2025

2. FLOOD RISK PLANNING POLICY & GUIDANCE

National Policy Statement for National Networks

2.1.1 The NPSNN[6] provides planning policy guidance for the promoters of nationally significant infrastructure projects. The NPSNN includes guidance about the generic, and other, impacts which should specifically be considered in assessing and designing projects. It also sets the context for the examination of proposals by the Planning Inspectorate (PINS).

2.1.2 Paragraph 5.128 highlights the requirement for an FRA to accompany the application and must demonstrate that the project will be safe for its lifetime, without increasing flood risk elsewhere and, where possible, will reduce flood risk overall.

2.1.3 The NPSNN specifically refers to the NPPF for further, more detailed guidance on flood risk.

National Planning Policy Framework

2.1.4 The NPPF[7] sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk.

2.1.5 Flood risk is identified as a combination of the probability and the potential consequences of flooding:

Flood Risk = Probability x Consequences

2.1.6 The probability is the chance of a flood occurring expressed as a return period or annual exceedance probability (AEP), and the consequences are the potential impacts of the flood (for example, damage to buildings or risk to people's safety).

2.1.7 Potential sources of flood risk are rivers and the sea, direct rainfall on the ground surface resulting in surface water runoff, rising groundwater, overwhelmed sewers and drainage systems, reservoirs, canals and lakes, and other artificial sources.

2.1.8 The NPPF states that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk. Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere. When considering flood risk, the NPPF requires development to account for future climate change.

National Planning Practice Guidance – Flood Risk and Coastal Change

2.1.9 The NPPF is accompanied by the Planning Practise Guidance (PPG) category entitled "Flood Risk and Coastal Change"[8]. This sets out the vulnerability to flooding of different land uses. It encourages development to be located in areas of lower flood risk where

[6] National Policy Statement for National Networks, Department for Transport, March 2024
[7] Revised National Planning Policy Framework, Ministry of Housing, Communities & Local Government, amended 2024
[8] Planning Practice Guidance: https://www.gov.uk/guidance/flood-risk-and-coastal-change, amended 2025

possible and stresses the importance of preventing increases in flood risk off site to the wider catchment area.

2.1.10 The PPG requires development to be designed to include flood risk management and resilience against the "design flood" for its lifetime. The PPG also states that all potential sources of flooding should be considered when preparing an FRA.

2.1.11 The "design flood" is an event of a given probability generally defined as:

- river flooding likely to occur with a 1% AEP (a 1 in 100 chance each year); or
- tidal flooding likely to occur with a 0.5% AEP (1 in 200 chance each year); or
- surface water flooding likely to occur with a 1% AEP (a 1 in 100 chance each year),

plus, an appropriate allowance for climate change.

2.1.12 The PPG includes a series of tables that define Flood Zones (Table 1), the flood risk vulnerability classification of development land uses (Table 2) and 'compatibility' of development within the defined Flood Zones (Table 3).

2.1.13 This FRA is written in accordance with the NPPF and the associated PPG.

Flood Map for Planning

2.1.14 With particular reference to planning and development, the Flood Map for Planning identifies Flood Zones in accordance with Table 1 of the PPG. Further details on the Flood Zone classifications are outlined in **Table 2.1**.

Table 2.1: Flood Zone Classifications

Flood Zone	Description
Flood Zone 1 (Low Probability)	Land having less than a 1 in 1000 annual probability of river or sea flooding (<0.1% AEP). All land outside of Flood Zone 2 and 3.
Flood Zone 2 (Medium Probability)	Land having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1% AEP); or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1% AEP).
Flood Zone 3a (High Probability)	Land having a 1 in 100 or greater annual probability of river flooding (>1% AEP); or land having a 1 in 200 or greater annual probability of flooding from the sea (>0.5% AEP). This is represented by "Flood Zone 3" on the Flood Map for Planning.
Flood Zone 3b (The Functional Floodplain)	Flood Zone 3b (The Functional Floodplain) is defined as land where water must flow or be stored in times of flood. This is not identified or separately distinguished from Zone 3a on the Flood Map for Planning.

Climate Change

2.1.15 Predicted future changes in peak rainfall intensity caused by climate change are provided by the EA[9], with a range of projections applied to River Basin District Management Catchments. The site falls within the Soar Management Catchment of the Humber River Basin District.

River Flows

2.1.16 **Table 2.2** identifies the relevant peak river flow climate change allowances from this Management Catchment.

Table 2.2: Peak River Flow Climate Change Allowances for the Soar Management Catchment within the Humber River Basin District

Allowance Category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2125)
Upper End	28%	35%	60%
Higher Central	18%	21%	37%
Central	14%	16%	28%

2.1.17 When determining the appropriate allowance for use in a FRA the Flood Zone classification, flood risk vulnerability and the anticipated lifespan of the development should be considered. **Table 2.3** provides a matrix summarising the EA's guidance on determining the appropriate allowance(s).

Table 2.3: Application of Appropriate Peak River Flow Climate Change Allowances

Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	Use the central allowance where a location may fall within Flood Zone 2 or 3 in the future.				
2	Use the higher central allowance	Use the central allowance			
3a	Use the higher central allowance	Development should not be permitted	Use the central allowance		
3b	Use the higher central allowance	Development should not be permitted			Use the central allowance

[9] Environment Agency, Flood risk assessments: climate change allowances: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances, last accessed April 2025.

Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
If development is considered appropriate by the local authority when not in accordance with Flood Zone vulnerability categories, then it would be appropriate to use the higher central allowance.					

2.1.18 Generally, the central allowance for the 2080s will be applicable to the EMG Project under the EA's guidance. However, in accordance with the NPSNN, the upper end allowance will also be assessed as a credible maximum climate change allowance.

Rainfall Intensity

2.1.19 **Table 2.5** identifies the relevant peak rainfall climate change allowances from the Management Catchment.

Table 2.4: Peak Rainfall Climate Change Allowances for the Soar Management Catchment

Allowance Category	Total potential change anticipated for the '2050s' epoch (2022 to 2060)		Total potential change anticipated for the '2070s' epoch (2061 to 2125)	
	1 in 30-Year	1 in 100-Year	1 in 30-Year	1 in 100-Year
Upper End	35%	40%	35%	40%
Central	20%	20%	25%	25%

2.1.20 The future increase in rainfall will need to be considered when designing a development to ensure its drainage system is sufficient to address the local surface water flood risk for its lifetime and so that it does not increase flood risk elsewhere. The increase in rainfall will also need to be considered when assessing the flood risk from surface water runoff from surrounding urban and rural catchments.

2.1.21 The local requirement is for less vulnerable developments to accommodate surface water run-off generated by a 1 in 100-year rainfall event with an uplift of 25% to allow for climate change, but to perform additional checks with a 40% uplift applied to ensure that runoff is still retained on the site, without the development or the surrounding area being placed at significant flood risk.

Table 2.5: Peak Rainfall Climate Change Allowances for the Soar Management Catchment

Allowance Category	Total potential change anticipated for the '2050s' epoch (2022 to 2060)		Total potential change anticipated for the '2070s' epoch (2061 to 2125)	
	1 in 30-Year	1 in 100-Year	1 in 30-Year	1 in 100-Year
Upper End	35%	40%	35%	40%
Central	20%	20%	25%	25%

2.1.22 When determining the appropriate allowance to assess for hydraulic flood modelling, catchment size, catchment urbanisation, and anticipated lifespan of the development should be considered. The EA guidance identifies that the central allowance should be considered for developments with a lifespan up to the 2100s, and the upper allowance used for those with a lifespan beyond the 2100s. The development has an anticipated lifespan of 75 years, meaning a +25% allowance has been considered.

2.1.23 However, in accordance with EA climate change guidelines and the NPSNN, the upper end allowance will also be assessed as a credible maximum storm event. Therefore, a climate change allowance of 40% was assessed.

2.1.24 Similarly, it is required for the drainage systems for less vulnerable developments in this location to accommodate surface water run-off generated by a 1 in 100-year rainfall event with an uplift of 25% to allow for climate change.

2.1.25 However, additional checks of the drainage design are to be made with a 40% uplift to ensure that runoff is still retained on the site, without the development or the surrounding area being placed at significant flood risk.

Local Plan

2.1.26 The North West Leicestershire Local Plan[10] sets out policies to ensure sustainable development within the district. The plan has been reviewed and the relevant policies and objectives for this FRA have been summarised below:

Objective 9

2.1.27 Objective 9 states that "New developments need to be designed to use water efficiently, to reduce flood risk and the demand for water within the district, whilst at the same time taking full account of flood risk and ensuring the effective use of Sustainable Drainage Systems (SuDS)".

[10] North West Leicestershire Local Plan (North West Leicestershire District Council, November 2017)

Policy Cc2 – Flood Risk

2.1.28 The risk and impact of flooding will be minimised through:

- Directing new development to areas with the lowest probability of flooding;
- Ensuring that all new development addresses the effective management of all sources of flood risk;
- Ensuring that development does not increase the risk of flooding elsewhere; and
- Ensuring wider environmental benefits of developments in relation to flood risk.

2.1.29 A proposal will be supported where:

- It is located in an area that is not at risk of flooding with reference to the EA's flood risk maps and the Council's SFRA, unless a Sequential Test, and if necessary an Exception Test, as set out in the PPG on flood risk, proves the development is acceptable;
- Site-specific FRAs should consider the issues of flooding from sewers, canal infrastructure failure, groundwater rising from former coal mining areas, and watercourses;
- Suitable flood protection/mitigation measures can be agreed as appropriate to the level and nature of flood risk and satisfactorily implemented and maintained; and
- There will be no increase in the risk of flooding for properties elsewhere. For previously undeveloped sites, the rate of runoff from the development site should be no greater than the existing (greenfield) rate of runoff from the site.

Policy Cc3 – Sustainable Drainage Systems

2.1.30 When assessing development proposals where it is necessary to manage surface water drainage, SuDS should be incorporated into developments in accordance with national and local standards unless it can be clearly demonstrated;

a) That SuDS are not technically, operationally or financially deliverable or viable and that surface water drainage issues from the development can be alternatively mitigated; or

b) That the SuDS scheme will itself adversely affect the environment or safety.

1) Where appropriate, every effort should be made to link SuDS into wider initiatives to enhance green infrastructure, improve water quality and benefit wildlife or contribute to the provision of the ecosystem service.

2) Arrangements in accordance with national policy will need to be put in place for the management and maintenance of the SuDS over the whole period during which they are needed.

2.1.31 An updated Local Plan is currently in production and undergoing consultation. Proposed policies *AP7 -Flood Risk* and *AP8 – Sustainable Drainage Systems* have been reviewed and align with the currently adopted policies.

Strategic Flood Risk Assessment

2.1.32 A Strategic Flood Risk Assessment (SFRA) is a study carried out by one or more local planning authorities to assess the risk to an area from flooding from all sources, now and in the future.

2.1.33 Although superseded, the North West Leicestershire SFRA (2015 Update)[11] provides information specific to the site location in the form of fluvial, surface water and groundwater flood risk mapping, as well as records of historical flooding. Information from the Level 1 SFRA will be referenced within **Section 3** and **Section 4**, where applicable. The report acts as a hybrid Level 1 and 2 SFRA and is used to facilitate the application of Sequential and Exception Tests to screen allocated development sites. The study site is not referenced within the SFRA.

2.1.34 A further update to the SFRA[12] was produced in 2024 to inform the emerging Local Plan for North West Leicestershire. The study site is referred to as a potential employment site under *EMP90 Land South of EMA*. The following flood risk summary of the EMG2 Main Site is provided:

- *"This site is proposed for employment development and therefore is less vulnerable. The site is located within Flood Zone 1 and therefore considered sequentially acceptable.*
- *The site is larger than 1 hectare, therefore a Flood Risk Assessment is required.*
- *In general, the site is currently considered to be at a low risk from surface water flooding.*
- *There is no groundwater data available."*

Preliminary Flood Risk Assessment

2.1.35 A Preliminary Flood Risk Assessment (PFRA) is an assessment of floods that have taken place in the past and floods that could take place in the future. It generally considers flooding from surface water runoff, groundwater and ordinary watercourses, and is prepared by the Lead Local Flood Authority (LLFA).

2.1.36 The LCC PFRA[13] considers flooding from surface water runoff, groundwater, ordinary watercourses and canals. It also references the historical river flooding which occurred in Diseworth from the Hall Brook and Diseworth Brook. However, no date is provided for these events.

2.1.37 An addendum to the PFRA[14] was produced in December 2017. The addendum notes that the majority of flooding within the Leicestershire area is a result of ordinary watercourses and surface water runoff; however, no locations or watercourses within close proximity to the study site are referenced within the addendum. Information from the PFRA will be referenced within forthcoming coming sections, where applicable.

[11] Strategic Flood Risk Assessment Update (Atkins, June 2015)
[12] Strategic Flood Risk Assessment Update (Atkins, March 2024)
[13] Preliminary Flood Risk Assessment (URS Scott Wilson, June 2011)
[14] Preliminary Flood Risk Assessment Addendum (Leicestershire County Council, December 2017)

Local Flood Risk Management Strategy

2.1.38 A Local Flood Risk Management Strategy (LFRMS) is prepared by an LLFA to help understand and manage flood risk at a local level.

2.1.39 The LFRMS aims to ensure that the knowledge of local flood risk issues is communicated effectively so that they can be better managed. The LFRMS also aims to promote sustainable development and environmental protection.

2.1.40 The LCC LFRMS[15] has been reviewed but no new relevant information was identified. The LCC LFRMS Action Plan[16] highlights the key objectives of the LFRMS and associated actions to achieve them. This action plan referred to the delivery of the Diseworth Flood Alleviation Scheme with a timeframe of March 2026; however, no further information on this scheme is provided.

River Basin Flood Risk Management Plan

2.1.41 Flood Risk Management Plans (FRMPs) explain the risk of flooding from rivers, the sea, surface water, groundwater and reservoirs. FRMPs set out how risk management authorities will work with communities to manage flood and coastal risk. Risk management authorities include the EA, Natural Resources Wales (NRW), local councils, Internal Drainage Boards, National Highways, and LLFAs.

2.1.42 The first FRMPs were published in March 2016 and the plans have since been updated in December 2022. These describe actions to manage flood risk across England between 2021 to 2027.

2.1.43 The study site is located within the Humber River Basin District, and the Humber River Basin FRMP[17] has been reviewed. However, there are no objectives relevant to the study site.

Other Relevant Policy and Guidance

2.1.44 This FRA has considered the following documents when assessing sources of flood risk and when recommending mitigation and resilience measures.

Flood Risk to People and New Developments

2.1.45 The Flood Risk to People (FD2321/TR1)[18] document was prepared as a research project considering flood hazard and factors that affect it.

2.1.46 Flood Risk Assessment Guidance for New Development (FD2320/TR2)[19] provides a framework and guidance for assessing and managing flood risks for new developments and sets flood hazard thresholds.

[15] Local Flood Risk Management Strategy (Leicestershire County Council, February 2024)
[16] Local Flood Risk Management Strategy Action Plan (Leicestershire County Council, February 2024)
[17] Humber River Basin District Flood Risk Management Plan (Environment Agency, December 2022)
[18] Flood Risk to People Methodology (FD2321/TR1), Defra/Environment Agency, 2006
[19] Flood Risk Assessment Guidance for New Development (FD2320/TR2), Defra/Environment Agency, 2005

2.1.47 Hazard ratings are derived using the following equation in line with the above:

$$\text{Hazard Rating} = D * (V+0.5) + DF$$

Where:
D = depth
V = velocity
DF = debris factor

2.1.48 A supplementary note[20] provides clarification of the hazard rating thresholds which should be used for development planning and control use. **Table 2.6** identifies the thresholds of the flood hazard categories.

Table 2.6: Hazard to People[21]

Threshold for Flood Hazard Rating	Degree of Flood Hazard	Description
< 0.75	Very Low	**Caution** "Flood zone with shallow flowing water or deep standing water"
0.75 - 1.25	Moderate	**Danger for some (i.e.: children, the elderly and the infirm)** "Danger: Flood Zone with deep or fast flowing water"
1.25 - 2.0	Significant	**Danger for most (includes the general public)** "Danger: Flood Zone with deep fast flowing water"
2.0 >	Extreme	**Danger for all (includes the emergency services)** "Extreme Danger: Flood Zone with deep fast flowing water"

[20] Supplementary Note on Flood Hazard Ratings and Thresholds for Development Planning and Control Purpose – Clarification of the Table 13.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1. (http://randd.defra.gov.uk/Document.aspx?Document=FD2321_7400_PR.pdf)
[21] 2008, DEFRA. Supplementary Note on Flood Hazard Ratings and Thresholds for Development Planning and Control Purposes.

3. EMG2 WORKS, INCLUSIVE OF THE HIGHWAY WORKS WITHIN THE IMMEDIATE VICINITY (WORKS NOS. 1 TO 7, 12, 17 & 21)

3.1.1 This Section of the FRA has been prepared in relation to the 'EMG2 Works' inclusive of the Highway Works within the immediate vicinity (Works Nos. 1 to 7, 12, 17 & 21), referred to as 'the study site' throughout **Section 3**. Due to its distance from the other EMG2 Works, for the purpose of assessing flood risk, the modification and extension of the EMG1 substation (Works No. 20) is discussed within **Section 4**.

3.1.2 The remaining Highway Works and EMG1 Works are reviewed in **Section 4** and **Section 5** respectively.

3.1.3 Summary information on this Section's study site is included as **Table 3.1**.

Table 3.1: Site Summary

Site Name	EMG2 Works Study Site • Works No. 1 to 5 • A453 EMG2 Access Works (Works No. 6) • Hyam's Lane Works (Works No. 7) • Public right of way amendments on Long Holden (Works No. 17) • A453 pedestrian crossing (Works No. 15) • Community Park (Works No. 21)
NGR (approx.)	SK459250
Development Type	Class B8/B2 Office and Warehouse
Flood Zone Classification	Flood Zone 1
NPPF Vulnerability	Less Vulnerable
Anticipated Development Lifetime	75 years*
Environment Agency Office	East Midlands
Lead Local Flood Authority	Leicestershire County Council (LCC)

** In accordance with Paragraph 006 of the Flood Risk and Coastal Change Planning Practice Guidance.*

3.2 Existing Conditions

3.2.1 The study site is bound to the north by East Midlands International Airport (EMIA), which lies beyond the Ashby Road (A453). Donnington Park Services is located immediately adjacent to the north-east. The A42 and the M1 motorway bound the site to the east. The south of the site is bound by the Long Holden public byway, with agricultural fields beyond. The west of the site is bound by agricultural fields. The village of Diseworth is located approximately 150m south-west of the study site. A public byway, known as Hyam's Lane, bisects the study site from south-west to north-east.

3.2.2 The Hall Brook flows along a portion of the western boundary before flowing in a south-westerly direction to its confluence with the Diseworth Brook approximately 500m south-east of the study site.

3.2.3 A series of field ditches are present in the south-east corner of the study site. These exit via a piped connection (500mm diameter) beneath Long Holden before entering a larger pipe system (525mm to a 700mm diameter) which runs alongside the A42 and outfalls to the Diseworth Brook beneath the A42 road bridge.

3.2.4 A public surface water sewer is also present in the east of the study site. This runs in parallel to the A42 culvert between the Donnington Services and the Diseworth Brook, outfalling just upstream of the A42 culvert.

3.2.5 A public foul water rising main is shown to flow along Hyam's Lane in a north-easterly direction. The rising main originates from a pumping station to the west off Grimes Lane and enters a public foul water gravity sewer to the north of the site beyond Ashby Road.

3.2.6 The study site includes a stretch of the Ashby Road (A453) from which a new access in the EMG2 Main Site is to be formed. This stretch of the A453 is understood to be positively drained to the Hall Brook.

3.2.7 The study site's location and key watercourses are illustrated within **Figure 3.1**.

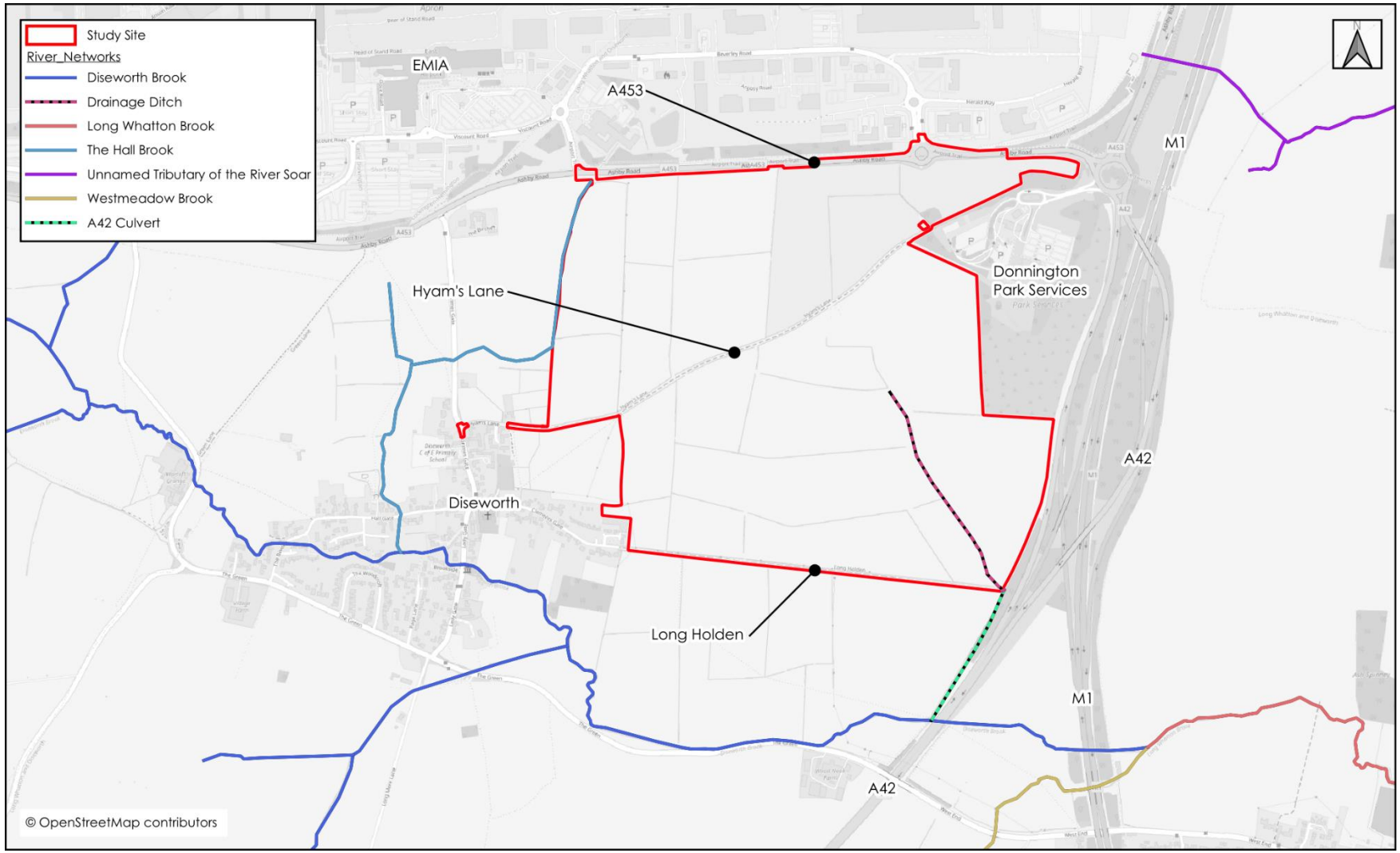

Figure 3.1: Site Location and Watercourse Network

3.2.8 The site is shown to be located within Flood Zone 1, as shown in **Figure 3.2**. The nearest Flood Zone extents are located approximately 260m south of the study site associated with the Diseworth Brook.

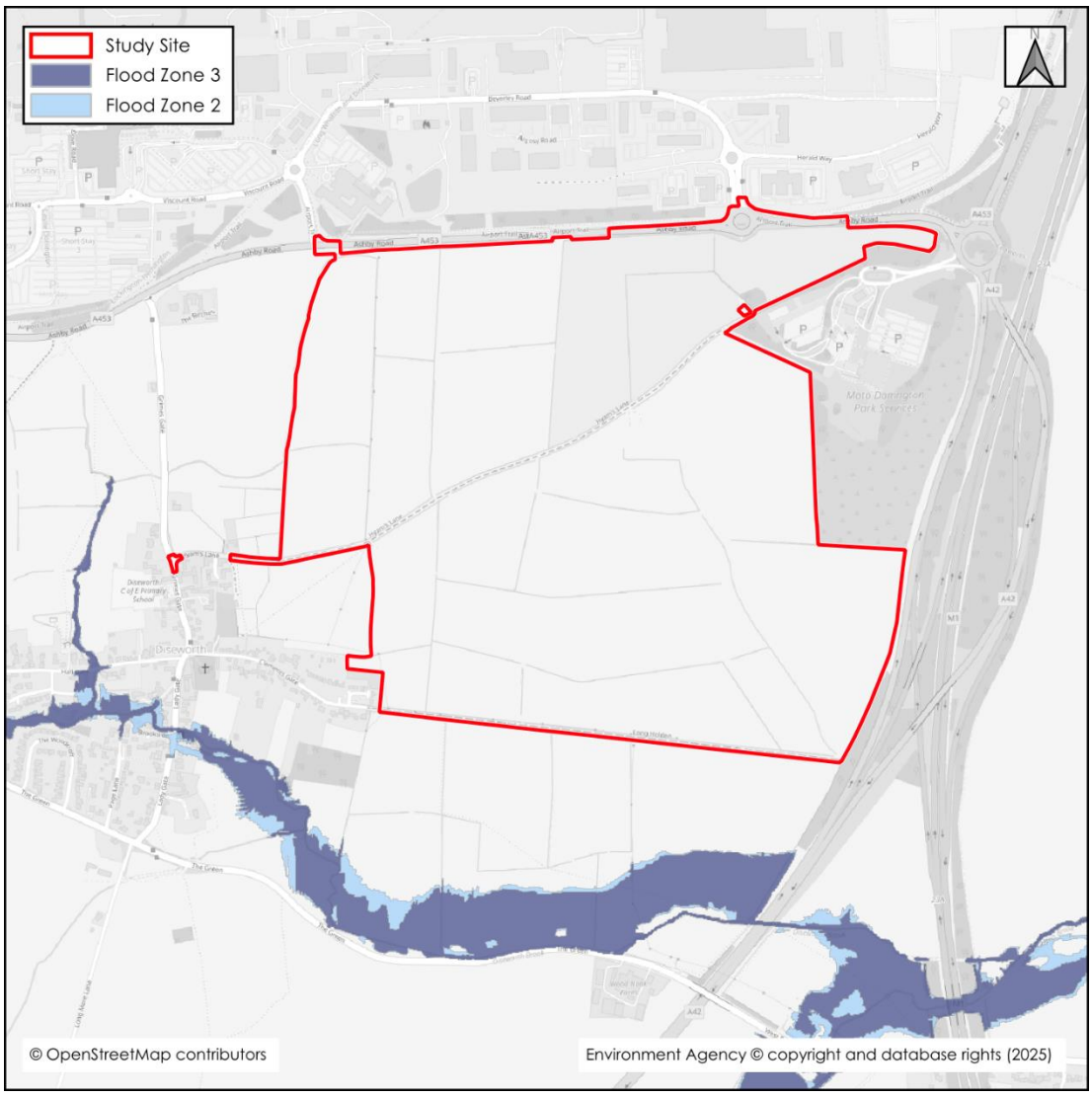

Figure 3.2: Flood Map for Planning

3.2.9 The generalised topography of the study site is shown in **Figure 3.3**, a topographical survey of the study site is included within the accommodating Sustainable Drainage statement ref: EMG2-BWB-ZZ-XX-RP-CD-0001_SDS. The study site can be split into two topographical catchments generally located to the north and south of Hyam's Lane. The northern catchment falls in a westerly direction towards the Hall Brook, with levels ranging from approximately 92.7metres Above Ordnance Datum (mAOD) in the north-east to approximately 67.1mAOD in the south-west. The southern catchment falls generally in a southerly direction with levels ranging from approximately 91.0mAOD in the north-east to approximately 52.6mAOD in the south-east.

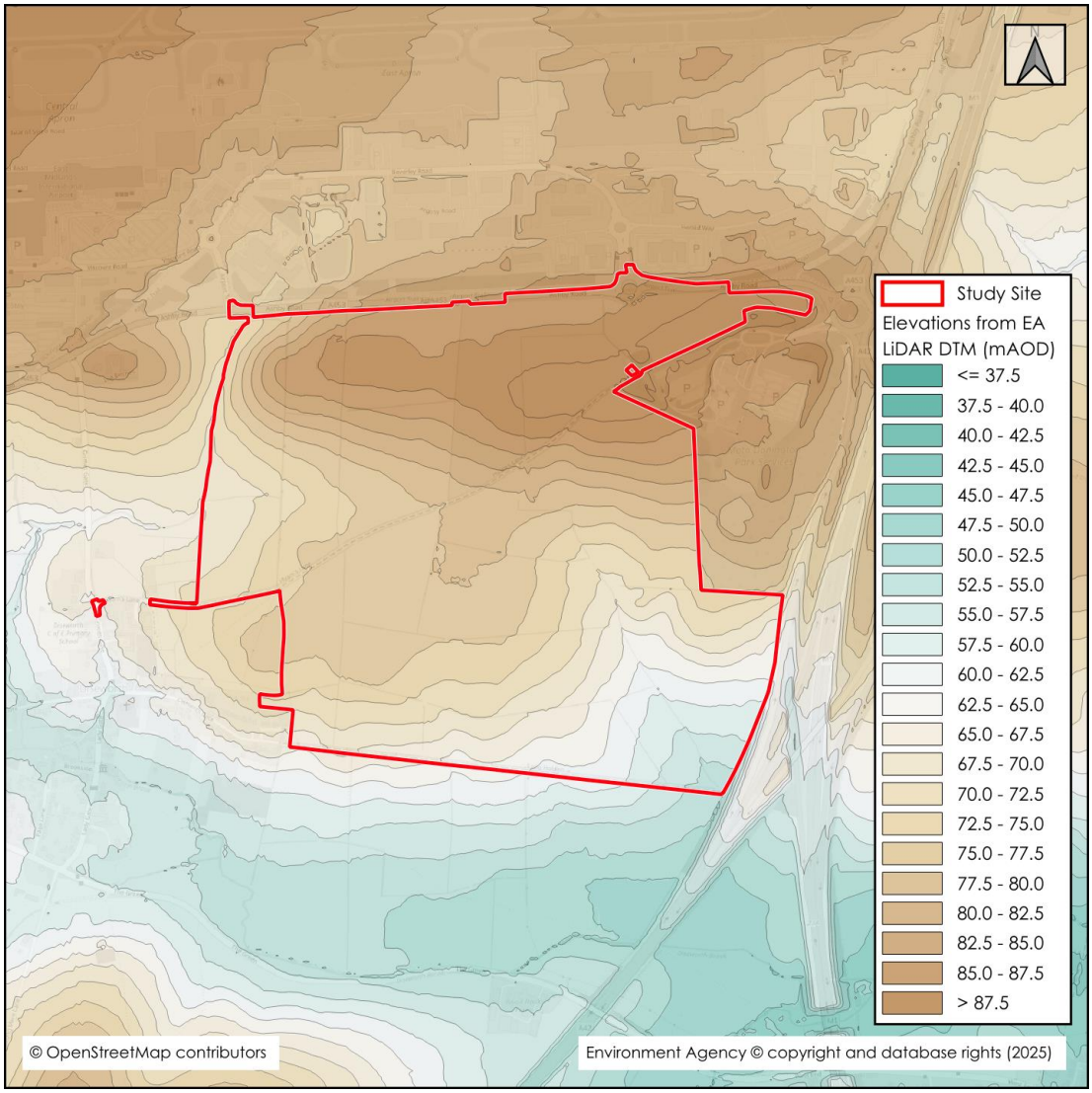

Figure 3.3: Existing Site Topography based on EA 1m LiDAR

3.2.10 The location of the proposed EMG2 Main Site and community park are currently greenfield in nature and is currently utilised for agricultural practices.

3.3 Proposed Development

3.3.1 The proposals within the EMG2 Main Site are for a multi-unit logistics/industrial development (Class B2 and B8) together with supporting and co-located office functions. Proposed access/egress for is to be achieved via Ashby Road (A453). Refer to Document DCO 2.5 for the Parameters Plan.

3.3.2 The proposed development units will be set up in a tiered arrangement upon a series of terraced plateaus created by reprofiling ground levels. A series of earth bunds will also be located on the western boundary to help screen the development.

3.3.3 The study site also includes the following within the coverage of this Section of the FRA:

- A453 EMG2 Access Works (Works No. 6) – associated with the construction of a new access from the existing roundabout and signalised crossing of the A453.
- Hyam's Lane Works (Works No. 7) – associated with improving the lane for use as cycle infrastructure.
- Long Holden Works (Works No. 17) – associated with providing new pedestrian connections between the EMG2 Main Site and Long Holden bridleway.
- Community Park (Works No. 21) - The community park is to be located between the EMG2 Main Site and the Hall Brook. A series of sustainable drainage systems (SuDS) basin will be located within the park which will serve the built EMG2 development.
- Pedestrian Crossing the A453 (Works No. 15)

3.3.4 As these are elements are generally associated with landscaping, relatively minor improvements to existing highway infrastructure and public rights of way, this FRA has primarily focussed upon the EMG2 Main Site.

3.4 Historical Flooding & Previous Studies

EA Recorded Flood Outlines

3.4.1 There are no EA Recorded Flood Outlines within the study site or the immediate surrounding area. The nearest outline is located approximately 2.5km to the east. This is associated with the River Soar exceeding channel capacity in 1983 and 1998.

Preliminary and Strategic Flood Risk Assessment

3.4.2 There are no references of historical flooding at the study site itself within the North West Leicestershire SFRA 2015 Update and LCC PFRA. However, both reports reference historical flooding of houses and roads on Hall Gate and Lady Gate in Diseworth from the Hall Brook and Diseworth Brook, in November 2000 and 2012, and of the B5401 in Long Whatton from the Long Whatton Brook. No additional records of historical flooding are reported within the North West Leicestershire SFRA 2024 update.

3.4.3 Although the Hall Brook and Diseworth Brook are known to take runoff from EMIA, these reports state the cause of flooding is a result of local issues regarding channel maintenance. This has been confirmed through correspondence with LCC (**Appendix 1**).

Environment Agency Consultation

3.4.4 In pre-application consultation, the EA confirmed that they hold no flood data relevant to the study site.

Diseworth and Long Whatton Catchment Study

3.4.5 The Diseworth and Long Whatton Catchment Study[22] was commissioned by LCC to determine the flooding mechanisms in Diseworth and Long Whatton, including the contribution that runoff from EMIA may have on flood risk in the catchment.

3.4.6 At the time of the report, the most recent flooding event in Diseworth and Long Whatton occurred in November 2012. Two localities within Diseworth are reported to have suffered flooding in the event – Shakespeare Close and Hall Gate.

3.4.7 The principal cause of flooding at Shakespeare Close was reported to be the channel geometry at this location, specifically a constriction and a reduction in channel capacity.

3.4.8 The flooding at Hall Gate was reported to be due to an exceedance of the Hall Brook channel capacity due to increased runoff from overland flows. At times during winter months, the runoff from EMIA is pumped to the River Trent and the Hall Brook does not receive discharge from the eastern attenuation basin; this was confirmed as the case in November 2012. It is therefore reported that flows were generated by runoff from the farmland to the north of the village, causing an increase in peak flows further

[22] Diseworth and Long Whatton Catchment Study (URS, January 2014)

downstream. This increase was sufficient to cause the watercourse to exceed channel capacity.

Long Whatton & Diseworth Flood Risk Mitigation & Resilience Study

3.4.9 Following on from The Diseworth and Long Whatton Catchment Study, Arcadis Consulting (UK) Limited were commissioned by LCC to produce the Long Whatton & Diseworth Flood Risk Mitigation & Resilience Study[23]. The purpose of the study was to further evaluate the flood mechanisms and to evaluate flood mitigation options. This study makes reference to a number of historical flooding incidents in Diseworth and Long Whatton, as follows: 2000, 2012, 2017, 2018, 2019 and 2020.

3.4.10 To inform the study, a bespoke 1D-2D hydraulic model was produced to provide flood depths, extents and mechanisms within the catchment. The model was developed using InfoWorks ICM due to its ability to represent fluvial networks, overland flows and sub-surface drainage in an integrated 1D-2D environment. Therefore, the model allows for representation of a number of key hydraulic features within the catchment including:

i. The Diseworth Brook;
ii. The Hall Brook;
iii. The Long Whatton Brook;
iv. Minor tributaries and land drainage;
v. Surface water and combined sewers;
vi. Property roof runoff;
vii. Local highway drainage;
viii. The M1 and A42 drainage catchments;
ix. EMIA drainage infrastructure including storage ponds;
x. Non-EMIA ponds; and
xi. The study site.

3.4.11 The observed historical flood incidents in the catchment were utilised to provide verification of the model results, providing direct evidence of both flood extents and depths. The model was shown to correlate well with respect to depths and extents in areas demonstrating historical flooding in Diseworth.

3.4.12 The results of the modelling demonstrated that the primary cause of flooding in Diseworth is the limited capacity of the channel and the lack of functional floodplain. It was reported that the EMIA drainage systems form a larger proportion of channel flow in lower magnitude flood events; however, the impact lessens in the higher magnitude events due to the effective attenuation capacity and the timing associated with the utilisation of the storage basins.

3.4.13 The investigation acknowledged that the peak discharge rates from the EMIA to Diseworth do vary due to antecedent conditions, but that the presence of EMIA ponds

[23] Long Whatton & Diseworth Flood Risk Mitigation & Resilience Study (Arcadis Consulting (UK) Limited, August 2020)

and drainage infrastructure significantly attenuates the magnitude of runoff which would have occurred before the EMIA was constructed. The report concludes the existence of the EMIA provides a significant level of protection to Diseworth.

3.4.14 A range of options for mitigating flood risk in Diseworth were tested, including options on both the Diseworth Brook and the Hall Brook. However, it was reported that an effective solution could not be identified; therefore, Property Level Resilience (PLR) measures were proposed to help prevent properties from flooding.

3.4.15 The LLFA provided a copy of their integrated Diseworth and Long Whatton hydraulic model for use in this FRA as it also provides coverage of the study site.

Anecdotal Evidence and Press Reports

3.4.16 A review has been undertaken for online press reports of historical flooding within Diseworth and Long Whatton, beyond those referenced above; however, none were found.

3.4.17 During public consultations undertaken in February 2025, anecdotal reports were made of flooding in Diseworth and Long Whatton in winter of 2024/25. The reports made reference to rapid surface water runoff from the EMG2 Main Site being observed.

3.5 Potential Sources of Flood Risk

3.5.1 Flooding can occur from a variety of sources, or combination of sources, which may be natural or artificial. **Table 3.2** below identifies the potential sources of flood risk to the study site in its current condition, prior to mitigation. These are discussed in greater detail in the forthcoming section. The mitigation measures proposed to address flood risk issues and ensure the development is appropriate for its location are discussed within **Section 3.6**.

Table 3.2: Pre-Mitigation Sources of Flood Risk

Flood Source	Potential Risk				Description
	High	Medium	Low	None	
Fluvial			X		The study site is located entirely within Flood Zone 1, and hydraulic modelling has identified that the Hall Brook remains within bank past the study site. The proposed built development is located over 170m from the Hall Brook.
Pluvial			X		There is the potential for surface water overland flow pathways to form within study site. However, these predominately originate from within the study site itself, are relatively shallow and of a very low flood hazard. There are no significant overland flow pathways passing through the study site from upstream third-party land.
Sewer			X		The LCC hydraulic model indicates that the limited drainage and sewer networks around the study site do not direct any exceedance flows onto the EMG2 Main Site.
Coastal				X	The study site is not at risk from tidal/coastal sources
Canals				X	The Trent and Mersey Canal is located approximately 5.3km north of the study site and therefore does not represent a potential source of flooding.

Flood Source	Potential Risk				Description
	High	Medium	Low	None	
Groundwater			X		Based on the low permeability of the geology, the local topography, and the measured depth of groundwater, the risk of groundwater emergence in the study site is considered to be low.
Reservoirs and waterbodies			X		The study site is shown to fall partially within an area at risk of inundation as a result of reservoir failure from the EMIA, but the development has been arranged to avoid the area at risk.

Fluvial, Pluvial, and Sewer Flood Risk

3.5.2 The mechanisms of flooding within the Hall Brook and Diseworth Brook catchment are largely surface water driven, and the LCC LLFA have provided a copy of their integrated Long Whatton & Diseworth hydraulic model to inform the assessment of flood risk at the study site. This model combines fluvial, surface water, private drainage, highway drainage, and public sewer sources, and provides a holistic appraisal of potential flood risk.

3.5.3 Due to its detail, the model provides a more representative picture of the potential flood risk than the strategic level flood mapping published by the EA in the form of the Flood Map for Planning and the Risk of Flooding from Surface Water (RoFSW) and Risk of Flooding from Rivers and Sea (RoFRS) maps.

3.5.4 For the purposes of this study, the model was updated to include additional site-specific detail from the topographical survey and a CCTV survey of the public sewer and A42 culvert in the east of the site. Further details on the hydraulic modelling amendments are provided within the hydraulic modelling report included as **Appendix 2**. The CCTV and topographical survey of the study site are included within the accommodating Sustainable Drainage statement ref: EMG2-BWB-ZZ-XX-RP-CD-0001_SDS. The minor amendments made to the model have been independently reviewed and approved by Arcadis Consulting (UK) at the request of the EA and LLFA.

3.5.5 For ease of reference, the baseline modelled floodplain extents are shown in **Figure 3.4** and peak flood depths for the credible maximum scenario and **Figure 3.5**. The peak flood depths within the model were sampled at multiple points and are summarised within **Table 3.3**.

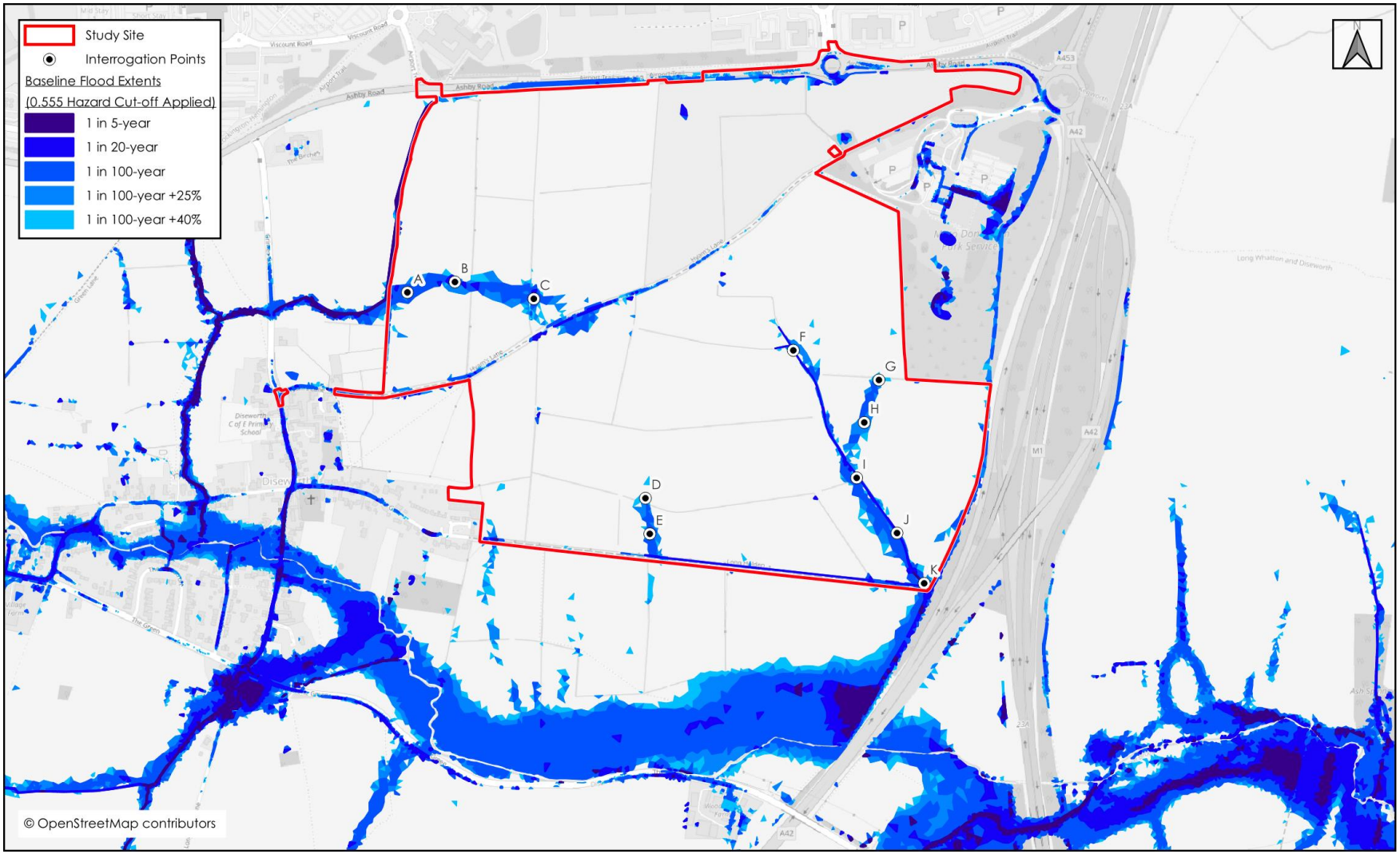

Figure 3.4: Baseline Conditions Modelled Floodplain Extents

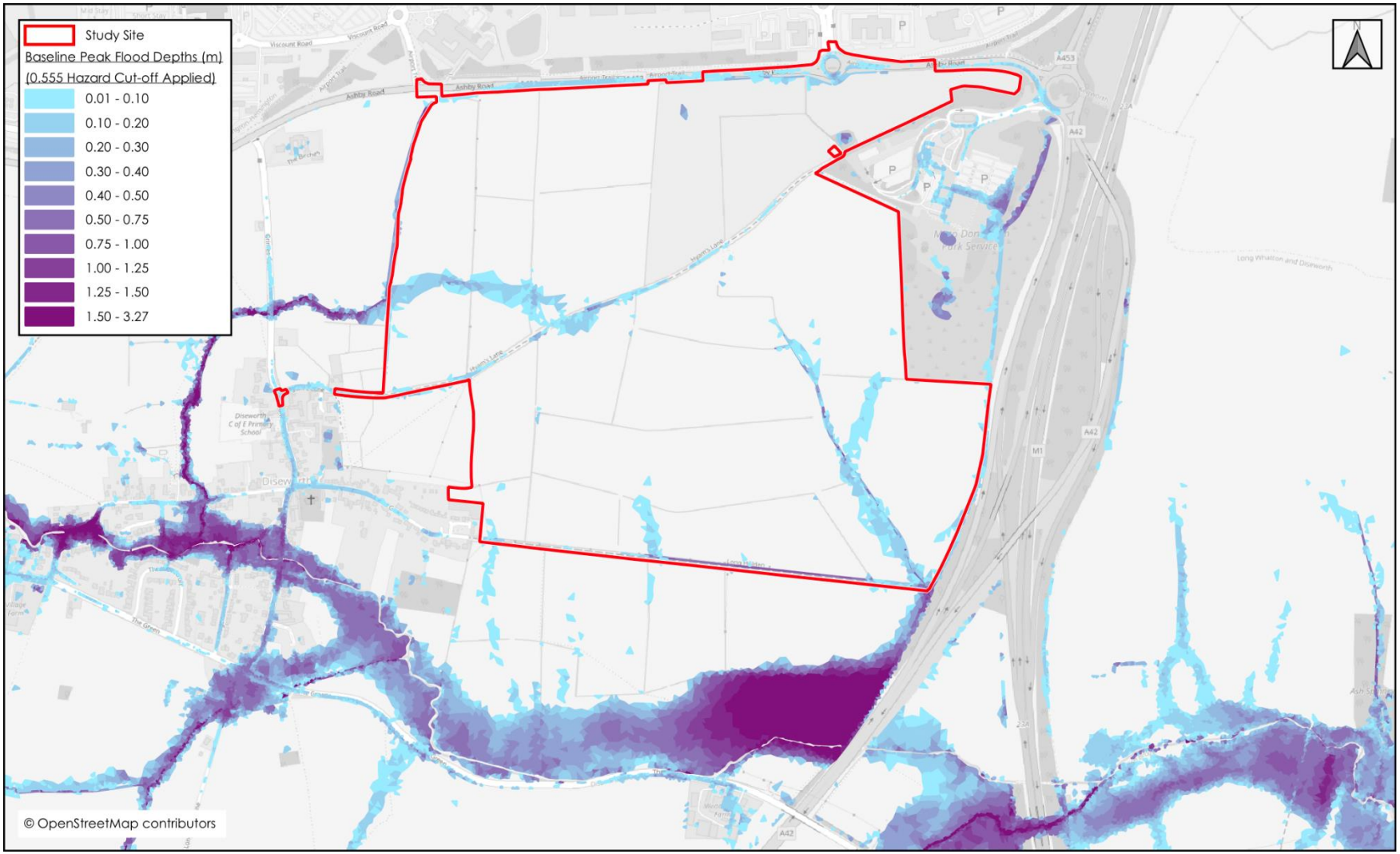

Figure 3.5: Baseline Conditions 1 in 100-year +40% Peak Flood Depths

Table 3.3: Baseline Conditions Modelled Peak Flood Depths

Node ID	20-year	100-year	100-year +25%	100-year +40%
A	-	0.06	0.09	0.10
B	0.13	0.31	0.35	0.38
C	0.16	0.24	0.27	0.29
D	-	-	-	-
E	-	-	0.06	0.06
F	0.23	0.38	0.46	0.50
G		0.06	0.07	0.08
H	-	-	0.07	0.08
I	-	-	-	-
J	0.31	0.49	0.57	0.61
K	-	0.25	0.34	0.39

3.5.6 The hydraulic modelling has shown that the Hall Brook floodplain is contained to its channel next to the study site, confirming that it poses a low fluvial flood risk to the proposed development. Further to this, the proposed built development at the EMG2 Main Site is located at least 170m to the east of the Hall Brook.

3.5.7 Additionally, the local sewer network and the EMIA drainage are not predicted to affect the study site. Therefore, the risk of flooding from existing sewer and drainage systems is also low.

3.5.8 The modelling has identified that there is the potential for surface water overland flow pathways to form within the study site, which are directed towards the downstream receiving watercourses by the fall of the topography. However, these flow routes are relatively shallow and of a very low flood hazard. For example, at the 1 in 100-year +40% event, the overland flows are generally between 0.05m to 0.15m deep. Greater depths and hazards only occur within low-lying areas such as within the drainage channels. Importantly, the overland flow pathways are shown to predominately originate from within the study site. There are no significant overland flow pathways passing through the study site from upstream third-party land. Therefore, these overland flow pathways will be resolved through developing the study site. This is discussed further within **Section 3.6**.

3.5.9 It should be noted that in accordance with hydraulic modelling best practice, the model data presented in **Figure 3.4** and **Figure 3.5** have been filtered to remove very shallow and slow moving water in order to identity the main flow pathways. Smaller and shallower flow pathways may be present that are not illustrated. Anecdotal evidence from the local residents has identified that runoff from fields to the north-east of Diseworth has historically been observed to flow towards properties on Clements

Gate, Long Holden and Langley Close, especially when the ground is saturated by preceding wet weather. The topography for the local area (see **Figure 3.3**) suggests that the contributing runoff from the study site towards these properties is limited (the study site generally sheds water to the Hall Brook or the field to the east of Diseworth). However, intercepting and managing as much runoff as possible from the study site as part of the EMG2 Works may help reduce the magnitude of flows generated. This is discussed within **Section 5**.

Groundwater Flood Risk

3.5.10 Groundwater flooding occurs when the water table rises above ground elevations, or it rises to depths containing basement level development. It is most likely to happen in low lying areas underlain by permeable geology. This is most common on regional scale chalk aquifers, but there may also be a risk on sandstone and limestone aquifers or on thick deposits of sands and gravels underlain by less permeable strata such as that in a river valley.

3.5.11 BGS mapping shows the study site to be underlain predominantly by Gunthorpe Member – Mudstone, with thin bands of Gunthorpe Member – Siltstone, Dolomitic and Diseworth Sandstone. The bedrock geology is shown in **Figure 3.6**. These bedrock layers are designated as Secondary B Aquifers, defined as predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.

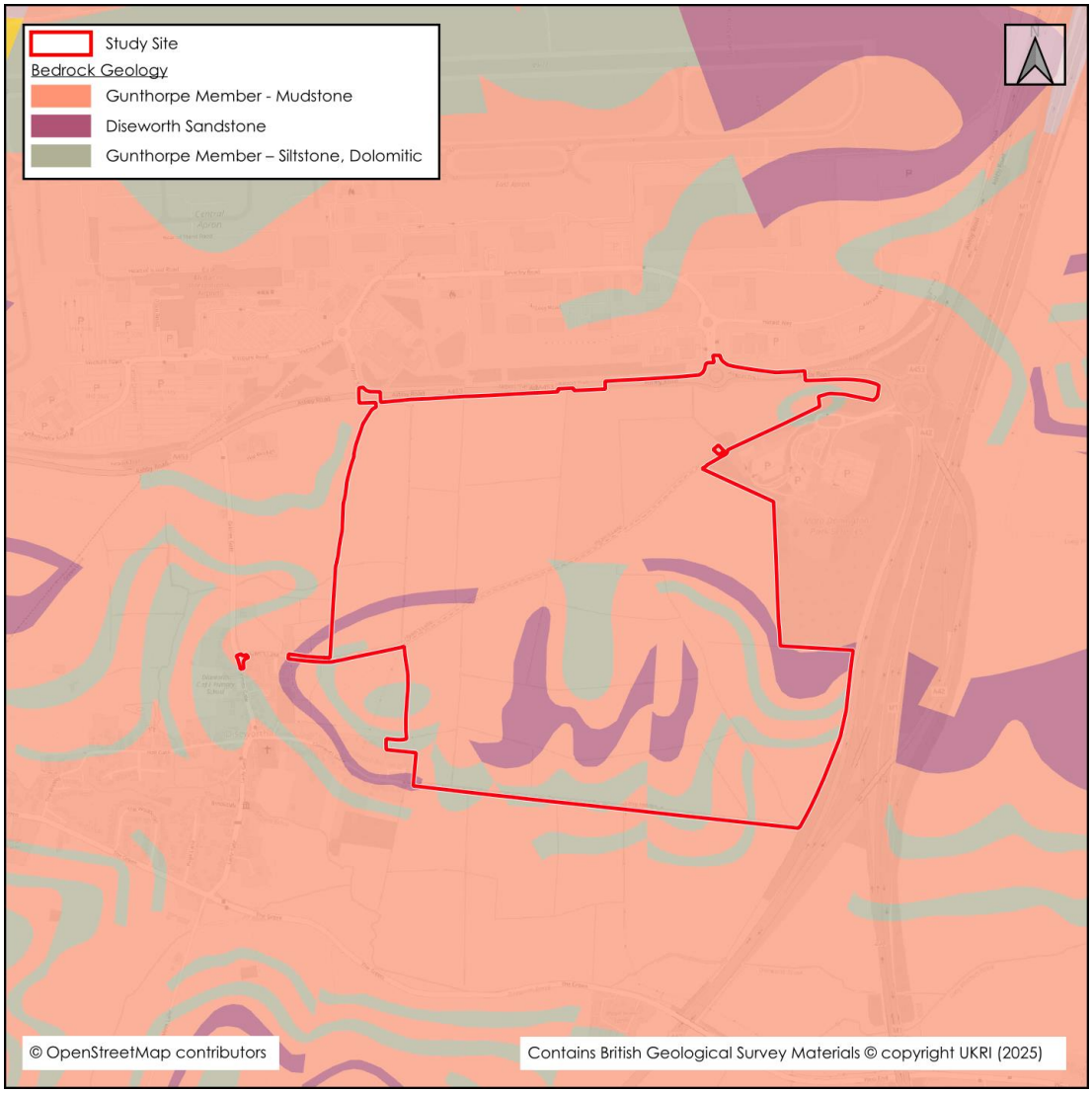

Figure 3.6: BGS Bedrock Map

3.5.12 Superficial deposits of Glaciofluvial Deposits, Mid Pleistocene – Sand and Gravel, Oadby Member – Diamicton and Head – Clay, Sand and Gravel are expected to be present within the study site. The superficial deposits are shown in **Figure 3.7**.

3.5.13 The Glaciofluvial Deposits are designated Secondary A Aquifers, defined as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. The Oadby Member – Diamicton and Head – Clay, Silt, Sand and Gravel are designated Secondary Undifferentiated assigned in cases where it has not been possible to attribute either category A or B to a rock type.

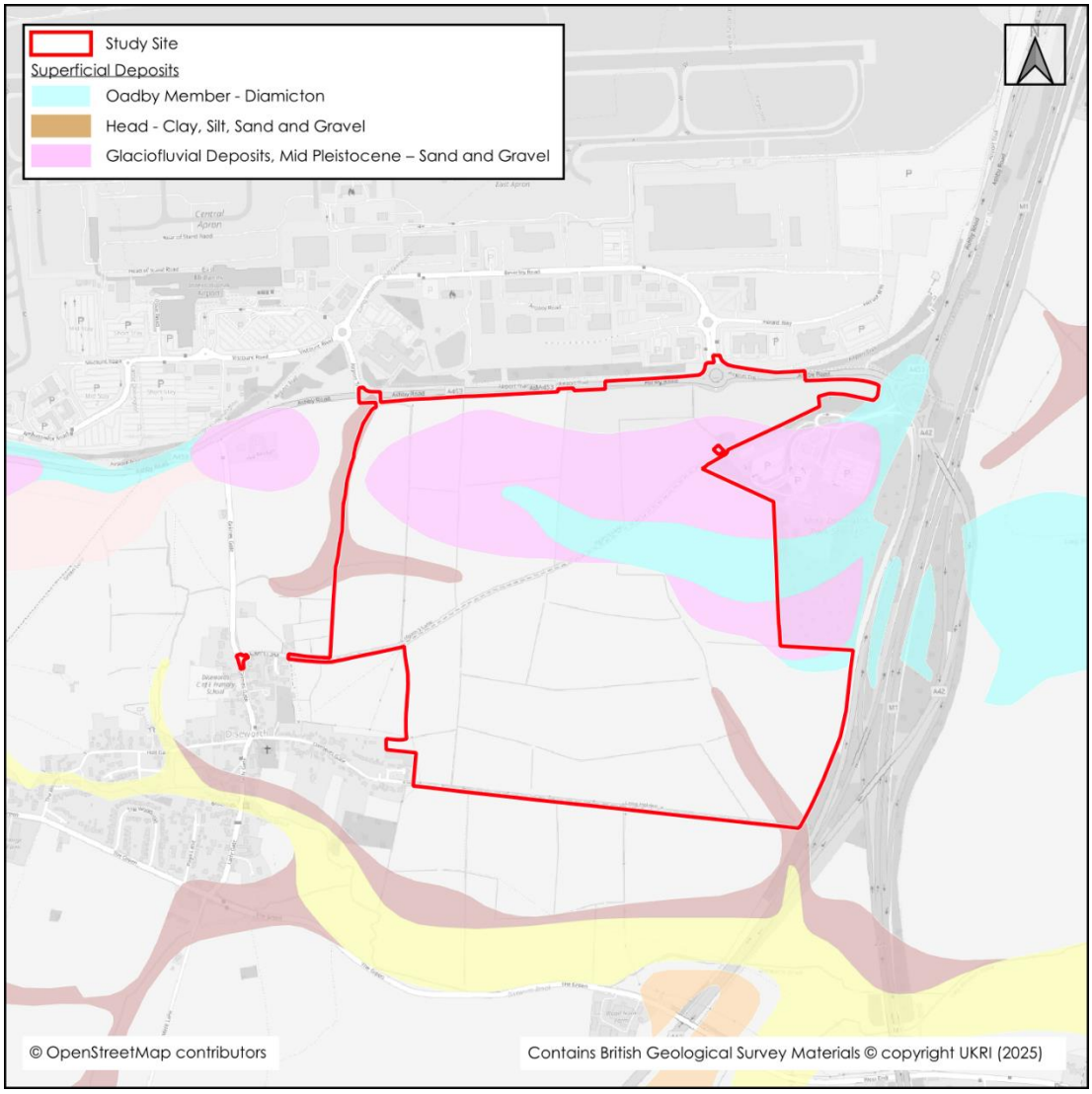

Figure 3.7: BGS Superficial Deposits

3.5.14 There are no BGS borehole logs located within the study site, but there are three borehole logs in areas immediately surrounding the site underlain by similar geologies (references: SK42NE80, SK42NE158 and SK42SE248). Groundwater levels in these logs range between 4.0 metres below ground level (m bgl) and 7.9m bgl. A further log located to the east (SK42SE244) notes shallow perched shallow groundwater; however, this sits within Made Ground and is therefore not considered to be representative of the natural groundwater levels.

3.5.15 The North West Leicestershire 2015 SFRA Update states that while the majority of the district is at a low risk from groundwater flooding, parts of North West Leicestershire are susceptible to rising groundwater due to the large-scale closure of the coal mines within the Leicestershire and South Derbyshire coalfield. However, the study site is well removed from areas where historical mining has occurred as per mapping produced by The Coal Authority[24]. It is therefore considered that the groundwater risk from these closures would not impact the study site.

[24] The Coal Authority Interactive Mapping (Interactive Map Viewer | Coal Authority (bgs.ac.uk))

3.5.16 The North West Leicestershire SFRA does not include groundwater flood risk mapping. However, while the study site does not fall within Nottinghamshire, the Greater Nottingham SFRA Addendum25 includes groundwater susceptibility mapping that provides coverage. This data suggests that the study site falls within an area where 25% to 50% of the land is potentially susceptible to groundwater flooding. However, the study site is relatively elevated in comparison to the surrounding area and it is raised above the nearby watercourses and floodplains. Therefore, it is considered that the land identified to be potentially susceptible to groundwater flooding is most likely to be associated with the nearby low-lying areas, such as the Diseworth Brook floodplain.

3.5.17 The Factual Ground Investigation Report (reference: 765514-01) prepared by Fairhurst outlines findings from extensive intrusive ground investigations. This has confirmed the following ground conditions:

3.5.18 Topsoil (proven from the surface to a maximum depth of between 0.10m and 0.85m bgl);

3.5.19 Isolated occurrences of Made Ground (proven to a maximum depth of 0.20m and 3.00m bgl), with the deeper Made Ground encountered within the northern site area (location of anticipated historically infilled clay pits – TP08 and BH04);

3.5.20 Superficial deposits of The Oadby Member and Glaciofluvial Deposits (proven to maximum depths of 16.40m bgl and 17.30m bgl, respectively); and

3.5.21 Bedrock geology of The Gunthorpe Member and Diseworth Sandstone (proven to a maximum depth of 18.50m bgl for the former, with the maximum depth of the latter not proven).

3.5.22 Soils were found to be comprise stiff clay beneath a layer of topsoil. Based on the observed conditions, it was anticipated that there would be limited infiltration potential and this was confirmed through a series of eight soakaway tests. Of the eight tests undertaken, two returned a very slow permeability rate of 10-6 m/s while the other six tests did not return an infiltration rate at all.

3.5.23 Groundwater monitoring suggested that two groundwater bodies are present, with a perched layer at a depth of 1.25 m bgl and the groundwater body within the Glaciofluvial, Weathered Gunthorpe Member and Gunthorpe Member at 15.32 m bgl (84.90 m AOD and 52.7 m AOD).

3.5.24 It was reported that the ground investigations found the ditch in the study site to be dry throughout the works. Therefore, this is likely to be seasonally dry, with its main purpose to drain surface water runoff from the adjacent fields.

3.5.25 Based on the low permeability of the geology, the local topography, and the measured depth of groundwater, the risk of groundwater emergence in the site is considered to be low. Any potential emergence would be most likely to occur in the low-lying river valleys and floodplains of the Hall Brook and Diseworth Brook.

[25] Greater Nottingham Strategic Flood Risk Assessment Addendum

3.5.26 However, there is a risk that the perched groundwater could be encountered during the construction phase due to the proposed reprofiling of the site. This risk should be considered in the design of the earthworks. This is discussed further within **Section 3.6**.

Flood Risk from Reservoirs & Large Waterbodies

3.5.27 Flooding can occur from large waterbodies or reservoirs if they are impounded above the surrounding ground levels or are used to retain water in times of flood. Although unlikely, reservoirs and large waterbodies could overtop or breach leading to rapid inundation of the downstream floodplain.

3.5.28 To help identify the area potentially at risk, reservoir failure flood risk mapping has been prepared and published by the EA. This shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. The map displays a worst-case scenario and is only intended as a guide. An extract of the mapping is shown in **Figure 3.8**.

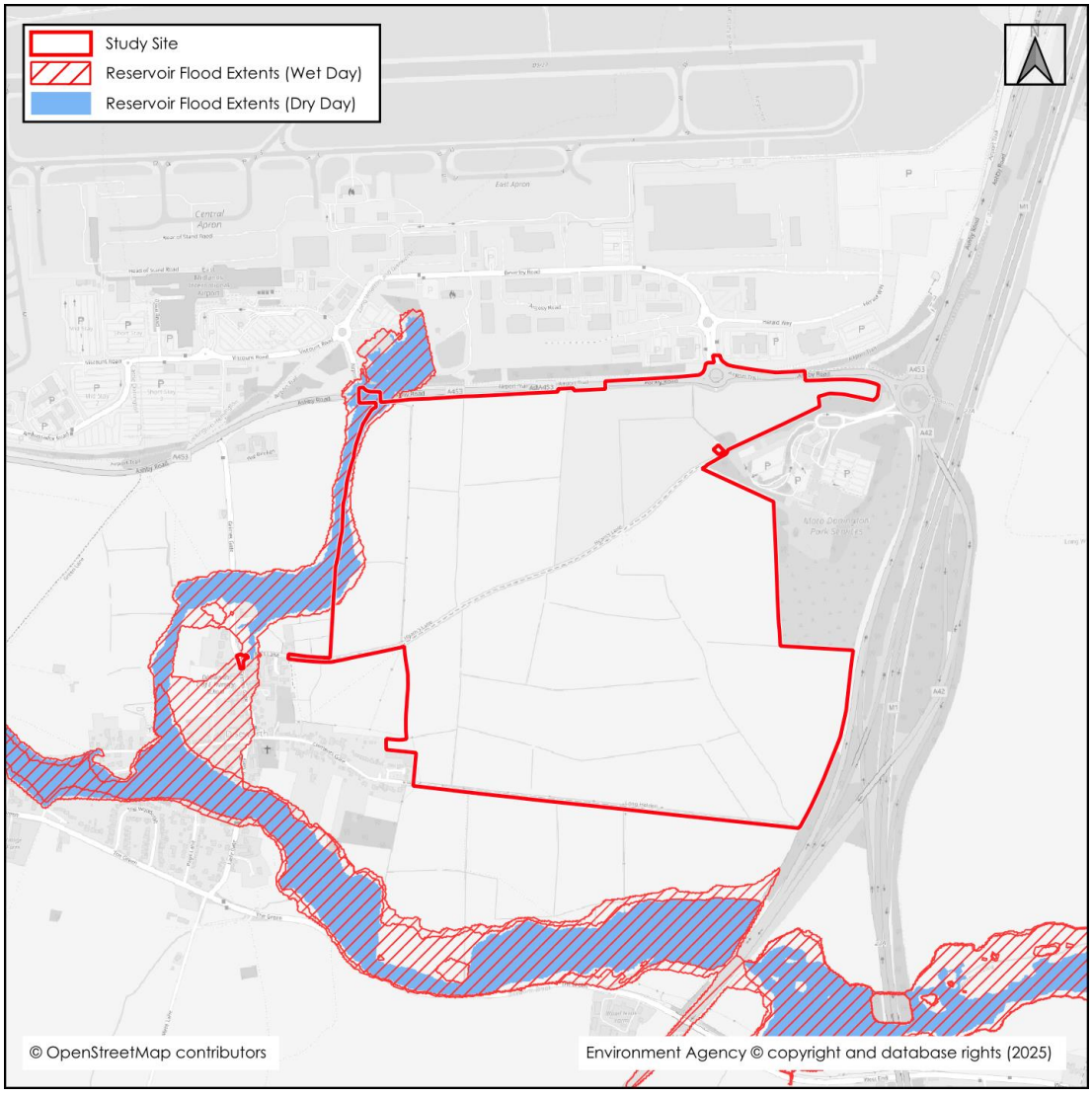

Figure 3.8: EA Reservoir Failure Mapping

3.5.29 There are two flooding scenarios shown on the reservoir flood maps: a 'dry-day' and a 'wet-day'. The 'dry-day' scenario predicts the flooding that would occur if the dam or reservoir failed when rivers are at normal levels. The 'wet-day' scenario predicts how much worse the flooding might be if a river is already experiencing an extreme flood.

3.5.30 There is shown to be a slight encroachment of both 'dry-day' and 'wet-day' reservoir failure extents in the very west of the study site, the location of the proposed community park and outside of the area actually proposed for built development. These extents are associated with the Central East Area Balancing Pond of the EMIA.

3.5.31 The reservoir is operated and maintained by EMIA who have ultimate responsibility for the safety of their reservoir assets. Their responsibilities include regular safety inspections, any necessary design or repairs undertaken where required and an annual statement produced on the operation and maintenance regime. Based on the safety legislation in place and the maintenance and repair responsibilities of EMIA, the actual probability of a significant failure is considered to be low.

3.5.32 As the proposed built development is removed from the failure flood extents, it is not at risk from this potential source of flooding. This also means that the development will not change the reservoir classification.

3.6 Flood Risk Mitigation

3.6.1 **Section 3.5** has identified the sources of flooding which could potentially pose a risk to the study site. This section of the FRA sets out the mitigation measures which are to be incorporated to address and reduce the risk of flooding to within acceptable levels.

Surface Water Drainage Strategy

3.6.2 The EMG2 Main Site is essentially wholly greenfield in nature. Storm water will currently drain through a combination of very limited infiltration into the soils and rapid surface water runoff to the local watercourses. The proposed development will introduce large areas of impermeable surfaces which will lead to an increase in surface water runoff, which could cause a detrimental impact to downstream flood risk unless appropriately mitigated.

3.6.3 The proposed development aims to manage the additional surface water runoff, and address the minor flood risk posed by the shallow surface water overland flows routes that can occur in the baseline conditions, through the implementation of a surface water drainage strategy.

3.6.4 The drainage strategy will be designed to intercept and store rainwater falling on the development before releasing it to the downstream watercourse. Full details of the drainage strategy are available within the accompanying Sustainable Drainage Statement (SDS) prepared by BWB Consulting (reference: EMG2-BWB-ZZ-XX-RP-CD-0001).

3.6.5 The drainage strategy will include an attenuated surface water discharge rate, equivalent to a 39% reduction to the greenfield (pre-development) 1 in 1-year runoff rate. Therefore, the surface water discharge rate from the site will be below existing greenfield runoff rates, thereby offering a degree of downstream betterment.

3.6.6 The excess surface water runoff will be stored within a combination of on-plot below ground storage tanks and above ground SuDS features that will be designed to accommodate the 1 in 100-year storm with a 25% uplift to reflect future climate change. Additionally, the storage will be designed to contain the larger 1 in 100-year +40% climate change storm event within their freeboard.

3.6.7 The drainage strategy seeks to direct all surface water runoff from the EMG2 Main Site development to the outfall in the southern-eastern corner of the study site, which outfalls to the Diseworth Brook downstream of Diseworth. Therefore, a reduction in the volume and rate of surface water runoff directed towards the Hall Brook and the existing downstream flood risk issues in Diseworth will be provided.

3.6.8 These surface water drainage principles have been built into the integrated Long Whatton & Diseworth hydraulic model, to allow them to be tested and ascertain the potential impact of the development on the downstream Hall Brook and Diseworth Brook catchment. Further details on how these principles were integrated into the model are included within the hydraulic modelling report (**Appendix 2**). The post-

development modelled floodplain extents and peak flood depths are illustrated in **Figure 3.9** and **Figure 3.10**.

3.6.9 Peak flood depths were compared against the equivalent baseline scenario to identify changes to flood risk outside of the development area. This analysis has been mapped and is included within the accompanying hydraulic modelling report (**Appendix 2**). The analysis from the 1 in 100-year +40% storm event is included as **Figure 3.11** for ease of reference.

3.6.10 The development is shown to offer a marginal reduction in downstream flood risk, of between 0.01m and 0.25m, during the 1 in 100-year +40% storm event. In Diseworth, the benefits are most pronounced on the Hall Brook, where the betterment is a result of the runoff from the EMG2 Main Site development area being redirected away from the village. On the Diseworth Brook, the benefits are most evident upstream of the A42 embankment, where the benefits are as a result of surface water runoff from the development area being attenuated at a significantly restricted rate within the EMG2 Works.

3.6.11 Downstream of the A42 and M1, the development is shown to offer a nominal reduction in flood levels across the village of Long Whatton. During the 1 in 100-year +40% storm event, flood depths are reduced between 0.01m and 0.10m. This is a result of the reduced discharge rate offered by the EMG2 Main Site development.

3.6.12 To help manage surface water runoff within the development site, ground levels will be profiled to encourage pluvial runoff and overland flows to flow away from the built development towards the nearest drainage feature.

3.6.13 The road infrastructure or landscaped corridors should be used to provide drainage exceedance (overland flood flow) routes through the development and towards the swales and basins, for storms events that exceed the capacity of the drainage system.

3.6.14 In the event that the capacity of the swales and basins are exceeded, exceedance flows should be directed towards the outfall in south-eastern corner of the study site and away from Diseworth in the first instance.

3.6.15 Further information on the drainage approach is provided within the accompanying SDS by BWB Consulting (reference: EMG2-BWB-ZZ-XX-RP-CD-0001_SDS).

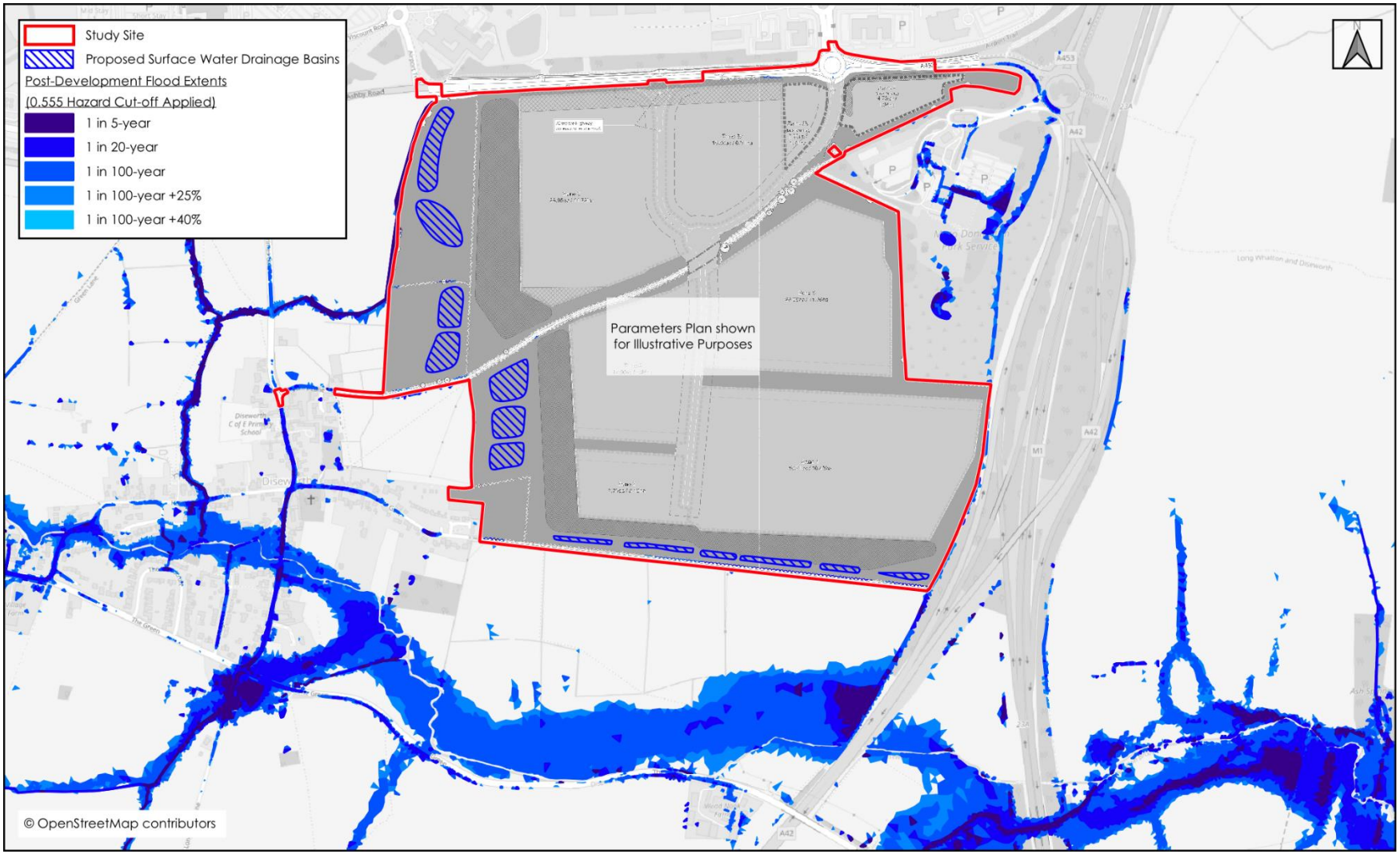

Figure 3.9: Post-Development Conditions Modelled Floodplain Extents

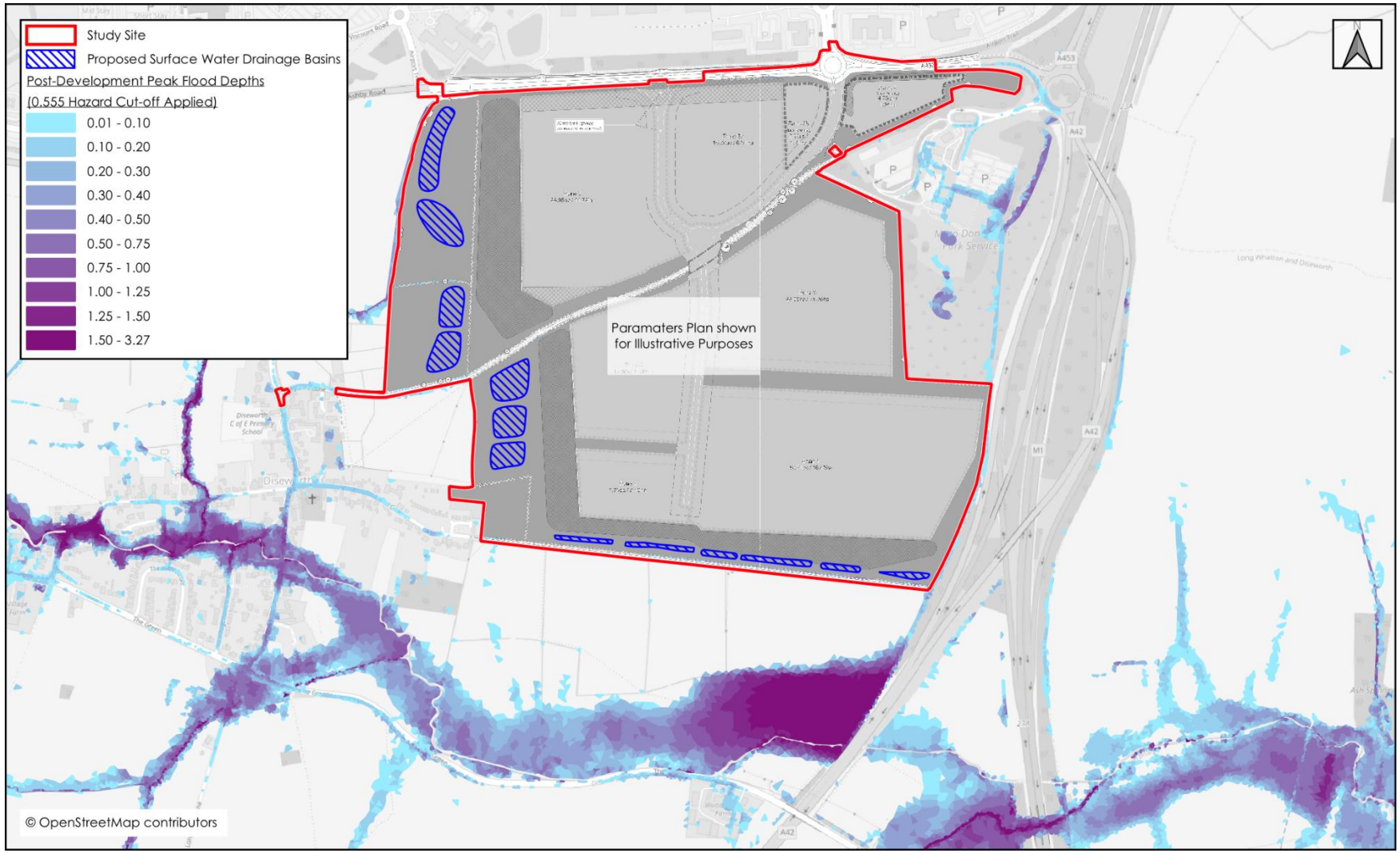

Figure 3.10: Post-Development Conditions 1 in 100-year +40% Modelled Peak Flood Depths

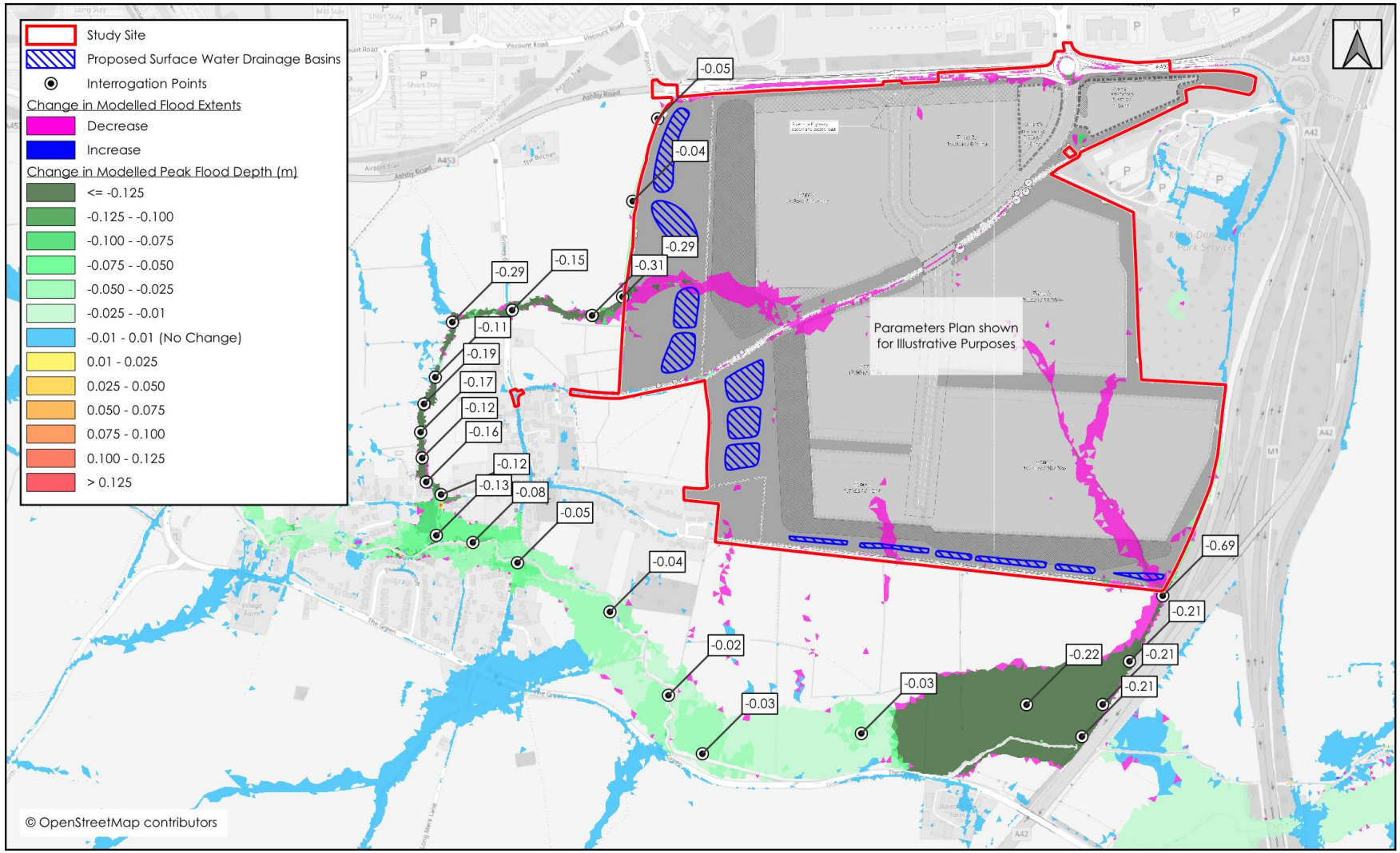

Figure 3.11: Change in Flood Depths Due to Development 1 in 100-year +40% Storm Event

3.6.16 The Highway Improvements associated with creating a new access from the A453 and creating a new pedestrian crossing will increase the impermeable area draining into the A453 highway drainage. At this stage, it is expected that this will be accommodated within the existing drainage infrastructure through the addition of new surface water storage infrastructure constructed in the location of the works. This will allow the additional runoff to be stored at the location it is generated and drain into the downstream drainage network when capacity is available. This approach will allow the downstream drainage network to be retained and will ensure that pass-on flows are retained at the existing rate.

Land Drainage

3.6.17 As reported in **Section 3.4**, anecdotal evidence from the local residents has identified that runoff towards properties on Clements Gate, Long Holden and Langley Close (to the south-west of the study site), has been observed historically. The EMG2 Main Site built development is proposed on areas of the study site that would not contribute to these flow pathways. However, to help manage the surface water runoff from the landscaped areas, drainage features, such as filter drains or similar, are proposed on the south-western boundary to help intercept and direct runoff from the landscaped areas away from the village.

3.6.18 The potential to encounter groundwater should be considered during the construction phase of the development, particularly during the excavations and reprofiling of the site. It is recommended that groundwater levels are monitored during the construction phase and where groundwater is encountered, appropriate dewatering and land drainage measures are employed.

3.6.19 It is recommended that appropriate land drainage is incorporated around the study site, such as at the base of any large landscape bunds and earthwork batters, to intercept surface water runoff and any groundwater that may emerge.

Safe Access and Egress

3.6.20 Access and egress for the EMG2 Main Site via Ashby Road (A453) is shown to be at low risk from surface water on the carriageway during the 1 in 100-year +40% event post-development. Post-development hazard mapping for the 1 in 100-year +40% event at the site is shown in **Figure 3.12**. During this event, there is predominantly a low flood hazard along most of the road's length past the study site. Therefore, safe access and egress is considered achievable.

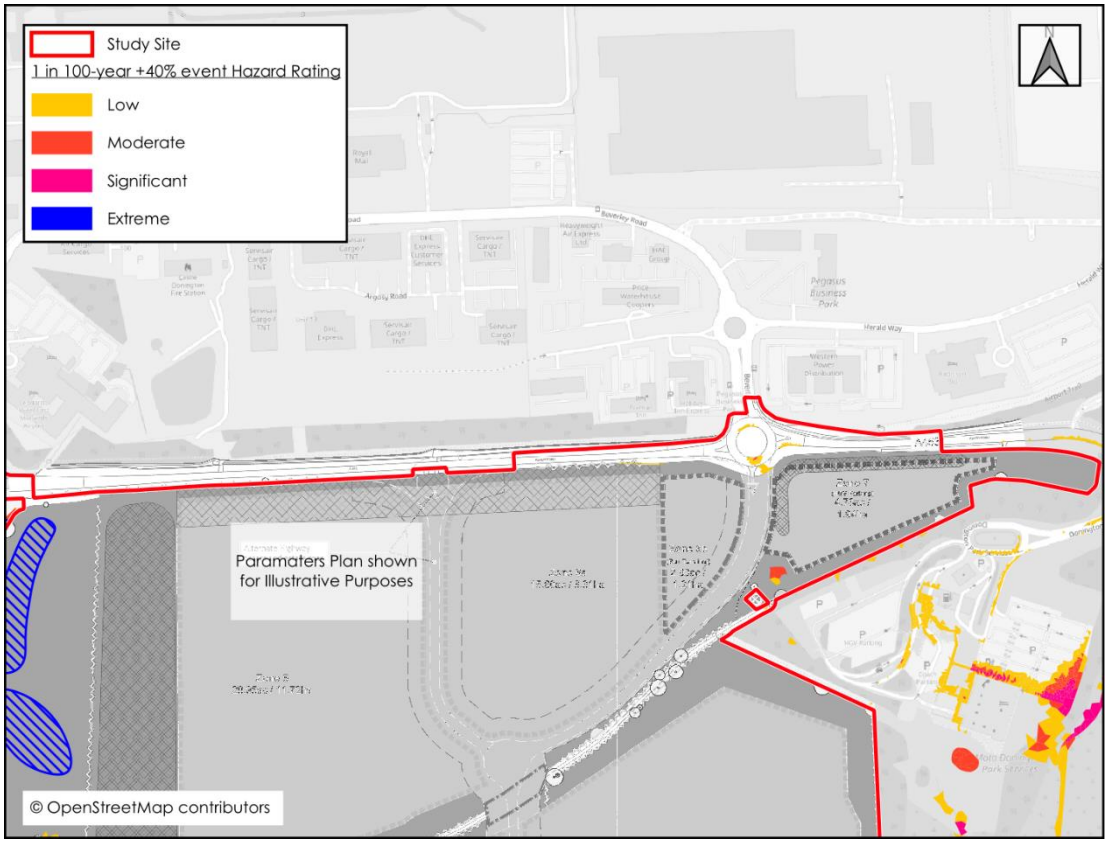

Figure 3.12: Post-development Conditions 1 in 100-year +40% Hazard Rating

Foul Water Drainage Strategy

3.6.21 Foul water will be drained from the development separately to surface water.

3.6.22 There will be early and ongoing consultation with Severn Trent Water to confirm the most appropriate point of discharge for foul drainage and to allow time for any necessary infrastructure improvements to be implemented.

3.6.23 Further information on the drainage approach is provided within the accompanying SDS by BWB Consulting (reference: EMG2-BWB-ZZ-XX-RP-CD-0001_SDS).

3.7 Summary of EMG2 Main Site inclusive of the Highway Works within the immediate vicinity (Works Nos. 1 to 7, 12, 17 & 21)

3.7.1 This Section of the FRA has been prepared in relation to the 'EMG2 Works' inclusive of the Highway Works within the immediate vicinity (Works Nos. 1 to 7, 12, 17 & 21). A summary of the findings is provided in **Table 3.4**.

3.7.2 This assessment has demonstrated that the proposed scheme is not at significant flood risk, subject to the recommended flood mitigation strategies being implemented. Moreover, the development will not increase flood risk to the wider catchment area subject to suitable management of surface water runoff.

Table 3.4: Summary of Flood Risk Assessment at EMG2 Main Site inclusive of the Highway Works within the immediate vicinity (Works Nos. 1 to 7, 12, 17 & 21)

Flood Source	Risk & Proposed Mitigation Measures
Fluvial	The study site is shown to be located entirely within Flood Zone 1, which is land at a low risk of fluvial flooding. This has been confirmed through detailed hydraulic modelling.
Pluvial	The hydraulic model has identified the potential for surface water overland flow pathways to form within the study site under the baseline conditions; these flow towards the Hall Brook and the Diseworth Brook. The flow routes are relatively shallow and originate from within the study site itself. There are no significant overland flow pathways passing through the study site from upstream third-party land. The proposed development aims to address this minor flood risk through the implementation of a surface water drainage strategy. Surface water runoff will be stored within a combination of above ground SuDS features and on-plot below ground storage tanks, or similar. These will be designed to accommodate the 1 in 100-year storm with a 25% uplift to reflect future climate change. Additionally, the storage will be designed to contain the larger 1 in 100-year +40% climate change storm event within their freeboard. Ground levels in the EMG2 Main Site development will be profiled to encourage pluvial runoff and overland flows to flow away from the built development towards the nearest drainage feature. The proposed road infrastructure or landscaped corridors should be used to provide drainage exceedance (overland flood flow) routes through the built development and towards the swales and basins. In the event that the capacity of the swales and basins are overwhelmed, exceedance flows should be directed towards the south-eastern corner of the study site and away from Diseworth in the first instance. To help manage the surface water runoff from the landscaped areas drainage features, such as filter drains or similar, are proposed on the south-western boundary to help intercept and direct runoff from the landscaped areas away from Diseworth.

Flood Source	Risk & Proposed Mitigation Measures
Other flood risk sources	The EMG2 Main Site development is considered to be at a low risk from sewers, groundwater, and reservoirs and large waterbodies. However, there is a risk that groundwater could be encountered during the construction phase due to the proposed reprofiling. This risk should be considered in the design of the earthworks and drainage strategies. It is recommended that groundwater levels are monitored during the construction phase and where groundwater is encountered, appropriate dewatering and land drainage measures are employed. It is recommended that appropriate land drainage is incorporated around the site, such as at the base of any large landscape bunds and earthwork batters, to manage surface water runoff and any groundwater.
Impact of the Development	The existing EMG2 Main Site is essentially wholly greenfield in nature. Storm water currently drains through a combination of very limited infiltration into the soils and surface water runoff to the local watercourses. The proposed development will introduce large areas of impermeable surfaces which will lead to an increase in surface water runoff. The potential impact this could have on downstream flood risk will be mitigated through implementation of a surface water drainage strategy. The drainage strategy will be designed to intercept and store rainwater falling on the development, before discharging it to the local watercourse, at a rate equivalent to a 39% reduction to the greenfield (pre-development) 1 in 1-year runoff rate. Additionally, the drainage strategy seeks to direct all surface water runoff from the development to an outfall located downstream of Diseworth, thus reducing the volume and rate of surface water runoff directed towards the village. This arrangement will provide a marginal reduction downstream flood risk.
This summary should be read in conjunction with BWB's full report. It reflects an assessment of the study site based on information received by BWB at the time of production.	

4. EMG2 OFFSITE HIGHWAY WORKS & SUBSTATION

4.1.1 This Section of the FRA focuses on the 'Highway Works' that are removed from the EMG2 Works, as outlined within **Table 4.1**. Where the proposed works include no material topographical alterations to the baseline conditions that could influence flood risk, they have been screened out of further assessment.

4.1.2 The Highway Works within close proximity to the EMG2 Main Site (i.e.: Works No. 6, 7, 15, 17 and 21) are discussed within **Section 3**. The EMG1 Works are reviewed in **Section 5**.

Table 4.1: Summary of Highway Works

Works No.	Location	Flood Zone Classification	Description of Proposed Works
8	M1 Northbound	Flood Zone 1	M1 northbound alterations. Gantry signage amendments. Hard shoulder amendments. M1 diverge to J24 lane.
9	M1 Northbound to A50 Westbound	Flood Zone 1	Providing a new free-flow link road from the M1 northbound at J24 to provide a direct link to the A50 westbound, which will cross over/under the A453.
10	A50 Westbound	Flood Zone 2 (Note: the forthcoming assessment identities that this is elevated above the 1 in 1000-year flood level, representative of Flood Zone 1)	A50 westbound merge. Widening of the A50 to the north of the new merge from the link road (Works No. 9).
11	A50 Eastbound to M1 J24	Flood Zone 3 (Note: the forthcoming assessment identities that this is elevated above the 1 in 1000-year flood level, representative of Flood Zone 1)	Providing widening of the A50 eastbound link at J24 and other related works and traffic management measures in this location.
12a & 12b	M1 Junction 24	Mostly Flood Zone 1, but the proposed alteration to the signage on the approach to the junction is located in Flood Zone 3.	Signage and lining amendments. Given the works are limited to signage and lining alterations of the existing highway, flood risk is not a material consideration. Therefore, this proposed element has not been assessed in any further detail.
13	EMG1 Access	Flood Zone 1	EMG1 access improvements - widening of existing roundabout.
14	West of A453	Flood Zone 1	A new shared-use cycle track north of the new toucan crossing alongside the A453 up to EMG1 connecting the two SEGRO developments for pedestrians

Works No.	Location	Flood Zone Classification	Description of Proposed Works
			and cyclists and providing an improved route for cyclists in the wider area such as between Kegworth and the Airport.
16	M1 south of Junction 23A	Flood Zone 1	Signage amendments. Given the works are limited to signage alterations, flood risk is not a material consideration. Therefore, this proposed element has not been assessed in any further detail.
18	Finger Farm Roundabout	Flood Zone 1	Signage Alterations. Given the works are limited to signage and lining alterations of the existing highway, flood risk is not a material consideration. Therefore, this proposed element has not been assessed in any further detail.
19	L57 Footpath	Flood Zone 1	Upgrade of footpath L57 to the west of EMG1 to cycleway standard.
20	EMG1	Flood Zone 1	Modification and extension of the existing EMG1 substation.

4.1.3 Due to their geographical distribution, an individual desktop assessment of flood risk at each location is undertaken within the forthcoming section. As the proposals are generally associated with improvements to existing infrastructure, the principle of a road, footway or new signage in each location has not been discussed. Instead, the assessment has focused on the presence of a potential flood risk source and the potential impact of the proposals on that flood risk source.

4.1.4 Where available, illustrative outlines of the proposed works are provided for context, although it should be noted that these are subject to change through design and development.

4.2 Works No. 8: M1 Northbound Hard Shoulder and Gantry Signage Amendments

Illustrative Proposals

4.2.1 The proposals include for amendments to the existing hard shoulder on the M1 Junction 24 diverge lane – this is illustrated in **Figure 4.1**. Additional works are proposed beyond those shown in **Figure 4.1**; however, these relate to changes to the gantry signage over the carriageway and will therefore have no flood risk implications.

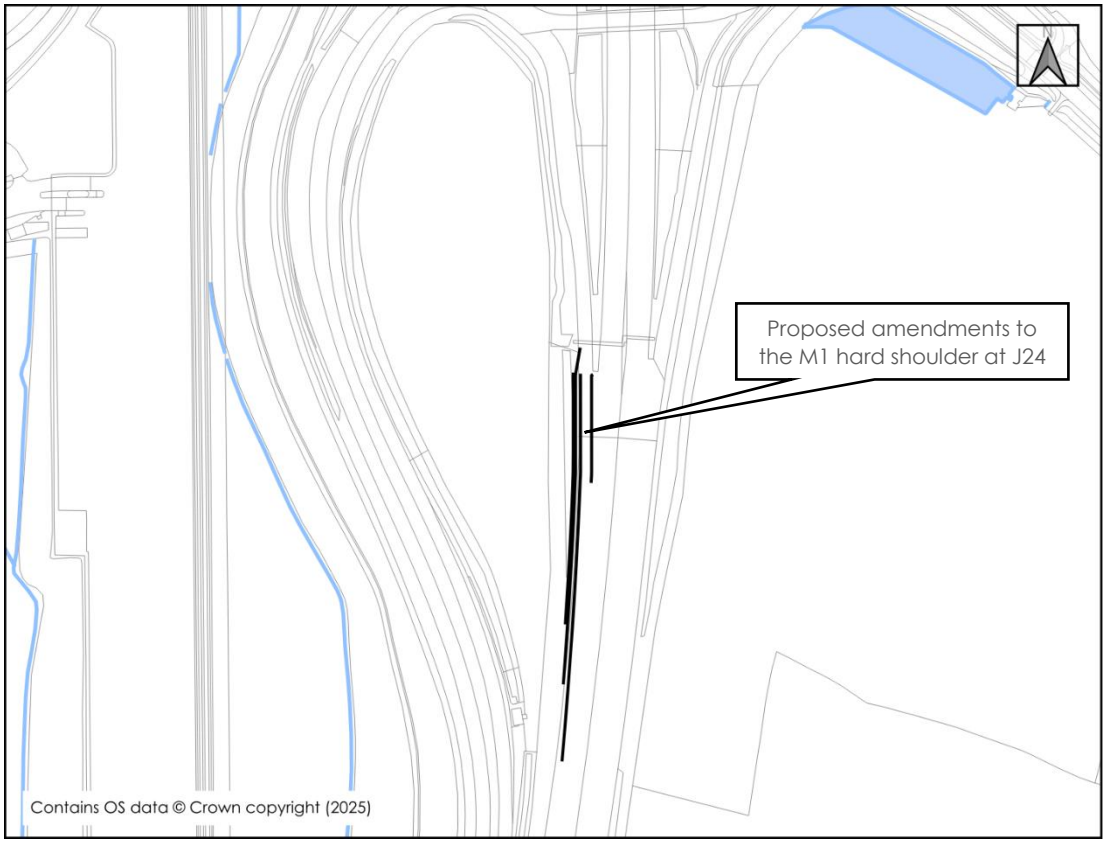

Figure 4.1: Illustrative Highway Improvements - Works No. 8

Historical Flooding Incidents

4.2.2 The EA Recorded Flood Outlines data does not show any recorded incidents within proximity to the proposed works. Furthermore, a review of historical incidents collated and listed in the PFRA and SFRAs also did not identify any which had affected the area.

Fluvial Flood Risk

4.2.3 The proposed works are located entirely within Flood Zone 1 which is land defined as having a low probability of flooding from rivers and sea. Additionally, EA RoFRS data identifies that the works are located outside of areas at fluvial risk.

Surface Water Flood Risk & Highway Drainage

4.2.4 The proposed works are shown to fall predominantly in an area at a very low probability of surface water flooding, although the southern extent does encroach into an area identified to have a medium to high probability of flooding, as shown in **Figure 4.2**.

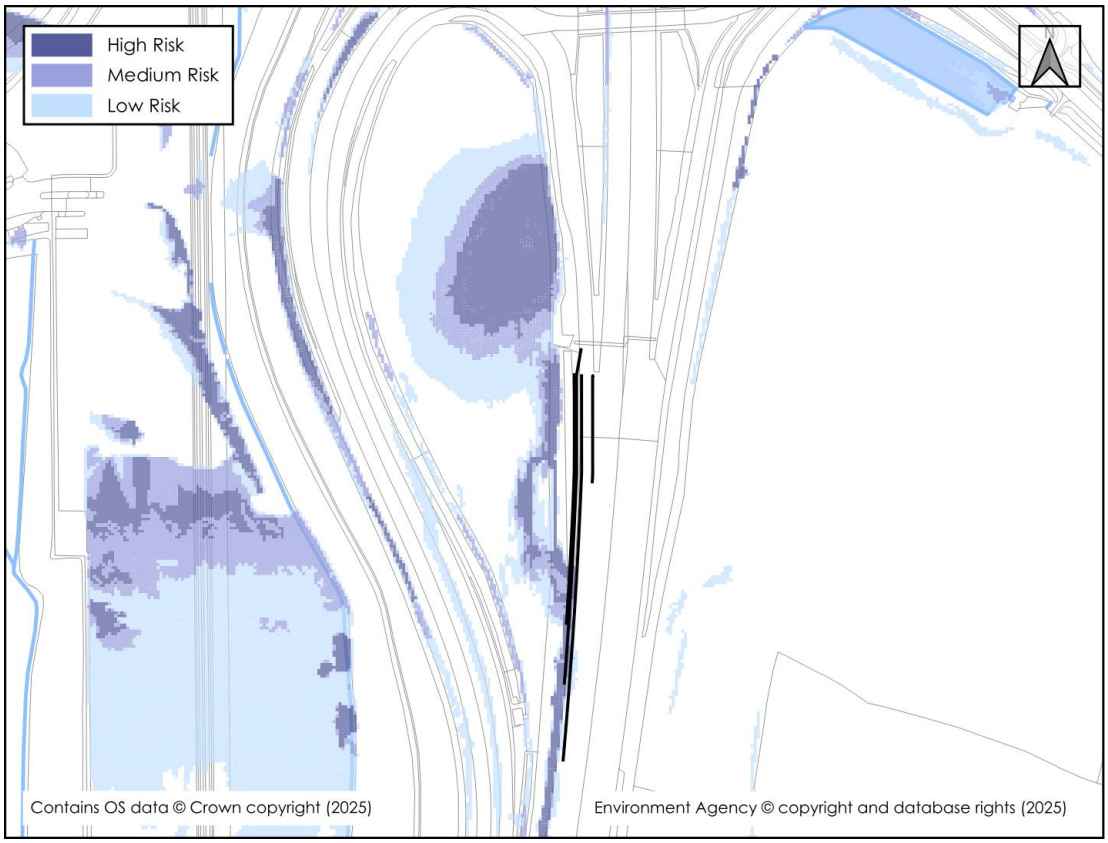

Figure 4.2: EA RoFSW data - Works No. 8

4.2.5 Upon review, it would appear that the flooding illustrated with the RoFSW is representative of water flowing down carriageway, before being shed into an adjoining low-lying field immediately to the west. In reality, the carriageway is positively drained which will manage the surface water runoff from the carriageway, limiting potential depths and the flood risk to road users. An example of the highway drainage is provided as **Figure 4.3**.

4.2.6 In the event of exceedance of the highway drainage, relatively shallow surface water would likely remain on the highway at nominal depths. It is common for the carriageway to be used to accommodate exceedance flows and so this is considered an acceptable source of flood risk. Therefore, the potential source of flood risk is not considered a barrier to the proposed works.

Figure 4.3: J24 M1 Kerb Drainage (Source: Google Street View)

4.2.7 The works will introduce new impermeable surfaces. The additional surface water runoff generated will be directed into the existing highway drainage. This will be accommodated through the addition of enhancements to the existing drainage infrastructure that will aim to preserve the existing discharge rate into the downstream receiving watercourse. Further information on the drainage approach is provided within the accompanying SDS by BWB Consulting (reference: EMG2-BWB-ZZ-XX-RP-CD-0003_SDS).

Groundwater Flood Risk

4.2.8 British Geological Survey (BGS) mapping identifies the proposed works are underlain by Helsby Sandstone Formation and Edwalton Member – Mudstone. Mapping from the 2015 SFRA shows the works to lie in a 1km2 square grid where >75% of the area is potentially susceptible to groundwater flooding. However, it is considered the susceptible areas are most likely to comprise the lower lying surrounding land which generally comprises the floodplain of the local watercourses, including the River Soar. Given the relatively elevated nature of the highway infrastructure at this location, the risk of groundwater flooding is low.

4.2.9 The relatively minor proposed improvement works will not detrimentally affect the risk of groundwater flooding in the surrounding area.

Other Sources of Flood Risk

4.2.10 Other sources of flood risk have been reviewed including the sea, canals, reservoirs and large waterbodies, and public sewers, and none have been identified as posing a flood risk in this location.

Summary

4.2.11 Overall, the risk of flooding from the reviewed sources in this area are all considered to be at an acceptable level; therefore, they will not pose a barrier to the proposed works. Additionally, the works are not expected to negatively affect flood risk in the surrounding area, subject to improvements being made to the local highway drainage infrastructure to accommodate the additional impermeable surfaces.

4.3 Works No. 9: Construction Of a New Motorway Link Road Between the M1 Northbound and the A50 Westbound

Illustrative Proposals

4.3.1 The proposals include providing a new free-flow link road from the M1 northbound at J24 to provide a direct link to the A50 westbound, which will cross over/under the A453. The proposed works are illustrated in **Figure 4.4**.

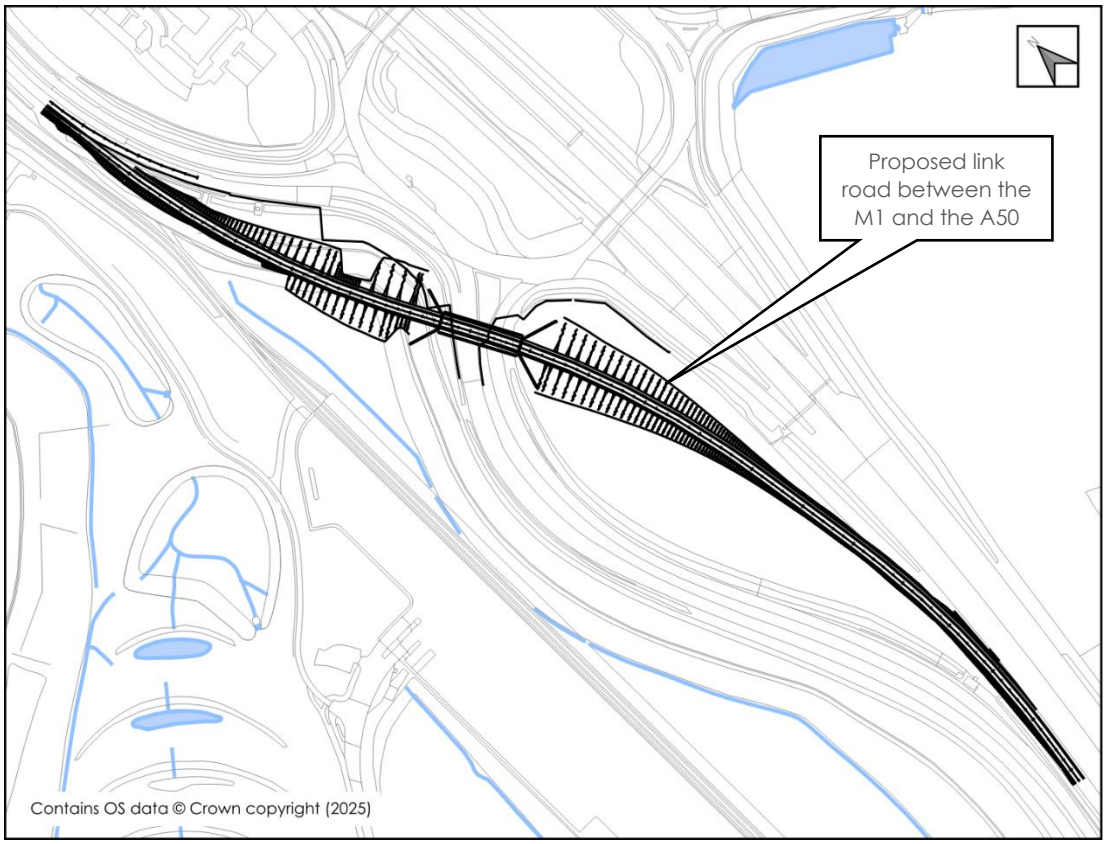

Figure 4.4: Illustrative Highway Improvements - Works No. 9

Historical Flooding Incidents

4.3.2 The EA Recorded Flood Outlines data does not show any recorded incidents within proximity to the proposed works. Furthermore, a review of historical incidents collated and listed in the PFRA and SFRAs did not identify any which had affected the area.

Fluvial Flood Risk

4.3.3 The proposed works are located entirely within Flood Zone 1, and EA RoFRS data identifies that the works are located outside of areas at fluvial risk.

Surface Water Flood Risk & Highway Drainage

4.3.4 The proposed works are shown to fall across two areas which are identified to be at potential flood risk in the EA RoFSW data, these are shown in **Figure 4.5**:

- Southern flooding: the flow route on the M1 carriageway and an area of ponded surface water in the adjacent field, as previously discussed in **Section 4.2**.
- Northern flooding: an area to the north located to the west of the A50 carriageway.

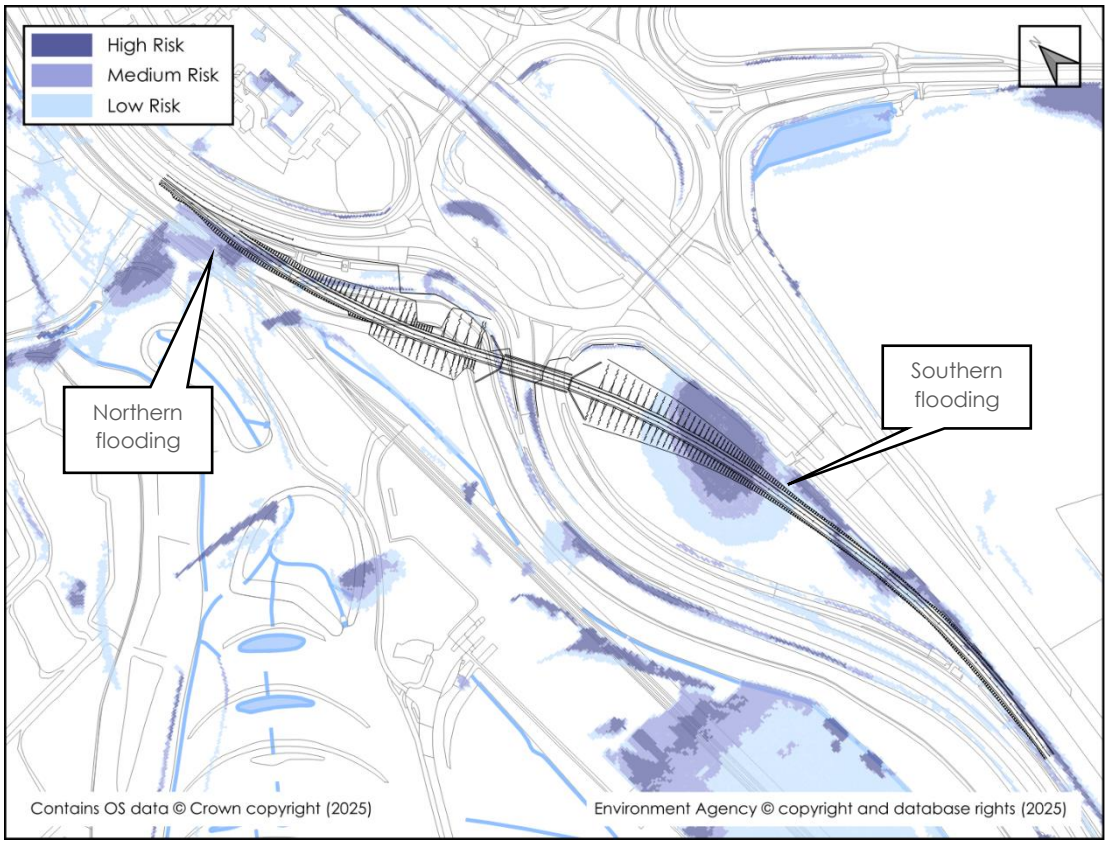

Figure 4.5: EA RoFSW - Works No. 9

Southern Surface Water Flood Route

4.3.5 As discussed in **Section 4.2**, the flooding illustrated with the RoFSW is representative of water flowing down the M1 carriageway, before being shed into an adjoining low-lying field immediately to the west. In reality, the carriageway is positively drained which will limit any contributing surface water runoff from the carriageway into the field.

4.3.6 Additionally, highway drainage records show the presence of filter drains at the toe of the M1/J24 embankment in the east of the field which provide a drainage connection into the highway drainage. Therefore, the illustrated surface water, which is shown to pond in the field, is likely to be overestimated. The potential level of flood risk is not considered a barrier to the proposed works.

Northern Surface Water Flooding

4.3.7 The potential flooding illustrated within the RoFSW at the northern extent of the link road would appear to be associated with surface water runoff from the local topography before EMG1 was constructed. As part of EMG1, the area to the west of the A50 was reprofiled and new drainage infrastructure constructed. For example, an elevated railway line now runs through the mapped area of surface water flooding isolating the A50 from EMG1 (see **Figure 4.6**), and a new highway ditch was formed to drain the area between the A50 and the railway. Therefore, the mapped RoSFW data is not considered to be accurate in this location. Given the area is positively drained, the potential level of flood risk is not considered a barrier to the proposed works.

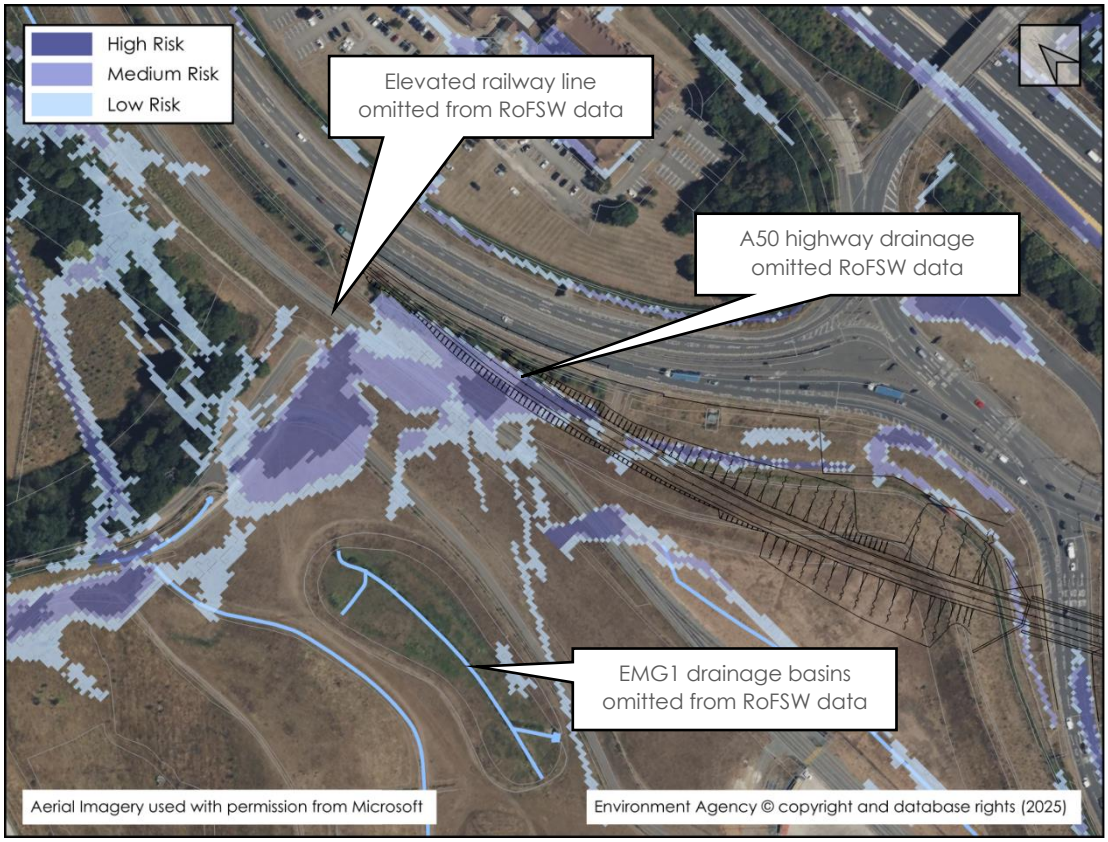

Figure 4.6: EA RoFSW - Works No. 9 – Northern Flood Risk Area

Mitigation

4.3.8 At this stage it is expected that the proposed link road will be located upon a raised embankment rising from the M1 to pass over the A453 before descending to meet the A50. The proposals will include new surface drainage in the form of Sustainable Drainage (SuDS) basin(s) that will provide the necessary attenuated storage for runoff from the new impermeable surfaces, preventing an adverse impact on downstream flood risk. The drainage will include an appropriately restricted discharge rate and attenuated storage for the 1 in 100-year plus climate change event. Further information on the drainage approach is provided within the accompanying SDS by BWB Consulting (reference: EMG2-BWB-ZZ-XX-RP-CD-0003_SDS).

4.3.9 The highway embankment will also include toe drainage that will help manage any runoff from the surrounding greenfield areas.

4.3.10 Any existing highway drainage features within the footprint of the link road, will either be preserved or relocated to ensure that existing drainage connectivity and capacity is not adversely affected.

Groundwater Flood Risk

4.3.11 British Geological Survey (BGS) mapping identifies the proposed works are underlain by Helsby Sandstone Formation and Edwalton Member – Mudstone. Mapping from the 2015 SFRA shows the works to lie in a 1km2 square grid where >75% of the area is potentially susceptible to groundwater flooding. However, it is considered the susceptible areas are most likely to comprise the lower lying surrounding land which generally comprises the floodplain of the local watercourses, including the River Soar.

4.3.12 The proposed works are not expected to detrimentally affect the probability of groundwater flooding in the surrounding area.

Other Sources of Flood Risk

4.3.13 Other sources of flood risk have been reviewed including the sea, canals, reservoirs and large waterbodies, and public sewers, and none have been identified as posing a flood risk in this location.

Summary

4.3.14 Overall, the risk of flooding from the reviewed sources in this area are all considered to be at an acceptable level; therefore, they will not pose a barrier to the proposed works. Additionally, the works are not expected to negatively affect flood risk in the surrounding area, subject to appropriate surface water management.

4.4 Works No. 10: Widening of the A50 Westbound

Illustrative Proposals

4.4.1 In this location the proposed highway improvements include widening of the A50 westbound carriageway to the north of the new merge from the link road (Works No. 9), the extent of the widening is shown in **Figure 4.7**. In this location the highway is located upon an embankment which may also require widening.

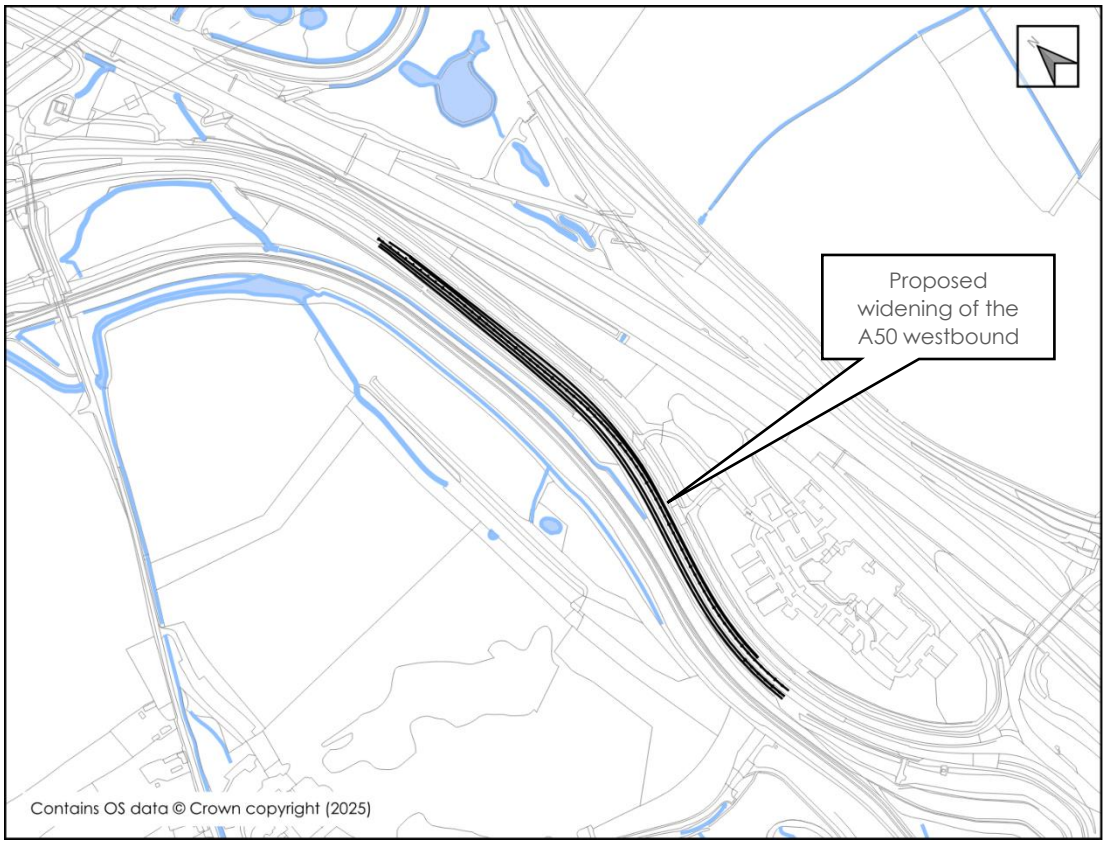

Figure 4.7: Illustrative Highway Improvements - Works No. 10

Historical Flooding Incidents

4.4.2 The EA Recorded Flood Outlines data does not show any recorded incidents within proximity to the proposed works. The nearest recorded flood outline is located approximately 130m north, attributed to the River Trent; however, the event dated 1932 does not represent the present-day topography of the floodplain and is not considered a reliable source of data. A review of historical incidents collated and listed in the PFRA and SFRAs also did not identify any which had affected the local area.

Fluvial Flood Risk

4.4.3 The proposed works are located partially within Flood Zone 2, which is land defined as having a medium probability of flooding from rivers and sea; this is shown in **Figure 4.8**. Whereas, the EA RoFRS, shown in **Figure 4.9**, indicates the works to be located in an area with a low probability of flooding from rivers and sea.

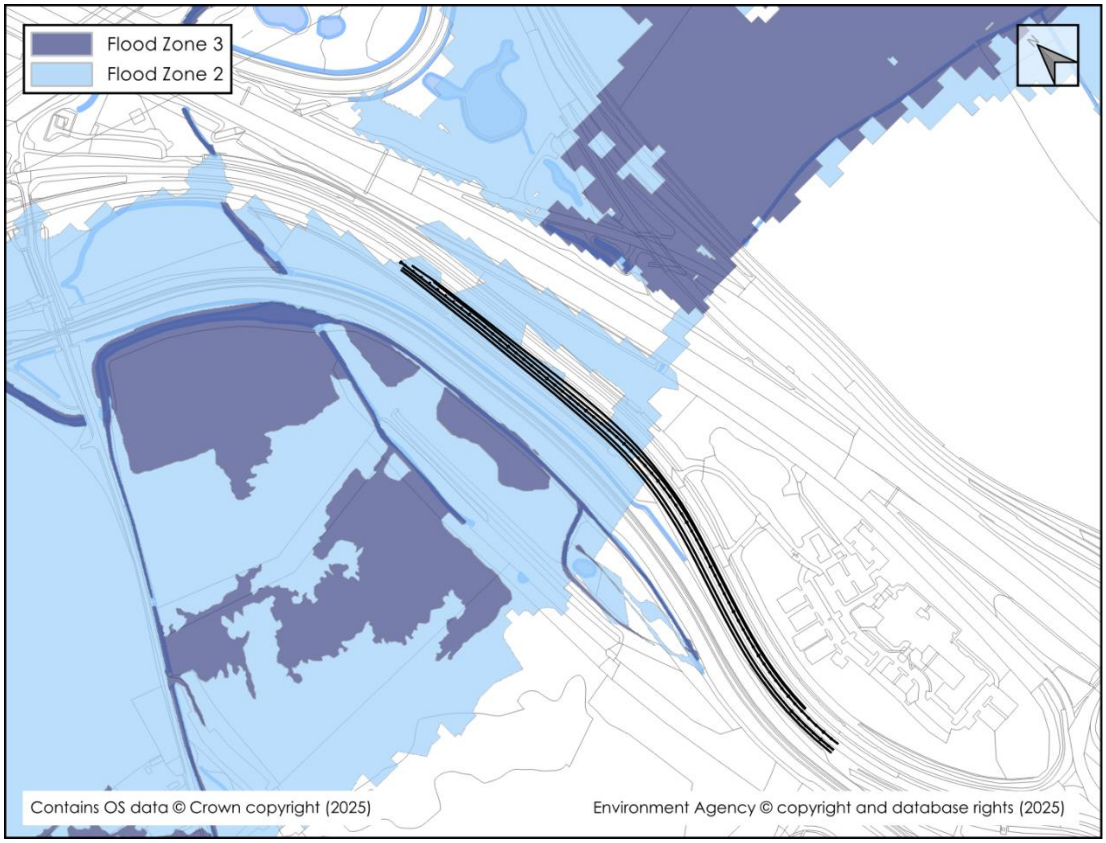

Figure 4.8: EA Flood Map for Planning - Works No. 10

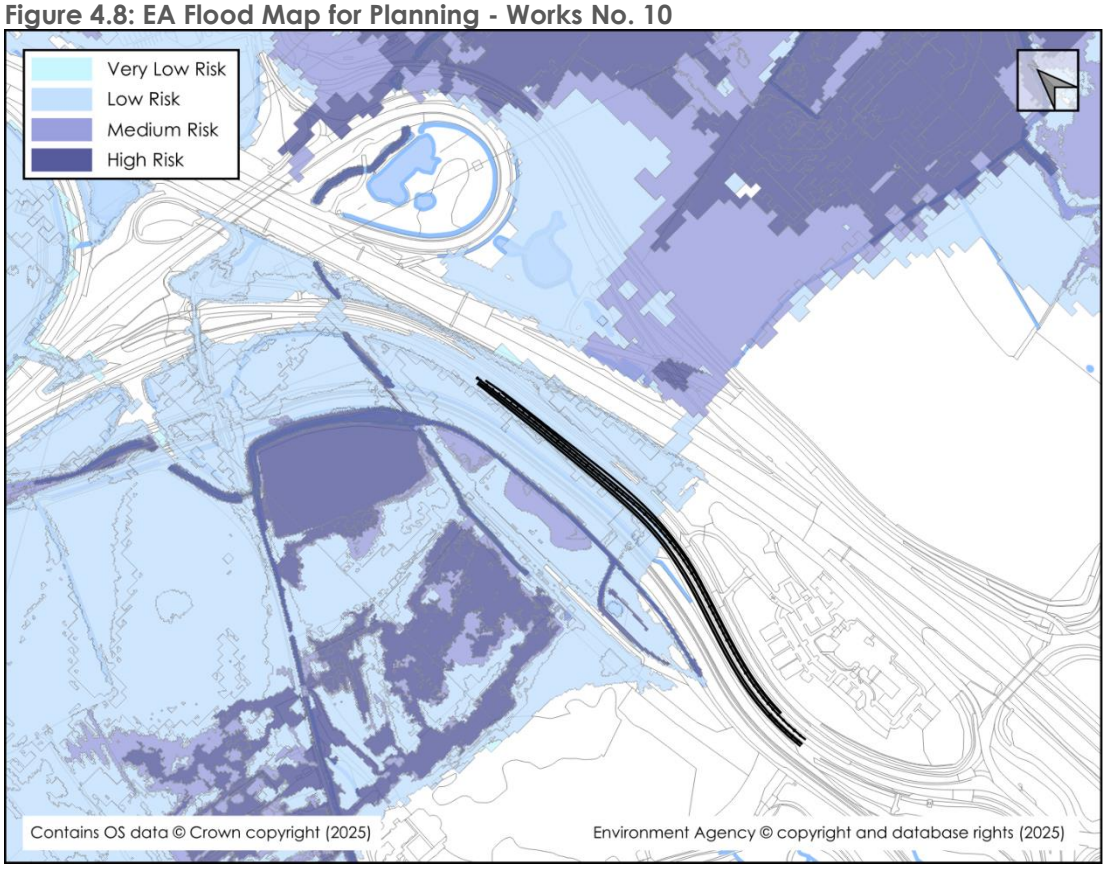

Figure 4.9: EA RoFRS - Works No. 10

4.4.4 The EA have provided the three local hydraulic models for the area, inclusive of the 2022 Lockington Brook flood model, the 2021 Derbyshire Trent flood model and the 2012 Lower Soar flood model. A review of the modelled flood data identifies that the River Trent generates the most precautionary flood levels in the area. The peak flood levels from the 2021 Derbyshire Trent flood model are provided within **Figure 4.10** along with the modelled floodplain outlines.

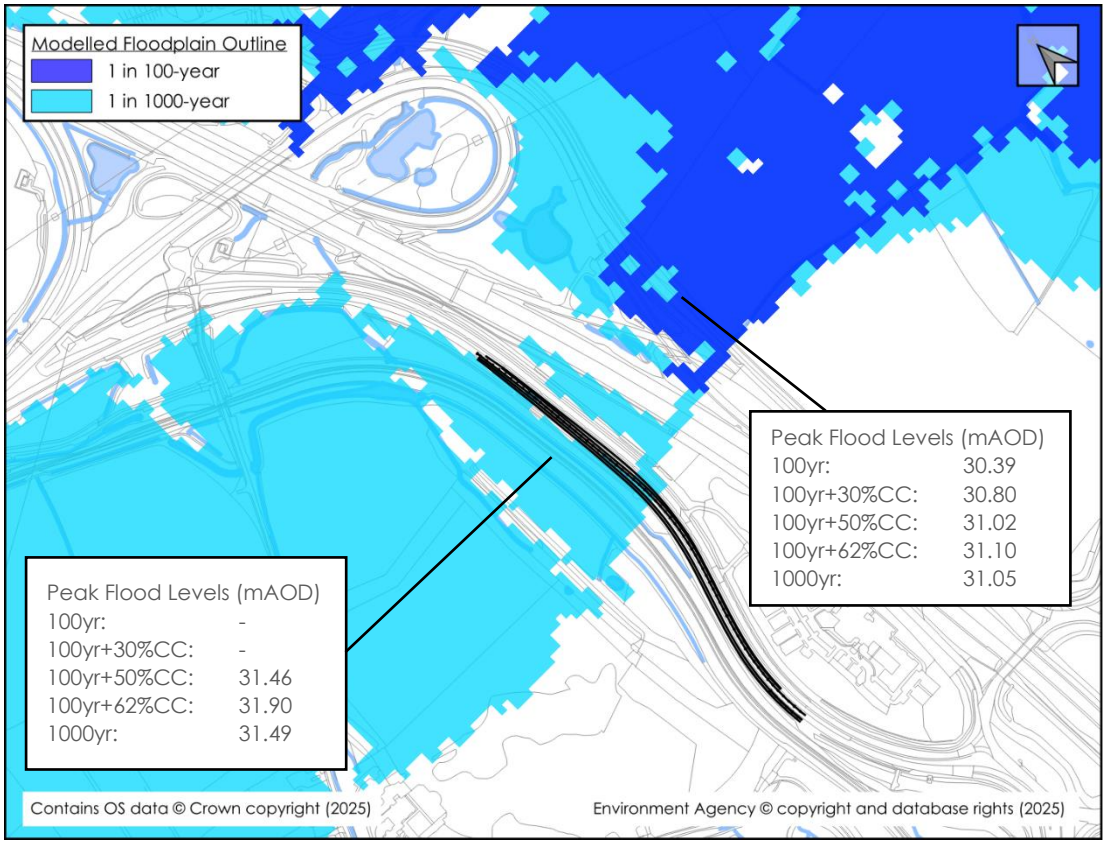

Figure 4.10: River Trent Modelled Floodplain Outlines - Works No. 10

4.4.5 It should be noted that the ground levels within the hydraulic model at this location are not reflective of the current topography. Therefore, the peak flood levels have been projected against the latest EA LiDAR DTM, as flown in 2022, to provide a more accurate floodplain outline. This is included as **Figure 4.11**.

4.4.6 This analysis has confirmed that the proposed works are located outside of the 1 in 100-year and 1 in 100-year+30% climate change (the design flood event) floodplain outlines.

4.4.7 The 1 in 1000-year floodplain extends to meet the A50 west boundary embankment, but it is not predicted to flow on the carriageway, confirming the A50 westbound is at a low risk of fluvial flooding.

4.4.8 During the 1 in 100-year+62% climate change flood event (the credible maximum climate change scenario), flood levels are predicted to reach an elevation that could overtop and flow onto the westbound carriageway, leading to approximately a 0.42m

depth of flooding. However, this residual flood risk is not a barrier to the proposed improvement works.

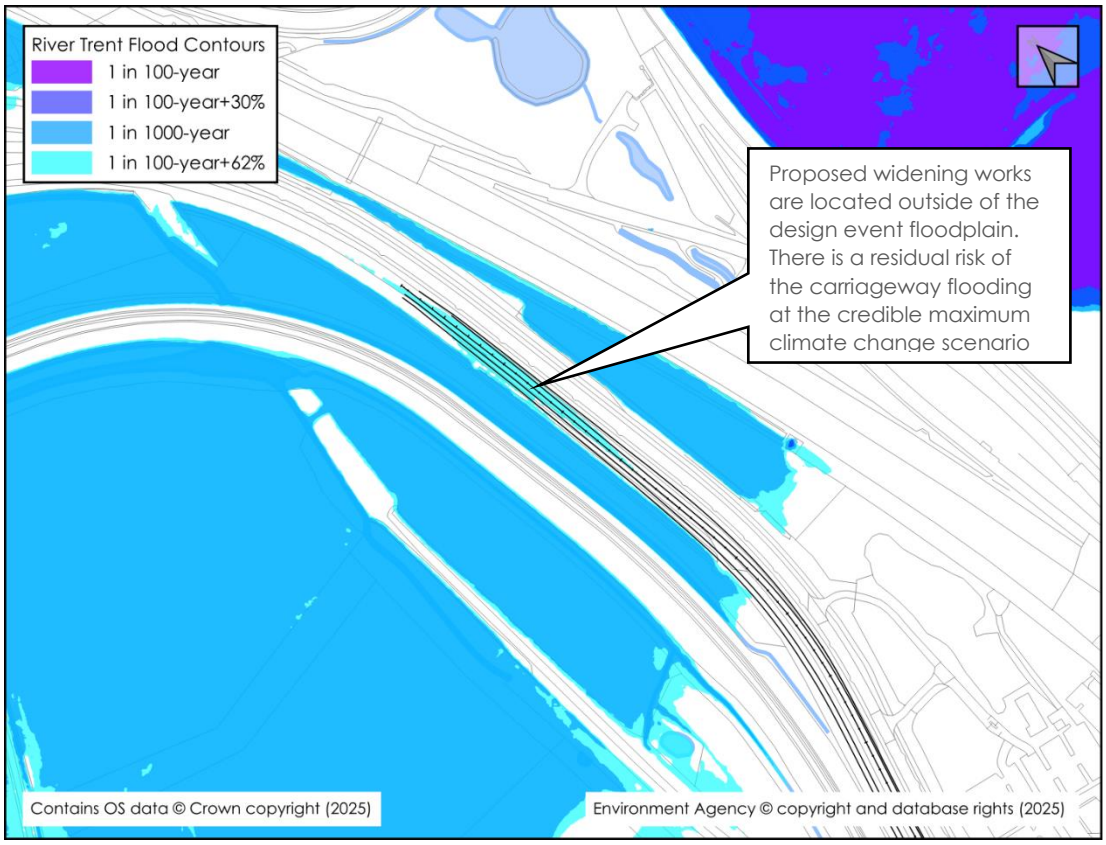

Figure 4.11: River Trent Peak Modelled Flood Levels Projected on to the Latest LiDAR DTM - Works No. 10

Surface Water Flood Risk & Highway Drainage

4.4.9 The proposed works are shown to fall predominantly in an area at a very low to low probability of surface water flooding, although an area of high to medium probability of flooding is illustrated at the low point of the carriageway, as shown in **Figure 4.12**. This flooding is associated with runoff from the A50 highway itself, and not an overland flow route of significance. Moreover, the highway is positively drained, which will not be fully reflected in the EA RoFSW data.

4.4.10 In the event of exceedance of the highway drainage, relatively shallow surface water would likely remain on the highway at nominal depths. It is common for the carriageway to be used to accommodate exceedance flows and so this is considered an acceptable source of flood risk. Therefore, the potential source of flood risk is not considered a barrier to the proposed works.

4.4.11 The EA RoFSW also identifies the potential for surface water to collect on land located to the west of the A50. However, this data does not reflect the topographical and drainage alterations made here as part of EMG1. The area to the west of the A50 now includes drainage channels located either side of a new railway line that provide drainage connectivity to the Lockington Brook.

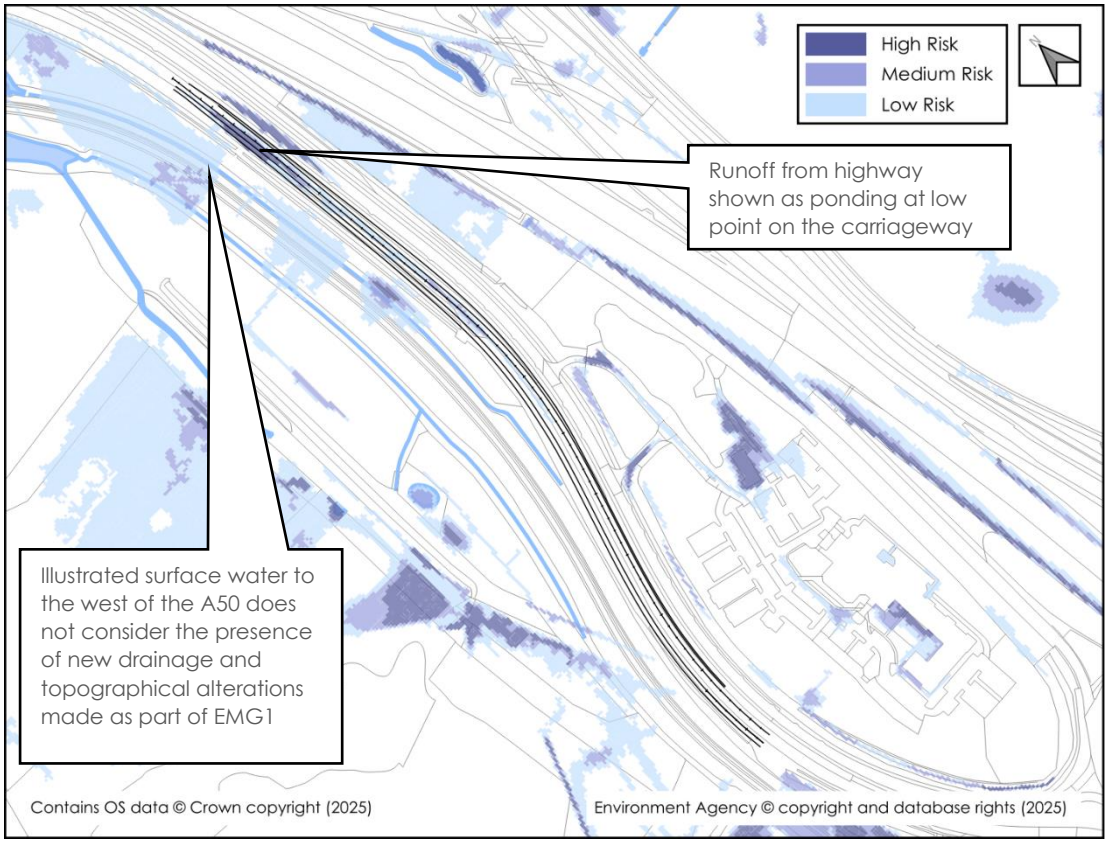

Figure 4.12: EA Risk of Flooding from Surface Water - Works No. 10

4.4.12 The works will introduce new impermeable surfaces. The additional surface water runoff generated will be directed into the existing highway drainage. This will be accommodated through the addition of enhancements to the existing drainage infrastructure that will aim to preserve the existing discharge rate into the downstream receiving watercourse. Further information on the drainage approach is provided within the accompanying SDS by BWB Consulting (reference: EMG2-BWB-ZZ-XX-RP-CD-0003_SDS).

Groundwater Flood Risk

4.4.13 British Geological Survey (BGS) mapping identifies the proposed works are underlain by Arden Sandstone Formation - Sandstone, Branscombe Mudstone Formation – Mudstone, and Edwalton Member – Mudstone. Mapping from the 2015 SFRA shows the works to lie in a 1km2 square grid where >75% of the area is potentially susceptible to groundwater flooding. However, it is considered the susceptible areas are most likely to comprise the lower lying surrounding land which generally comprises the floodplain of the local watercourses, including the Lockington Brook and River Trent. Given the elevated nature of the highway infrastructure at this location the risk of groundwater flooding is low.

4.4.14 The relatively minor proposed improvement works will not detrimentally affect the risk of groundwater flooding in the surrounding area.

Flood Risk from Reservoirs and Large Waterbodies

4.4.15 Reservoir failure mapping prepared and published by the EA, identifies that the proposed works are located in an area at risk of inundation from reservoir failure during a 'wet-day' scenario attributed to several reservoirs. However, based on the safety legislation in place and the maintenance and repair responsibilities of responsible authority, the actual probability of a significant failure is considered to be low. Therefore, the risk of flooding from this source is also considered to be low.

4.4.16 The proposed works represent improvements to existing highway infrastructure, and not new development. Therefore, it will not alter the classification of any upstream reservoirs.

Other Sources of Flood Risk

4.4.17 Other sources of flood risk have been reviewed including, the sea, canals, and public sewers, and none have been identified as posing a flood risk in this location.

Summary

4.4.18 Overall, the risk of flooding from the reviewed sources in this area are all considered to be at an acceptable level; therefore, they will not pose a barrier to the proposed works. Additionally, the works are not expected to negatively affect flood risk in the surrounding area, subject to appropriate surface water management.

4.5 Works No. 11 Widening of the A50 Eastbound to M1 J24

Illustrative Proposals

4.5.1 In this location the proposed highway improvements include widening of the A50 eastbound link at J24 and other related works and traffic management measures, these are shown in **Figure 4.13**. In this location the highway is located upon an embankment which will also require widening to accommodate the works.

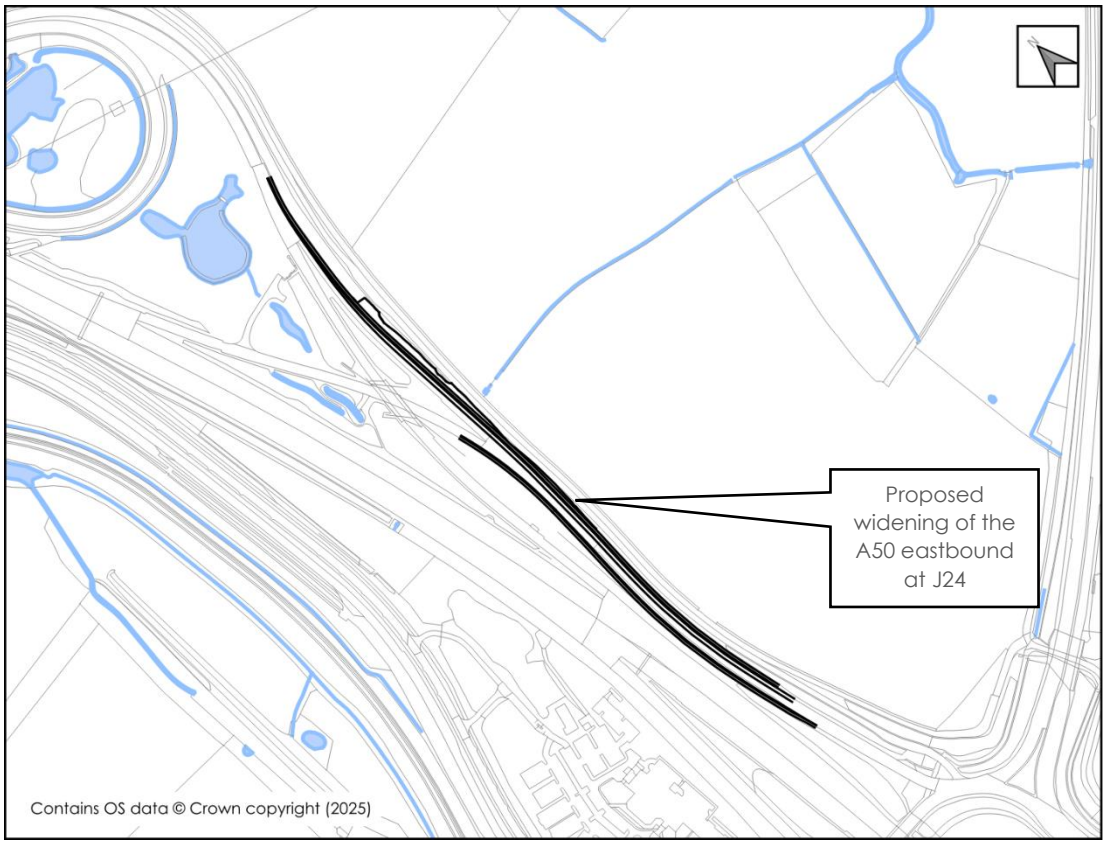

Figure 4.13: Illustrative Highway Improvements – Works No. 11

Historical Flooding Incidents

4.5.2 The EA Recorded Flood Outlines data does not show any recorded incidents within proximity to the proposed works. The nearest recorded flood outline is located approximately 200m north of the proposed works, attributed to the River Trent. A review of historical incidents collated and listed in the PFRA and SFRAs did not identify any which had affected the area.

Fluvial Flood Risk

4.5.3 The proposed works are partially located within Flood Zone 2 and Flood Zone 3, as shown in **Figure 4.14**. Flood Zone 3 is land defined as having a high probability of flooding from rivers and sea. RoFRS data, shown in **Figure 4.15**, indicates the site to be located in an area with a low to medium probability of flooding from rivers and sea.

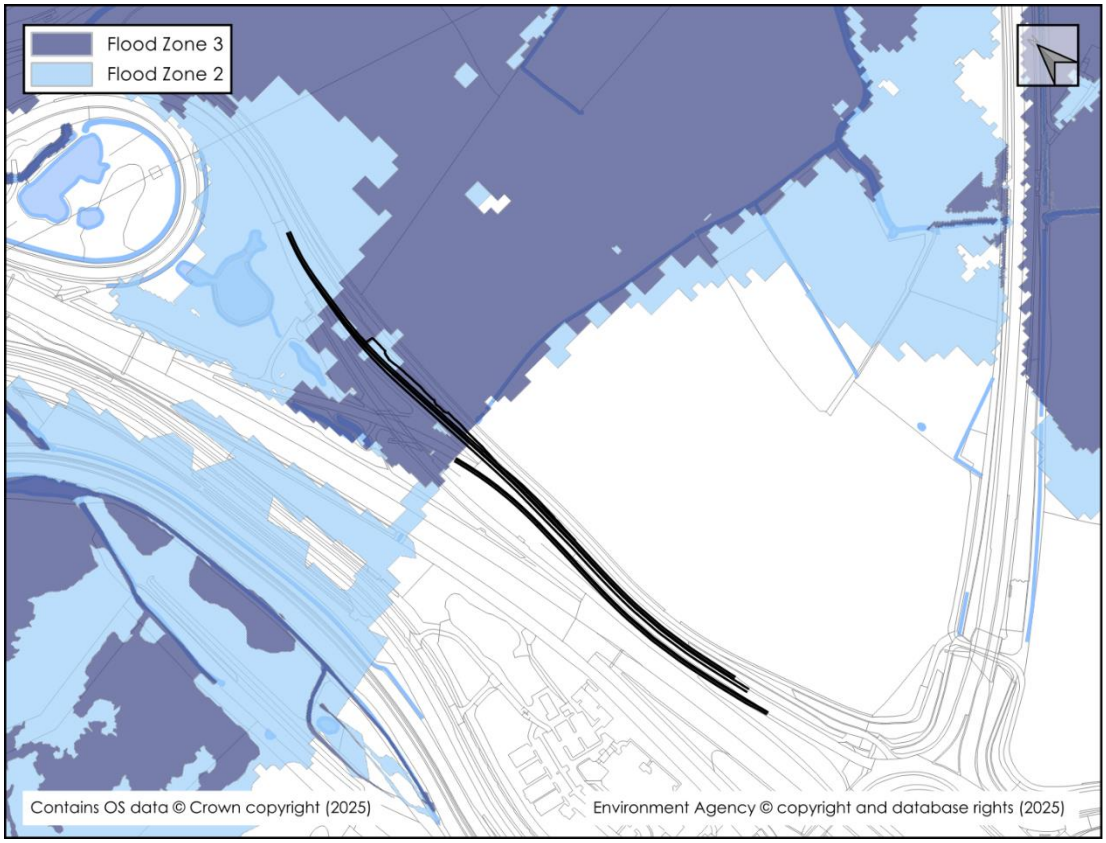

Figure 4.14: EA Flood Map for Planning - Works No. 11

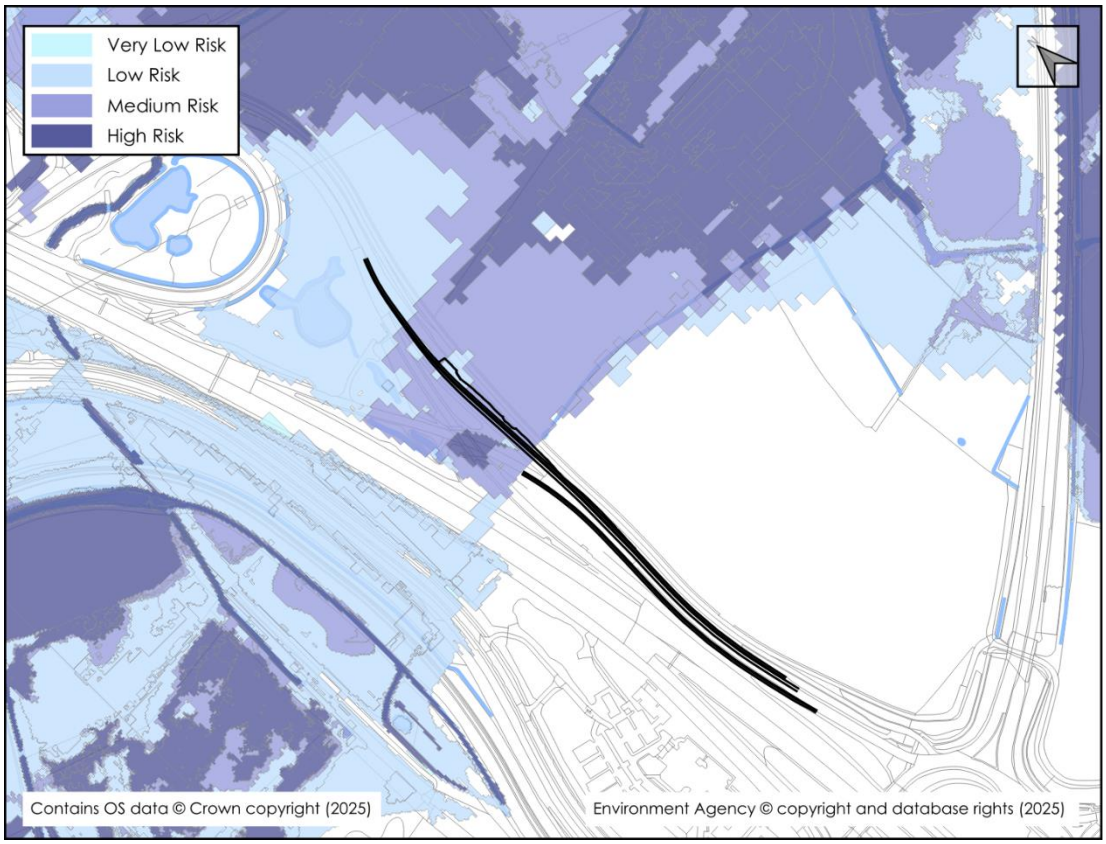

Figure 4.15: EA RoFRS - Works No. 11

4.5.4 A review of the previously discussed EA modelled flood data in the area has identified that the River Trent also generates the most precautionary flood levels. The peak flood levels from the 2021 Derbyshire Trent flood model are provided **Figure 4.16**, along with modelled floodplain outlines.

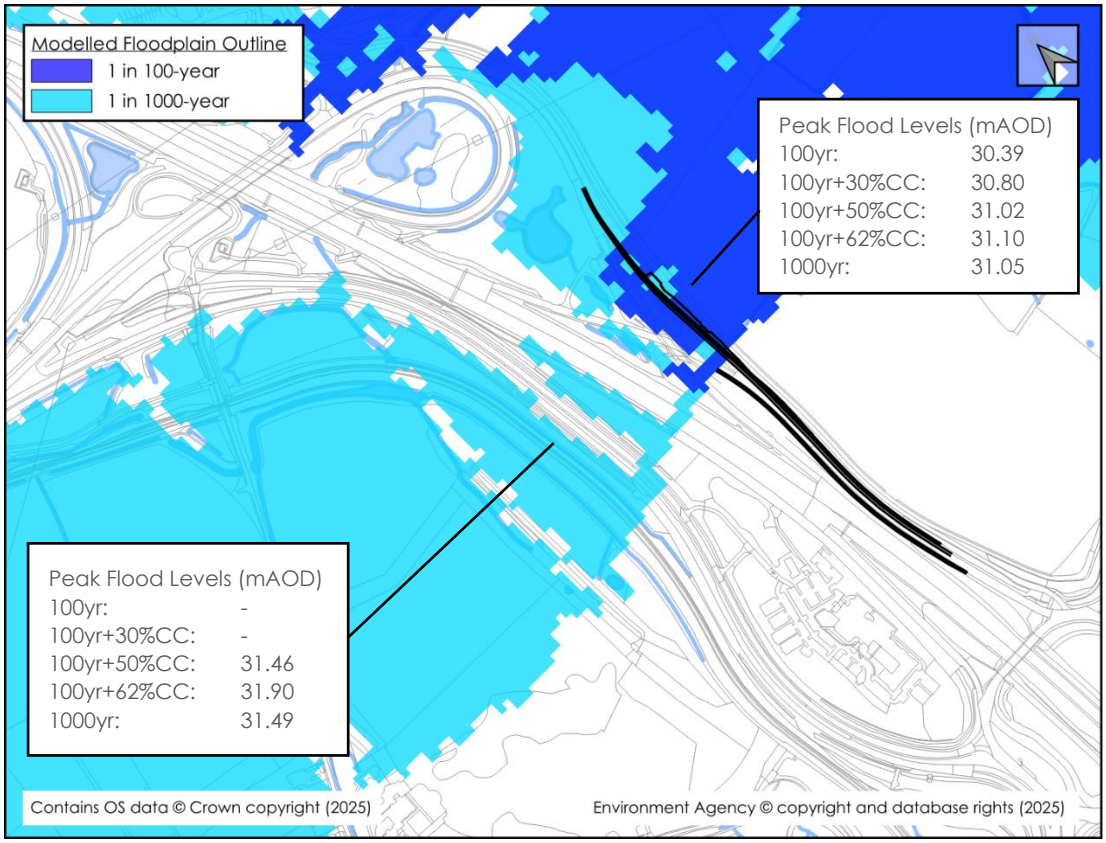

Figure 4.16: River Trent Modelled Floodplain Outlines - Works No. 11

4.5.5 It should be noted that the ground levels within the hydraulic model at this location are not reflective of the current topography. Therefore, the peak flood levels have been projected against the latest EA LiDAR DTM (2022), to provide a more accurate floodplain outline. This is included as **Figure 4.17**.

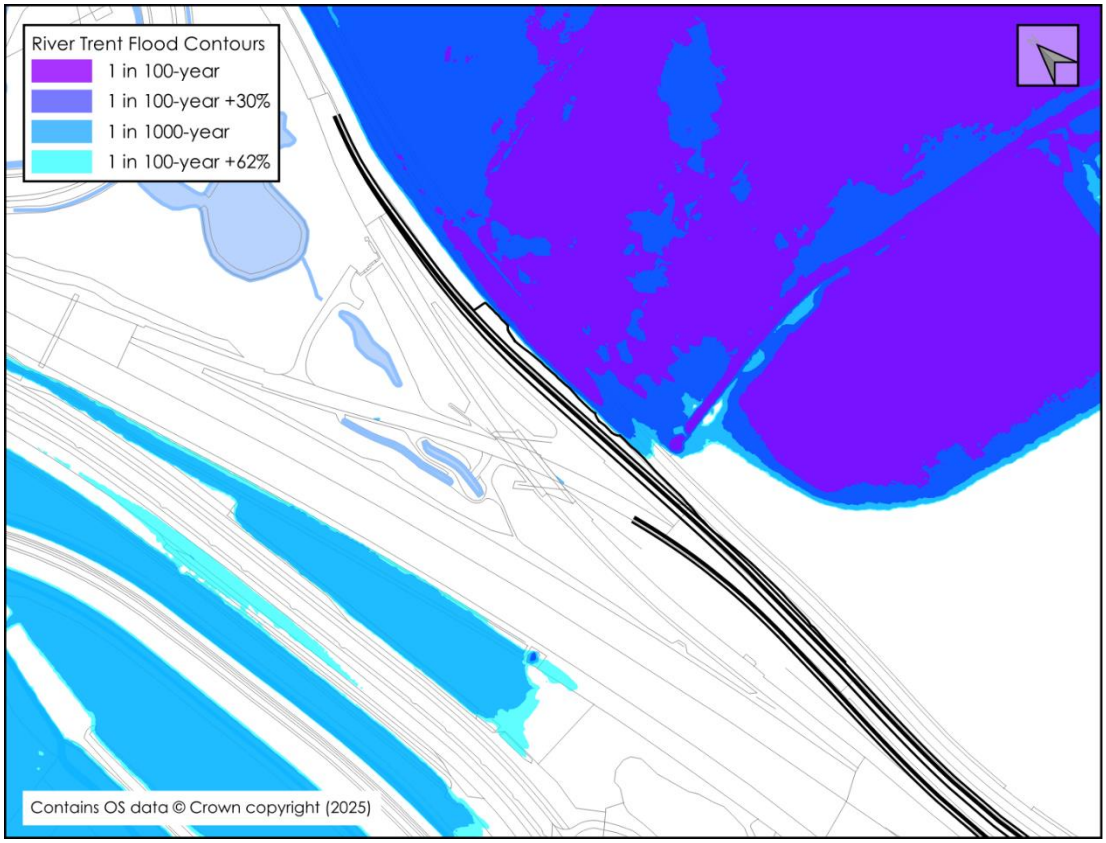

Figure 4.17: River Trent Peak Modelled Flood Levels Projected on to the Latest LiDAR DTM - Works No. 11

4.5.6 The existing carriageway is generally at an elevation of 32.8mAOD or above next to the Trent floodplain. This is 2m above the design flood level for the Trent (the 1 in 100-year+30% climate change event), 1.75m above the 1 in 1000-year flood level, and 1.70m above the maximum credible climate change scenario (1 in 100-year+62% climate change event).

4.5.7 However, the analysis has identified that the toe of the highway embankment is located on the edge of the floodplain; therefore, a review the potential alterations to embankment has been undertaken to investigate if this could result in any displacement of the design event floodplain.

4.5.8 The analysis included taking sections through the existing and proposed embankment (see **Figure 4.18**) and reviewing the works against the design flood level and floodplain extent (see **Figure 4.19**). The analysis has confirmed that the proposed works will occur outside of the design event floodplain, and above the design flood level.

Figure 4.18: Plan View, A50 Embankment Alterations next to the Trent Floodplain - Works No. 11

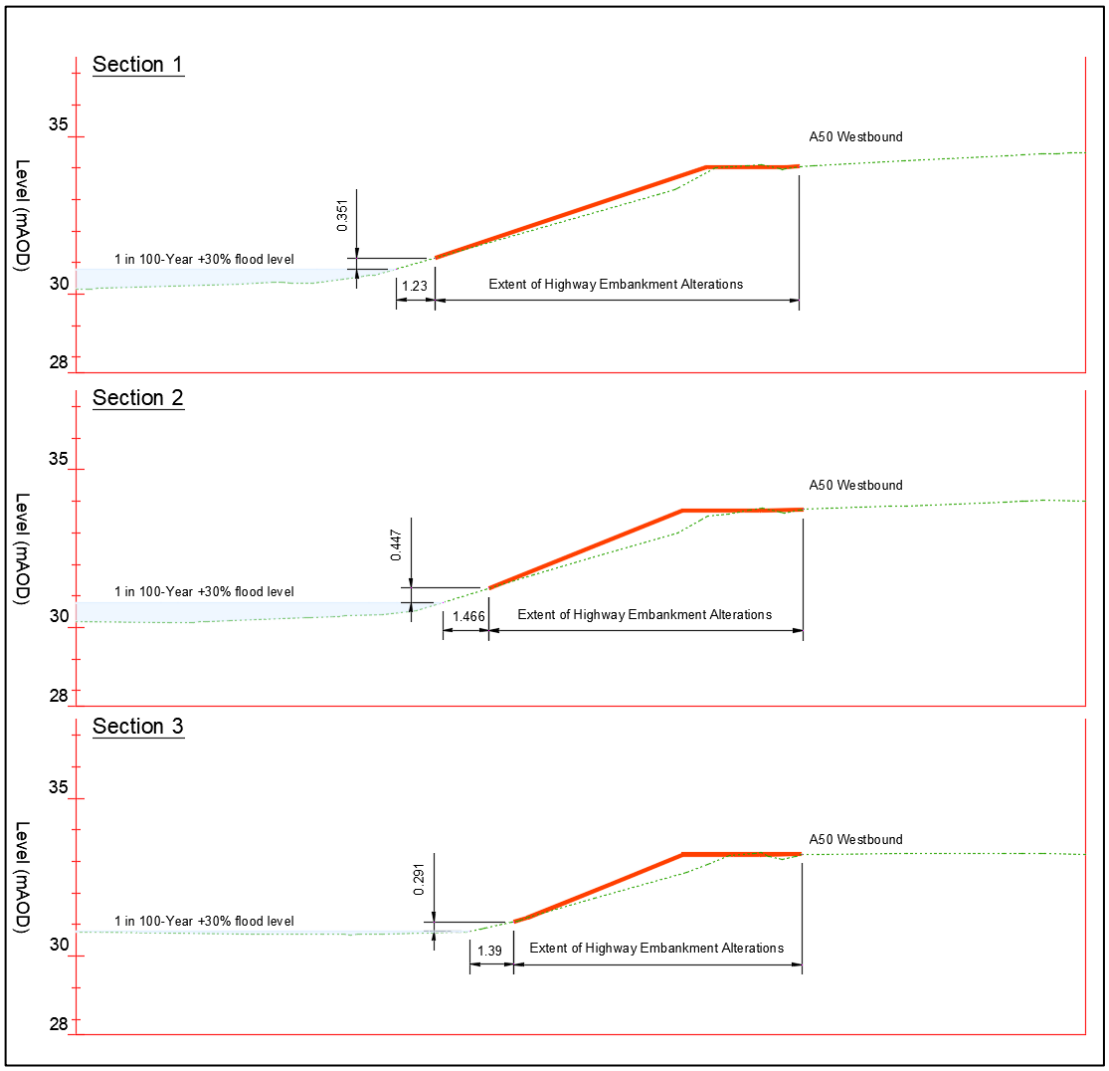

Figure 4.19: Section View, A50 Highway Embankment Alterations next to the Trent Floodplain - Works No. 11

Surface Water Flood Risk & Highway Drainage

4.5.9 EA RoFSW data identifies that the extent of the proposed works are at a very low to low risk of surface water flooding, as shown in **Figure 4.20**.

4.5.10 In the event of exceedance of the highway drainage, relatively shallow surface water would likely remain on the highway at nominal depths. It is common for the carriageway to be used to accommodate exceedance flows and so this is considered an acceptable source of flood risk. Therefore, the potential source of flood risk is not considered a barrier to the proposed works.

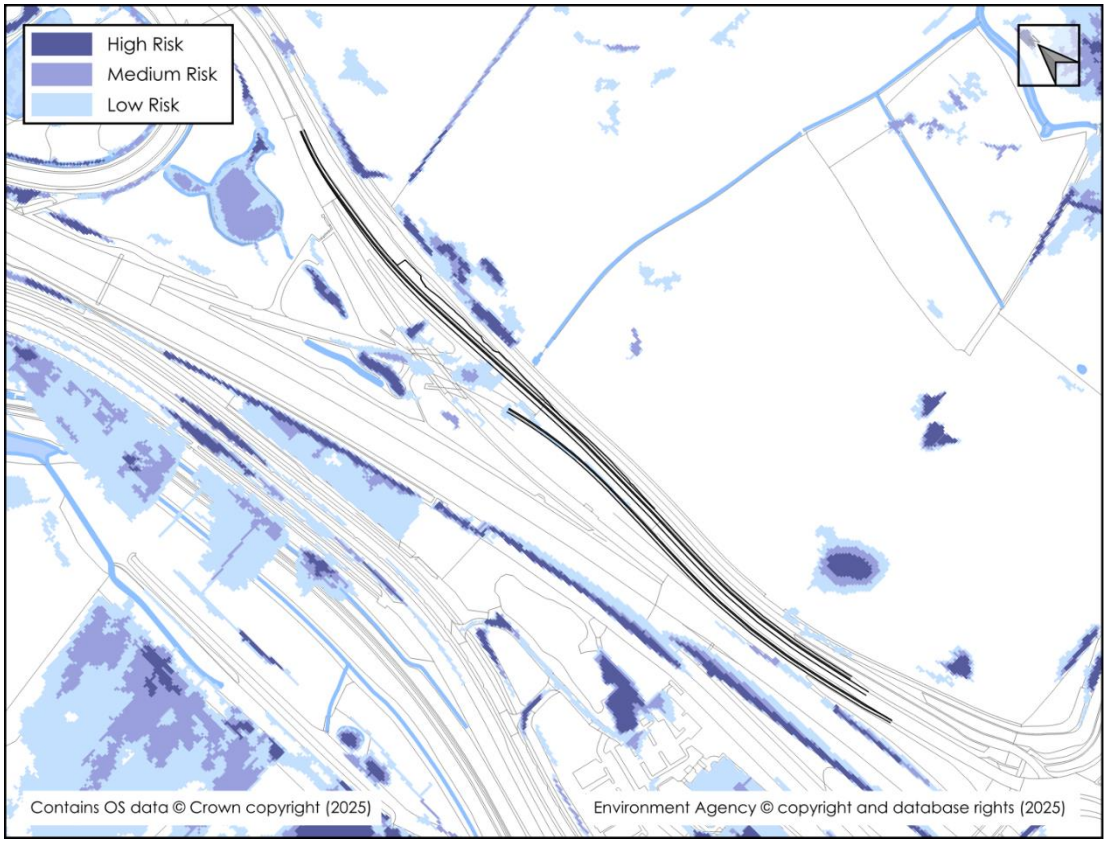

Figure 4.20: EA RoFSW - Works No. 11

4.5.11 The works will introduce new impermeable surfaces. The additional surface water runoff generated will be directed into the existing highway drainage. This will be accommodated through the addition of enhancements to the existing drainage infrastructure that will aim to preserve the existing discharge rate into the downstream receiving watercourse. Further information on the drainage approach is provided within the accompanying SDS by BWB Consulting (reference: EMG2-BWB-ZZ-XX-RP-CD-0003_SDS).

Groundwater Flood Risk

4.5.12 British Geological Survey (BGS) mapping identifies the proposed works are underlain by Arden Sandstone Formation - Sandstone, Branscombe Mudstone Formation – Mudstone, and Edwalton Member – Mudstone. Mapping from the 2015 SFRA shows the works to lie in a 1km^2 square grid where >75% of the area is potentially susceptible to groundwater flooding. However, it is considered the susceptible areas are most likely to comprise the lower lying surrounding land which generally comprises the floodplain of the local watercourses, including the River Trent. Given the elevated nature of the highway infrastructure at this location the risk of groundwater flooding is low.

4.5.13 The relatively minor proposed improvement works will not detrimentally affect the risk of groundwater flooding in the surrounding area.

Flood Risk from Reservoirs and Large Waterbodies

4.5.14 Reservoir failure mapping prepared and published by the EA, identifies that the proposed works are located in an area at risk of inundation from reservoir failure during a 'wet-day' scenario attributed to several reservoirs. However, based on the safety legislation in place and the maintenance and repair responsibilities of responsible authority, the actual probability of a significant failure is considered to be low. Therefore, the risk of flooding from this source is also considered to be low.

4.5.15 The proposed works represent improvements to existing highway infrastructure, and not new development. Therefore, it will not alter the classification of any upstream reservoirs.

Other Sources of Flood Risk

4.5.16 Other sources of flood risk have been reviewed including, the sea, canals, and public sewers, and none have been identified as posing a flood risk in this location.

Summary

4.5.17 Overall, the risk of flooding from the reviewed sources in this area are all considered to be at an acceptable level; therefore, they will not pose a barrier to the proposed works. Additionally, the works are not expected to negatively affect flood risk in the surrounding area, subject to appropriate surface water management.

4.6 Works No. 13: EMG1 Access Improvements - Widening of Existing Roundabout.

Illustrative Proposals

4.6.1 The proposals include for improvements to the existing EMG1 access roundabout through the provision of an additional lane, this is shown in **Figure 4.21**.

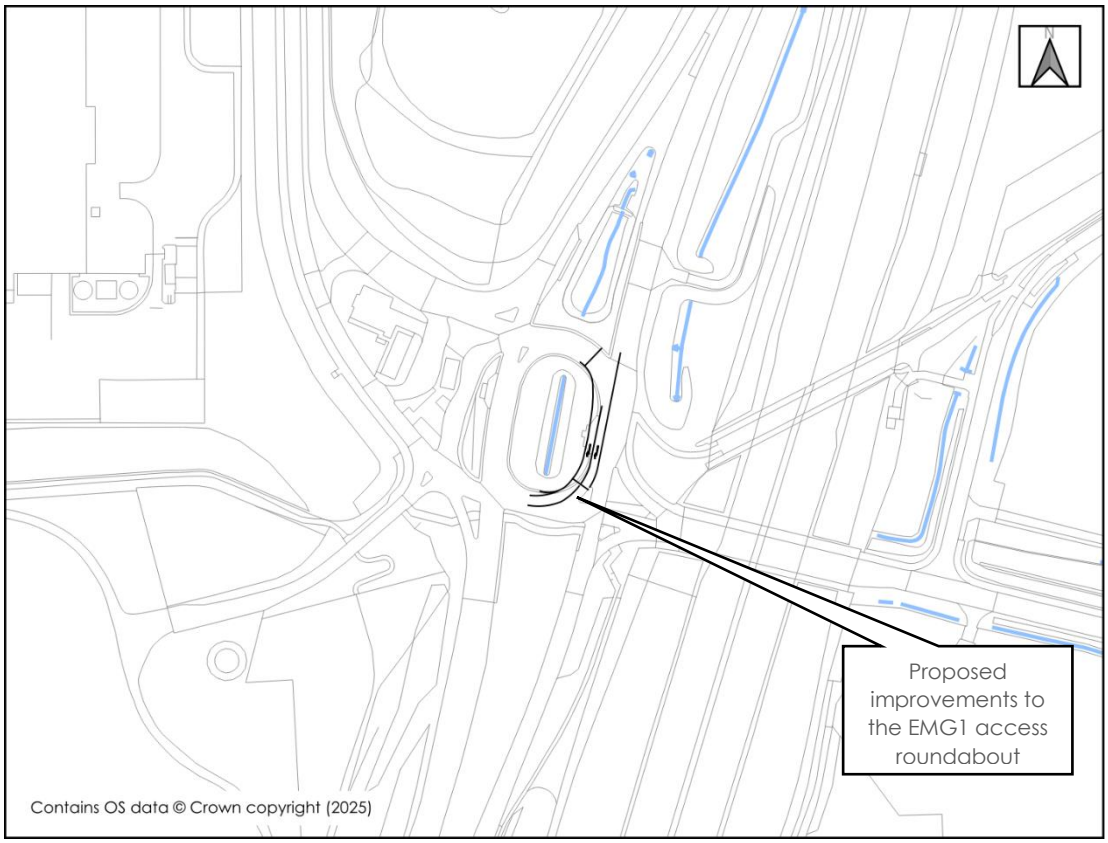

Figure 4.21: Illustrative Highway Improvements - Works No. 13

Historical Flooding Incidents

4.6.2 The EA Recorded Flood Outlines data does not show any recorded incidents within proximity to the proposed works. Furthermore, a review of historical incidents collated and listed in the PFRA and SFRAs did not identify any which had affected the area.

Fluvial Flood Risk

4.6.3 The proposed works are located entirely within Flood Zone 1 and EA RoFRS data identifies that the works are located outside of areas at fluvial risk.

Surface Water Flood Risk

4.6.4 EA RoFSW data identifies that the extent of the proposed works are at a very low to low risk of surface water flooding, as shown in **Figure 4.22**.

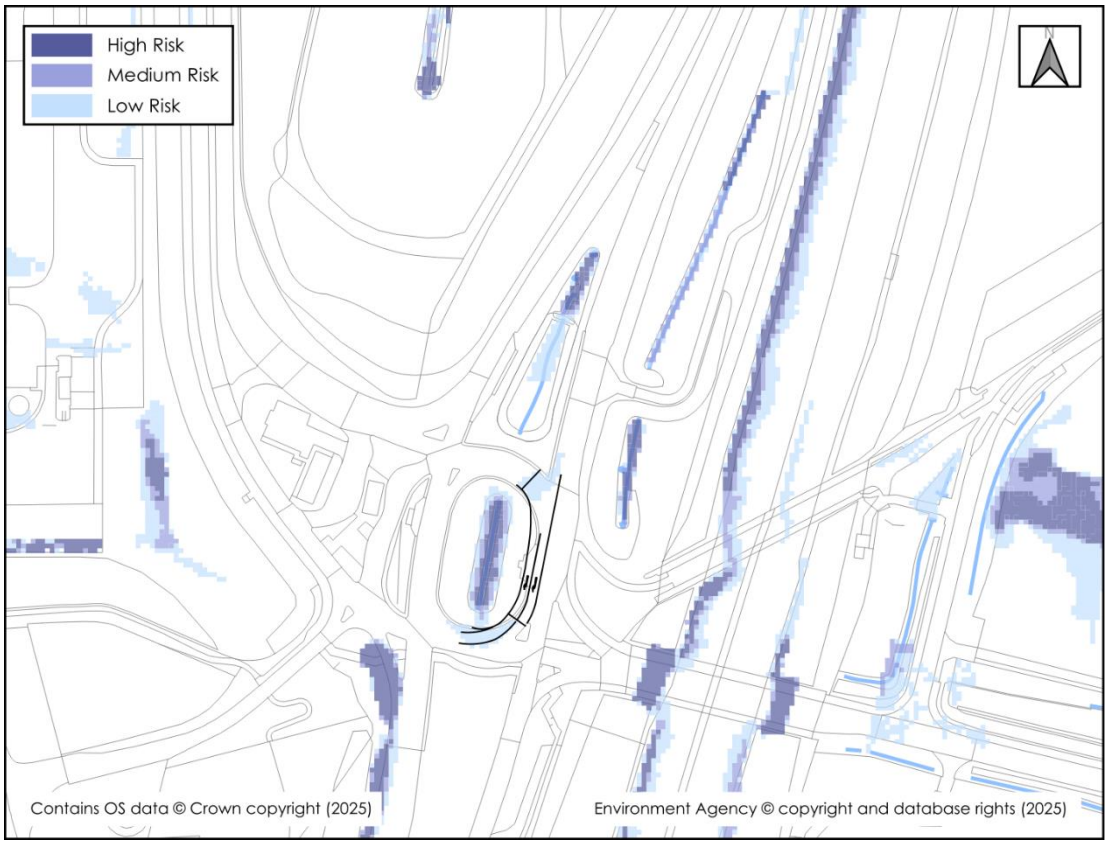

Figure 4.22: EA RoFSW - Works No. 13

4.6.5 In the event of exceedance of the highway drainage, relatively shallow surface water would likely remain on the highway at nominal depths. It is common for the carriageway to be used to accommodate exceedance flows and so this is considered an acceptable source of flood risk. Therefore, the potential source of flood risk is not considered a barrier to the proposed works.

4.6.6 The works will introduce new impermeable surfaces. The additional surface water runoff generated will be directed into the existing highway drainage. This will be accommodated through the addition of enhancements to the existing drainage infrastructure that will aim to preserve the existing discharge rate into the downstream receiving watercourse. Further information on the drainage approach is provided within the accompanying SDS by BWB Consulting (reference: EMG2-BWB-ZZ-XX-RP-CD-0003_SDS).

Groundwater Flood Risk

4.6.7 BGS mapping identifies the proposed works are underlain by Tarporley Siltstone Formation - Siltstone, Mudstone and Sandstone and Gunthorpe Member Mudstone. It is considered the susceptible areas are most likely to comprise the lower lying

surrounding land which generally comprises the floodplain of the local watercourses. Given the relatively elevated nature of the highway infrastructure at this location the risk of groundwater flooding is low.

4.6.8 The relatively minor proposed improvement works will not detrimentally affect the risk of groundwater flooding in the surrounding area.

Other Sources of Flood Risk

4.6.9 Other sources of flood risk have been reviewed including, the sea, canals, reservoirs and large waterbodies, and public sewers, and none have been identified as posing a flood risk in this location.

Summary

4.6.10 Overall, the risk of flooding from the reviewed sources in this area are all considered to be at an acceptable level; therefore, they will not pose a barrier to the proposed works. Additionally, the works are not expected to negatively affect any flood risk in the surrounding area, subject to appropriate surface water management.

4.7 Works No. 14: A New Foot/Cycle Way Alongside the A453 Between EMG1 & EMG2

Illustrative Proposals

4.7.1 The proposed improvements in this location include a new shared use foot/cycle way connecting EMG1 with EMG2. The extent of the works is illustrated in **Figure 4.23**.

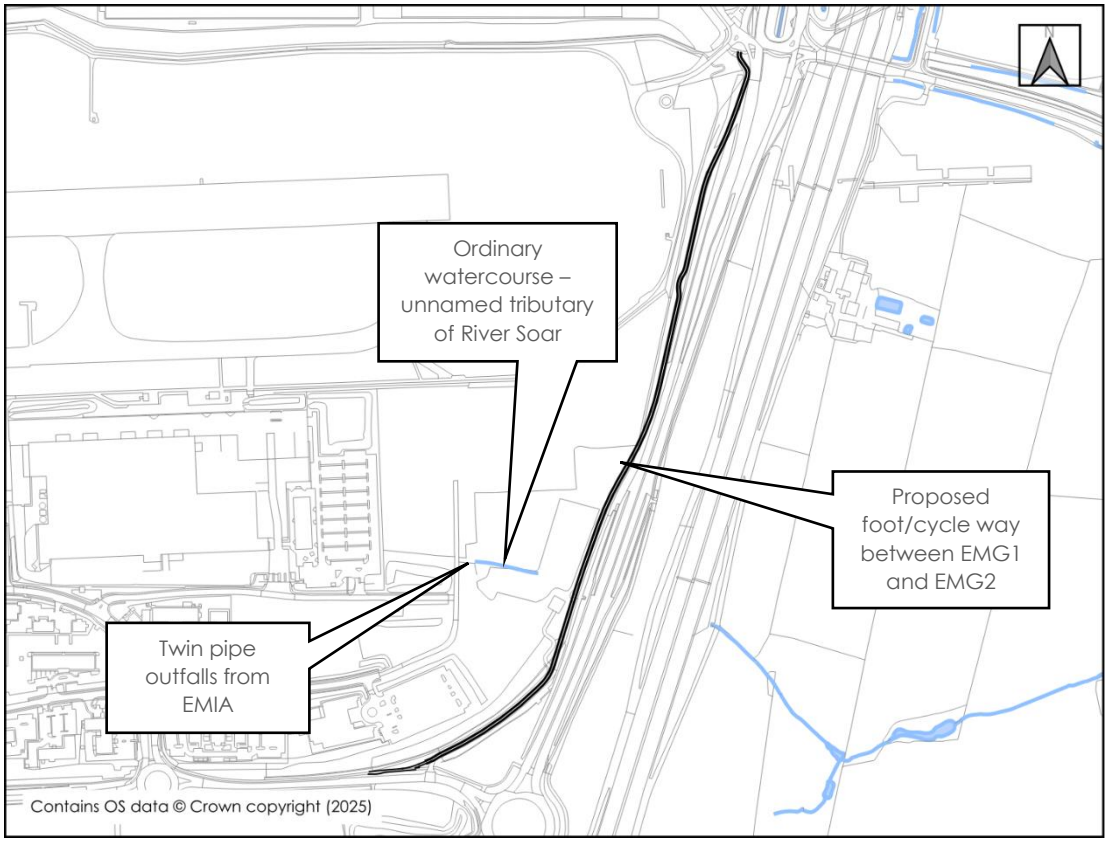

Figure 4.23: Illustrative Highway Improvement - Works No. 14

Historical Flooding Incidents

4.7.2 The EA Historical Flood Map does not show any recorded flood outlines within close proximity to the proposed works. Furthermore, a review of historical incidents collated and listed in the PFRA and SFRAs did not identify any which had affected the area.

Fluvial Flood Risk

4.7.3 The proposed works are located entirely within Flood Zone 1 and EA RoFRS data identifies that the works are located outside of areas at fluvial risk.

4.7.4 The route of the foot/cycle way runs in close proximity to a small ordinary watercourse which issues from the eastern side of the East Midlands Internal Airport (EMIA) via twin pipe outfalls (500mm and 700mm diameter pipes). After a very short open reach the watercourse is then culverted beneath the A453 and the M1, before outfalling to open

fields on the eastern side of the M1. The watercourse continues to flow towards the east, eventually outfalling to the River Soar.

4.7.5 The watercourse is not included in the Flood Map for Planning or RoFRS data due to its small size (<3km2), and there is no known hydraulic model available from the EA or Lead Local Flood Authority (LLFA). In such instances EA RoFSW data can provide a proxy to the potential floodplain. However, in this instance this data does not include for the A453 or M1 culverts and consequently flood water is shown to unrealistically pond to the west of the A453 – this is illustrated within **Figure 4.24**.

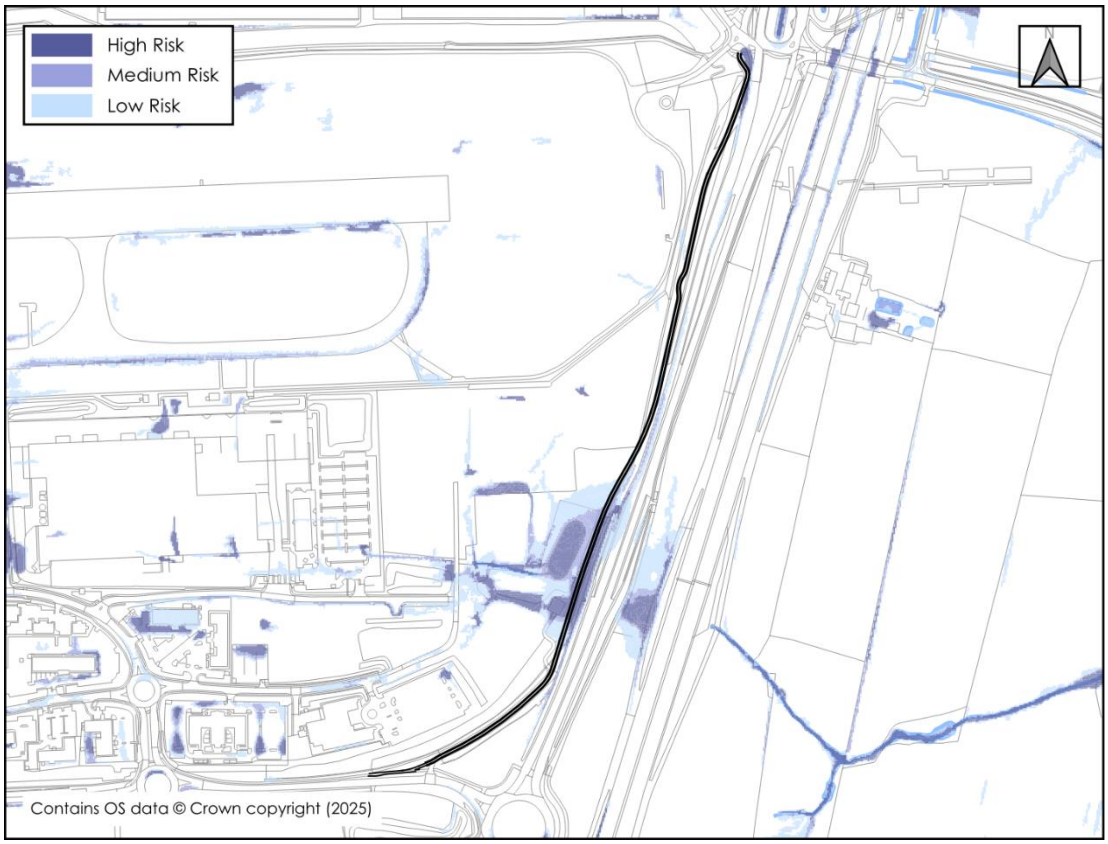

Figure 4.24: EA RoFSW - Works 14

4.7.6 Therefore, an assessment of the capacity of the A453 and M1 culverts against the predicted peak flows generated in the catchment has been undertaken to improve upon the understanding of potential flood risk. This is documented within the Technical Note (reference: EMG2-BWB-ZZ-XX_T-W-0005), included as **Appendix 3.**

4.7.7 The hydraulic assessment has identified that there is capacity for the 1 in 30-year and 1 in 100-year with the culvert A453/M1 culvert. There is potential for surcharging to occur at the culvert inlet during the 1 in 100-year +28% and 1 in 100-year +60% climate change flood events; however, this was not shown to result in overtopping of the culvert and flood levels were predicted to remain in channel upstream of the culvert. Therefore, the watercourse poses a low risk of flooding to the proposed works.

4.7.8 To accommodate the proposed foot/cycle way it will be necessary to extend the existing 500mm/700mm diameter outfalls from the west a short distance to allow the proposed footway/cycleway to run on top. This approach ensures that conveyance

of flows towards the A453 culvert will be unaffected. This was confirmed as part of the hydraulic assessment (see **Appendix 3**). Therefore, the proposed works will have no detrimental impact on the fluvial flood risk of third parties.

Surface Water Flood Risk & Highway Drainage

4.7.9 The surface water flood risk in the area, as mapped by the EA, is considered to be a representation of the floodplain associated with the River Soar tributary and as such, considered to be fluvial in nature and is discussed above. Away from the watercourse, the proposed improvement works are considered to be at a very low to low probability of flooding from surface water.

4.7.10 A site visit to the area identified the presence of highway drainage channels at the toe of the A453. Any existing highway drainage features within the footprint foot/cycle way, will either be preserved or relocated to ensure that existing drainage connectivity and capacity is not adversely affected by the proposed foot/cycle way.

4.7.11 The works will introduce a relatively small area of new impermeable surfaces. The additional surface water runoff generated will be directed into adjacent watercourses, as existing. Due to the small area, it is not practical to restrict the discharge rate to the equivalent greenfield rate, instead the rate will be restricted to the lowest practicable rate, a discharge rate below 5l/s. The excess surface water will be stored within the footway's drains and a swale. Further information on the drainage approach is provided within the accompanying SDS by BWB Consulting (reference: EMG2-BWB-ZZ-XX-RP-CD-0003_SDS).

Groundwater Flood Risk

4.7.12 BGS mapping identifies the proposed works are underlain by Diseworth Sandstone – Sandstone, Gunthorpe Member - Siltstone, Dolomitic and Gunthorpe Member Mudstone. Mapping from the 2015 SFRA shows the works to lie in a 1km2 square grid where <25% of the area is potentially susceptible to groundwater flooding. It is considered the susceptible areas are most likely to comprise the lower lying surrounding land which generally comprises the floodplain of the local watercourses. Any groundwater emergence would likely occur with the local watercourse and drained away beneath the A453 and M1 is the same manner as the fluvial and surface water.

4.7.13 The relatively minor proposed improvement works will not detrimentally affect the risk of groundwater flooding in the surrounding area.

Other Sources of Flood Risk

4.7.14 Other sources of flood risk have been reviewed including, the sea, canals, reservoirs and large waterbodies, and public sewers, and none have been identified as posing a flood risk in this location.

Summary

4.7.15 Overall, the risk of flooding from the reviewed sources in this area are all considered to be at an acceptable level; therefore, they will not pose a barrier to the proposed works. Additionally, the proposed highway works are not expected to negatively affect any flood risk in the surrounding area, subject to appropriate surface water management.

4.8 Works No 19: Upgrade Of Footpath L57 to the West of EMG1 to Cycleway Standard

Illustrative Proposals

4.8.1 It is proposed to upgrade an existing footpath located to the east of Castle Donnington to a shared foot/cycleway. The route of the foot/cycleway crosses the upper reach of the Hemington Brook, as shown in **Figure 4.25**.

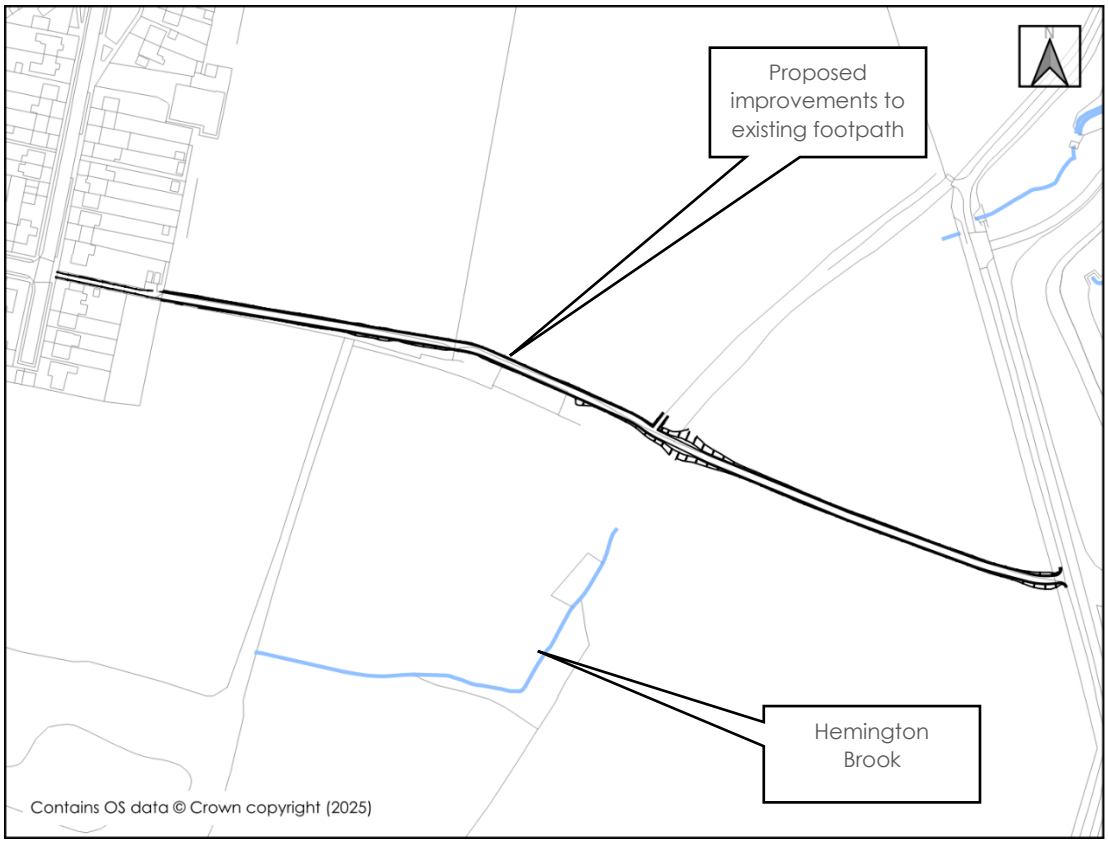

Figure 4.25: Illustrative Highway Improvements - Works No. 19

Historical Flood Incidents

4.8.2 The EA Recorded Flood Outlines data does not show any recorded incidents within proximity to the proposed works. Furthermore, a review of historical incidents collated and listed in the PFRA and SFRAs did not identify any which had affected the area.

Fluvial Flood Risk

4.8.3 The proposed works are located entirely within Flood Zone 1 and EA RoFRS data identifies that the works are located outside of areas at fluvial risk.

4.8.4 The Hemington Brook in this location is not included in the Flood Map for Planning or RoFRS due to its small size, and the hydraulic model coverage available from the EA only starts 550m downstream. In such instances, EA RoFSW data can be used to provide

a proxy of the potential floodplain, this is illustrated in **Figure 4.26**. The data suggests that the floodplain associated with the watercourse remains in close proximity to the channel.

Figure 4.26: EA RoFSW - Works No. 19

4.8.5 Topographical survey of the area identifies that a 500mm diameter pipe provides hydraulic connectivity beneath the existing footpath and that exceedance flows, in excess of the culvert's capacity, can overtop the footpath, which is set 400mm above the culvert soffit.

4.8.6 As part of the proposed works, there is an opportunity to improve the capacity of the culvert and decrease the risk of the footpath being made impassible during a flood event.

4.8.7 A hydraulic assessment of the local watercourse reach has been prepared and is included as **Appendix 4**. This was prepared to estimate the potential flood flows generated in the upstream catchment, estimate the capacity of the existing culvert, and assess the impact of raising the footpath and installing a larger 750mm diameter pipe.

4.8.8 The assessment identified that the existing culvert is readily overtopped during flood events. The proposed improvements will raise the footpath above modelled flood levels.

4.8.9 A comparison between the baseline and proposed conditions identified that upstream flood levels would increase by up to 0.40m; however, due to the relatively steep gradient the increase in flood levels dissipates within 38m from the footpath, an impact that is contained within the wider land ownership of the applicant. Therefore, the localised increase in upstream flood levels is not considered significant.

4.8.10 Modelled water levels downstream of the proposed improvements were predicted to be unaffected, and a comparison of modelled flow hydrographs at the downstream section confirmed that there would not be a significant change in pass on flows.

Surface Water Flood Risk

4.8.11 The EA RoFSW mapping (**Figure 4.26**) shows areas of a high probability of flooding associated with the Hemington Brook, this is discussed in the Fluvial Flood Risk sub-section above. Beyond this, the proposed improvements are at a low to very low probability of flooding from surface water.

4.8.12 The minor alterations to the existing footpath are not expected to have a significant impact on the existing surface water regime.

Groundwater Flood Risk

4.8.13 BGS mapping identifies the proposed works are underlain by Helsby Sandstone Formation – Sandstone and Tarporley Siltstone Formation - Siltstone, Mudstone and Sandstone. Mapping from the 2015 SFRA shows the works to lie in a 1km2 square grid where >= 25% to <50% of the area is potentially susceptible to groundwater flooding. It is considered the susceptible areas are most likely to comprise the lower lying surrounding land which generally comprises the floodplain of the local watercourses. Any groundwater emergence would likely occur with the local watercourse and be drain away from the proposed works.

4.8.14 The relatively minor proposed improvement works will not detrimentally affect the risk of groundwater flooding in the surrounding area.

Other Sources of Flood Risk

4.8.15 Other sources of flood risk have been reviewed including the sea, canals, reservoirs and large waterbodies, and public sewers, and none have been identified as posing a flood risk in this location.

Summary

4.8.16 Overall, the risk of flooding from the reviewed sources in this area are all considered to be at an acceptable level; therefore, they will not pose a barrier to the proposed works. Additionally, the proposed improvements are not expected to negatively affect flood risk in the surrounding area.

4.9 Works 20 – Modification and Extension of the EMG1 Substation

Illustrative Proposals

4.9.1 Within the area shown on the works plans for Works No. 20, the provision of a modified and extended substation is proposed. For the purpose of the FRA the full area of the works, as shown in **Figure 4.25,** has been assessed.

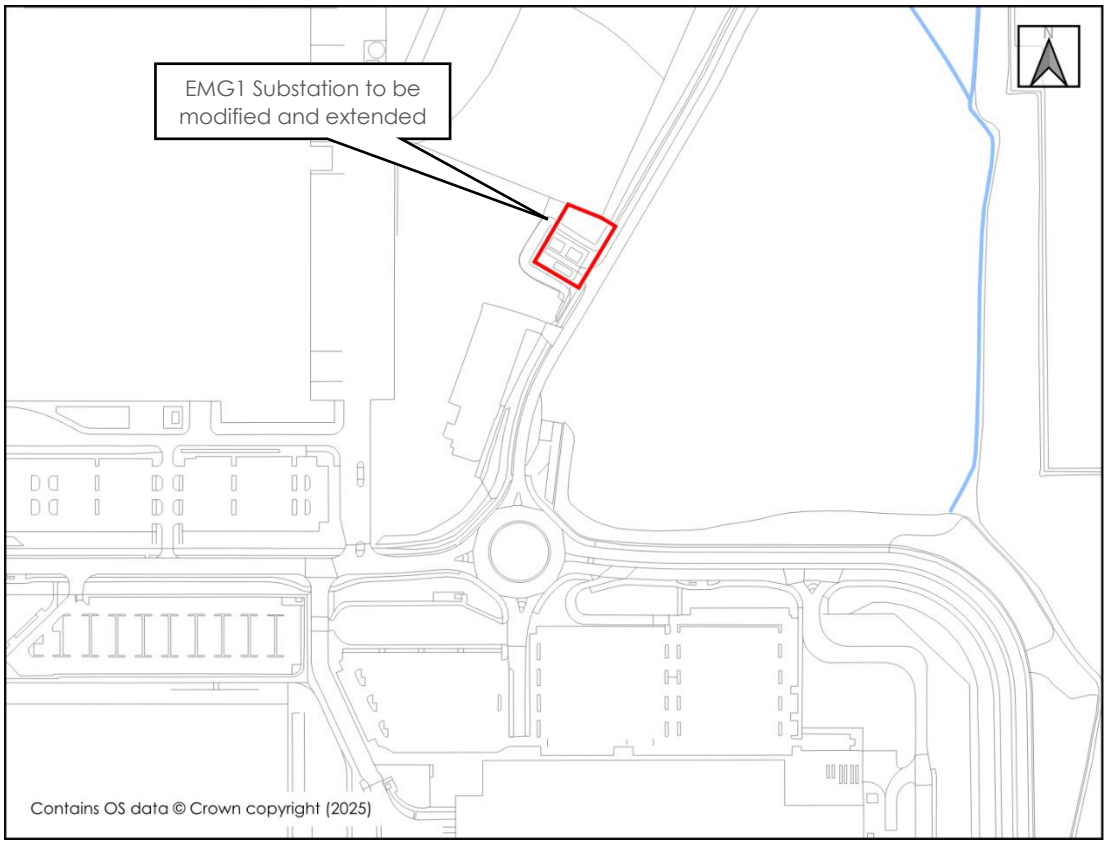

Figure 4.27: Illustrative Substation Extension - Works No. 20

4.9.2 The flood risk vulnerability of substation is regarded to be "essential infrastructure".

Historical Flood Incidents

4.9.3 The EA Recorded Flood Outlines data does not show any recorded incidents within proximity to the proposed works. Furthermore, a review of historical incidents collated and listed in the PFRA and SFRAs did not identify any which had affected the area.

Fluvial Flood Risk

4.9.4 The proposed works are located entirely within Flood Zone 1 and EA RoFRS data identifies that the works are located outside of areas at fluvial risk.

Surface Water Flood Risk

4.9.5 The EA RoFSW mapping (**Figure 4.26**) shows areas of a medium and low probability of flooding associated with the footprint of the existing substation. However, the substation forms part of the surrounding EMG1 drainage system, that will not be fully represented in the EA's strategic data. This will manage surface water flood risk to an acceptable level. Therefore, the surface water flood risk to the existing substation is regarded to be low.

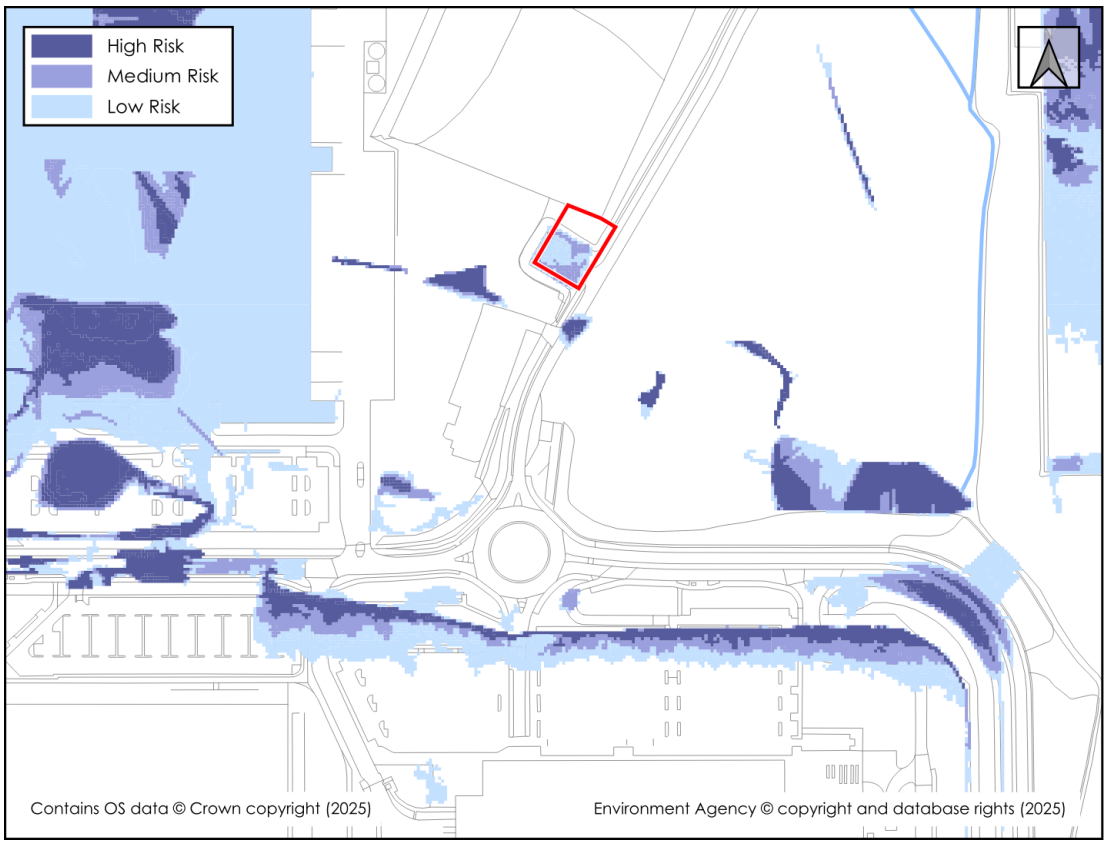

Figure 4.28: EA RoFSW - Works No. 20

4.9.6 The area outside of the existing sub-station, i.e.: the area most likely to be used for expansion, is shown to be at a very low probability of surface water flooding.

4.9.7 The surrounding EMG1 drainage network intercepts and conveys surface water in a northerly direction to two detention basins located to the north. The drainage infrastructure and basins are designed to manage the 1 in 100-year storm event including an allowance for climate change. In the unlikely event of exceedance, overtopping flows would be directed in a northerly direction away from the area of works, following the general fall of the topography. Therefore, the risk of exceedance impacting the works is low.

4.9.8 The works will introduce new impermeable surfaces. The additional surface water runoff generated will be directed into adjacent EMG1 surface water drainage infrastructure. The EMG1 surface water drainage is attenuated with sufficient overhead in its storage basins to accommodate the additional runoff from the relatively small additional area,

no further mitigation is required to prevent a downstream impact. Further information on the drainage approach is provided within the accompanying SDS by BWB Consulting (reference: EMG2-BWB-ZZ-XX-RP-CD-0002_SDS).

Groundwater Flood Risk

4.9.9 BGS mapping identifies the proposed works are underlain by Tarporley Siltstone Formation. These geologies are generally classified as Secondary B Aquifers, which comprise predominantly lower permeability layers that may store and yield limited amounts of groundwater through characteristics like fissures and openings or eroded layers.

4.9.10 Mapping from the 2015 SFRA shows the works to lie in a 1km^2 square grid where <25% of the area is potentially susceptible to groundwater flooding.

4.9.11 Based on the available data, and because of its elevated location above the surrounding land and floodplain, the risk of groundwater flooding is regarded to be low. The relatively minor proposed works will also not detrimentally affect the risk of groundwater flooding in the surrounding area.

Other Sources of Flood Risk

4.9.12 Other sources of flood risk have been reviewed including the sea, canals, reservoirs and large waterbodies, and public sewers, and none have been identified as posing a flood risk in this location.

Summary

4.9.13 Overall, the risk of flooding from the reviewed sources in this area are all considered to be at an acceptable level; therefore, they will not pose a barrier to the proposed works. Additionally, the proposed improvements are not expected to negatively affect flood risk in the surrounding area, subject to appropriate surface water management.

4.10 Summary of Highway Works & Substation Remote of the EMG2 Works

4.10.1 This Section of the FRA provide an assessment of the 'Highway Works' and the substation extension that are removed geographically from the EMG2 Works. The results of the assessment are summarised within **Table 4.2**.

4.10.2 This assessment has demonstrated that the proposed works are not at significant flood risk, and that they will not increase flood risk to the wider catchment area, subject to suitable management of surface water runoff.

Table 4.2: Summary of Flood Risk at the Highway Works and Substation, remote from the EMG2 Works

Works No.	Flood Risk Source						
	Fluvial	Surface Water & Highway Drainage	Groundwater	Reservoirs	Canal	Public Sewers	Sea
8	No Risk	Low Risk – subject to improvements being made to the local highway drainage infrastructure, where capacity improvements are identified as necessary.	Low Risk	No Risk	No Risk	No Risk	No Risk
9	No Risk	Low Risk – subject to preservation or relocation of existing highway drainage infrastructure, and improvements being made to the local highway drainage infrastructure, where capacity improvements are identified as necessary.	Low Risk	No Risk	No Risk	No Risk	No Risk
10	Low Risk	Low Risk – subject to improvements being made to the local highway drainage infrastructure, where capacity improvements are identified as necessary.	Low Risk	Low Risk	No Risk	No Risk	No Risk
11	Low Risk	Low Risk – subject to improvements being made to the local highway drainage infrastructure, where capacity improvements are identified as necessary.	Low Risk	Low Risk	No Risk	No Risk	No Risk
12a & 12b	Proposed improvement works limited to signage and lining improvements, there will be no impact on flood risk.						
13	No Risk	Low Risk – subject to improvements being made to the local highway drainage infrastructure, where capacity improvements are identified as necessary.	Low Risk	No Risk	No Risk	No Risk	No Risk
14	Low Risk	Low Risk – subject to preservation or relocation of existing highway drainage infrastructure, and improvements being made to the local highway drainage infrastructure, where capacity improvements are identified as necessary.	Low Risk	No Risk	No Risk	Low Risk	No Risk

Works No.	Flood Risk Source						
	Fluvial	Surface Water & Highway Drainage	Groundwater	Reservoirs	Canal	Public Sewers	Sea
16	Proposed works limited to signage improvements, there will be no impact on flood risk.						
18	Proposed works limited to signage improvements, there will be no impact on flood risk.						
19	Low Risk, subject to upgrading the existing culvert beneath the footpath	Low Risk	Low Risk	No Risk	No Risk	No Risk	No Risk
20	No Risk	Low Risk	Low Risk	No Risk	No Risk	No Risk	No Risk

5. EMG1 WORKS

5.1.1 This FRA has been prepared in relation to the 'EMG1 Works', referred to as 'the study site' throughout Section 5. Refer to Document MCO 2.5 for the Parameters Plan.

5.1.2 The EMG2 Works and Highway Works and are reviewed in **Section 3** and **Section 4** respectively.

5.2 Existing Site

5.2.1 The study site is located across three parcels within EMG1. They are located approximately 1.5km northeast of the EMG2 Main Site and are bound to the south and west by the existing EMG1 development, to the north by greenfield grassland, and to the east by the A453 and A50. Their location is shown within **Figure 5.1**.

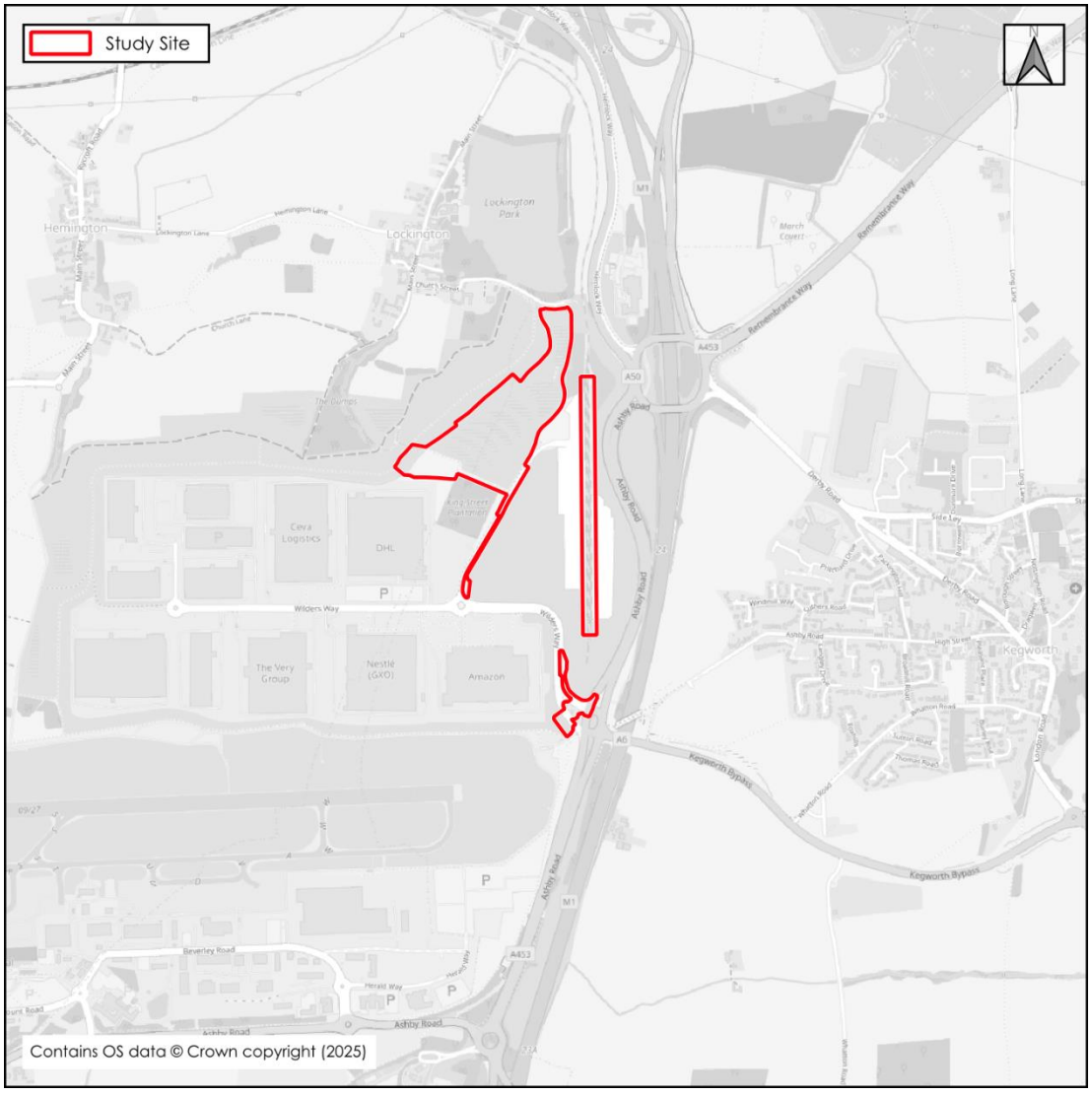

Figure 5.1: Study Site Location

5.2.2 EA LiDAR data provides an overview of the ground levels within the study site and in the wider area, an extract of mapping is included as **Figure 5.2**.

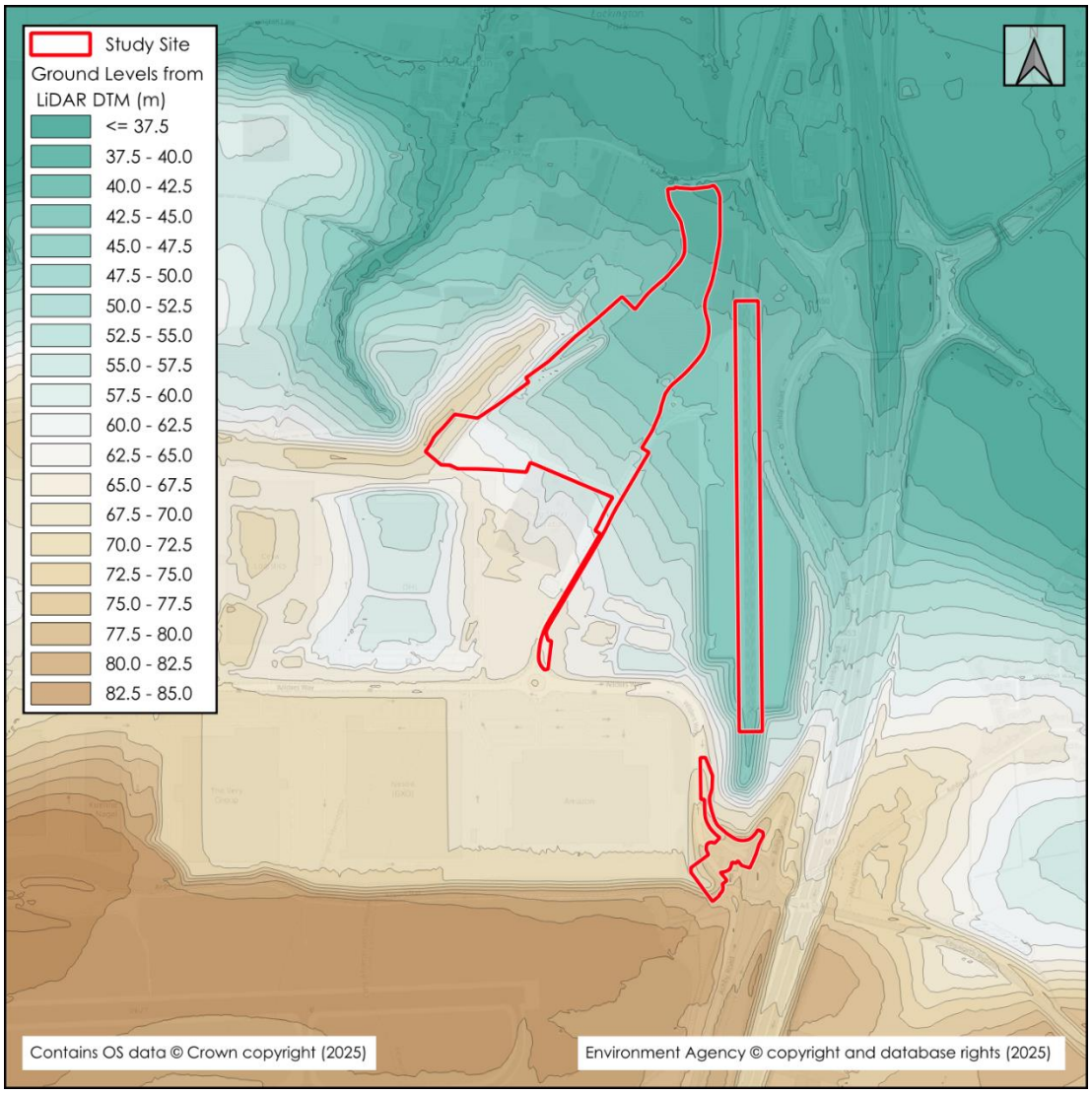

Figure 5.2: Site Topography

5.2.3 The LiDAR data identifies that the local area falls in a northerly direction, falling from a high point of approximately 80 metres Above Ordnance Datum (mAOD) at the southern entrance to EMG1 to a low point of approximately 38mAOD on the northern boundary.

5.3 Potential Sources of Flood Risk

5.3.1 Flooding can occur from a variety of sources, or combination of sources, which may be natural or artificial. **Table 5.1** below identifies the potential sources of flood risk to the study site in its current condition, and the impacts which the development could have in the wider catchment, prior to mitigation. These are discussed in greater detail in the forthcoming section. The mitigation measures proposed to address flood risk issues and ensure the development is appropriate for its location are discussed within **Section 5.4**.

Table 5.1: Pre-Mitigation Sources of Flood Risk

Flood Source	Potential Risk				Description
	High	Medium	Low	None	
Fluvial				X	The study site is located entirely within Flood Zone 1.
Canals				X	The nearest canal (the Trent and Mersey Canal) is located approximately 3.2km north of the study site. There is no hydraulic connectivity between the canal and the study site.
Groundwater			X		The study site is located in a relatively elevated position set above the local floodplain, the underlying soils are cohesive, and the available borehole records did not encounter any shallow groundwater.
Reservoirs and waterbodies				X	The study site falls outside of the area at risk of reservoir failure for both 'dry-day' and 'wet-day' scenarios. There are no large waterbodies within the surrounding vicinity that would pose a risk to the study site.
Pluvial runoff			X		Surface water runoff from the surrounding EMG1 development is managed by drainage infrastructure design to manage the 1 in 100-year plus climate change storm event.
Sewers			X		
Effect of Development			X		Development will not result in impedance of surface water or loss of floodplain.

Flood Source	Potential Risk				Description
	High	Medium	Low	None	
on Wider Catchment		X			The development will increase the area of impermeable surfaces leading to a potential increase in runoff, unless mitigated.

Fluvial Flood Risk

5.3.2 Flooding from watercourses occurs when flows exceed the capacity of the channel, or where a restrictive structure is encountered, which leads to water overtopping the banks into the floodplain. This process can be exacerbated when debris is mobilised by high flows and accumulates at structures.

Historical Flood Risk

5.3.3 The EA Historical Flood Map shows there are no previously recorded flood outlines which have impacted the study site. The nearest recorded flood outline is located approximately 1km northwest, attributed to the River Trent exceeding its channel capacity when no raised defences were present in January 1932.

5.3.4 'Historical Flooding' mapping appended to the North West Leicestershire SFRA shows there are no previously recorded flood events which have impacted the study site or immediate surrounding area. No additional records of historical flooding are reported within the North West Leicestershire SFRA 2024 update.

5.3.5 The Leicestershire County Council PFRA states that there has previously been flooding attributed to the Lockington Brook; however, the date, magnitude and specific locations of flooding are not provided. Anecdotally, it is understood that the historical flooding occurred within the village of Lockington.

Flood Map for Planning

5.3.6 As shown in Figure 3.2, the study site is located entirely within Flood Zone 1. The nearest Flood Zones are located approximately 180m north attributed to the Lockington Brook, a designated EA Main River. A review of EA LiDAR data shows the study site is raised above the nearest Flood Zones by a minimum 8m. The route of the Lockington Brook and surrounding watercourses are shown within **Figure 5.3**.

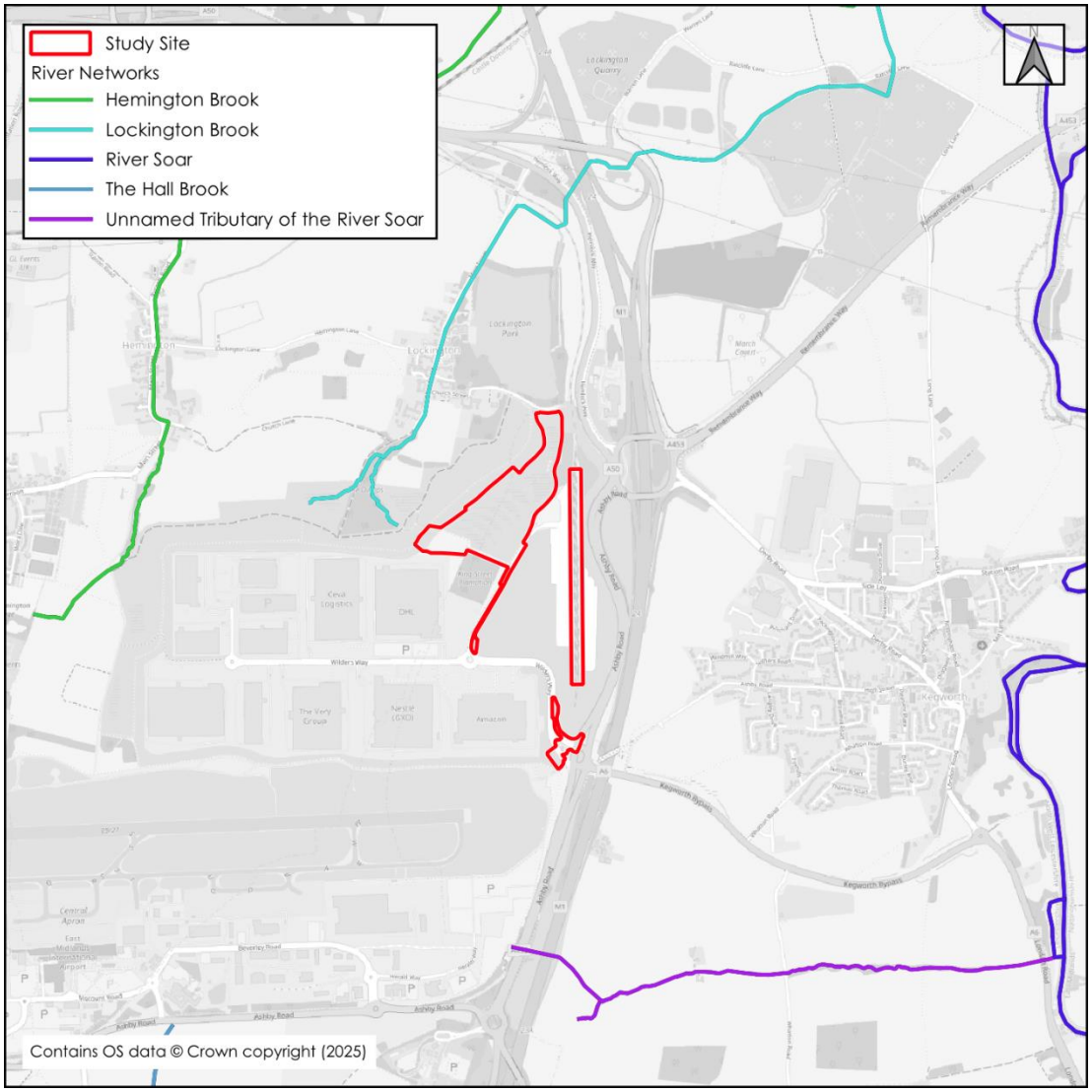

Figure 5.3: Local Watercourse Network

Risk of Flooding from Rivers and Seas

5.3.7 The EA released the new National Flood Risk Assessment (NaFRA2) dataset in January 2025 which reportedly uses the best available data from the EA and local authorities to inform current and future probability of flooding.

5.3.8 The Risk of Flooding from Rivers and Sea (RoFRS) mapping shows the probability of flooding from rivers and the sea to areas of land, taking into account the presence and condition of flood defences. The mapping considers the Central climate change allowances for the '2050s' epoch, which is the most precautionary data projections currently published by the EA. An extract of mapping is included as **Figure 5.4**.

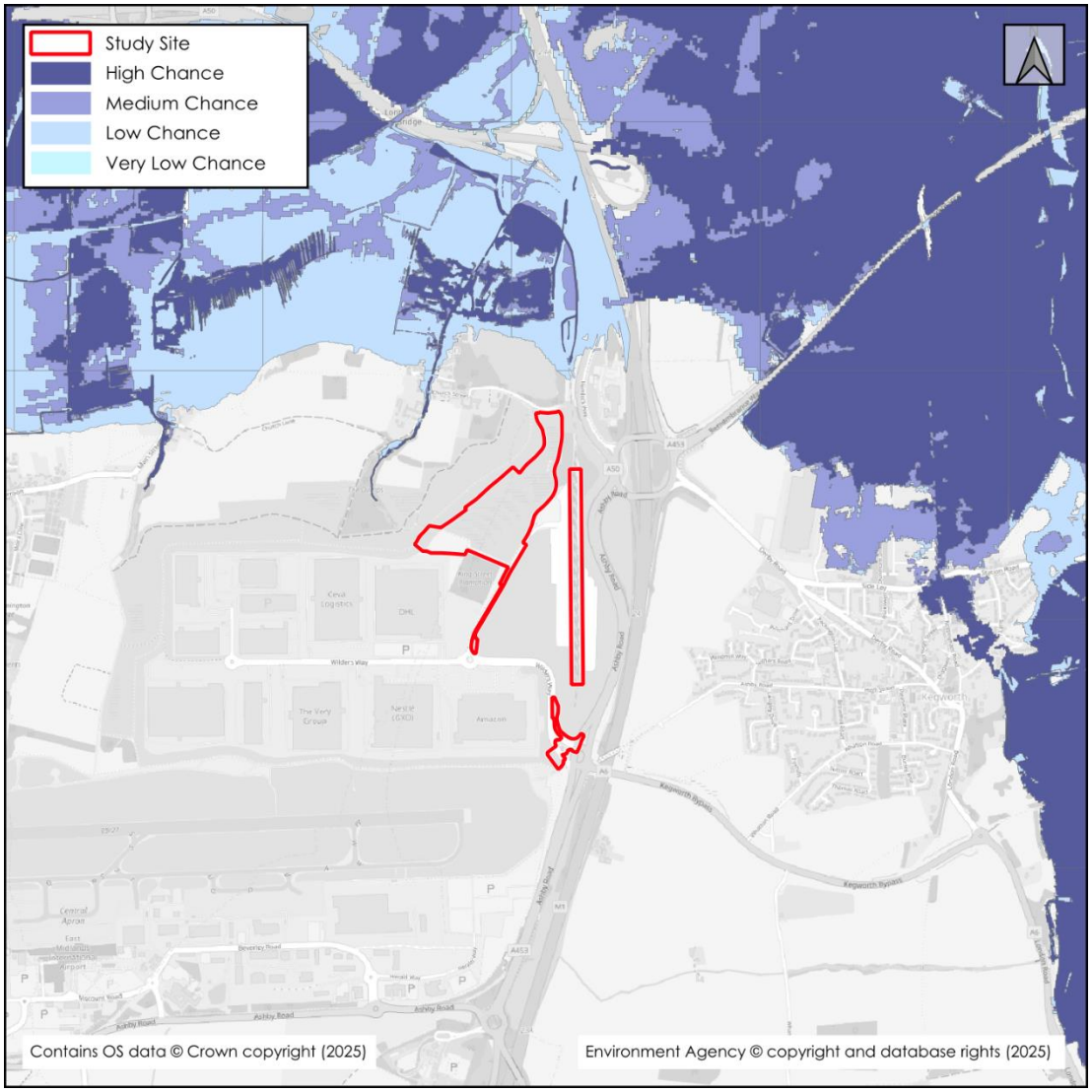

Figure 5.4: Risk of Flooding from Rivers and Sea (Yearly Chance of Flooding Between 2036 and 2069)

5.3.9 The mapping aligned with the Flood Map for Planning and shows the study site to be located outside of all modelled probabilities up to 2069.

Hemington, Lockington, Castle Donington Brooks Modelling Study (2022)

5.3.10 Hydraulic modelling information has been provided by the EA for the Hemington, Lockington, Castle Donington Brooks Modelling Study completed in 2022. The modelled fluvial flood extents, shown in **Figure 5.5**, show the study site is located outside of all modelled scenarios attributed to the Lockington Brook, including the 1 in 1000-year event and the credible maximum climate change scenario (the 1 in 100-year+60% event).

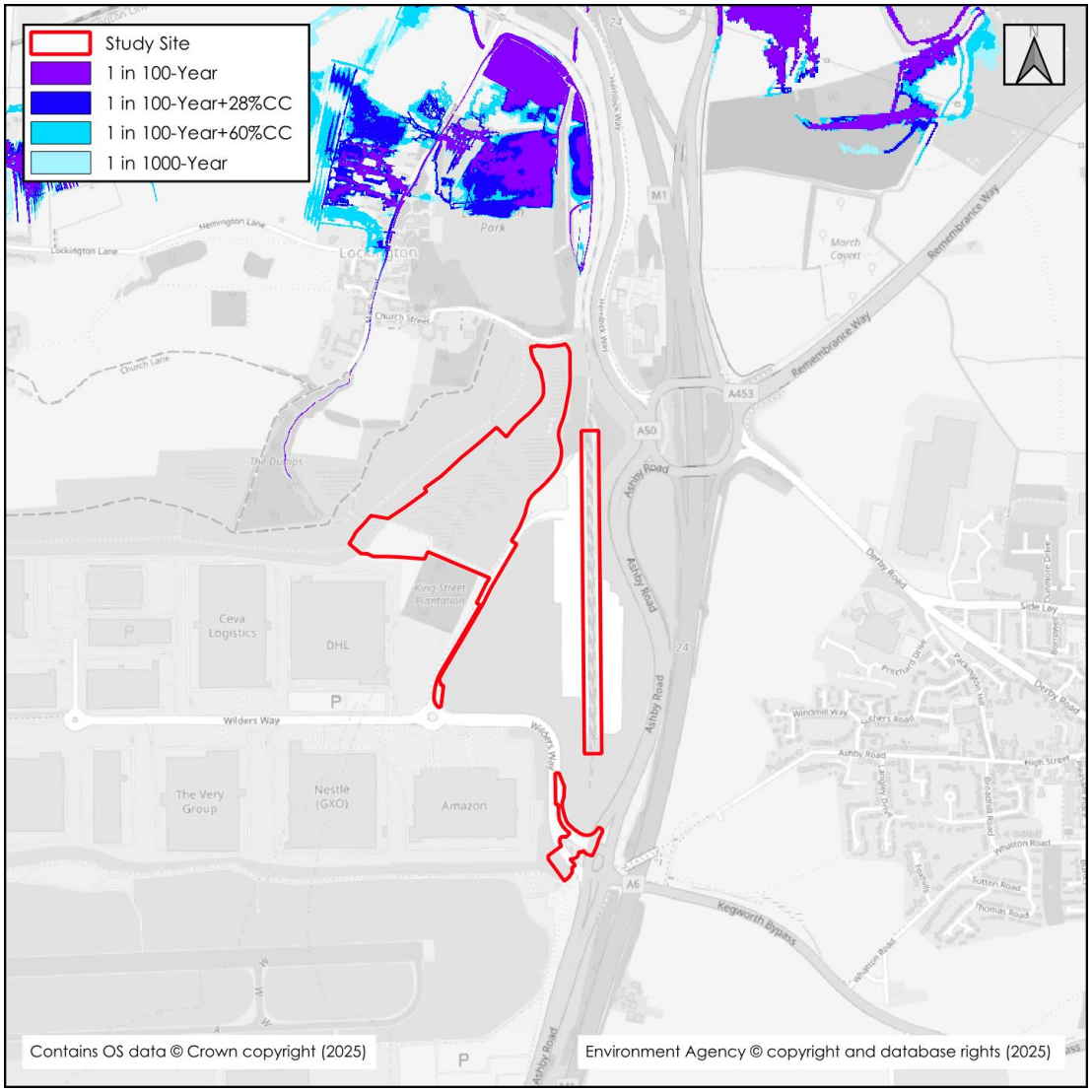

Figure 5.5: Model Floodplain Outlines (Hemington, Lockington, Castle Donington Brooks Modelling Study)

Drainage Channels

5.3.11 OS mapping identifies the presence of a number of drainage channels within the surrounding EMG1 development site. These channels are associated with the surface water drainage infrastructure for EMG1, which is designed to manage runoff from EMG1 up to and including the 1 in 100-year storm event including an allowance for climate change. Therefore, there are not expected to pose a significant flood risk to the development.

Summary

5.3.12 Therefore, it can be concluded that the study site is not at fluvial flood risk.

Groundwater Flood Risk

5.3.13 Groundwater flooding occurs when the water table rises above ground elevations, or it rises to depths containing basement level development. It is most likely to happen in low lying areas underlain by permeable geology. This is most common on regional scale chalk aquifers, but there may also be a risk on sandstone and limestone aquifers or on thick deposits of sands and gravels underlain by less permeable strata such as that in a river valley.

5.3.14 BGS mapping identifies that the study site is underlain by a number of bedrock geologies, as shown in **Figure 5.6**. These geologies are generally classified as Secondary B Aquifers, which comprise predominantly lower permeability layers that may store and yield limited amounts of groundwater through characteristics like fissures and openings or eroded layers. A small area of Helsby Sandstone Formation is located below the existing EMG1 gantry cranes. This classified as Principal Aquifer, a strategically important rock unit that has high permeability and water storage capacity.

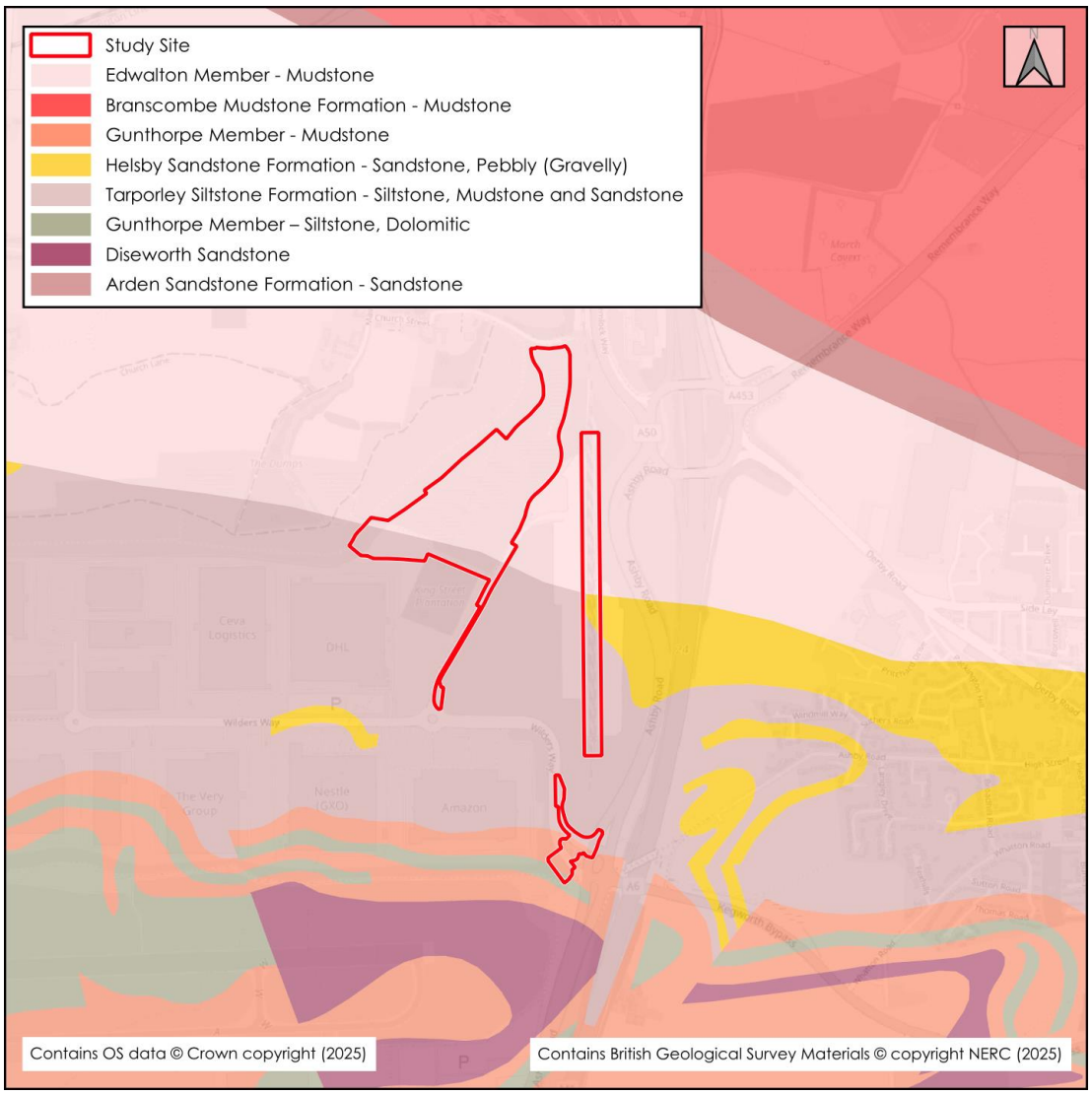

Figure 5.6: BGS Bedrock Geology

5.3.15 Superficial deposits of Head (Clay, Silt, Sand and Gravel), Egginton Common Sand and Gravel Member (Sand and Gravel) and Egale Moor Sand and Gravel Member (Sand and Gravel) are mapped across portions of the development sites; with large areas where no superficial deposits are present. An extract of mapping is included as **Figure 5.7**.

5.3.16 The EA class the Egginton Common Sand and Gravel Member and Egale Moor Sand and Gravel Member as a Secondary A Aquifers, whereas the Head deposits are classified as a Secondary (Undifferentiated) Aquifer. Secondary A Aquifers comprise permeable layers that can support local water supplies and, in some cases, forms an important source of base flow to rivers. Secondary (Undifferentiated) Aquifers are assigned in cases where it is not possible to apply either category Secondary A or B because of the variable characteristics of the rock type.

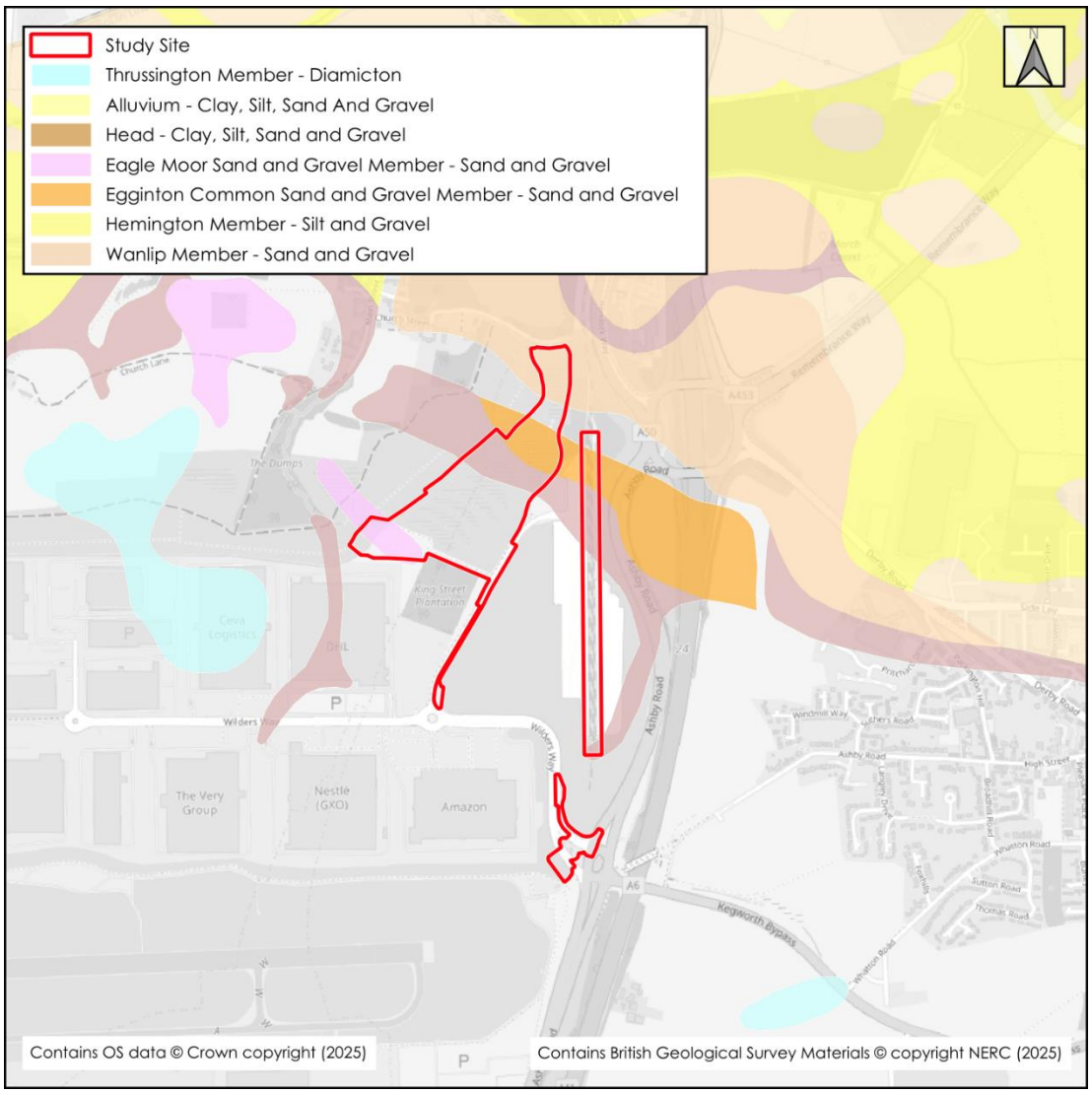

Figure 5.7: BGS Superficial Deposits

5.3.17 The Leicestershire County Council PFRA and North West Leicestershire SFRA do not report any historical groundwater flood events which have impacted the study site or immediate surrounding area.

5.3.18 'Areas Susceptible to Groundwater Flooding' mapping appended to the SFRA shows the study site is located across three cells which are shown to have between '<25%' and '≥75%' of the area susceptible to groundwater flooding. It should be noted that the mapping is based on strategic scale mapping which identifies areas susceptible to flooding from groundwater at a broad scale on the basis of geological and hydrogeological conditions. Therefore, the classification could potentially be based on another area within the particular cell. The high groundwater susceptibility is likely to be in continuity with the water levels of the Lockington Brook and are unlikely to extend beyond the extent of the fluvial floodplain.

5.3.19 There are no BGS borehole logs located within the development sites, but there are seven borehole logs located within the surrounding vicinity and underlain by similar geologies. The interrogated logs are summarised in **Table 5.2**.

Table 5.2: Summary of Interrogated BGS Borehole Records

Borehole Reference	Date Sampled	Depth of Borehole (m)	Groundwater Strike (m bgl)
SK42NE716	2006	3.1	Groundwater not encountered
SK42NE717	2006	1.9	Groundwater not encountered
SK42NE718	2006	4.0	Groundwater not encountered
SK42NE719	2006	2.6	Groundwater not encountered
SK42NE720	2006	3.5	Groundwater not encountered
SK42NE111	1984	4.1	Groundwater not encountered
SK42NE112	1984	5.9	Groundwater not encountered

5.3.20 Ground investigations undertaken by RSK have reported clayey cohesive soils across the study site which have very limited infiltration. These soils will also limit the potential for groundwater to exceed ground levels.

5.3.21 Based on the available data, the study site is considered to be at a low risk of groundwater flooding due to its cohesive soils and elevated position above the local watercourses and floodplain. Any groundwater emergence in the local area would likely occur in the low-lying floodplain located below the study site. Due to the sloping topography any groundwater emergence that did occur near the study site would be directed towards the Lockington Brook and away from the development. Mitigation measures to address any residual risk are discussed in **Section 5.4**.

Pluvial Flood Risk

5.3.22 Pluvial flooding can occur during prolonged or intense storm events when the infiltration potential of soils, or the capacity of drainage infrastructure is overwhelmed leading to the accumulation of surface water and the generation of overland flow routes.

5.3.23 The Leicestershire County Council PFRA does not report any historical surface water flood events which have impacted the study site or immediate surrounding area.

5.3.24 Risk of Flooding from Surface Water (RoFSW) mapping has been collated and published by the EA, this shows the potential flooding which could occur when rainwater does not drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead. An extract from the mapping is included as **Figure 5.8**.

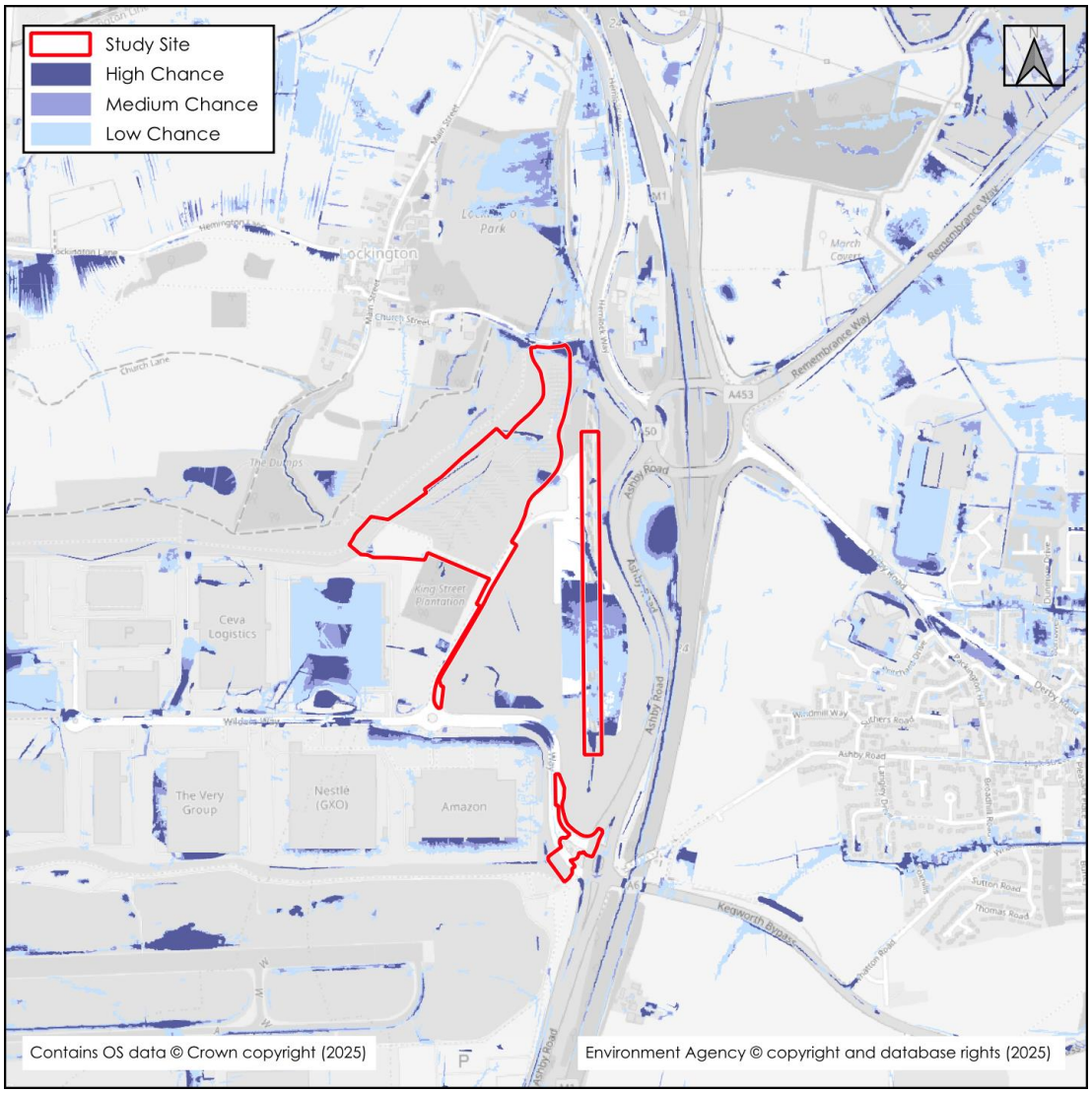

Figure 5.8: Risk of Flooding from Surface Water Flooding Mapping (Yearly chance of flooding between 2040 and 2060)

5.3.25 The mapping shows the that the study site generally has a very low to low probability of surface water flooding, with the exception of isolated areas of medium to high probability of flooding predicted at the existing rail terminal and within localised topographical depressions in landscaped areas.

5.3.26 However, the RoFSW mapping does not reflect the existing drainage infrastructure implemented as part of EMG1. As outlined within the Fluvial Flood Risk sub-section, EMG1 includes drainage infrastructure that manages surface water runoff and therefore surface water flood risk within the EMG1 site.

5.3.27 The misrepresentation is most apparent within the existing rail-freight interchange, where an area of low to high probability surface water ponding is present in the EA data. In reality, drainage infrastructure is included to manage surface water runoff and direct it to a series of attenuation basins located to the north.

5.3.28 As part of the construction phase of EMG1, Plot 16 was utilised as an area for surface water treatment. EA LiDAR data shows the existing site to comprise a number of cascading terraces used to treat surface water. As the construction phase has since been completed, these terraces are now redundant and are to be removed.

5.3.29 Overall, the study site is considered to be at a low risk of surface water flooding.

Flood Risk from Sewers

5.3.30 Sewer flooding can occur when the capacity of the infrastructure is exceeded by excessive flows, or as a result of a reduction in capacity due to collapse or blockage, or if the downstream system becomes surcharged. This can lead to the sewers flooding onto the surrounding ground via manholes and gullies, which can generate overland flows.

5.3.31 As previous discussed, the study site forms part of the existing EMG1 drainage catchment. The private drainage network intercepts and conveys surface water in a northerly direction to two detention basins located within the north of the study site. The drainage infrastructure and basins are design to manage the 1 in 100-year storm event including an allowance for climate change. In the unlikely event of exceedance, overtopping flows would be directed in a northerly direction away from the development, following the general fall of the topography.

5.3.32 A foul water rising main runs along the unnamed access road to the east of Plot 16, connecting to a pumping station located immediately north of the rail-freight interchange. This pumps foul flows in a southerly direction towards the public foul network located within the A453. In the unlikely event of exceedance, overtopping flows would be directed in a northerly direction away from the development, following the general fall of the topography.

5.3.33 Therefore, the risk of either sewerage networks exceeding capacity and impacting the EMG1 Works is considered to be low.

Effect of Development on Wider Catchment

5.3.34 The introduction of development at Plot 16 and the improvements to the public transport interchange will increase the area of impermeable surfaces within EMG 1. This will result in an increase in surface water runoff, which could increase flood risk downstream unless properly mitigated. Appropriate surface water management is discussed in **Section 5.4**.

5.4 Flood Risk Mitigation

5.4.1 **Section 5.3** has identified the sources of flooding which could potentially pose a risk to the study site. This section of the FRA sets out the mitigation measures which are to be incorporated to address and reduce the risk of flooding to within acceptable levels.

Sequential Arrangement

5.4.2 The site is located entirely within Flood Zone 1 and is shown to be at a low risk of flooding from all sources. Therefore, the site is sequentially located.

Development Levels

5.4.3 Finished floor levels of any proposed built development are to be raised a minimum of 150mm above surrounding ground levels to help mitigate against any residual flood risk from overland flows.

5.4.4 To help manage surface water runoff within the study site, ground levels will be profiled to encourage pluvial runoff and overland flows to flow away from the built development towards the nearest drainage feature.

Groundwater Considerations

5.4.5 Based on the available data, the study site is considered to be at a low risk of groundwater flooding. However, the potential to encounter local perched groundwater should be considered during the construction phase of the development, particularly during any excavations and any required reprofiling. It is recommended that groundwater levels are monitored during the construction phase, and should shallow groundwater be encountered during construction, a groundwater specialist should be consulted, and appropriate dewatering should be employed as necessary.

Safe Access and Egress

5.4.6 The existing site access routes are considered to be at a low risk of flooding from all sources, therefore, safe access and egress can be achieved.

Surface Water Drainage Strategy

5.4.7 To mitigate the development's impact on the current runoff regime, it is proposed to provide upgrades to the available surface water storage within the EMG1 drainage infrastructure so that it can accommodate the additional runoff generated by the EMG1 Works without altering the discharge rate leaving EMG1. This will ensure that surface water runoff from the EMG1 Works is managed on site, without detrimentally affecting downstream flood risk.

5.4.8 Within the study site, the road infrastructure or landscaped corridors should be used to provide drainage exceedance (overland flood flow) routes through the development

and towards the downstream detention basins, for storms events that exceed the capacity of the drainage system.

5.4.9 Further information on the drainage approach is provided within the accompanying SDS by BWB Consulting (reference: EMG2-BWB-ZZ-XX-RP-CD-0002_SDS).

Foul Water Drainage Strategy

5.4.10 Foul water will be drained from the development separately to surface water.

5.4.11 There will be early and ongoing consultation with Severn Trent Water to confirm the most appropriate point of discharge for foul drainage and to allow time for any necessary infrastructure improvements to be implemented.

5.4.12 Further information on the drainage approach is provided within the accompanying SDS by BWB Consulting (reference: EMG2-BWB-ZZ-XX-RP-CD-0002_SDS).

5.5 Summary of EMG1 Works

5.5.1 This Section of the FRA has been prepared in relation to the 'EMG1 Works'. A summary of the findings is provided in **Table 5.3**.

5.5.2 This assessment has demonstrated that the proposed scheme is not at significant flood risk, subject to the recommended flood mitigation strategies being implemented. Moreover, the development will not increase flood risk to the wider catchment area subject to suitable management of surface water runoff.

Table 5.3: Summary of Flood Risk Assessment

Flood Source	Risk & Proposed Mitigation Measures
Fluvial	The study site is shown to be located entirely within Flood Zone 1, which is land at a low risk of fluvial flooding.
Groundwater	The study site is located in a relatively elevated position set above the local floodplain, the underlying soils are cohesive, and the available borehole records did not encounter any shallow groundwater. Therefore, based on the available data groundwater flooding is considered to pose a low risk to the development. However, the potential to encounter localised shallow groundwater should be considered during the construction phase, particularly during any excavations and reprofiling required.
Pluvial & Drainage	The proposed EMG1 Works falls within the surface water drainage catchment of the existing EMG1 development. This drainage infrastructure was designed to manage surface water runoff from EMG1 up to and including the 1 in 100-year storm event including an allowance for future climate change. Therefore, the potential flood risk from surface water runoff and drainage/sewer sources is low. Ground levels in the EMG1 Works will be profiled to encourage pluvial runoff and overland flows to flow away from the built development towards the nearest drainage feature. The road infrastructure or landscaped corridors will be used to provide drainage exceedance (overland flood flow) routes through the built development and towards the downstream detention basins.
Other Sources	The sites have been assessed against other sources of flood risk including coastal, canals, and reservoirs and large waterbodies. These do not pose a risk to the site.
Impact of the Development	The EMG1 Works will introduce new areas of impermeable surface to EMG1. To manage the additional surface water runoff that this will generate it is proposed to provide upgrades to the existing EMG1 drainage infrastructure in the form of additional attenuated storage and Sustainable Drainage Systems (SuDS). These will be designed to ensure surface water is restricted to the equivalent greenfield QBAR rate and are designed with capacity for the 1 in 100-year storm with an allowance for climate change.
This summary should be read in conjunction with BWB's full report. It reflects an assessment of the study site based on information received by BWB at the time of production.	

6. EMG2 PROJECT CONCLUSIONS

6.1.1 This Flood Risk Assessment (FRA) has been prepared in accordance with the requirements set out in the National Policy Statement for National Networks (NPSNN). It has been produced on behalf of SEGRO (Properties) Ltd in respect of a Development Consent Order (DCO) for the proposed East Midlands Gateway Phase 2 (EMG2) and the East Midlands Gateway Rail Freight Interchange Material Change Order (MCO).

6.1.2 Due to the geographical distribution of the EMG2 Project, for the purpose of the FRA, the individual components have been grouped together for assessment based upon their location.

6.1.3 The EMG2 Works inclusive of the Highway Works within the immediate vicinity (Works Nos. 1 to 7, 12, 17 & 21) are not at significant flood risk, subject to the recommended flood mitigation strategies being implemented. Moreover, they will not increase flood risk to the wider catchment area subject to suitable management of surface water runoff.

6.1.4 The remaining Highway Works and the substation extension are not at significant flood risk, and they will not increase flood risk to the wider catchment area subject to suitable management of surface water runoff.

6.1.5 The EMG1 Works are not at significant flood risk, subject to the recommended flood mitigation strategies being implemented. Moreover, they will not increase flood risk to the wider catchment area subject to suitable management of surface water runoff.

6.1.6 Therefore, it can be concluded that the EMG2 Project is not at significant flood risk, subject to the recommended flood mitigation strategies being implemented, and that the EMG2 Project will not increase flood risk to the wider catchment area subject to suitable management of surface water runoff.

APPENDICES

Appendix 1: LLFA Correspondence

From: [redacted]
Sent: 04 April 2022 17:36
To: [redacted]
Subject: RE: 220500 EMG2 - Telephone call 31/03/22

Follow Up Flag: Follow up
Flag Status: Completed

This email originated from outside of our organisation. Please exercise caution with content, links and attachments.

Many thanks,

I've got back in touch with ARCADIS so you should hear something shortly. If not, please get in touch and I'm happy to raise this on your behalf.

Many thanks

[redacted]

From: [redacted]
Sent: 04 April 2022 17:28
To: [redacted]
Subject: RE: 220500 EMG2 - Telephone call 31/03/22

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

[redacted]

Further to your call, the statement below has been updated where highlighted.

Regards

[redacted]

From: [redacted]
Sent: 31 March 2022 16:49
To: [redacted]
Subject: RE: 220500 EMG2 - Telephone call 31/03/22

[redacted]

Thank you for the call today, it was very useful to talk things through. I have summarised our key discussion points below:

- A hydraulic model of the Diseworth Brook is available and you will ask Simon at Arcadis to contact me to provide a copy for our use.

- The Hall Brook flows down the western boundary of our site, but this is not the main source of flood risk to the village.

- Ideally you would like to see discharge rates from our site to the Hall Brook minimised as far as practicable, and you would not be against diverting all runoff from our site further to the east, bypassing the village entirely. The feasibility of this aspiration is subject to a number of assessments

and design stages, but is something that we are targeting. The discharge rate must not exceed the greenfield rate.

- The flood risk issues in Diseworth are to receive relief through property level protection and natural flood risk management. No flood alleviation options include this site.

- It will be necessary to provide a standoff from the watercourse top of bank to any development. The default in Leicestershire is a 5m standoff from top of bank. Consideration should be made on how the standoff will be accessed, to allow the ongoing maintenance of the watercourse by the riparian owner.

- Due to the proximity of the airport and the risk of bird strike, we will not be able to offer wetlands, basins, or ponds as surface water storage features. All surface water storage will need to be located underground.

- You are happy to be reconsulted and kept up to date with the development and drainage strategy as it progresses.

Thanks again for your time and your help.

Kind regards

[redacted]
Associate Director | Flood Risk & Water Environment | BWB Consulting Limited

[redacted]

From:
Sent: 22 March 2022 16:57
To: [redacted]>
Subject: 220500 EMG2 - Request for Information

[redacted]

I have been passed your details by my colleague Matthew Day who you have previously assisted on the Diseworth Brook.

We have been asked to start investigations at the second phase of the East Midlands Gateway development site, located next to East Midlands Airport and the village of Diseworth – a location plan is attached for reference. I understand that Leicestershire have a hydraulic model of the Diseworth Brook which would provide coverage of this site. Would it be possible to request a copy of the model?

The site itself appears to be at a low flood risk, but we are aware of the downstream issues in Diseworth and so we think it may be useful to obtain the model to help our assessment. It would also be useful to understand if there are any local requirements relating to drainage and/or flood risk for this site. I have also put in an enquiry to the general LLFA email address (see below).

Once we have collated the available data and appraised the baseline conditions at the site, we think it would be useful to have a meeting to discuss the future development and the approach to drainage. Would you be the best person to talk to about this, or would it be one of your colleagues?

Kind regards

[redacted]
Associate Director | Flood Risk & Water Environment | BWB Consulting Limited

[redacted]

From: [redacted]
Sent: 22 March 2022 16:38
To: [redacted]
Subject: 220500 EMG2 - Request for Information

Dear Sir, Madam

We are undertaking a study of flood risk within the vicinity of East Midlands Airport and the village of Diseworth in Leicestershire. A site location plan is attached.

To aid our assessment please could I also ask for any relevant information relating to Flood Risk that you may hold. A list of potential information is provided below:

- Hydraulic model data of the Diseworth Brook and the Hall Brook
- Any available data on historical flood events (photos, wrack marks, etc.)
- Any available hydrometric data of recorded flows or water levels within the area
- Details of any potential flood alleviation works that may be planned in the local catchment
- Details of any sensitive flooding receptors that may be present within the study area or on the downstream river channels.
- Monitoring records for the catchment.
- Water quality data for the catchment.
- Abstractions on the watercourses.
- Waterbody catchment objectives/mitigation measures for the catchment.
- All available WFD data including fish, macrophytes, invertebrates, water quality and hydromorphological data for the catchment.
- Details of any sensitive waterbody receptors that may be present in the local area or on the downstream river channels.

Please note that this list is not exhaustive, therefore please let us know of any other relevant information that we may need to consider.

Please let me know if you need any more information to help you answer this query.

Kind regards

[redacted]
Associate Director | Flood Risk & Water Environment | BWB Consulting Limited

[redacted]

Appendix 2: Diseworth Brook Catchment Hydraulic Modelling Report

ENVIRONMENT

SEGRO (Properties) Ltd
East Midlands Gateway Phase 2 (EMG2)
Hydraulic Model Summary Report

August 2025

Document Number:	EMG2-BWB-ZZ-XX-RP-YE-0002_HMR
BWB Reference:	220500_HMR

Revision	Date of Issue	Status	Author:	Checked:	Approved:
P01	14/01/25	S2	Craig Crowe BSc (Hons) MSc GradCIWEM	Robin Green BSc (Hons)	Robin Green BSc (Hons)
P02	01/08/25	S2	Craig Crowe BSc (Hons) MSc GradCIWEM	Robin Green BSc (Hons)	Matthew Bailey BSc (Hons)

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(ii) The date on which the final report is delivered

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All Environment Agency mapping data used under special license. Data is current as of August 2025 and is subject to change.

The information presented, and conclusions drawn, are based on statistical data and are for guidance purposes only. The study provides no guarantee against flooding of the study site or elsewhere, nor of the absolute accuracy of water levels, flow rates and associated probabilities.

1. INTRODUCTION

1.1 This report has been prepared to summarise a hydraulic modelling exercise undertaken to inform a Flood Risk Assessment (FRA) of the Main Site proposed second phase of the East Midlands Gateway Phase 2 (EMG2) DCO development – referred to as the study site within this report.

1.2 This report summarises the hydraulic model made available for this study by the Lead Local Flood Authority (LLFA), it details the updates made to the model to improve its representation at the study site, and it outlines how the proposed development has been represented within the model. The findings of the modelling exercise will be discussed within the overarching Flood Risk Assessment (FRA).

Situational Context

1.3 The study site is located to the west of Junction 23A of the M1, the A42, and Donnington Park Services. A location plan is included within **Figure 1.1**.

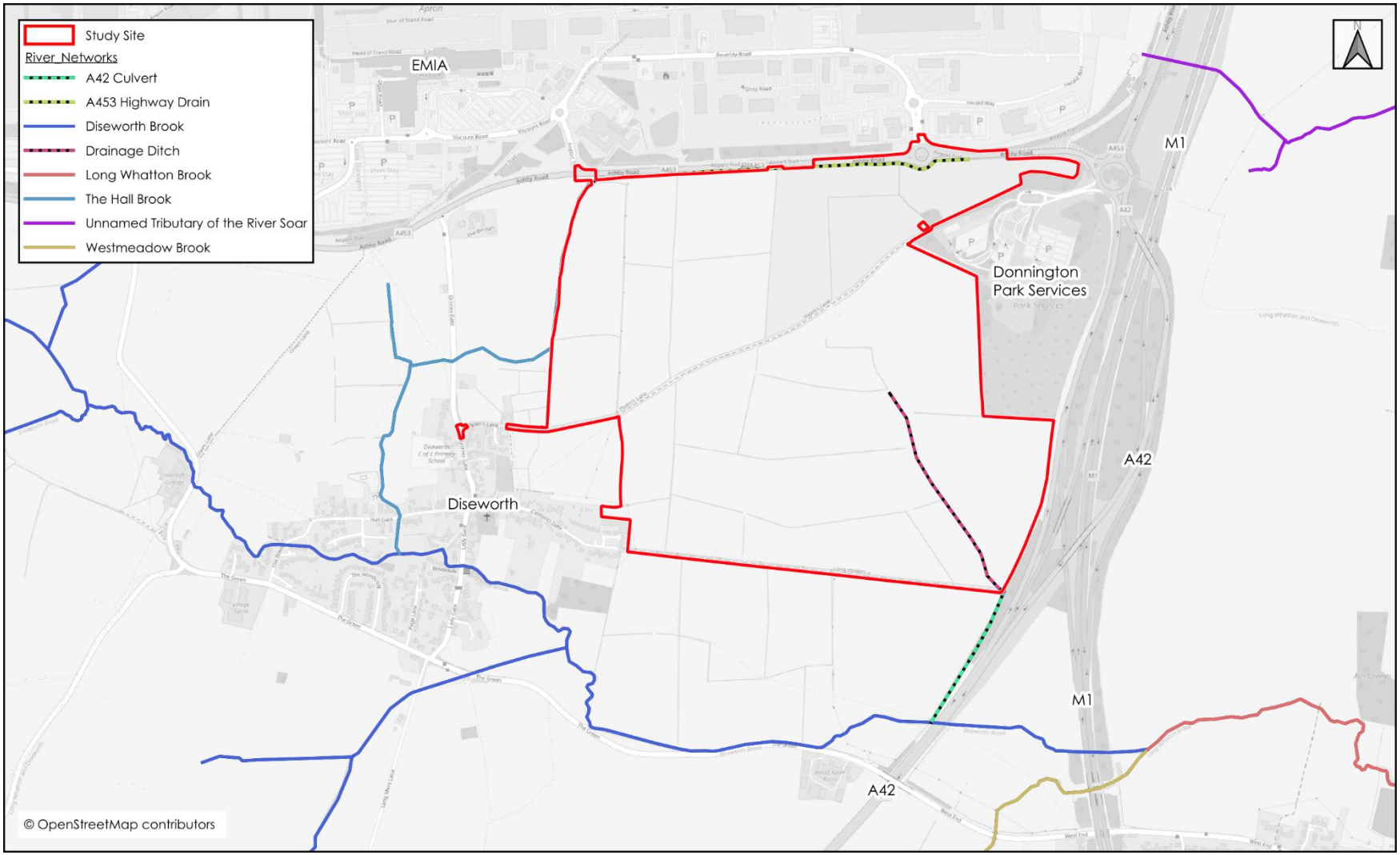


Figure 1.1: Site Location Plan

1.4 The A453 (Ashby Road) is located on the northern boundary, with the East Midlands International Airport (EMIA) and Phase 1 of the East Midlands Gateway development located beyond. The Hall Brook and agriculture fields/pasture are located on the study site's western boundary. The village of Diseworth is located off the south-western corner. An access track and footpath are located on the southern boundary with agriculture fields/pasture located beyond.

1.5 The study site is primarily comprised of agriculture fields and pasture. A public byway, known as Hyam's Lane, bisects the study site from south west to north east. There are several drainage channels present on the field boundaries which direct runoff from the land south of Hyam's Lane to a relatively short length of minor watercourse located in the south-eastern corner of the study site. This watercourse exits the study site via a piped connection (500mm diameter) which outfalls to larger pipe system (525mm to a 700mm diameter) which runs alongside the A42 and outfalls to the Diseworth Brook beneath the A42 road bridge. The on-site channels have been observed to be seasonally dry; therefore, their main purpose is likely to be limited to draining surface water runoff from the fields.

1.6 A public surface water sewer is also present in the east of the study site. This runs in parallel to piped watercourse between the Donnington Services and the Diseworth Brook, outfalling just upstream of the A42 culvert.

1.7 The Hall Brook, an ordinary watercourse, outfalls from the EMIA and flows alongside the western boundary of the study site for approximately 450m, before diverting to the west and then to the south to enter the village of Diseworth. The potential contributing flows from the airport to the Hall Brook are understood to be restricted and controlled by the airport's drainage systems. A maximum discharge rate of 1.50m^3/s is reported to occur in summer events[1]. In winter events the outflow is reportedly reduced due to pumping operations and increased storage times to aerate the surface water and remove pollutants. The remainder of the watercourse's catchment is predominately rural, and this includes a proportion of the study site roughly comprised of land located to the north of Hyam's Lane.

1.8 The Diseworth Brook, an ordinary watercourse, drains a largely rural catchment to the west of Diseworth. The brook flows from west to east through Diseworth, where it is joined by the Hall Brook. Downstream of Diseworth, the brook passes beneath the A42 and M1 road embankments where it joins the Long Whatton Brook. The Long Whatton Brook continues to flow towards the east where it joins the River Soar.

1.9 The nearest main river to the site is the River Soar, which is located approximately 2.5km to the east. The entire study site is located within Flood Zone 1 according to the EA Flood Map for Planning, which is defined as land at a low probability of flooding from rivers or seas.

[1] URS, 2014. Diseworth and Long Whatton Catchment Study. Leicestershire County Council

Available Data

1.10 The Environment Agency (EA) have confirmed that they hold no relevant flood data or hydraulic model in the area.

1.11 Leicestershire County Council (LCC) LLFA were able to provide a copy of their integrated Diseworth and Long Whatton catchment hydraulic model to inform this assessment.

2. THE DISEWORTH AND LONG WHATTON MODEL OVERVIEW

2.1 It is reported that in 2020 Arcadis Consulting (UK) Limited were commissioned by LCC to evaluate the flood mechanisms throughout the Diseworth and Long Whatton catchment, which included assessment of the EMIA surface water management system. This study included the development of a detailed 1D-2D hydraulic model of the catchment to provide enhanced resolution and confidence in the prediction of flood depths, extents, and mechanisms. LCC have provided a copy of the 2020 model for use in this assessment.

2.2 The model is provided within InfoWorks ICM (Integrated Catchment Modelling) software. This is able to represent fluvial system, overland flows, and subsurface drainage networks within a fully integrated 1D-2D environment.

2.3 A summary of the modelling approach is provided within the forthcoming section. Full details are available in the Arcadis 2020 modelling report[2].

Overview of the Model Hydrology

2.4 The model uses a combination of inflow hydrographs to account for the runoff entering the model domain from the Westmeadow Brook catchment, and the direct application of rainfall on to the Diseworth and Long Whatton catchments (i.e.: the 1D-2D model domain). The differing hydrological approaches in the catchments are illustrated within **Figure 2.1**.

2.5 This Westmeadow Brook is a tributary of the Long Whatton Brook and this catchment is omitted from the 1D-2D model domain. It is reported that the Westmeadow Brook inflow hydrographs were derived from a standalone 2D direct rainfall model, as this was found to be more conservative than hydrographs generated by the Revitalised Flood hydrograph hydrological rainfall-runoff model (ReFH2).

2.6 The direct rainfall profiles are applied to the 1D-2D model domain, including the EMIA drainage sub-catchments. Storm profiles were derived from Flood Estimation Handbook (FEH) design profiles. It is reported that an analysis of critical duration was undertaken for storm events between 60 and 2880 minutes, and that the 60-minute summer storm was found to represent the greatest flood risk within the catchment. This duration was verified against observed historical events in the catchment, and subsequently adopted as the critical duration for the hydrological events.

2.7 The model includes hydrological boundaries for the following return period storm events: 1 in 5, 1 in 20, 1 in 50, 1 in 75, and 1 in 100-year.

[2] https://www.lwdpc.org.uk/uploads/long-whatton-diseworth-flood-risk-mitigation-resilience-report-final.pdf

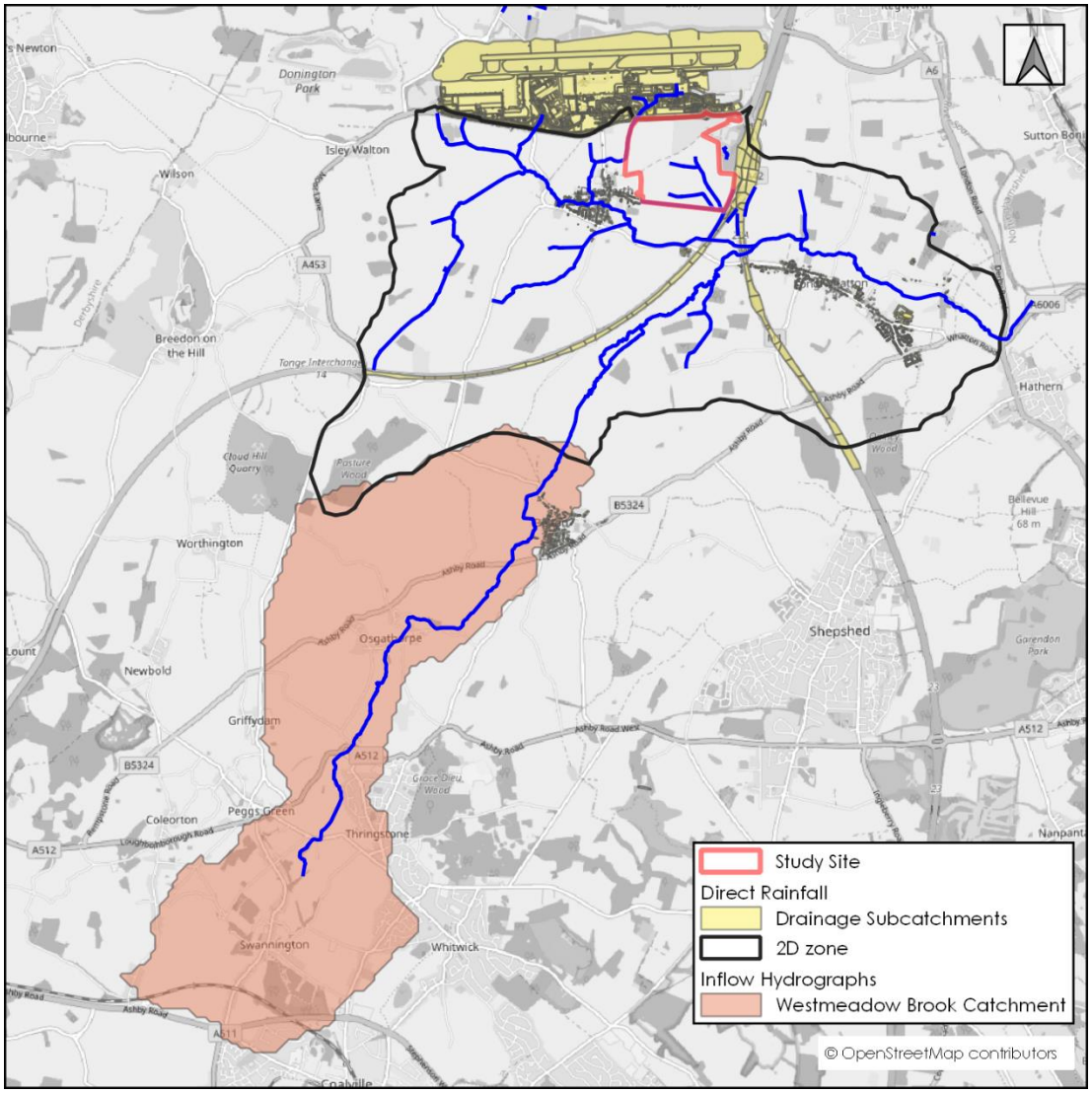


Figure 2.1: Hydrological Approaches

Overview of Hydraulic Model Geometry

2.8 It is reported that a watercourse survey was undertaken in 2018 to inform the hydraulic model. This included sections through the primary channels and details of the on-line hydraulic structures. This allowed the construction of a detailed 1D model environment. Minor channels were modelled within the 2D environment using 'mesh zones' to enhance their topographical detail where necessary.

2.9 Public sewers based upon data provided by Severn Trent Water (STW), including surface water and combined systems, are represented in the model. Building outlines from Ordnance Survey (OS) MasterMap data form sub-catchments which allocate property roof runoff and foul water flow from the household to the appropriate sewer networks.

2.10 A representation of the road drainage system (excluding the M1 and A42) is also included, based on gully data location information provided by LCC.

2.11 It is reported that no engineering drawings of the M1 and A42 were available. Therefore, the associated drainage is represented using sub-catchments based upon the carriageway gradients.

2.12 The surface water drainage network for the EMIA is included in the model. This reportedly based upon engineering drawings provided by EMIA.

2.13 The 2D topographical elevations are informed by LiDAR Digital Terrain Model (DTM) data flown in 2018. OS MasterMap data is used to define land type, infiltration rates, roughness and topographical detail.

Modelled Representation at the Study Site

2.14 The study site is located entirely within the 2D direct rainfall model domain, this is illustrated within **Figure 2.2**. Therefore, the potential flood risk from the surface water runoff can be fully assessed.

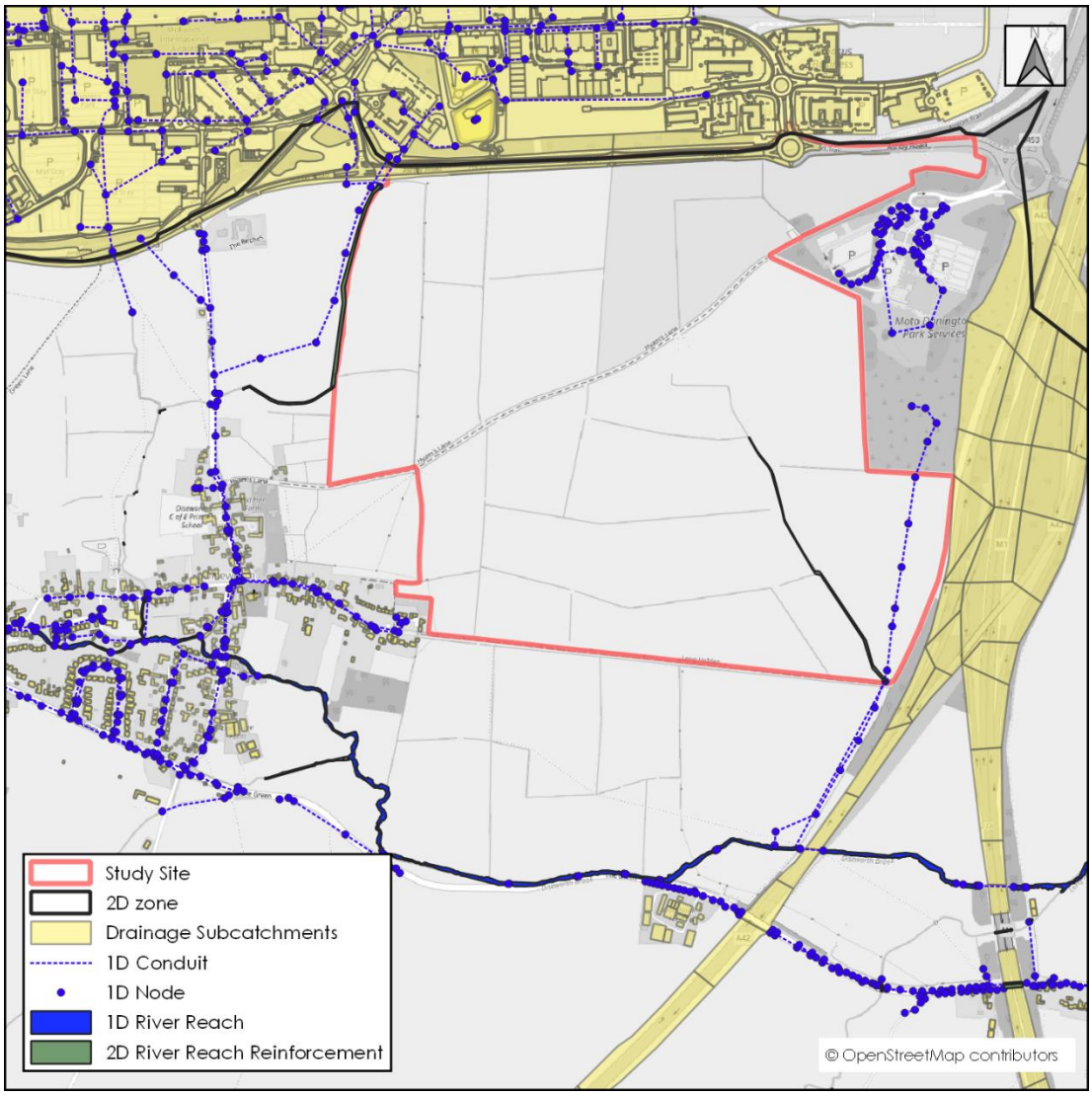


Figure 2.2: Hydraulic Model at the Study Site

2.15 The minor channels around the study site are captured in the 2D mesh, but a number of culverts and boundary ditches are omitted. The representation of the site in the model could be improved through the addition of these site-specific details.

2.16 The Hall Brook and the outfall from the EIMA on the western boundary are included in the model, allowing these potential sources of flood risk to be assessed.

2.17 The drainage networks from the adjacent Donnington Park services, and the public sewer and piped watercourse connection to the Diseworth Brook on the eastern boundary are represented in the model. However, the public sewer and pipe data is understood to be largely interpolated in this location. Model accuracy could be improved through detailed survey of these features.

2.18 There is shown to be no significant overland flows or flooding entering the study site from outside sources.

2.19 The downstream model boundary is located approximately 4.3km downstream of the study site, and 5.3km downstream of Diseworth. This is significantly removed from the area of interest and given the influence of the intervening hydraulic structures (A42 and M1), it gives confidence that the model results will not be influenced significantly by the downstream boundary.

2.20 Upon review, the model is considered suitable for use in this assessment. However, the following items will be updated using the available surveys:

- representation of the on-site ditches and culverts - using the topographical survey of the site
- the public sewer on the eastern site boundary – using CCTV survey
- the piped watercourse connection to the Diseworth Brook on the eastern boundary – using CCTV survey
- Creation of 1 in 100-year +25% and +40% climate change storm hydrological boundaries.
- Creation of a 1 in 100-year +60% fluvial inflow for the Weastmeadow Brook.

3. SITE-SPECIFIC UPDATES MADE TO THE HYDRAULIC MODEL

Hydrology

3.1 The hydrological approach has been retained from the model as provided with the exception of the below:

- Derision of a 1 in 100-year +60% climate change fluvial inflow was derived from the 1 in 100-year hydrograph for comparison against the 1 in 100-yeat +40% rainfall event.

3.2 As discussed, previous analysis work undertaken by Arcadis Consulting (UK) Limited identified that the 60-minute storm was the critical event in the wider catchment. To verify that the 60-minute storm is also critical for the study site, a series of 1 in 100-year storm events were simulated, at 60, 120, 180, 360-minute durations, under winter and summer conditions. Peak flood depths in and around the study site are compared within **Table 3.1**, with interrogation locations illustrated within **Figure 3.1**.

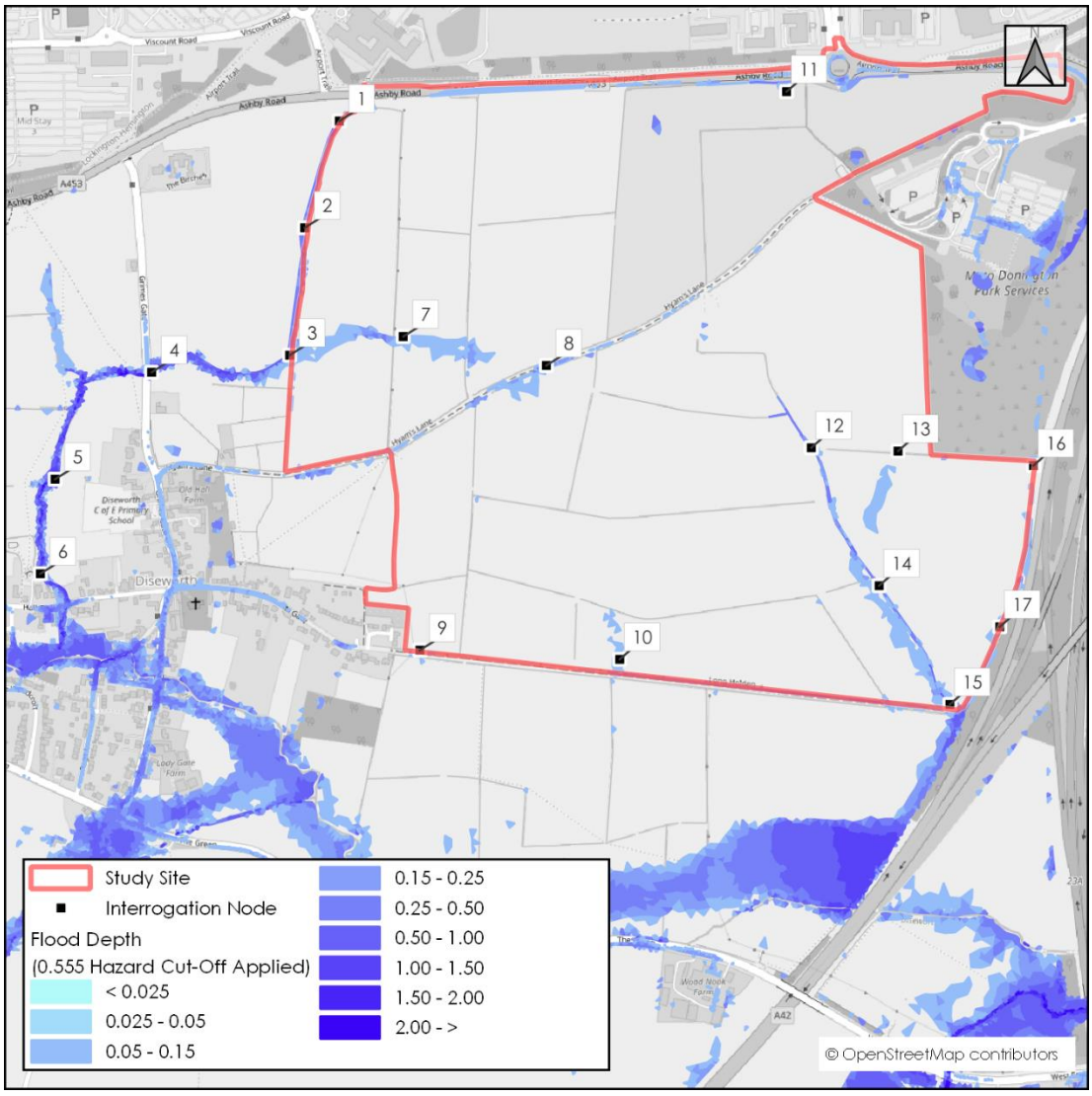


Figure 3.1: **Storm Duration & Seasonality Sensitivity Tests - Node Locations**

Table 3.1: Storm Duration & Seasonality Sensitivity Tests – Depth Comparison

ID	1 in 100-year return Period Storm | Peak Flood Depths (m)							
	60-min		120-min		180-min		360-min	
	winter	summer	winter	summer	winter	summer	winter	summer
1	0.88	0.90	0.82	0.86	0.82	0.83	0.84	0.83
2	0.21	0.23	0.17	0.20	0.16	0.17	0.16	0.16
3	0.65	0.67	0.55	0.60	0.49	0.54	0.34	0.40
4	2.24	2.27	0.37	1.96	0.31	0.36	0.21	0.24
5	2.06	2.08	1.89	1.95	1.78	1.87	1.59	1.67
6	1.62	1.64	1.44	1.51	1.29	1.41	1.02	1.12
7	0.20	0.20	0.16	0.17	0.13	0.15	0.07	0.10
8	0.10	0.11	0.07	0.08	0.05	0.07	-	-
9	0.04	0.05	0.03	0.04	-	0.03	-	-
10	0.06	0.07	0.04	0.05	0.04	0.04	-	-
11	0.03	0.04	-	0.03	-	-	-	-
12	0.42	0.45	0.32	0.37	0.26	0.31	0.11	0.18
13	0.04	0.05	0.03	0.04	0.03	0.03	-	-
14	0.20	0.21	0.14	0.17	0.11	0.14	0.05	0.08
15	1.03	1.04	0.95	0.98	0.89	0.94	0.58	0.81
16	0.05	0.06	0.04	0.04	0.04	0.04	0.03	0.03
17	0.07	0.07	0.05	0.06	0.04	0.05	-	0.03

3.3 This comparison confirms that the 60-minute summer storm is the critical event for the study site, correlating with the previous Arcadis study's conclusion. Therefore, this season and duration were adopted in all further analysis.

3.4 To inform the assessment for future climate change new hydrological storm events were created by applying 25% and 40% uplifts to the 1 in 100-year storm profile. Typically, only a 25% uplift would need to be considered for a less vulnerable development in this location. However, given the permanent changes that the development will make to the topography in the site, it was also considered appropriate to assess a more precautionary allowance.

Rainfall Version

3.5 Leicestershire's adopted ICM model uses storm profiles derived from the FEH99 dataset, whereas the latest available dataset is FEH22. A comparison of the design storm depths at the 60 minute critical duration event can be made between the two datasets in **Figure 3.2** and **Figure 3.3**. This shows that FEH22 generates greater flood depths at events up to a 1 in 50-year storm, but that FEH99 generates greater depths at events in larger events. While FEH22 is based on a much larger record of real-world rainfall data and is the more reliable dataset, as the FEH99 data returns a more precautionary result at the larger events, and specifically the design storm (see **Figure 3.4**), it has been retained for the purpose of this study.

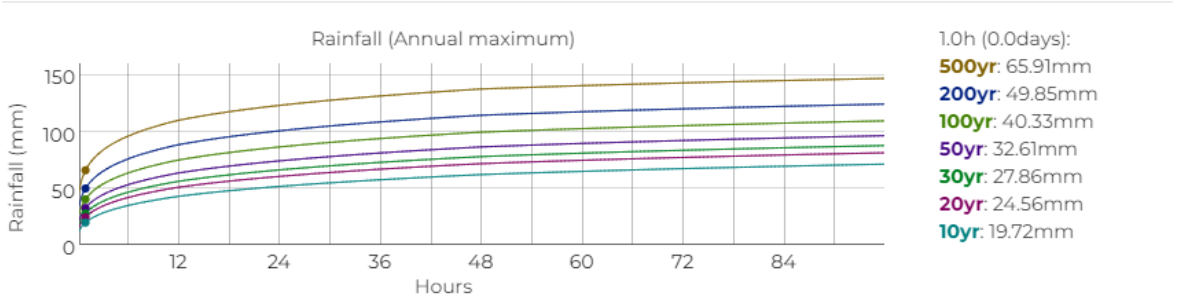


Figure 3.2: FEH99 Rainfall Data

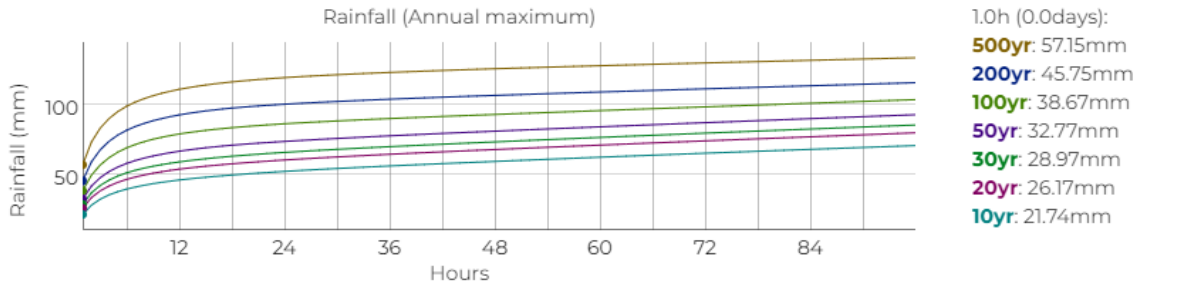


Figure 3.3: FEH22 Rainfall Data

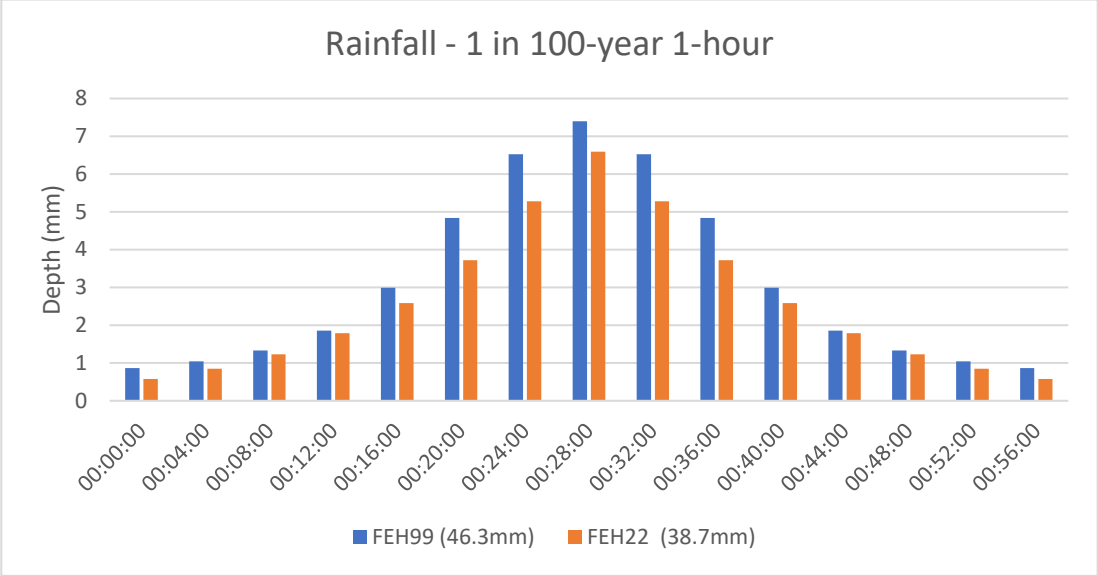


Figure 3.4: FEH99 & FEH22 1 in 100-year 1-hour storm comparison

Hydraulic Model Geometry

3.6 To improve the accuracy of the hydraulic model within the study site a number of alterations were made which are summarised below and illustrated within **Figure 3.5**. These were made using data extracted from a site-specific topographical survey (ref: 34529A_T_REV1) and a CCTV survey of the local drainage infrastructure (ref: 34529A_CCTV_REV1).

- The minor ditches/watercourses in the south of study site were reinforced using mesh level zones derived from surveyed channel invert levels, and break lines to reinforce the surveyed bank levels.
- On-site culverts were added to the model from the topographical survey. Roughness values have been applied using a Manning's 'n' value of 0.015 to represent concrete structures.
- The alignment, manhole locations, pipe sizes, and inverts of the public surface water sewer in the east (running between the Donnington Services and the Diseworth Brook) were corrected.
- The alignment, manhole locations, pipe sizes, and inverts of the piped watercourse running between the on-site minor watercourse and the Diseworth Brook was corrected.

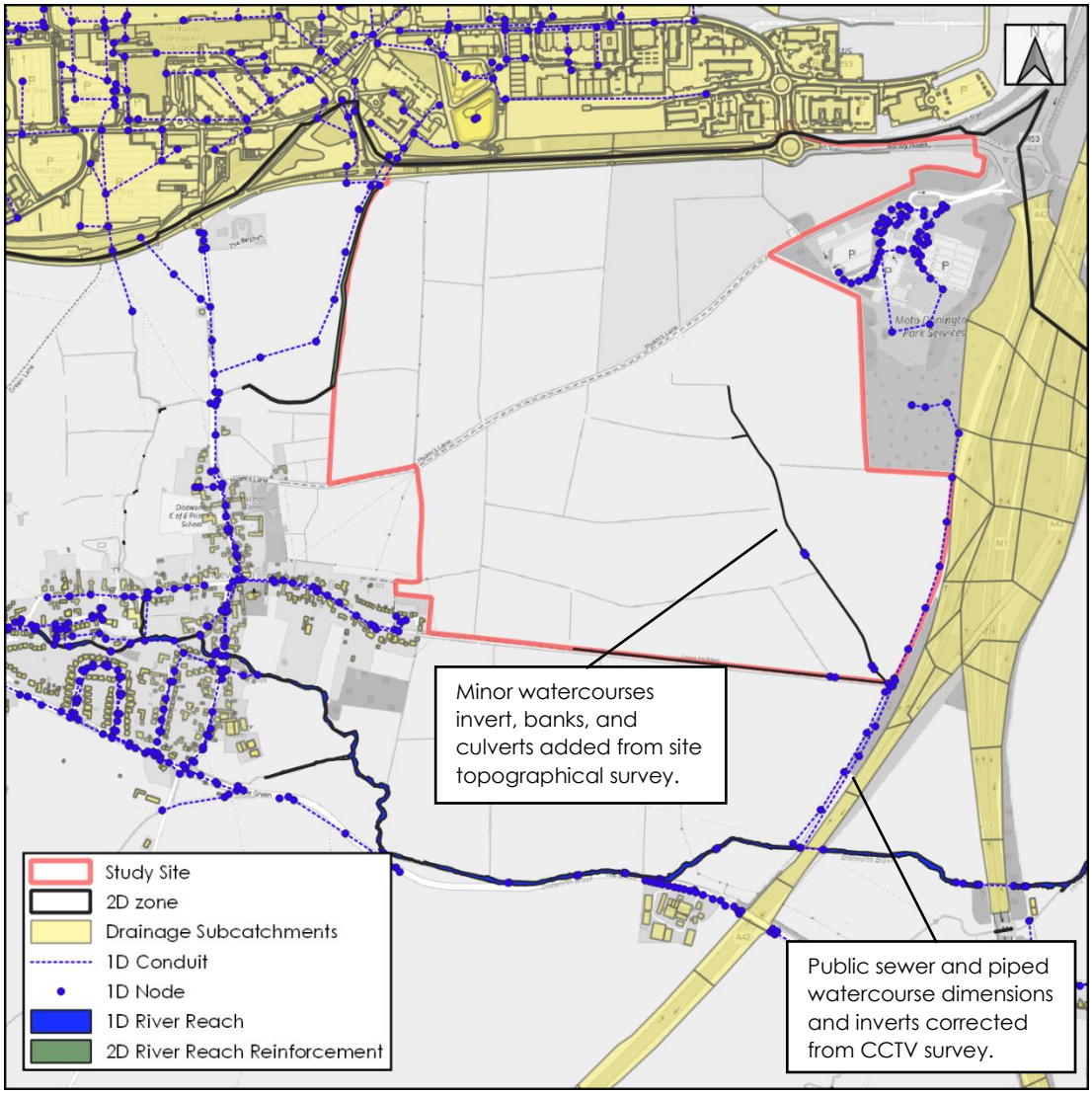


Figure 3.5: BWB Site-Specific Alterations

3.7 Additionally, it was necessary to make some minor schematisation corrections in the wider model. While these are removed from the study site, and do not influence the results at the study site, the updates were necessary to allow the model geometry to be validated in the latest version of the software and a series of stable simulation to be performed. The amendments included:

- Minor re-schematisation at the M1 culvert inlet on the Diseworth Brook (reach SK46238904.1& SK46238901.1), as follows: void polygon amended to allow the river reach to be connected to the 2D mesh. Polygons derived from OS mapping amended to be aligned with river reach and to prevent overly small triangles. Section line remade to remove Manning's n of 0.0001, and better reflect in channel conditions.
- Roughness zone MM17095! (Diseworth Brook channel between the A42 and the M1) increased from 0.0001 to 0.035 to better reflect the channel roughness.

- Reach SK45243402.1 (between Diseworth and the A42) re-schematised to improve stability, as follows: roughness zone value increased from 0.0001 to 0.035; section 5767 extended 3m over left bank using LiDAR; section 5688 extended 1m over both banks using LiDAR; section 5566 extended 4m over left bank using LiDAR; section 5174 extended 2m over left bank using LiDAR; connecting banks redrawn to follow top of bank as shown on LiDAR rather than OS MasterMap.
- Reach SK44245701.1 (upstream of Diseworth) re-schematised to improve stability, as follows: river channel roughness zone amended from 0.0001 to 0.035; section 6992 extended a total of 8m over both banks using LiDAR; section 6883 extended a total of 5m over both banks using LiDAR; bank lines amended to avoid low lying areas as it previously followed the channel bed in places. Inline bank in this location has been brought in line with the amended cross section to allow a smoother transition between the 1D and 2D domains in this area.
- Reach SK44247408.1 (upstream of Diseworth) schematisation corrected, as follows: sections 6574-6468, 6574 extended over RB; and bank position amended to follow top of bank. Previously the river reach cut a meander in the channel.
- MM17323! & MM17336! mesh zones - lower limit set to 56.2mAOD to capture Lady Gate bridge deck.
- Reaches SK44249401.1, SK44246602.1, SK45240403.1, SK44249404.1 (within Diseworth) amended to follow river banks as shown in LiDAR rather than OS MasterMap data. Roughness zone updated from 0.0001 to 0.035 to better reflect the channel conditions.
- Pipe SK46244001!.1 (surface water sewer outfall to the Diseworth Brook) connected to nearest 1D node rather than outfalling to the 2D domain next to river.
- Bank lines and river reach boundaries regenerated to link with 2020 LiDAR mesh.
- Terrain sensitive meshing was enabled to increase the resolution of the mesh in areas that have a large variation in height, without increasing the number of elements in relatively flat areas.
- The original LiDAR DTM was not supplied with the hydraulic model, so the latest composite dataset (2020) was downloaded from the EA. This was used when re-generating the 2D mesh.

3.8 The majority of the model was left unchanged from the data received from the LLFA.

4. MODEL STABILITY & LIMITATIONS

Stability

4.1 All simulations reported no significant loss of volume, and a review of flow and stage hydrographs did not identify any significant fluctuations or unrealistic flow patterns that could affect the assessment of flood risk at the study site.

4.2 The original model included two errors, and a number of warnings. Following the minor amendments, the model reported zero errors and a reduced number of warnings.

4.3 The majority of the warnings are associated with insignificant aspects of the modelling software. For example, a large proportion relate to result interrogation points falling outside of the model domain - these will not affect the results.

4.4 The remaining warnings generally relate to the sub-surface drainage network in the wider model, such as where the interpolated pipe soffit exceeds ground level, or similar. This is symptom and limitation of the quality of the public sewer datasets used in the wider catchment. As previously reported, the pipe network in and around the study site has been updated from a CCTV survey to ensure that the results at the study site are reliable.

Limitations

4.5 The following limitations have been identified in the original Arcadis model report; these will not affect the assessment of flood risk at the study site:

i. All property roofs in Long Whatton and Diseworth have been assumed to be connected to the nearby appropriate system.

ii. M1 and A42 drainage connections have been assumed – All paved areas and cutting slopes have been assumed to effectively drain to the relevant watercourse / land drainage channel. This is considered a conservative approach.

iii. The highway drainage system in Long Whatton and Diseworth has been based on manually digitised locations and interpolated connectivity. Some gullies may have been omitted, reducing the capacity to discharge surface water into the public sewers. Any restrictions due to hydraulic capacity or blockages within the connecting lateral pipes (i.e.: between the gullies and public sewers) are omitted.

iv. Sedimentation within most pipes has been assumed based on gradient and pipe diameter, to ensure a conservative representation of likely capacity. Sediment has been included in all pipes with a gradient less than 1 in 100, scaled up to 20% of pipe height for pipes with a gradient of 1 in 10 or higher.

v. It has been assumed that design rainfall falls consistently over the entire catchment.

vi. 1D sub catchments have been used to represent runoff from the M1/A42 and EMIA instead of the 2D Mesh.

vii. The runoff model roughness and infiltration rates are simplified and based on the downstream catchment characteristics.

4.6 Additionally, the following limitations have been observed by BWB in the review of the model:

viii. Model represents channel conditions at the time of survey (2018). The modelling exercise has made use of the available data at the time of construction and simulation.

ix. A 2020 LiDAR DTM was used for the model topography which was current at the time of undertaking the model updates.

x. No hydrometric data or recorded flood levels were available to allow for a detailed calibration exercise. However, the flood predictions have been verified within Diseworth and Long Whatton against observed events.

xi. The out of bank topography has derived from LiDAR which has limited accuracy (+/- 0.15m). However, this is considered to be sufficient for the purpose of this exercise.

xii. The bare earth DTM does not include for the presence of minor walls or other structures. Buildings have been modelled with a 150mm uplift and highways have been lowered by 100mm to better represent these potential barriers / conveyance routes.

xiii. A cut-off to the result data has been applied to remove very shallow and slow-moving water and highlight overland flow routes.

xiv. While the peak river flow and peak rainfall climate change allowances are not directly comparable with respect to their percentages they are considered to be directly related with respect to the appropriate epoch as stipulated by the EA's climate change guidance for peak river flow[3] and peak rainfall[4].

[3] https://environment.data.gov.uk/hydrology/climate-change-allowances/river-flow
[4] https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall

5. BASELINE HYDRAULIC MODEL RESULTS

5.1 For the purpose of informing the Flood Risk Assessment, the following return period events were performed using a 60-minute summer storm event:

- 1 in 5-year (20% Annual Exceedance Probability (AEP))
- 1 in 20-Year (5.0% AEP)
- 1 in 100-Year (1.0% AEP)
- 1 in 100-Year (1.0% AEP) +25% Rainfall & 28% Fluvial Climate Change Allowance
- 1 in 100-Year (1.0% AEP) +40% Rainfall & 60% Fluvial Climate Change Allowance

5.2 It was not considered necessary to simulate any additional events below the 1 in 100-year storm due to the very limited flooding predicted in and around the study site.

5.3 Due to the nature of direct rainfall modelling the entire model domain will appear as 'wet' during a simulation. Therefore, it is necessary to apply a cut-off to the data to identify key areas of flooding and overland flow routes. In the national Risk of Flooding from Surface Water (RoFSW) mapping, the EA adopt a cut-off based upon a hazard rating, where data below a hazard value of 0.575 are removed. For the purpose of this assessment a lower value of 0.555 has been applied to the model results to remove very shallow and slow-moving water.

5.4 Modelled outlines are presented within **Figure 5.1** for reference. Peak depths and the flood hazard ratings have been mapped and are appended to the FRA.

5.5 The hydraulic modelling has shown that the Hall Brook floodplain is contained to its channel next to the study site, confirming that the study site is at a low fluvial flood risk. Additionally, the local sewer network and the EMIA drainage does not affect the study site.

5.6 The modelling identifies that in the 1 in 100-year event and above, there is the potential for surface water overland flow pathways to form over the study site. However, these are relatively shallow and of a low flood hazard. For example, at the design event (the 1 in 100-year +40% event) the overland flows are generally between 0.03 to 0.15m deep. Greater depths and hazards only occur within low-lying areas such as the drainage channels and minor watercourse. Importantly, the overland flow pathways are shown to predominately originate from within the site itself. There are no significant overland flow pathways passing through the site from upstream third-party land.

5.7 The findings of the modelling are discussed within the FRA.

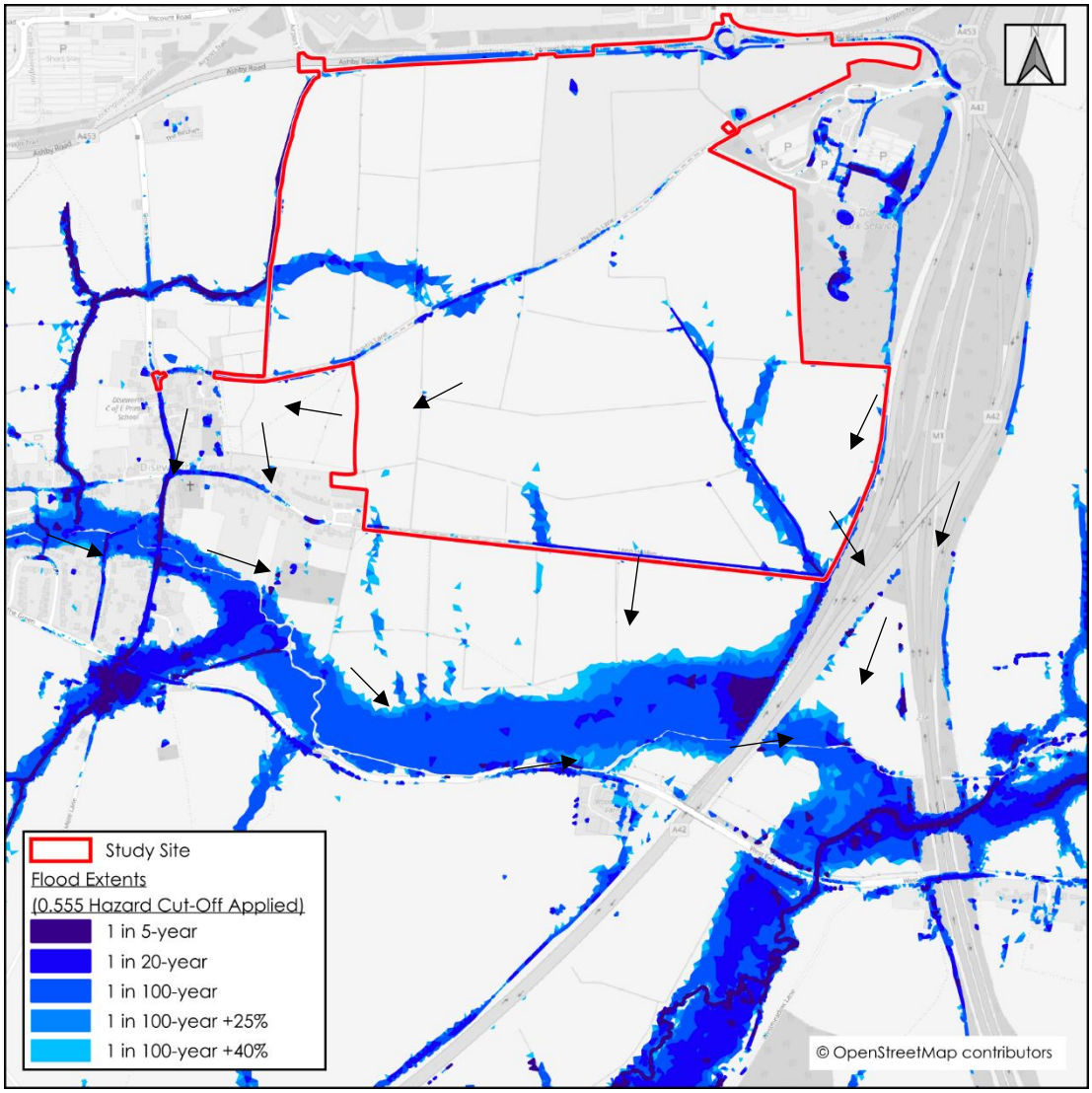


Figure 5.1: Baseline Modelled Flood Outlines

6. ASSESSING THE IMPACT OF THE PROPOSED DEVELOPMENT

Philosophy

6.1 The proposed development aims to address the minor flood risk posed by the shallow surface water overland flows routes that can occur in the baseline conditions through the implementation of a surface water drainage strategy. The drainage strategy will be designed to intercept and store rainwater falling on the development before releasing it to the downstream watercourse.

6.2 In addition to managing the minor flood risk present in the site, the drainage strategy will include an attenuated surface water discharge rate, limiting the discharge rate from the development to the annual average runoff rate (QBAR). Under typical rainfall events this will mimic the existing runoff rate, but in larger storm events this will represent a reduction, thereby offering downstream betterment.

6.3 The excess surface water runoff will be stored within a combination of on-plot below ground storage tanks and above ground SuDS features that will be designed to accommodate the 1 in 100-year storm with a 25% uplift to reflect future climate change. The larger 1 in 100-year +40% climate change storm event will be contained within the freeboard of the surface water storage components. As a precautionary approach, the impact of the development up to the 1 in 100-year +40% storm has been assessed within this study.

6.4 Additionally, the drainage strategy seeks to direct all surface water runoff from the development to the minor watercourse in the southern-eastern corner of the site, thus reducing the volume and rate of surface water runoff directed towards the Hall Brook and the existing downstream flood risk issues in Diseworth.

Hydraulic Model Representation

6.5 To represent the influence of the proposed drainage strategy for the purpose of assessing the developments impact on off-site flood risk, the development's drainage sub-catchment was added to the hydraulic model. Rain falling on this area was replaced with a constant outflow to the A42 culvert in the south-east of the study site. The flow rate discharging from the sub-catchment was set to the equivalent QBAR 114.3l/s. This is illustrated within **Figure 6.1**.

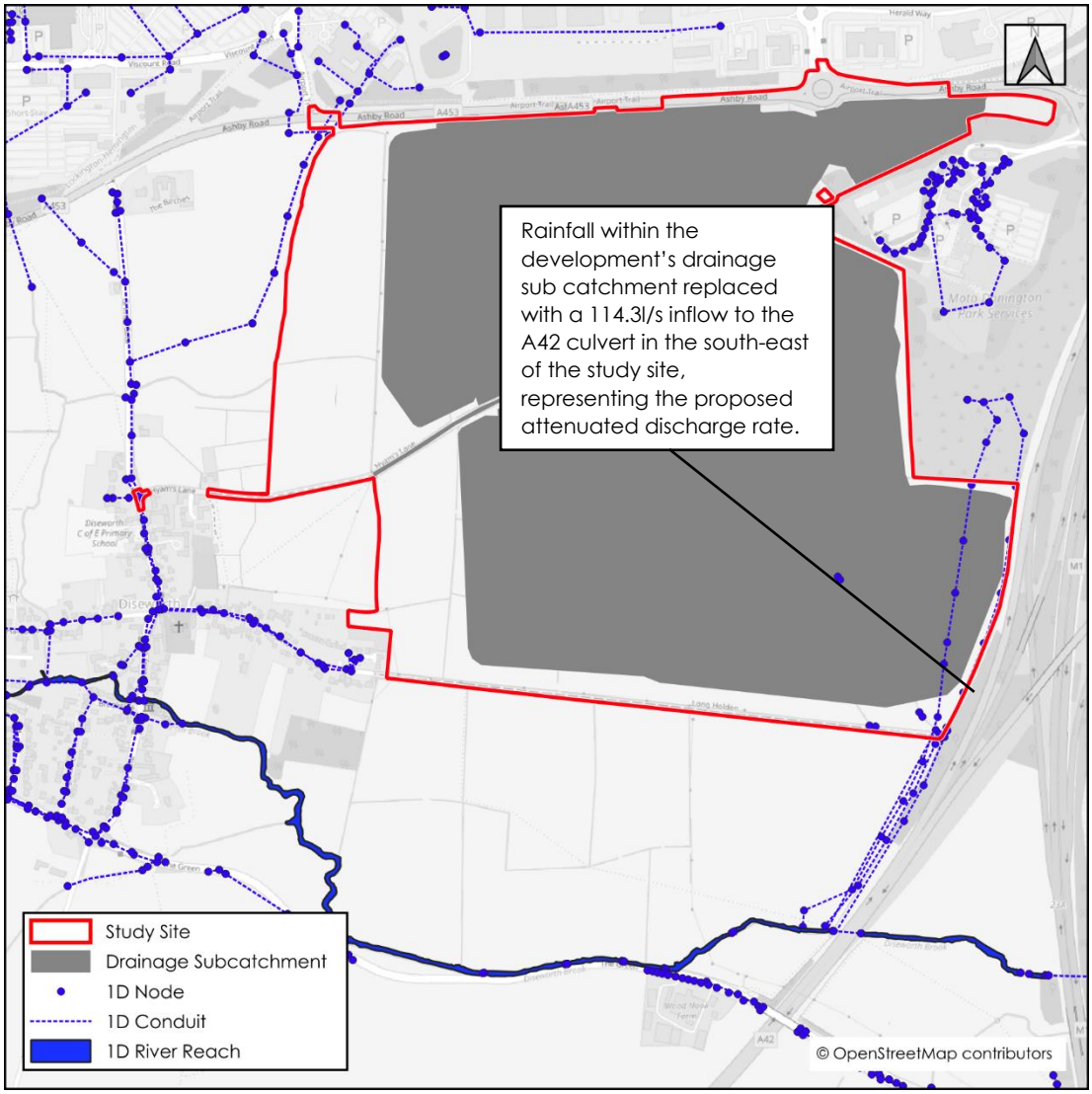


Figure 6.1: Model Modifications to Represent Proposed Development Drainage

Hydraulic Model Results

6.6 For the purpose of informing the FRA, the following return period events were performed using a 60-minute summer storm event:

- 1 in 5-year (20% Annual Exceedance Probability (AEP))
- 1 in 20-Year (5.0% AEP)
- 1 in 100-Year (1.0% AEP)
- 1 in 100-Year (1.0% AEP) +25% Rainfall & 28% Fluvial Climate Change Allowance
- 1 in 100-Year (1.0% AEP) +40% Rainfall & 60% Fluvial Climate Change Allowance

6.7 Modelled outlines are presented within **Figure 6.2** for reference.

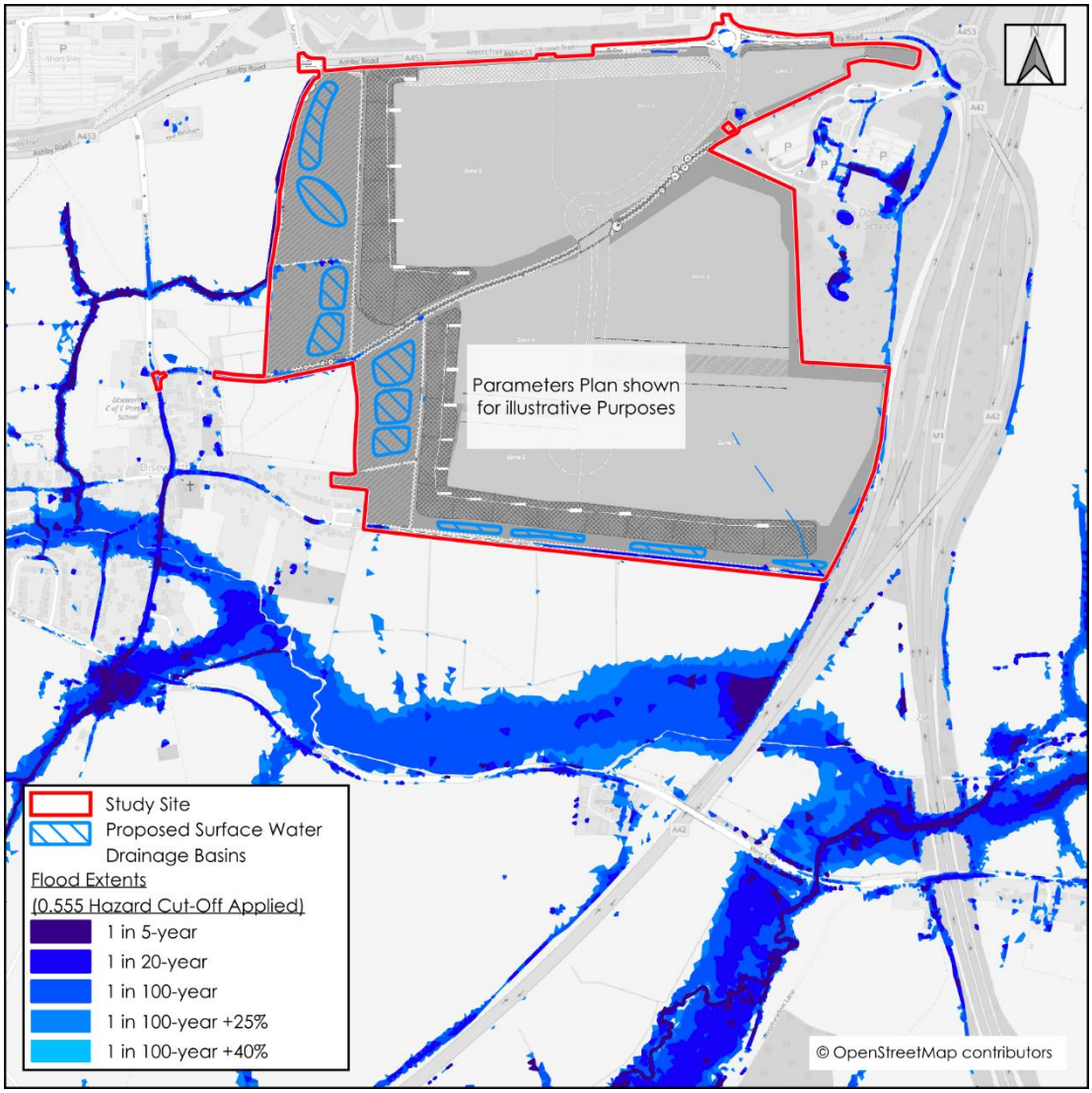


Figure 6.2: Post-Development Illustrative Modelled Outlines

6.8 Peak flood depths were compared against the equivalent baseline scenario to identify changes to flood risk outside of the development area. This analysis has been mapped and is appended to the FRA, where the findings are also discussed in detail. For ease of reference and as an example, the analysis from the return periods outlined above are included in **Figure 6.3** to **Figure 6.7**.

6.9 The analysis identifies that the development will offer a marginal reduction downstream flood risk. This is most evident on the Hall Brook through Diseworth because runoff from the development area is now directed away from the Hall Brook, and into the Diseworth Brook upstream of the A42 embankment because surface water runoff from the development area is now limited to QBAR. This is illustrative of the impacts at all of the modelled events, although the magnitude of the betterment reduces at lesser storm events.

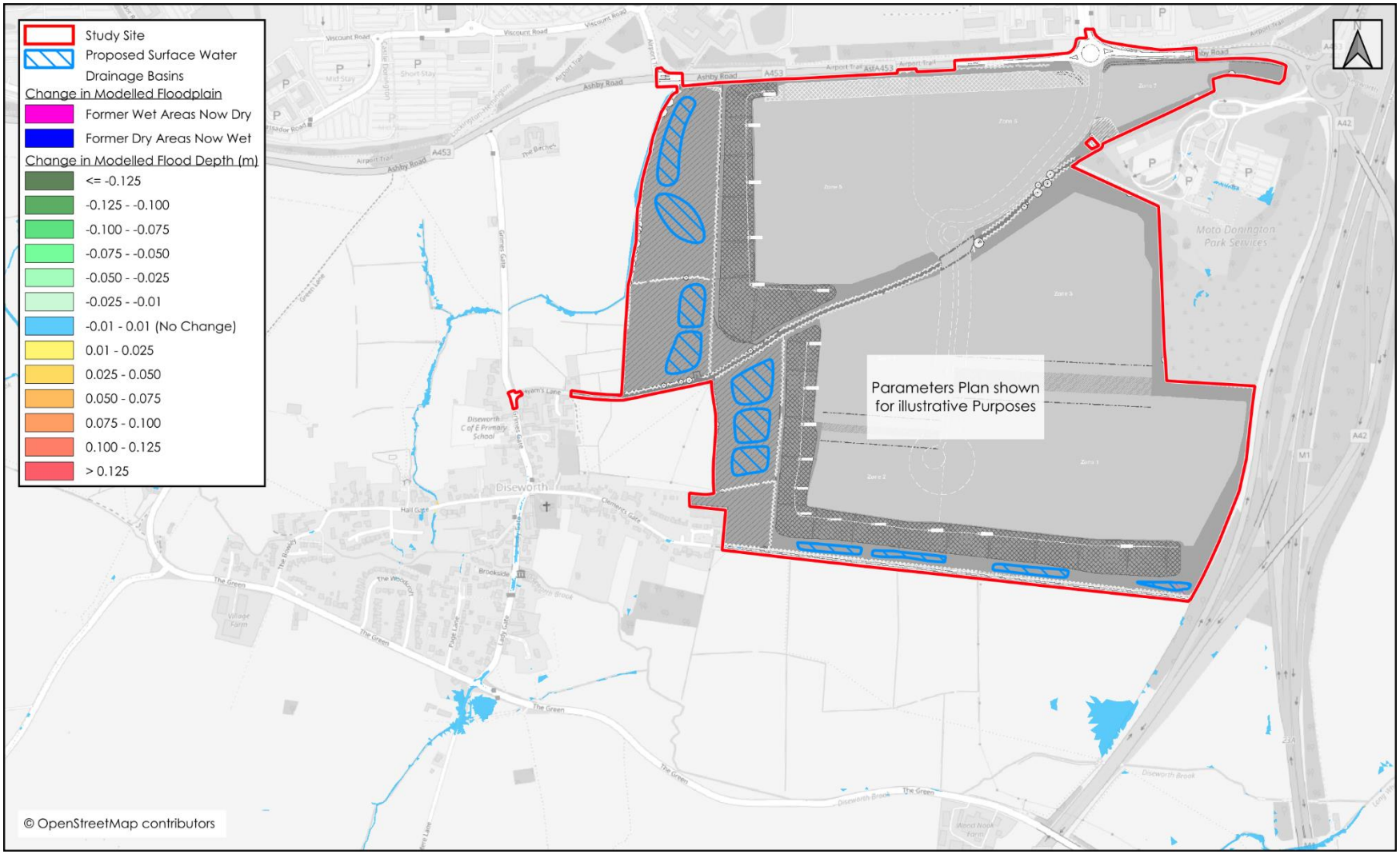


Figure 6.3: Change in Flood Depths Due to Development | 1 in 5-year Storm Event

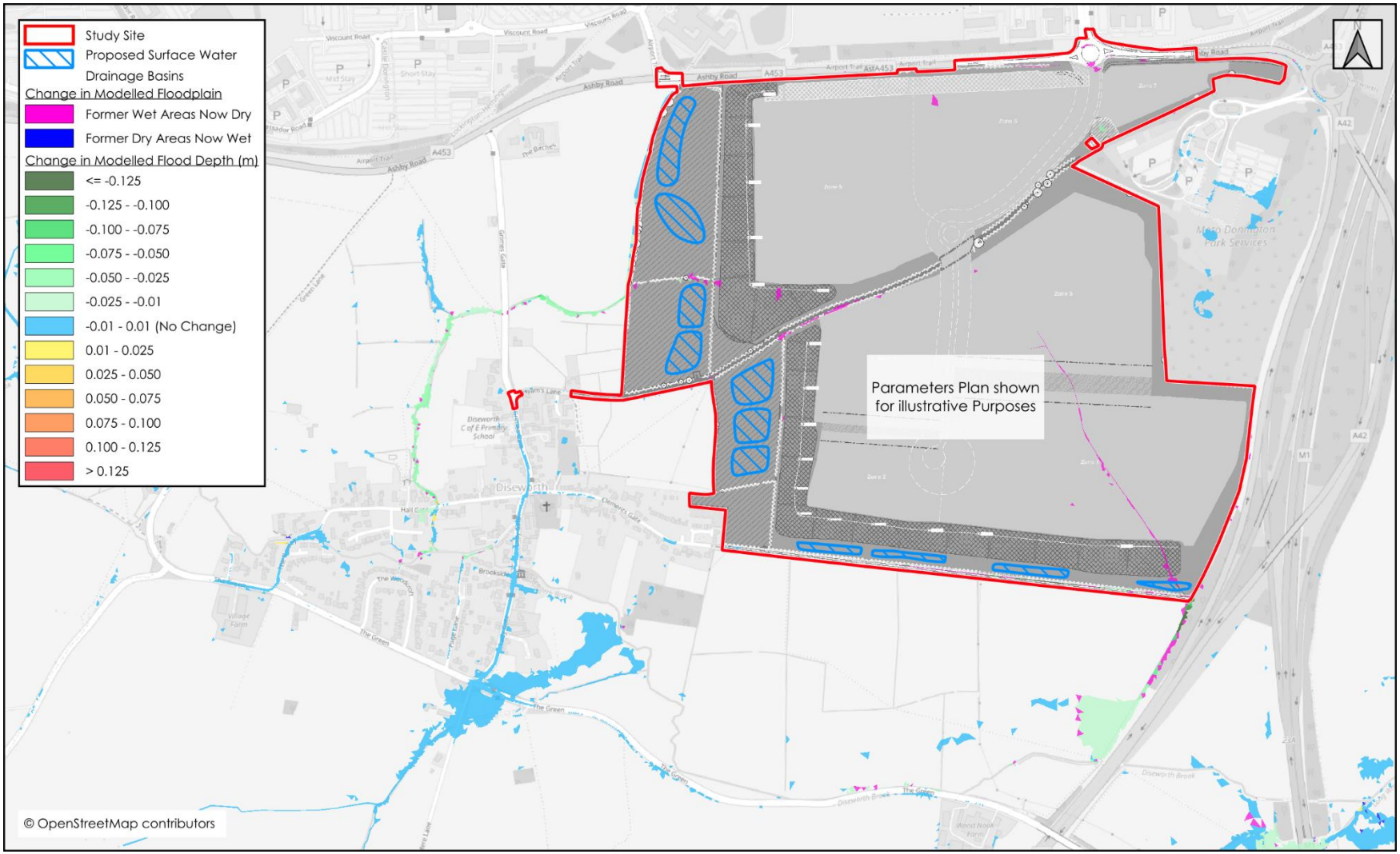


Figure 6.4: Change in Flood Depths Due to Development | 1 in 20-year Storm Event

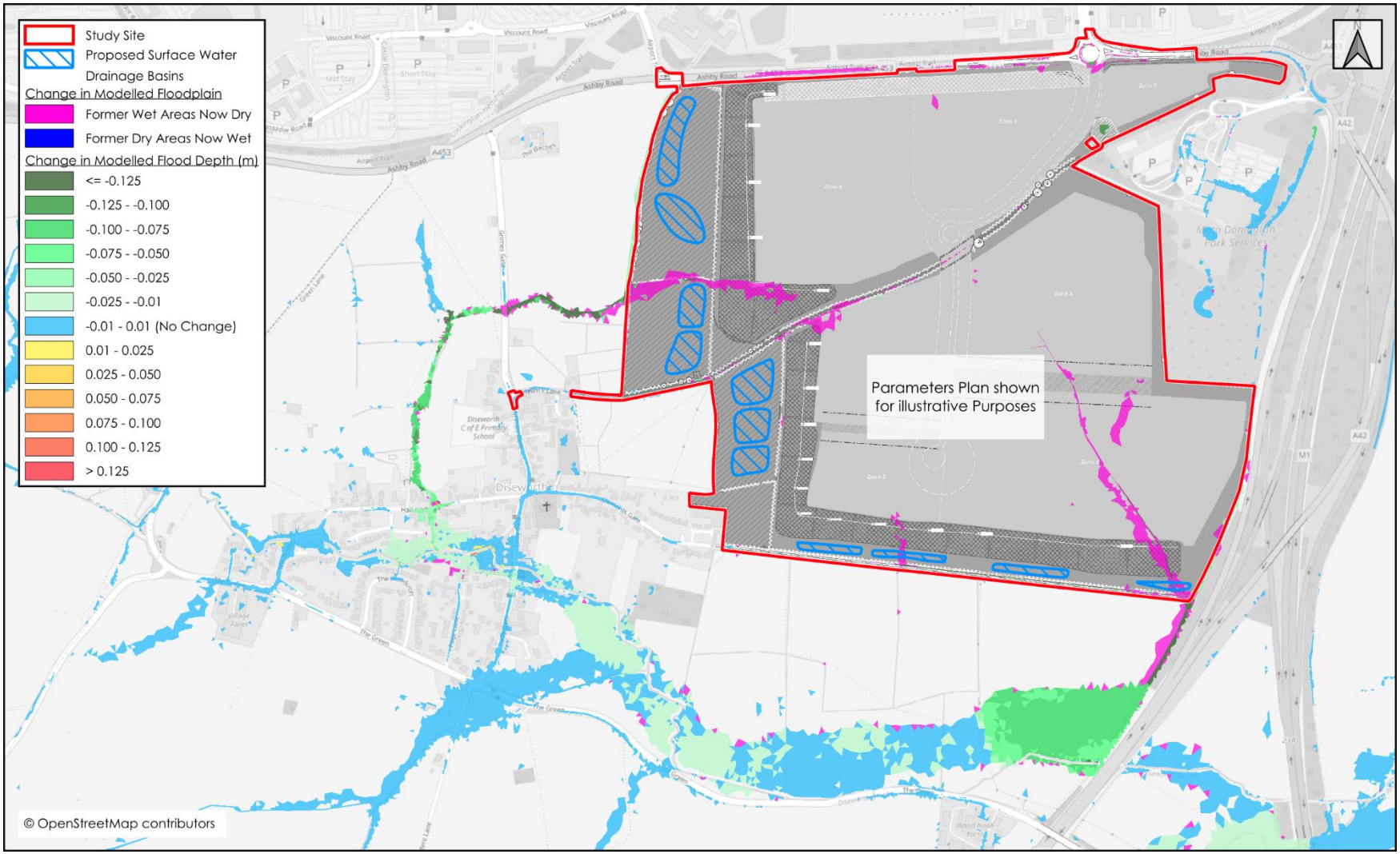


Figure 6.5: Change in Flood Depths Due to Development | 1 in 100-year Storm Event

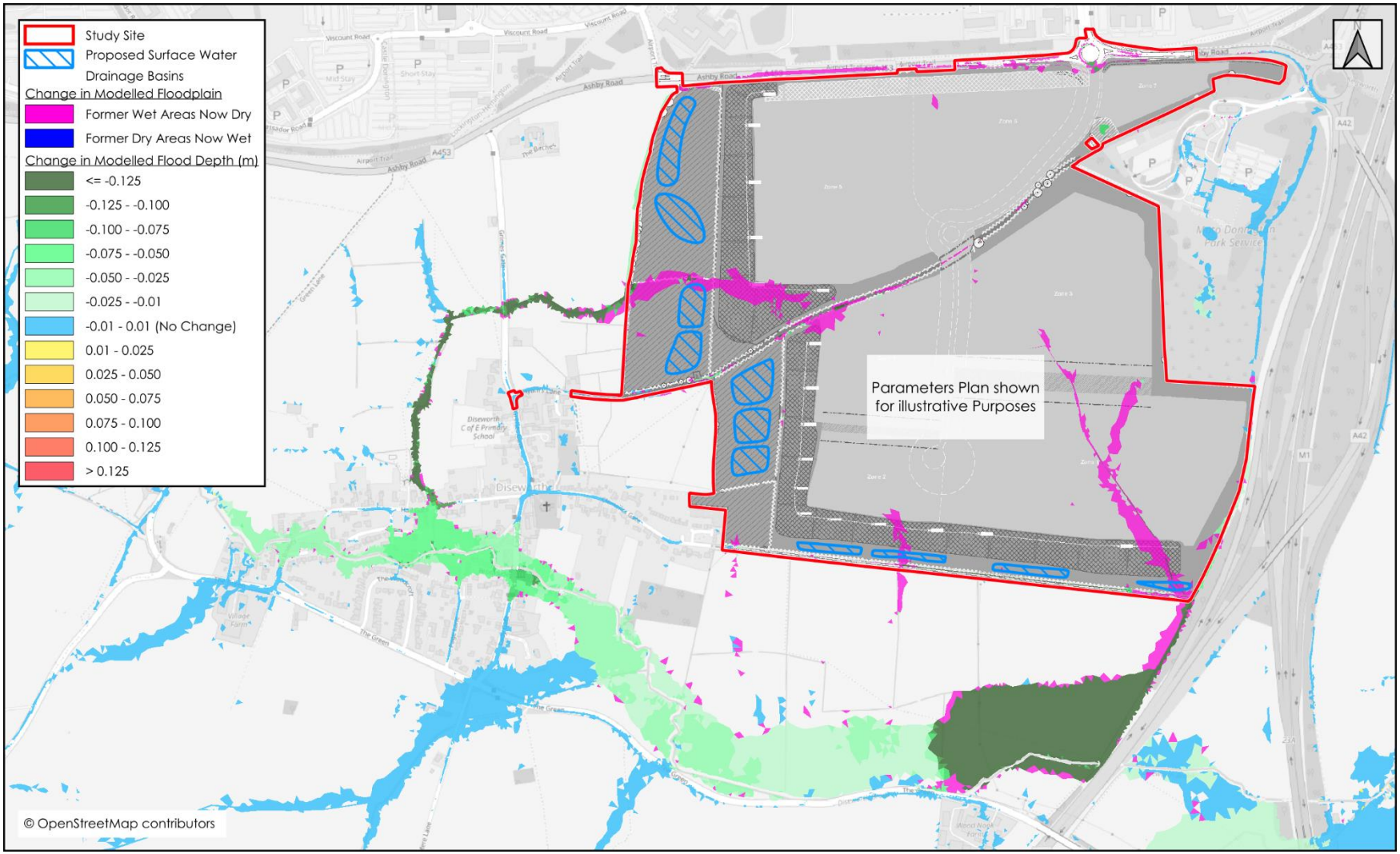


Figure 6.6: Change in Flood Depths Due to Development | 1 in 100-year +25% Storm Event

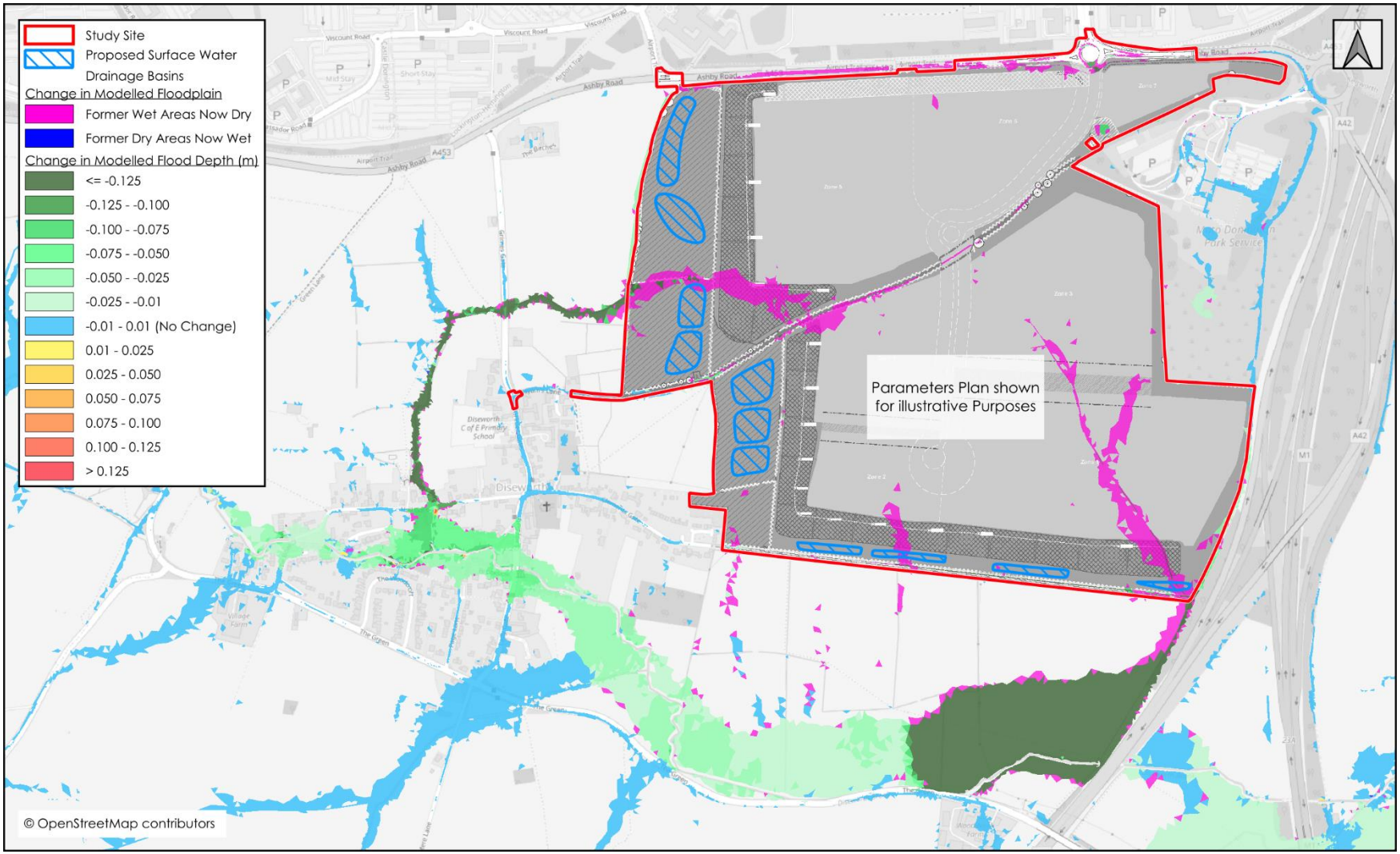


Figure 6.7: Change in Flood Depths Due to Development | 1 in 100-year +40% Storm Event

7. SUMMARY

Summary

7.1 LCC LLFA have provided a copy of their Diseworth and Long Whatton catchment hydraulic model for use in this assessment. This combines watercourses, sewers, and drainage networks into a single integrated model. The model provides complete coverage of the study site.

7.2 The model was updated to include additional site specific detail including the addition of the minor watercourses and associated culverts in the southeast of the site, and the correction on the location, size, and inverts of the public surface water sewer and pipe watercourse present in the east of the site. A number of amendments were also made in the wider model to correct unrealistic roughness values and improve channel schematisation. However, the model largely remains unchanged from that received from LCC.

7.3 The hydraulic modelling has shown that the Hall Brook floodplain is contained to its channel next to the study site, confirming that the development is at a low fluvial flood risk. Additionally, the local sewer network and the EMIA drainage is shown to not affect the site.

7.4 The modelling has identified that in the 1 in 100-year storm event and above, there is the potential for surface water overland flow pathways to form over the study site. However, even at the 1 in 100-year + 40% event these are relatively shallow and of a low flood hazard. Importantly, the overland flow pathways are shown to be predominately originate from within the site itself. There are no significant overland flow pathways passing through the site from upstream third-party land.

7.5 The proposed development aims to address the minor flood risk posed by the shallow surface water overland flows routes that can occur in the baseline conditions through the implementation of a surface water drainage strategy. The drainage strategy will be designed to intercept and store rainwater falling on the development, before discharging it to the local watercourse at the equivalent QBAR rate. Additionally, the drainage strategy seeks to direct all surface water runoff from the development to the minor watercourse in the southern-eastern corner of the site, thus reducing the volume and rate of surface water runoff directed towards the Hall Brook and the existing downstream flood risk issues in Diseworth.

7.6 A comparison between the baseline and post-development conditions has identified that the proposed scheme would offer a reduction downstream flood risk. This is most evident on the Hall Brook through Diseworth and on the Diseworth Brook upstream of the A42 embankment.

Appendix 3: River Soar Tributary Culvert Capacity Hydraulic Review

Introduction:

As part of the works associated with the East Midlands Gateway Phase 2 (EMG2) development it is proposed to create a new footway/cycleway to the west of the A453 that will improve active travel between the East Midlands Gateway Phase 1 (EMG1) and EMG2 sites. The route of the footway/cycleway runs in close proximity to a small ordinary watercourse which issues from the eastern side of the East Midlands Internal Airport (EMIA) via twin pipe outfalls (500mm and 700mm dia pipes). After a very short open reach the watercourse is culverted beneath the A453 and the M1, before outfalling to open fields on the eastern side of the M1. The watercourse continues to flow towards the east, eventually outfalling to the River Soar.

The watercourse is not included in the Flood Map for Planning due to its small size, and there is no known hydraulic model available from the Environment Agency (EA) or Lead Local Flood Authority (LLFA). In such instances EA Risk of Flooding from Surface Water (RoFSW) data can provide a proxy to the potential floodplain. However, in this instance this data does not include for the A453 or M1 culverts and consequently flood water is shown to unrealistically pond to the west of the A453 on the proposed route of the footway/cycle – this is illustrated within **Figure 1**.

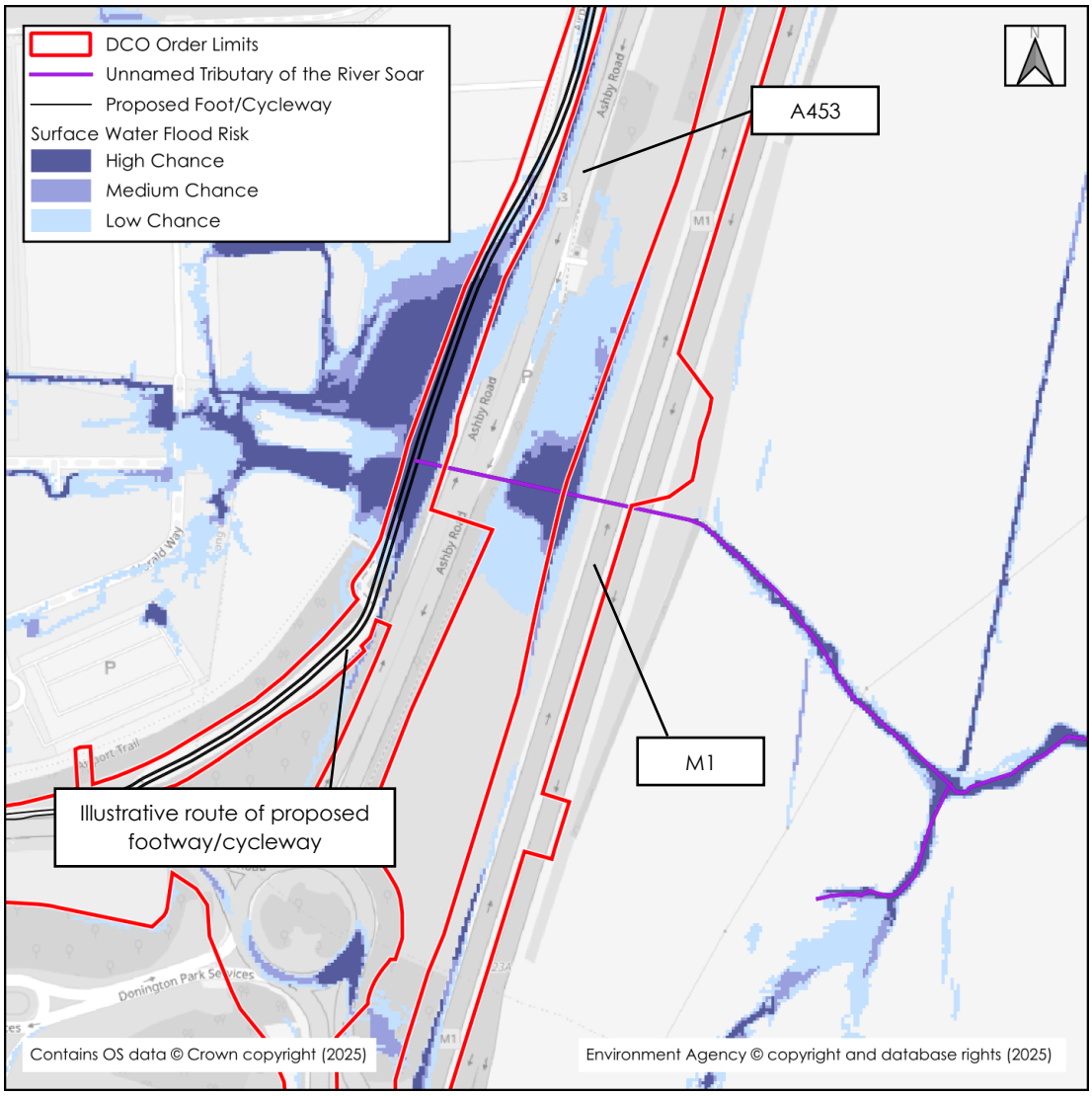


Figure 1 - EA RoFSW Flood Data

Therefore, this note has been prepared to review the capacity of the A453 and M1 culverts against the predicted peak flows generated in the catchment to improve upon the understanding of potential flood risk.

Estimation of Peak Flows:

Catchment descriptors for the headwaters of the watercourse were obtained from the FEH web service. These are illustrated within **Figure 2**.

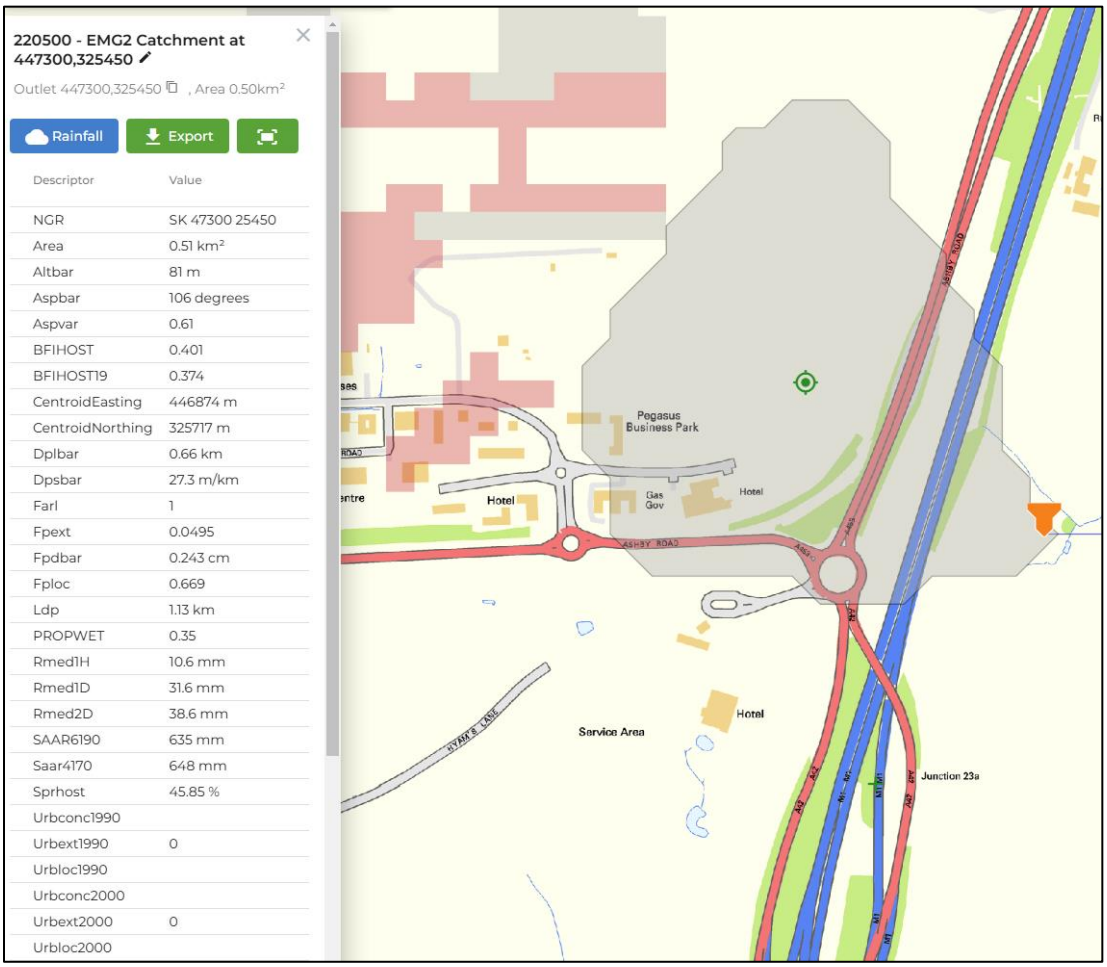


Figure 2 - FEH Web Service Catchment Descriptors

A watershed analysis was undertaken in QGIS using EA 2020 Composite LiDAR DTM to identify the topographical catchment upstream of the M1 northbound carriageway. National Highway drainage records identify that the south bound carriageway outfalls directly to the open channel to the east rather than into the culverted watercourse beneath the M1, so this area was omitted from the catchment analysis. A total catchment area of 0.53km^2 was identified.

The EMIA drainage catchments (see **Figure 3**) are shown to overlap with this area (see **Figure 4**). These intercept and redirect 0.18km^2 of this catchment to the Diseworth Brook and which is accounted for in the Diseworth and Long Whatton flood model. Therefore, the catchment of the study watercourse is limited to the south-eastern corner of the airport associated with airport long term parking and a proportion of the Pegasus Business Park, an area of 0.35km^2.

Figure 3 – East Midlands Airport Surface Water Catchments
(Image extracted from the Diseworth and Long Whatton flood model report[1])

The urban area within the remaining catchment has been measured at 0.17km^2, giving an effective URBEXT2000 of 0.31. It is understood that the EMIA long term parking and Pegasus Business Park are served by attenuated storage, which is evidenced by the detention basin located next to the pipe outfalls. However, as no information of the restricted rates are available, this has been discounted for the purpose of this analysis.

The measured catchment and urban areas are illustrated within **Figure 4**.

An estimation of peak flows was undertaken using the FEH catchment data within the ReFH2 rainfall-runoff software (v4.1) and in WINFAP (v5) statistical analysis software, after its area and URBEXT2000 had been updated. The resultant peak flow estimates are provided in **Table 1**.

This shows that ReFH2 provides the more precautionary flow estimates. Therefore, this has been taken forward for analysis against the culvert capacities. A design event peak flow of 1.16m^3/s has been idenftied.

Table 1 – Peak Flow Estimates

Return Period	Peak Flows (m^3/s)	
	ReFH2 (v3.2)	FEH Statistical (WINFAP v5)
1 in 30	0.66	0.36
1 in 100	0.91	0.50
1 in 100+28%CC	1.16	0.64
1 in 100+60%CC	1.46	0.80
1 in 1000	1.71	0.97

[1] 2020, Arcadis. Long Whatton & Diseworth Flood Risk Mitigation & Resilience Study.

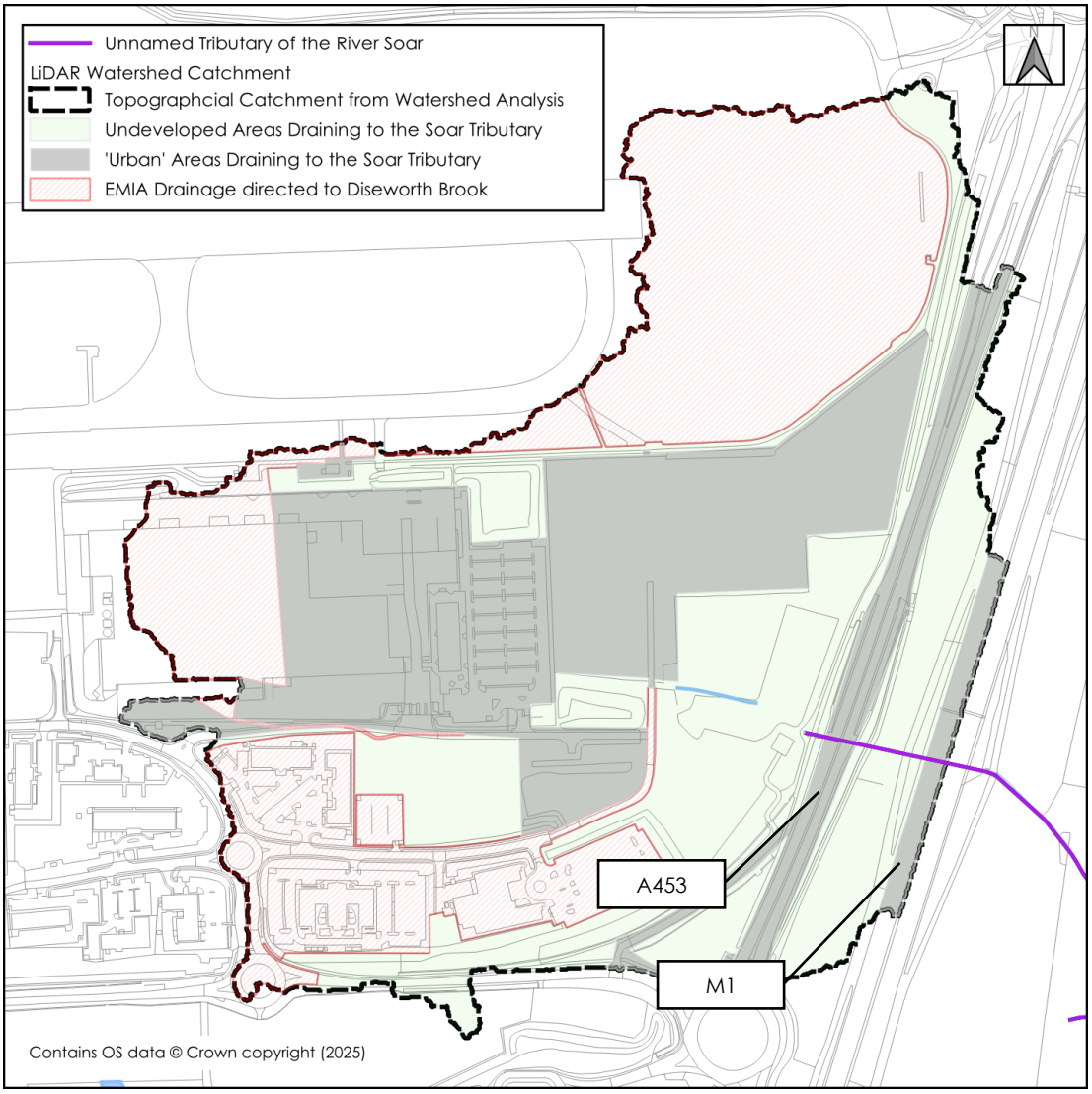


Figure 4 – Watershed Analysis & Measured Urban Areas

HEC-RAS Model

Topographical survey of the local area has captured the culvert inlet on the western side of the A453 and the culvert outfall on the eastern side of the M1, as well as a manhole chamber between the two roads. This shows that the watercourse is culverted within a continuous run, though the gradient changes at the manhole. The key culvert parameters from the topographical survey are illustrated within **Figure 5**.

The topographical survey has been used to derive a number of cross-sections of the watercourse which are located in magenta within **Figure 5**. These sections have been used to develop a relatively simple 1D hydraulic model of the local reach through the EMG2 order limits, a reach of 236m.

A Manning's 'n' of 0.05 was adopted for the river channel to reflect the relatively straight channel with medium to heavy vegetated banks. The culvert was modelled with a base Manning's 'n' roughness of 0.015 and a top roughness of 0.012, which reflects the observed conditions (see **Figure 6**). An entrance loss of coefficient of 0.5 was adopted which is reflective of a square edge inlet with headwall.

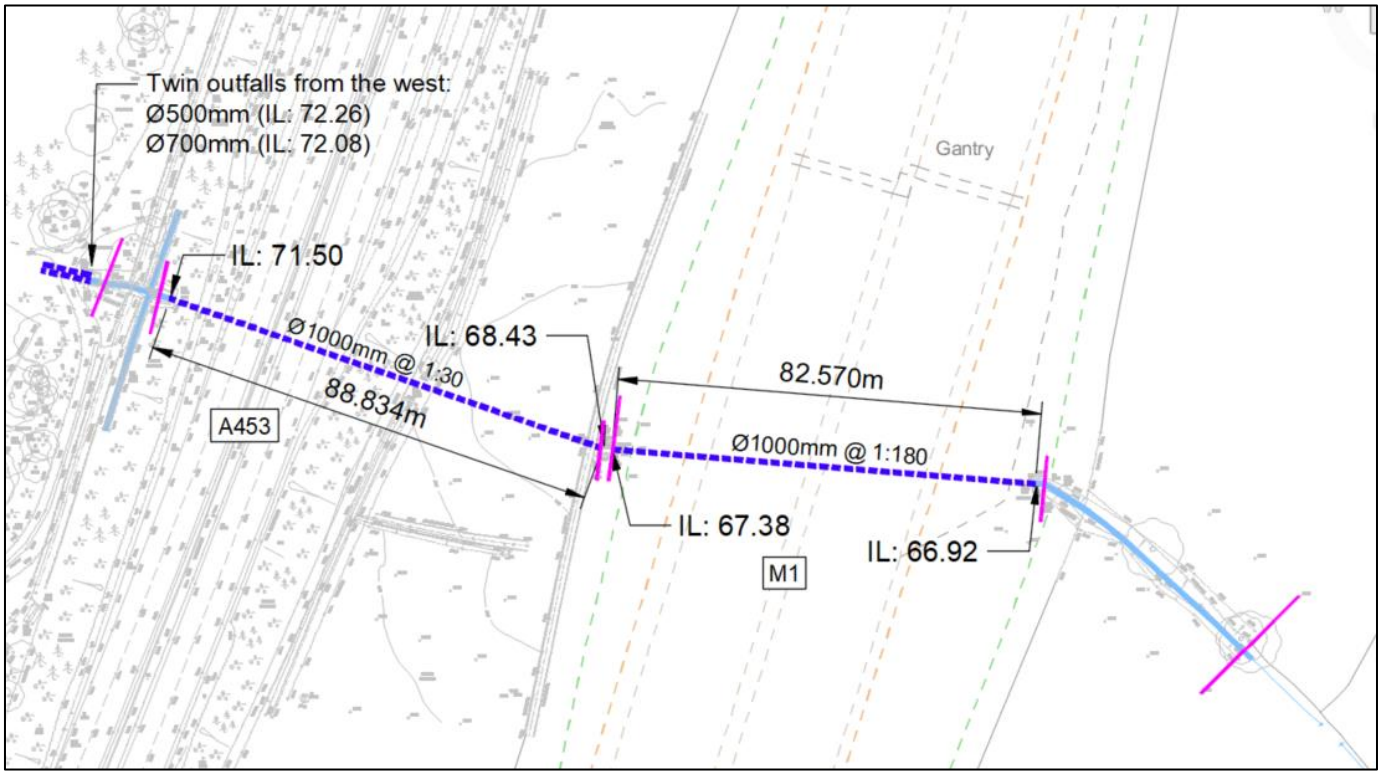


Figure 5 – Surveyed Culvert Parameters

Figure 6 – A453 Culvert Inlet

The survey identifies that the A453 culvert has a diameter of 1000mm at the inlet, which was confirmed during site visit undertaken by BWB Consulting Ltd in March 2025 as demonstrated by **Figure 6**.

A channel gradient of 1:36 was adopted for the downstream normal depth boundary, which reflects the surveyed gradient of the downstream channel from the culvert outlet to the downstream most surveyed invert level of the channel. The flow hydrographs have been derived using ReFH2 software (Version 4.1) and applied to the upstream extent of the modelled reach. The model was simulated against the 1 in 30-year, 1 in 100-year, 1 in 100-year+28%CC, and the 1 in 100-year+60%CC return period flood events.

Results

A long section of the modelled reach is provided in **Figure 7**. The section shows there to be available capacity for the 1 in 30-year and 1 in 100-year with the culvert. There is potential for surcharging of the inlet during the 1 in 100-year +28%CC and 1 in 100-year +60%CC flood events; however, this is not shown to result in overtopping of the culvert and flows continue to remain in channel upstream of the culvert, this is illustrated by the upstream cross section shown in **Figure 8**. During the 1 in 100-year +28%CC flood event the flood level within the upstream reach peak at 72.55mAOD, which increases to 72.68mAOD in the 1 in 100-year +60%CC flood event

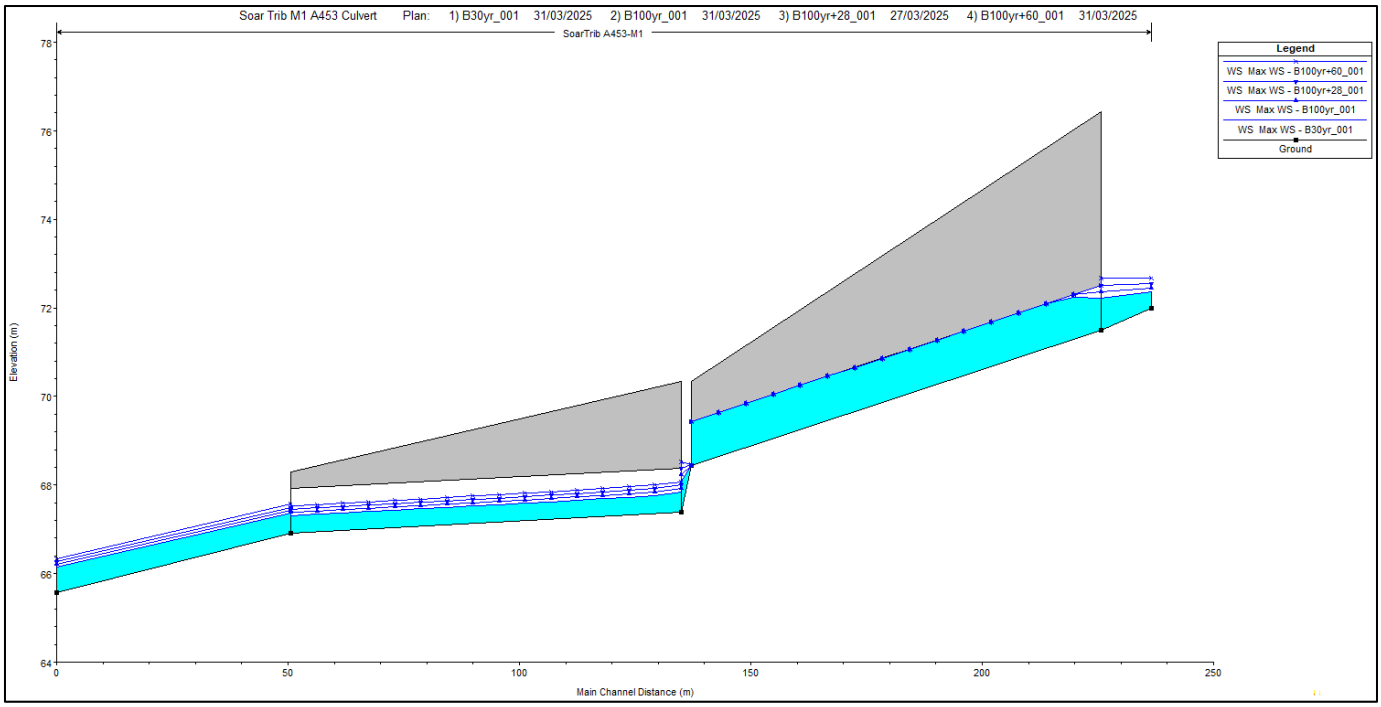


Figure 7 – Baseline Model Long Section

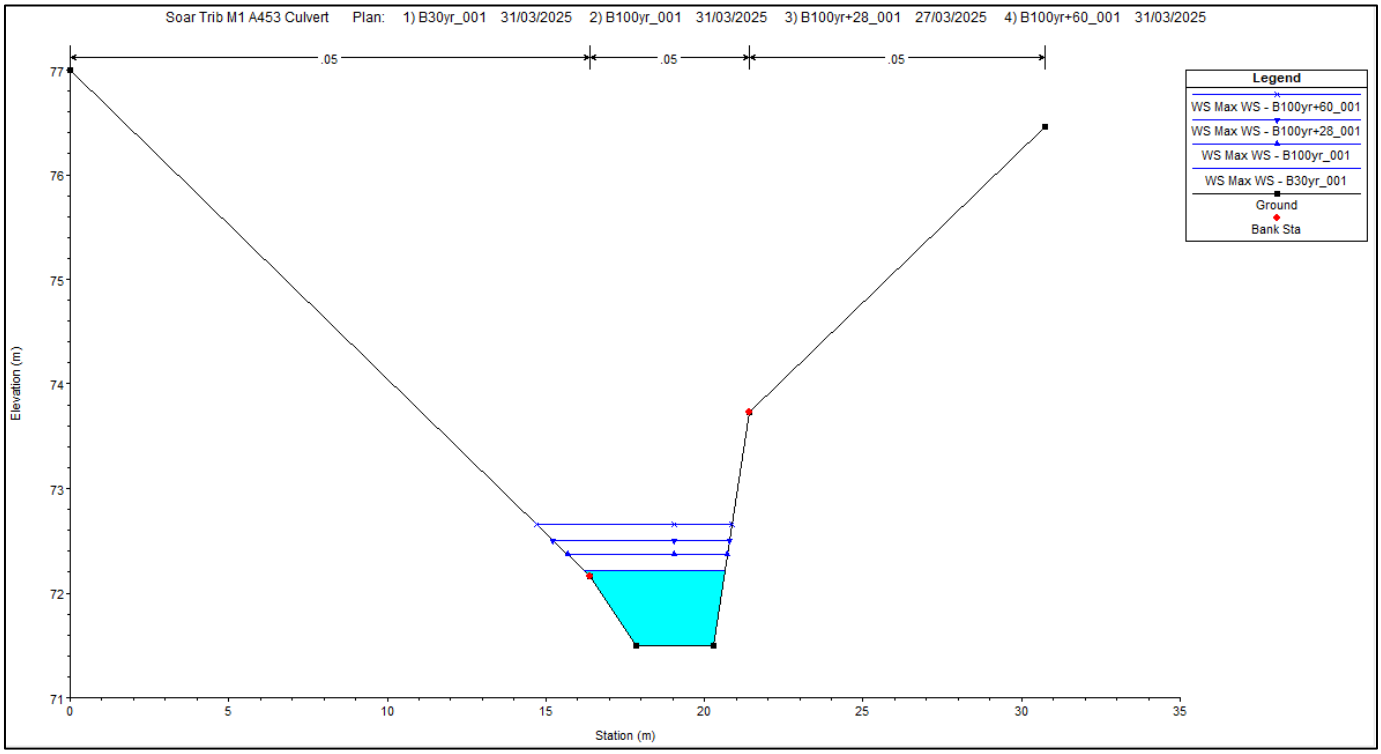


Figure 8 – Baseline Model Cross Section (228)

Alterations to Accommodate the Footway/Cycleway

At this stage, it is expected that the existing 500mm/700mm diameter outfalls from the west will be extended a short distance to allow the proposed footway/cycleway to run on top – this concept is illustrated within **Figure 9**. This approach ensures that conveyance of flows towards the A453 culvert will be unaffected.

A review of the topographical survey shows that the proposed footway/cycleway follows a route with a low point of 72.76mAOD (excluding the channel that is to be culverted). Therefore, the footway/cycleway will be located above the 1 in 100-year +28%CC design event flood level, and outside of the design event floodplain.

To assess the potential impact of the extended pipe lengths beneath the footway/cycleway, the open channel reach upstream of the A453 culvert was reduced by 6m from the upstream extent of the model – thereby removing any online flood storage that the length of channel that is to be culvert currently offers.

The food events were re-run and the proposed peak water levels compared to the equivalent baseline events. This is illustrated within **Figure 10** to **Figure 13**. The comparisons confirm that there is no significant change between the baseline and proposed conditions.

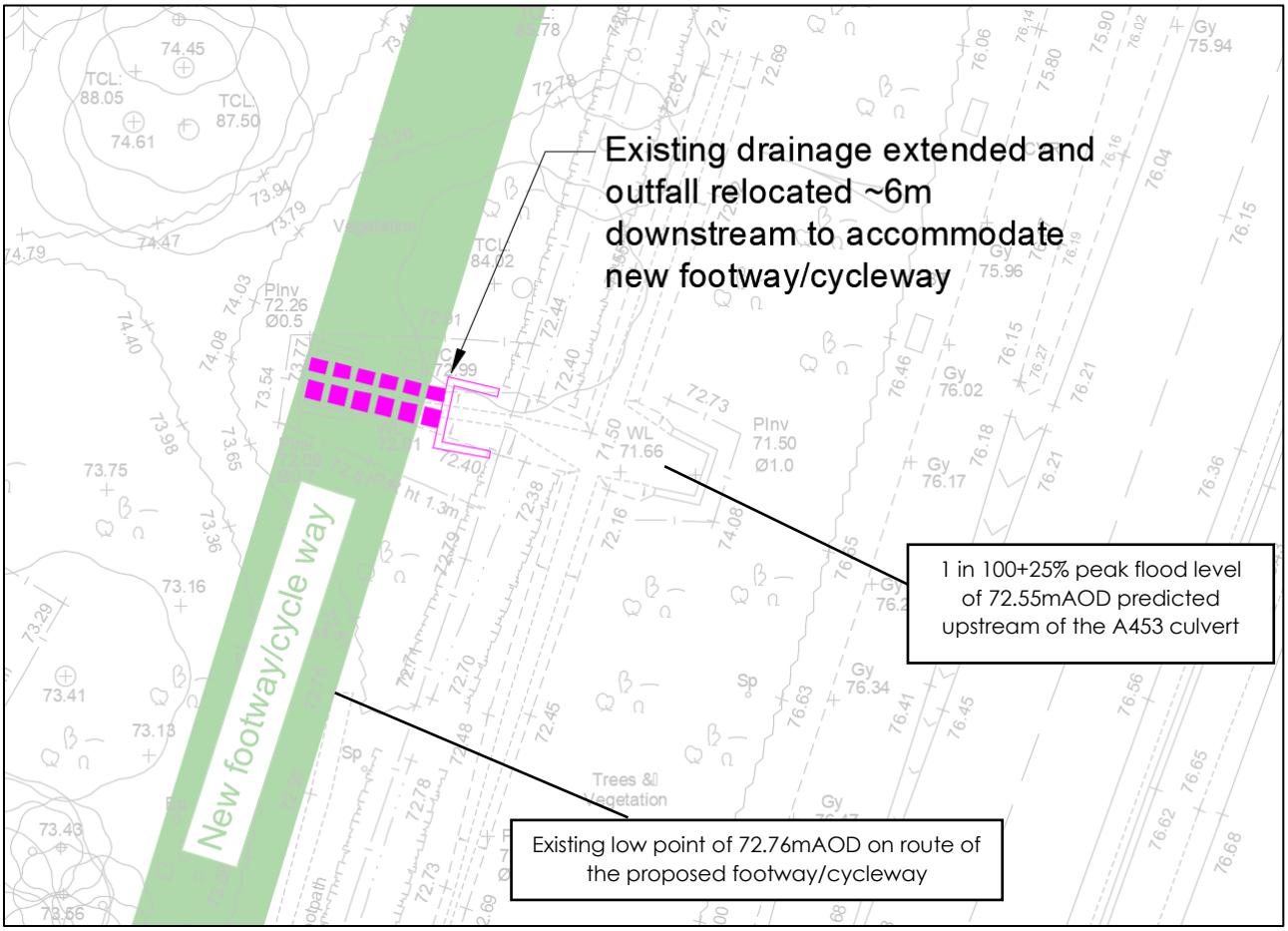


Figure 9 – Concept Culvert Extension Beneath New Footway/Cycleway

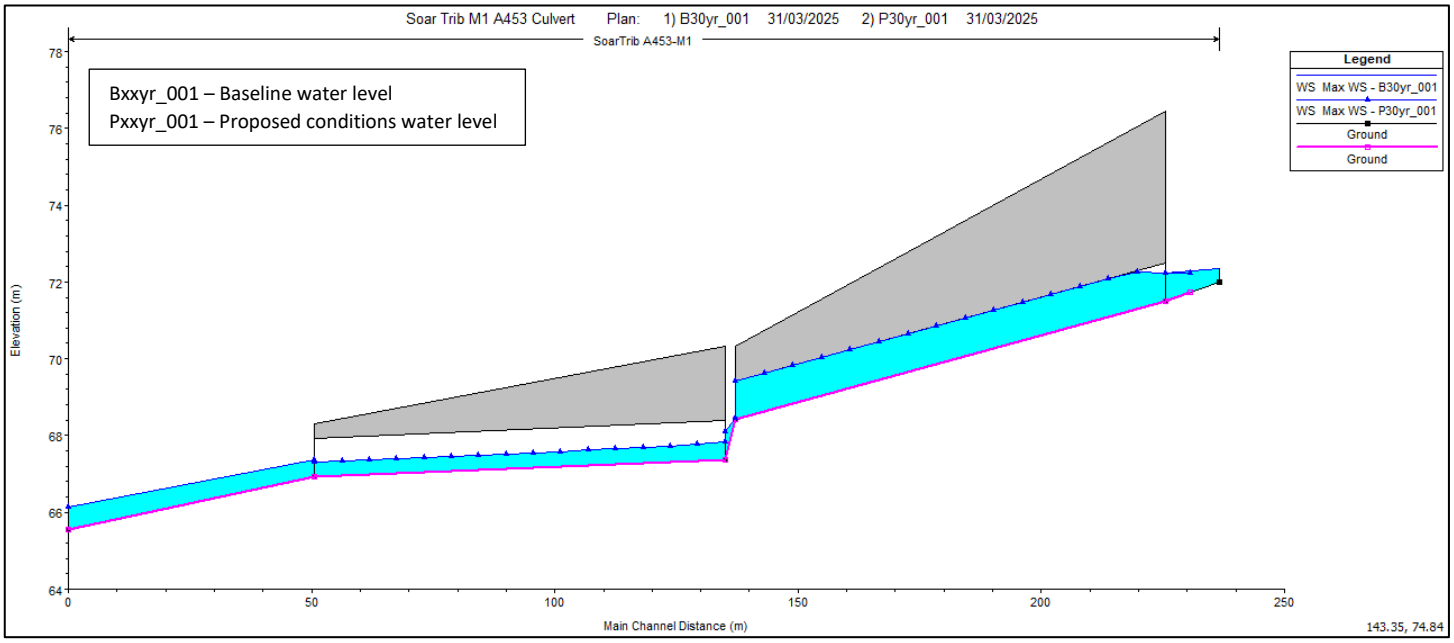


Figure 10 - 1 in 30-Year Long Section Comparison

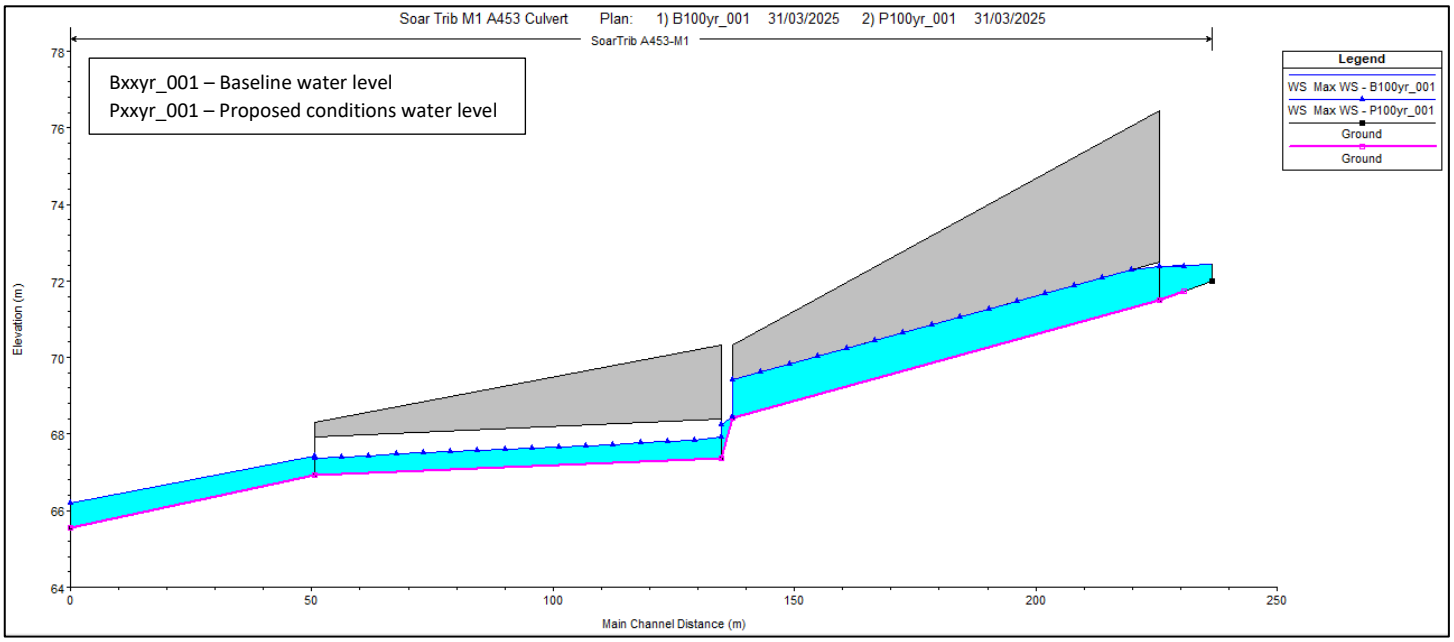


Figure 11 - 1 in 100-Year Long Section Comparison

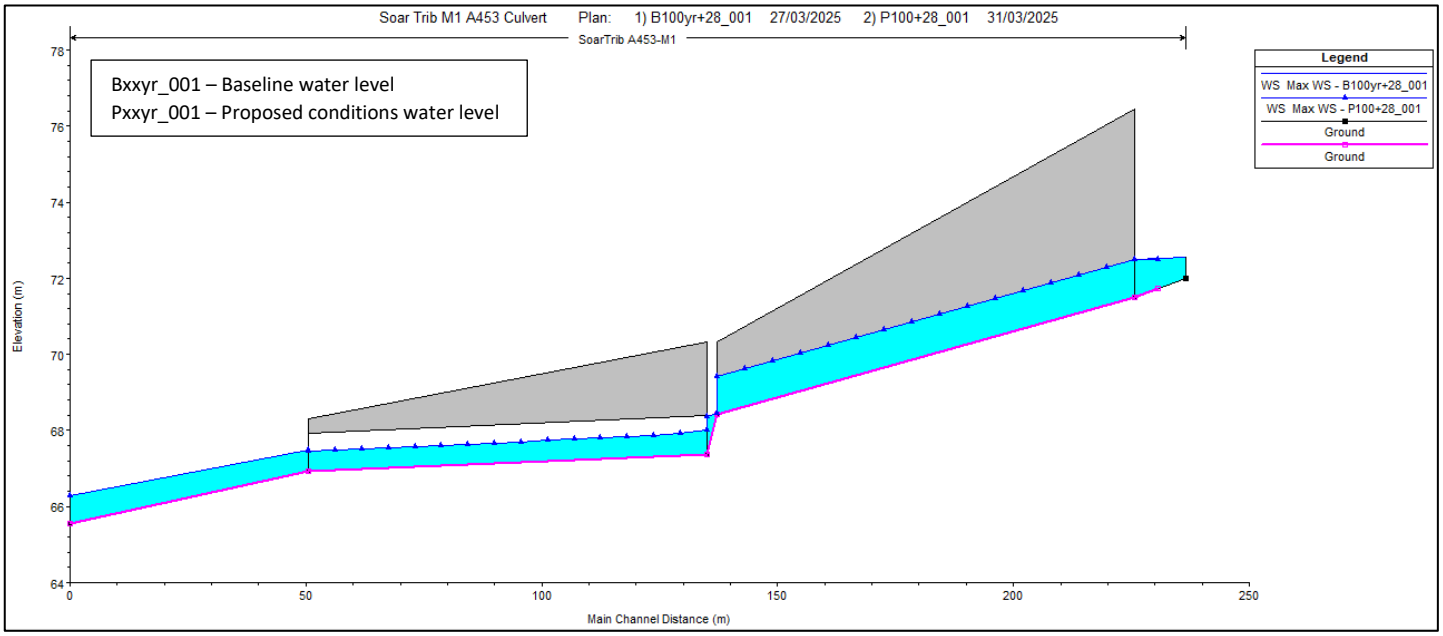


Figure 12 - 1 in 100-Year +28%CC Long Section Comparison

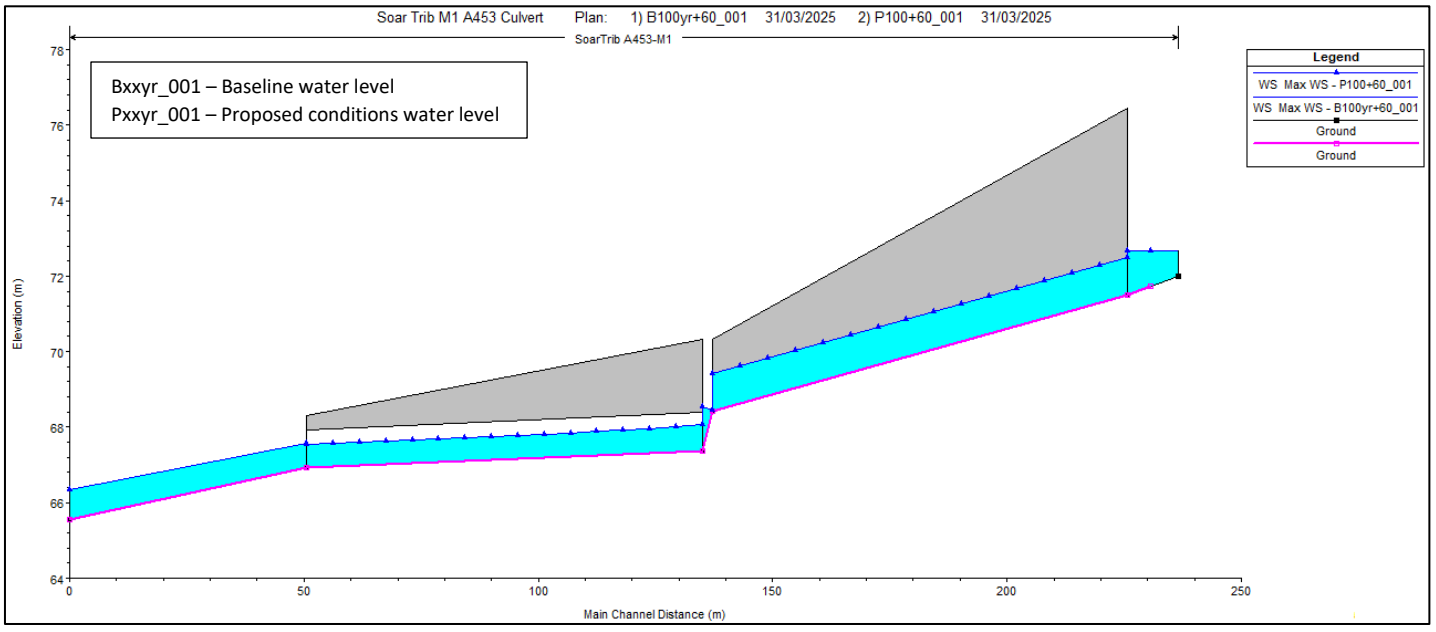


Figure 13 - 1 in 100-Year +60%CC Long Section Comparison

Appendix 4: Hemington Brook Culvert Capacity Hydraulic Review

Introduction:

As part of the works associated with the East Midlands Gateway Phase 2 (EMG2) development it is proposed to upgrade an existing footpath located to the east of Castle Donnington to a shared footway/cycleway. The route of the footway/cycleway crosses the upper reach of the Hemington Brook.

The Hemington Brook in this location is not included in the Flood Map for Planning due to its small size, and the hydraulic model coverage available from the Environment Agency (EA) only starts 550m further downstream. In such instances Environment Agency (EA) Risk of Flooding from Surface Water (RoFSW) data can provide a proxy to the potential fluvial floodplain – the latest flood mapping from NaFRA2 is illustrated within **Figure 1**. This suggests that the floodplain is likely to be restricted to the channel and the corridor immediately next to the channel.

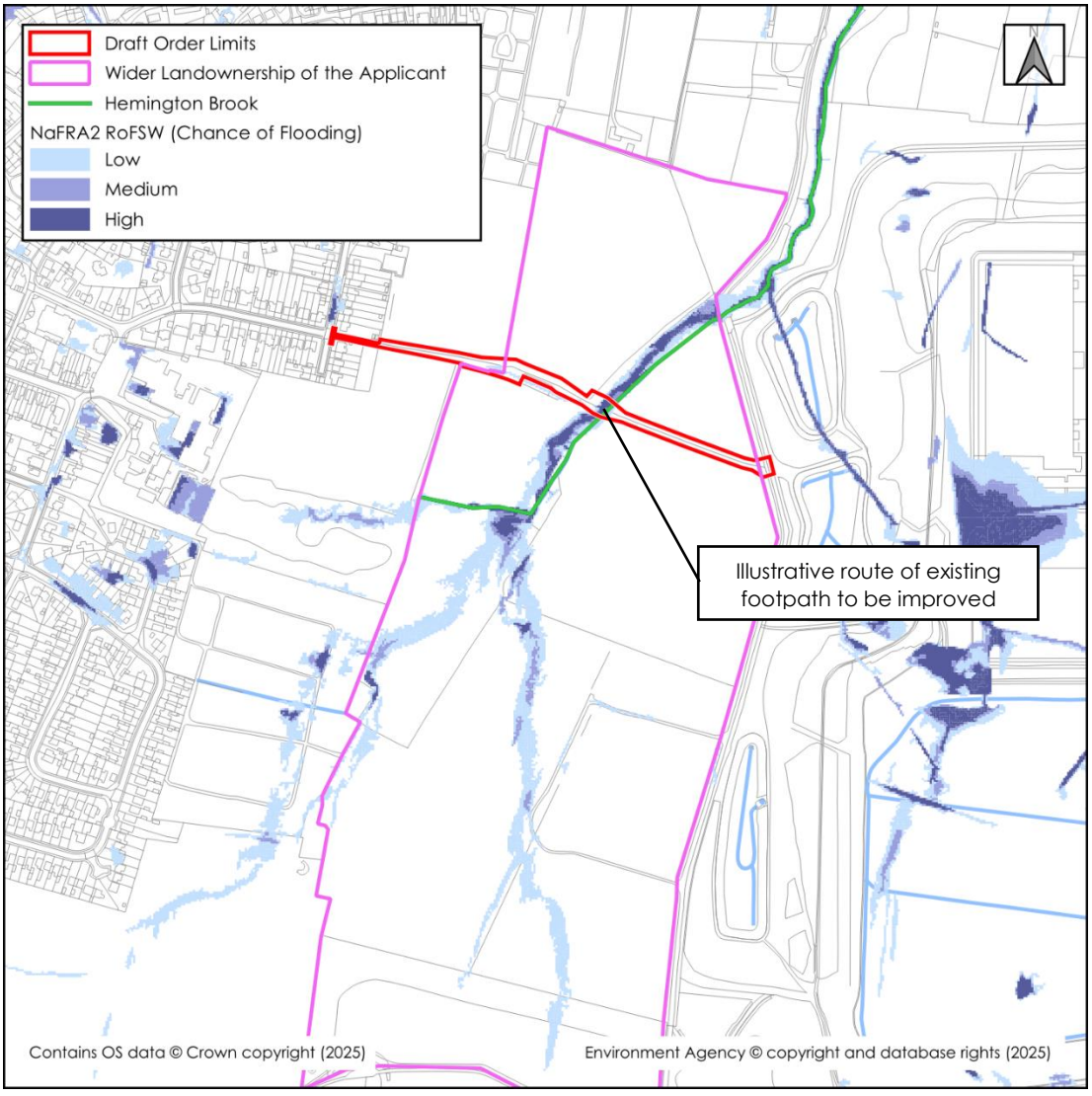


Figure 1 - EA RoFSW Flood Data

Topographical survey of the area identifies that a 500mm diameter pipe provides hydraulic connectivity beneath the existing footpath and that exceedance flows, in excess of the culvert's capacity, can overtop the footpath, which is set 400mm above the culvert soffit. As part of the proposed works, there is an opportunity to improve the capacity of the culvert and decrease the risk of the footpath being made impassible during a flood event.

Therefore, this note has been prepared to estimate potential flood flows generated in the upstream catchment and review the potential impact of the proposals on downstream flood risk. During consultation with the Environment Agency (EA) it was recommended that a simple one-dimensional (1D) Hec-Ras model was developed to confirm that there would be no significant downstream impacts.

Estimation of Peak Flows:

The footpath is located at NGR: 445270, 327105, upstream of the start of the EA's Hemington Brook hydraulic model. The EA model includes adopted flood hydrology for the Hemington Brook catchment. The model inflow 'HEM01' is located at NGR: 445554, 327575.

The FEH Web Service identifies a catchment area of 1.47km^2 at HEM01, and a catchment area of 0.7km^2 at the footpath location.

The peak flows applied within the downstream EA model can be prorated on an area basis to provide an estimate of the peak flows at the footpath location. These are illustrated within **Table 1**.

Table 1 – Peak Flow Estimates

Return Period	Peak Flows (m^3/s)	
	EA Peak flows at HEM01 (1.47km^2)	Prorated peak flows at L57 footpath (0.7km^2)
1 in 30	0.90	0.43
1 in 100	1.30	0.62
1 in 100+28%CC	1.67	0.80
1 in 100+60%CC	2.08	1.00
1 in 1000	2.33	1.12

Baseline HEC-RAS Model:

Topographical survey of the area has captured the culvert beneath the footpath. The key culvert parameters from the topographical survey are illustrated within **Figure 2**.

Additionally, cross-sections through the watercourse channel upstream and downstream of the footpath have been surveyed at regular intervals – the watercourse survey accompanies this note, drawing ref: *34529A_T_REV5-34529F*. The surveyed cross-sections confirm the incised nature of the valley in which the watercourse flows. The surveyed reach has a steep average gradient of 1:17; this means that there will be little backwater influence from downstream structures. For example, the footpath at the next downstream culvert is approximately 4m below the invert of the L57 culvert. Therefore, development of an extensive hydraulic model was not necessary, and a model of the local reach next to the study area was prepared. This extends 45m upstream of the L57 footpath and 92m downstream.

A Manning's 'n' of 0.05 was adopted for the river channel to reflect the relatively straight channel with medium to heavy vegetated banks. The culvert was modelled with a base manning's 'n' roughness of 0.020 and a top roughness of 0.015. An entrance loss of coefficient of 0.5 was adopted which is reflective of a square cut concrete pipe projecting from fill.

A channel gradient of 1:50 was adopted for the downstream normal depth boundary, which reflects the surveyed gradient to the next downstream surveyed section (i.e.: between section 10 and 9 on 34529A_T_REV5-34529F). The flow hydrographs at "HEM01" from the EA's Hemington Brook hydraulic model were prorated on an areas basis and applied to the upstream extent of the modelled reach. The model was simulated against the 1 in 30-year, 1 in 100-year, 1 in 100-year+28%CC, and the 1 in 100-year+60%CC return period flood events.

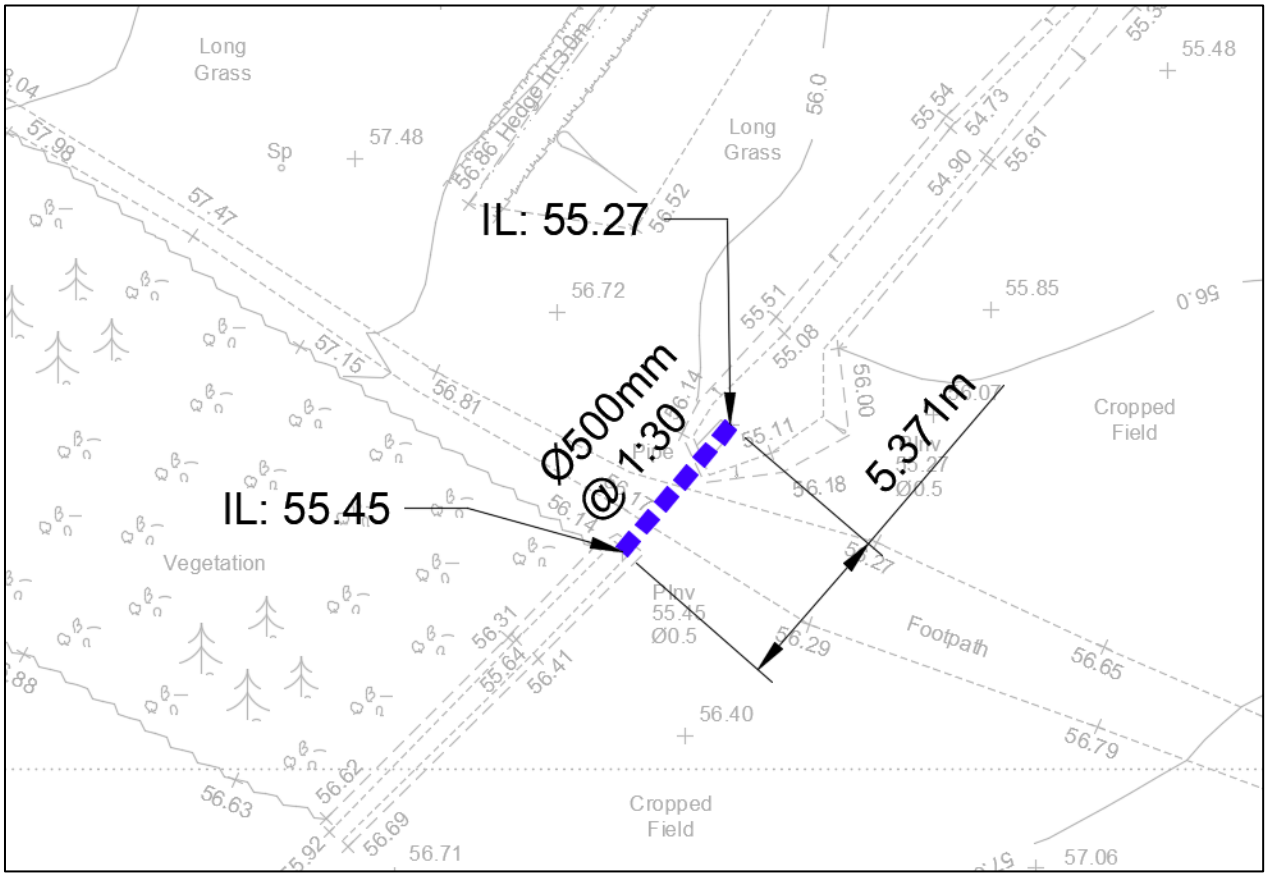


Figure 2 – Baseline Surveyed Culvert Parameters

Alterations to Accommodate the Footway/Cycleway

To achieve the necessary geometry for a shared footway/cycleway it will be necessary to raise the existing footpath circa 950mm at the culvert. This also provides an opportunity to reduce the risk of the footpath being overtopped in a flood event.

It is understood that Leicestershire County Highways, the authority responsible for footpath maintenance, will not accept a footbridge structure in this location due to the additional maintenance burden. Therefore, a 750mm diameter culvert is proposed. This will provide additional flow capacity when compared to the existing 500mm diameter culvert, without increasing the maintenance burden.

Due to the additional height of the footpath, the culvert will need to be extended to a length of approximately 13.8m. Plans illustrating the preliminary design of the footpath and culvert accompany this note (ref: EMG2-BWB-HGT-04-DR-H-0600-S3-P03 & EMG2-BWB-HDG-04-DR-W-0501-S3-P02.

These changes were made to the hydraulic model geometry and the flood events were re-simulated.

Results

A long section of the baseline modelled reach is provided in **Figure 3**, which confirms that the existing culvert is readily overtopped in flood events. A long section of the proposed modelled reach is provided in **Figure 4**, which shows that the increased footpath height and larger culvert will decrease the risk of flooding to the footpath.

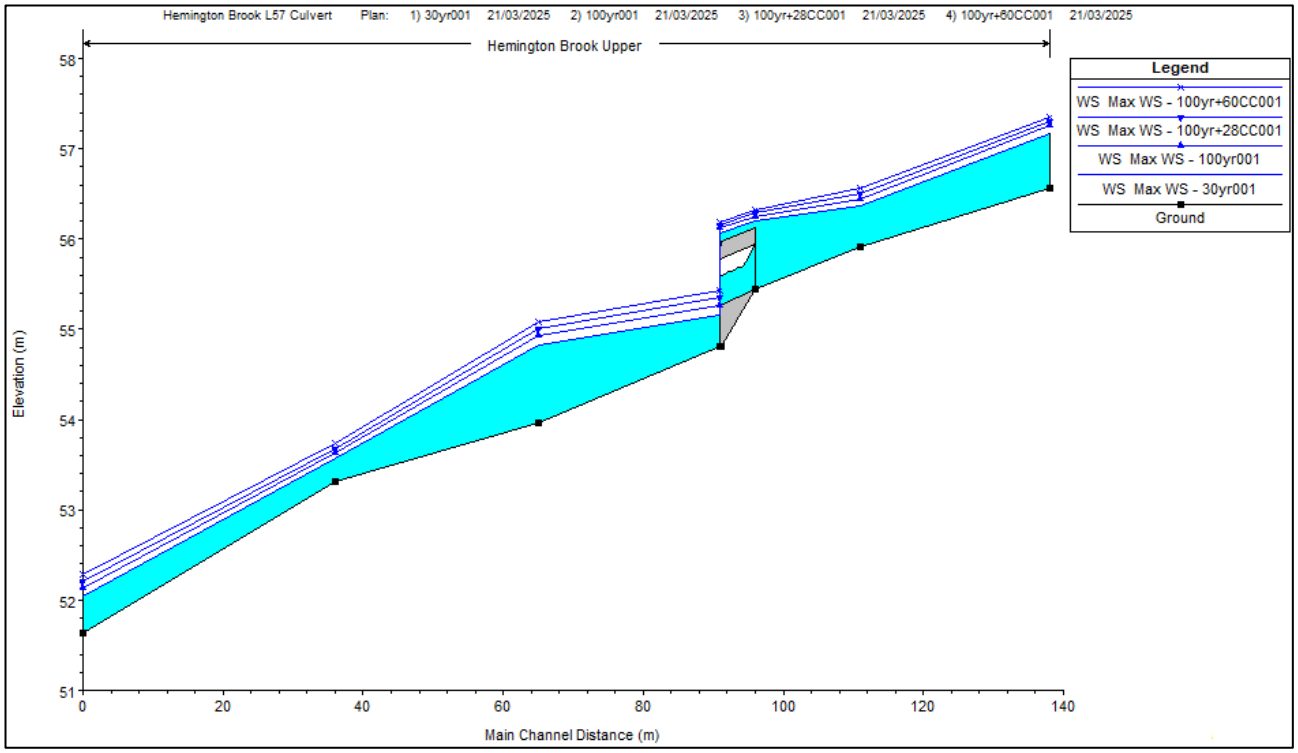


Figure 3 – Baseline Model Long Section

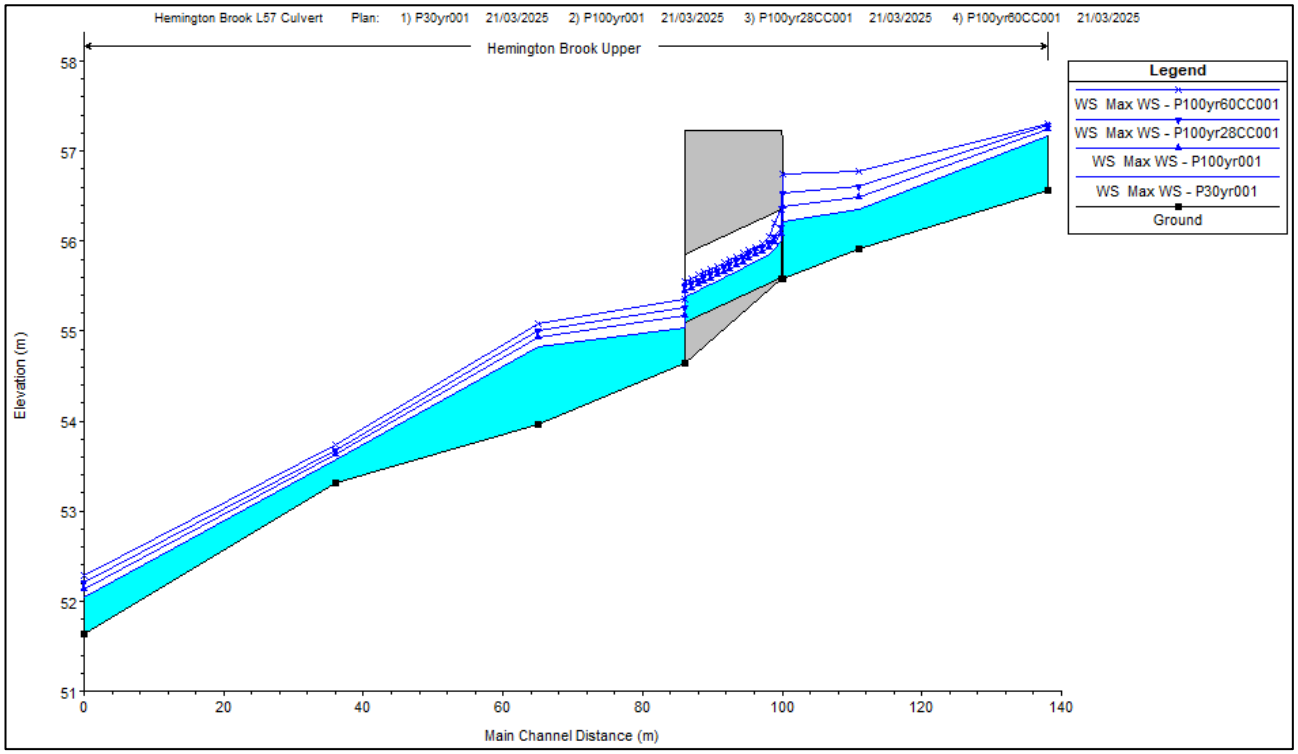


Figure 4 - Proposed Model Long Section

The baseline and proposed flood levels are compared at each return period event in the long sections included as **Figure 5** to **Figure 8**. These show that in flood events greater than a 1 in 30-year, an increase in flood levels would be expected within the reach immediately upstream of the culvert. An increase in peak flood levels of up to 0.09m is predicted in the 1 in 100-year event, and up to 0.40m in the 1 in 100-year+28%CC and +60%CC events. However, due to the relatively steep gradient the increase in flood levels dissipates within 38m from the footpath, and, as shown in **Figure 1**, an upstream reach of approximately 230m falls within the wider land ownership of the applicant. Therefore, the localised increase in upstream flood levels is not considered significant.

Modelled water levels downstream of the culvert are generally unaffected. To confirm that pass-on flows are also not significantly affected, a comparison of modelled flow hydrographs at the downstream section was undertaken - this is included as **Figure 9**. The comparison confirms that there is no significant change in downstream flows between the baseline and proposed conditions.

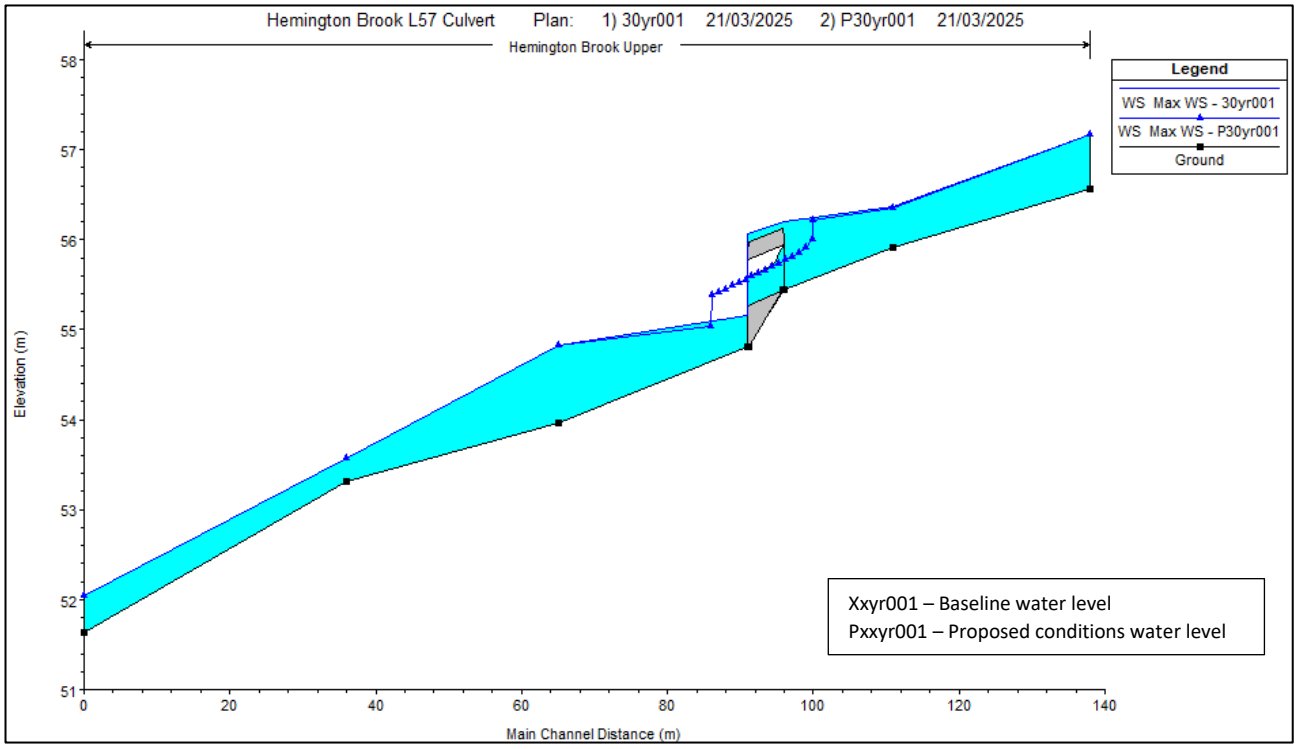


Figure 5 – 1 in 30-Year Long Section Comparison

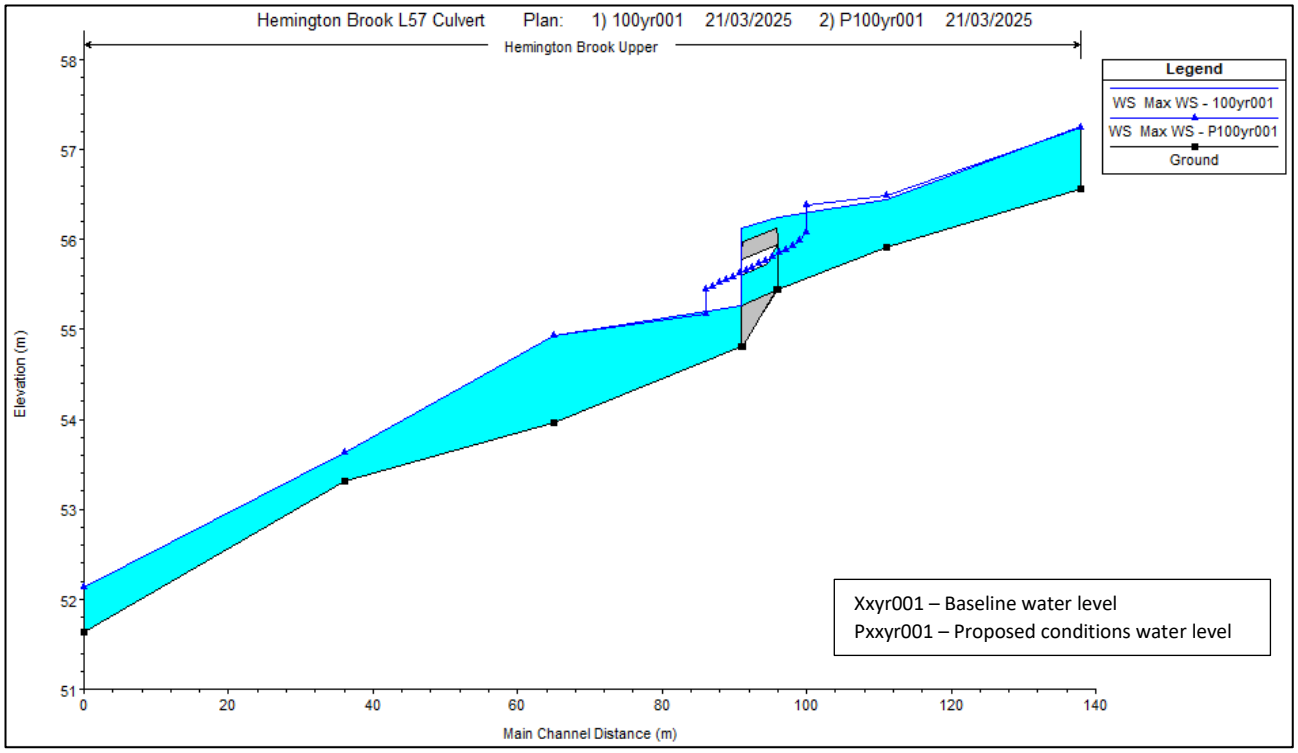


Figure 6 – 1 in 100-Year Long Section Comparison

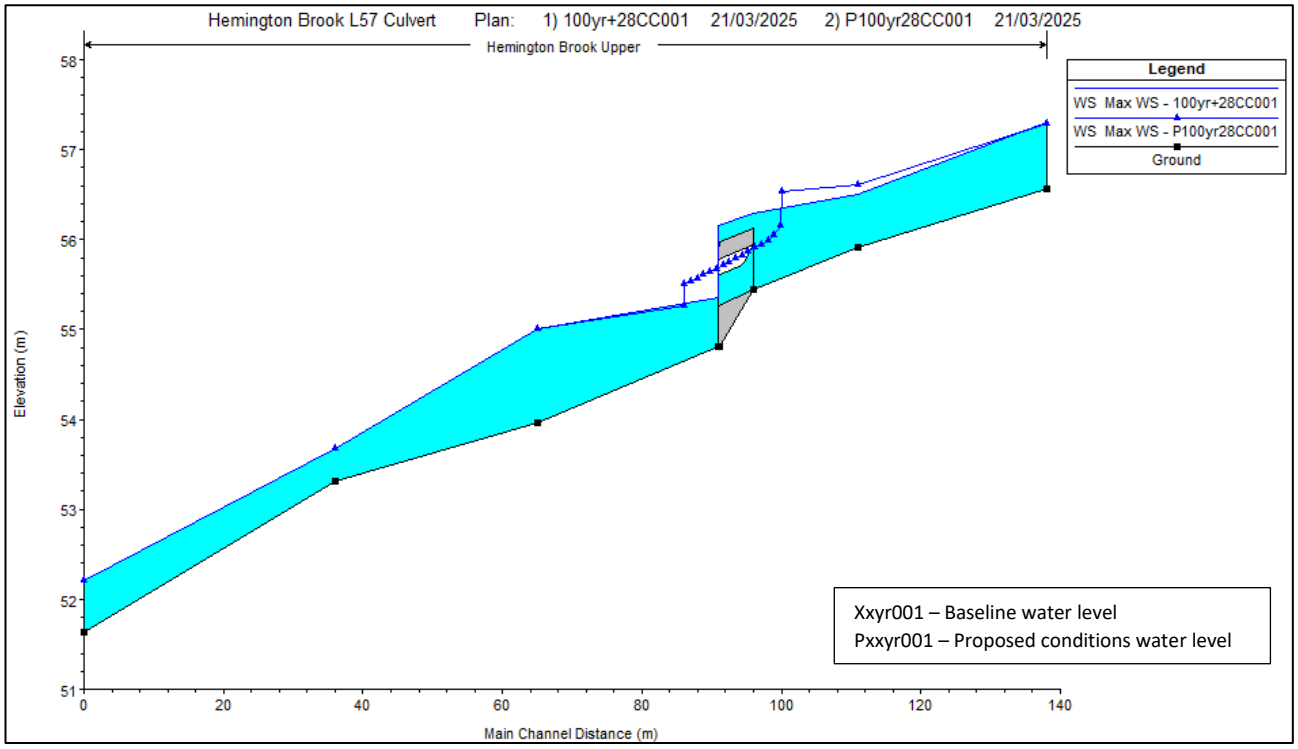


Figure 7 – 1 in 100-Year+28%CC Long Section Comparison

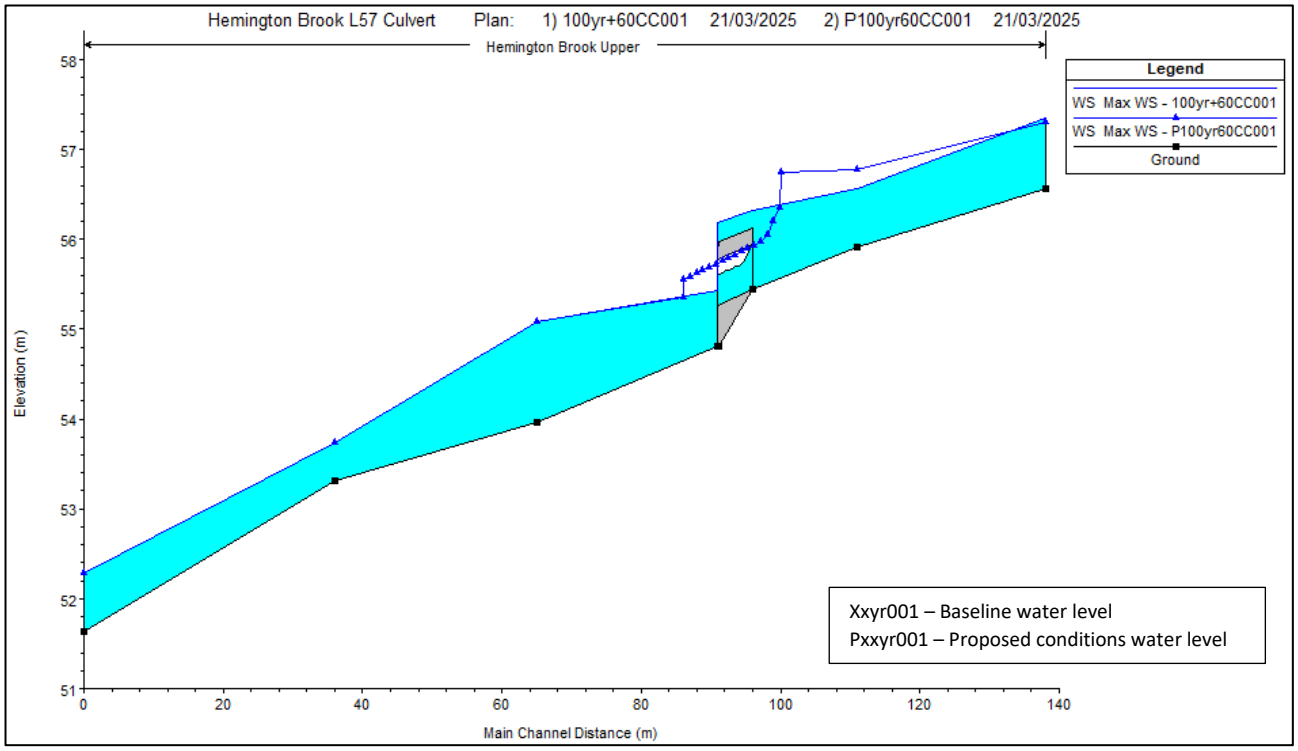


Figure 8 – 1 in 100-Year+60%CC Long Section Comparison

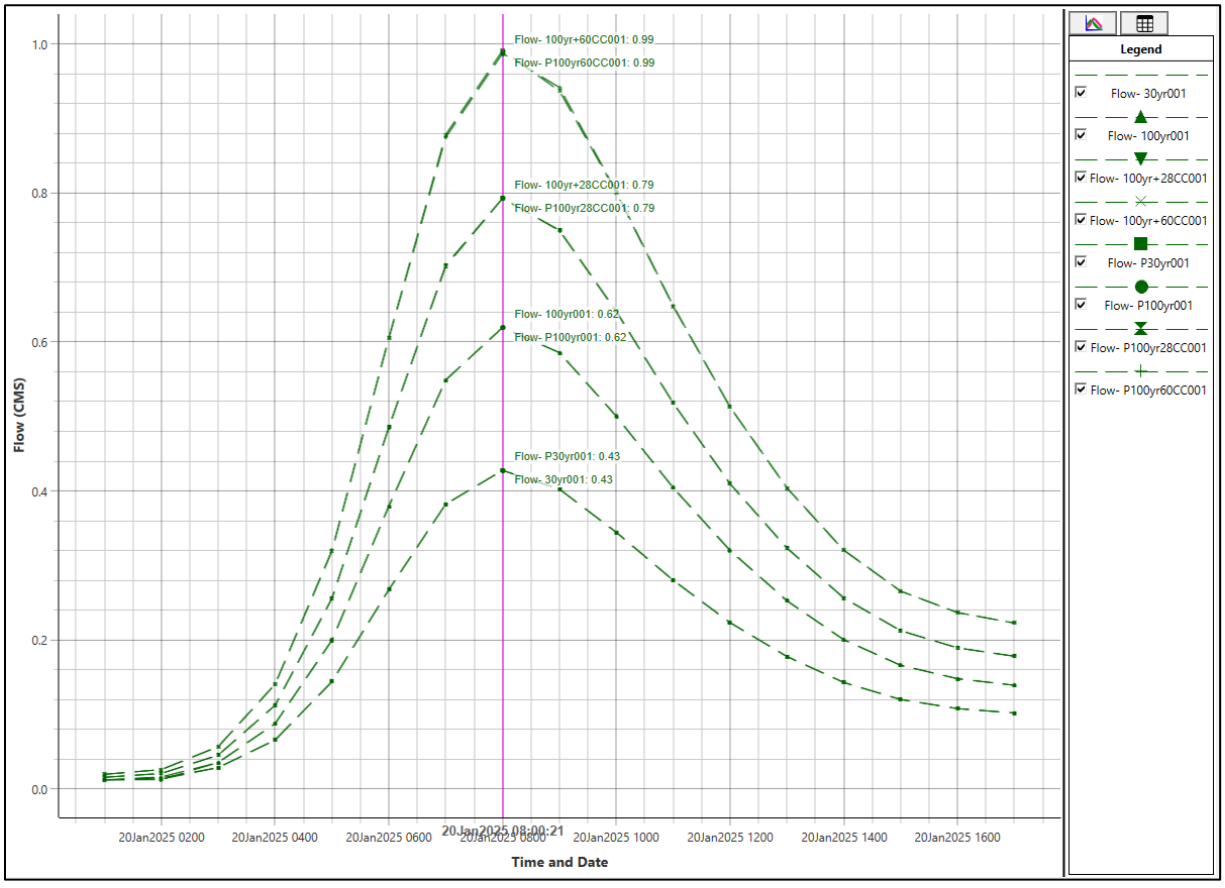
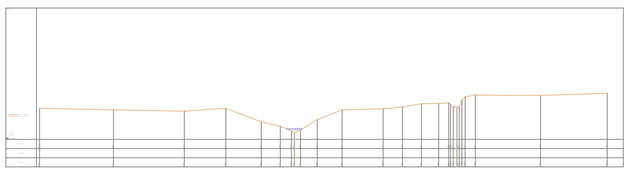


Figure 9 – Modelled Downstream Flow Hydrographs

REACH 1



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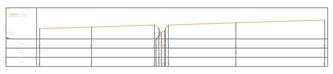

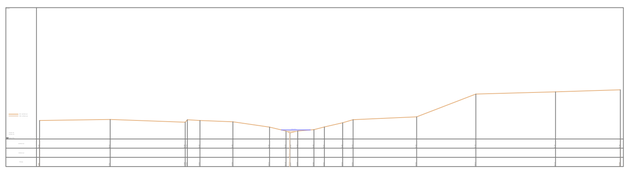

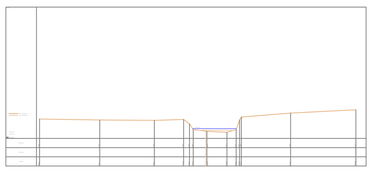

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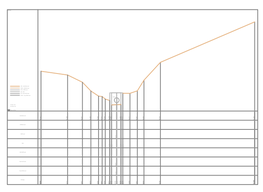

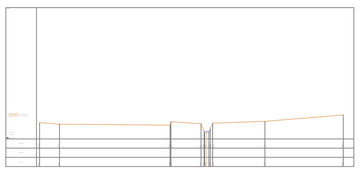

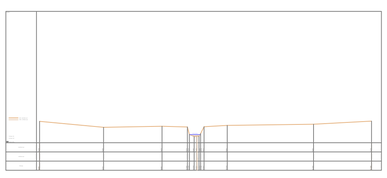

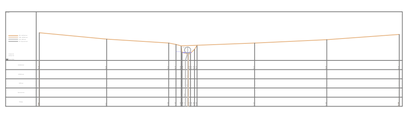

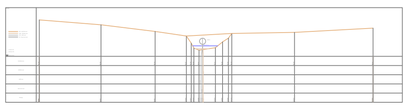

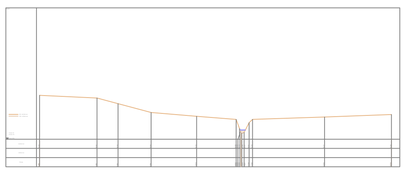

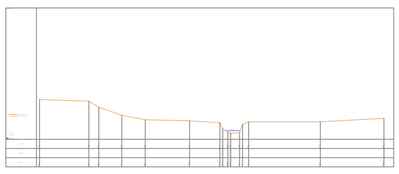

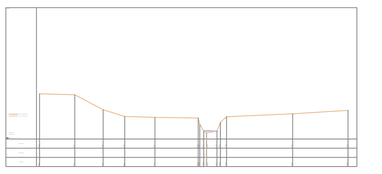

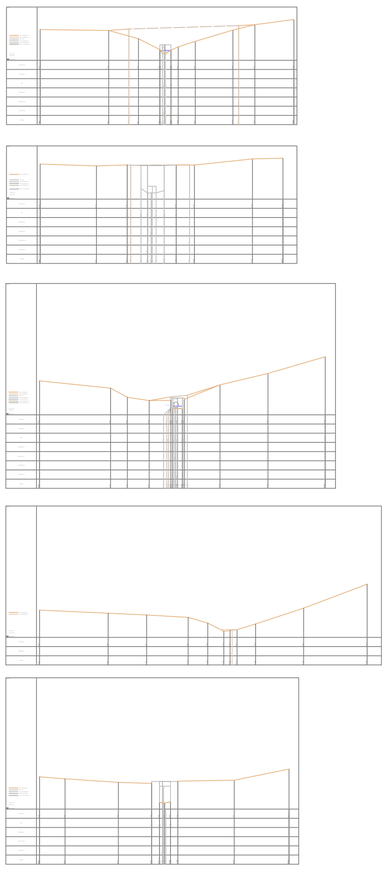

N

OS Note:

This survey has been orientated to the Ordnance Survey (O.S) National Grid OSGB36(15) via Global Navigation Satellite Systems (GNSS) and the O.S. Active Network (OS Net).

A true OSGB36 coordinate has been established near to the site centre via a transformation using the OSTN15GB & OSGM15GB transformation models.

The survey has been correlated to this point and a further one or more OSGB36 (15) points established to create a true O.S. bearing for angle orientation.

No scale factor has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied.

Please refer to Survey Station Table to enable establishment of the on-site grid and datum.

Legend:

Buildings	Overhead Cable	CVR	Cover (generic)	DrDuct	Drainage duct
Wall	Concrete edge	IC	Inspection chamber	Bo	Bollard
Kerb line	Tarmac edge	PInv	Pipe invert	IB	Illuminated bollard
Line marking	Grass verge	Gy	Gully	Bin	Rubbish bin
Drop kerb	Canopy/Overhang	Bg	Back gully	Vp	Vent pipe
Centre line	Verge	Dp	Down pipe	Grl	Ground light
Top of bank	Bottom of bank	Pipe	Pipe above ground	Lbox	Letter box
100.000	Station and Name / Station Level	MH	Manhole	Stmp	Tree Stump
		WL	Water level	Sty	Stile
		Fl	Flood light	IFL	Internal floor level
	Tree / Bush / Sapling	Lp	Lamp post	THL	Threshold level
	Area of Undergrowth	Tp	Telegraph post	Sp	Sign post
	Woodland	Ep	Electricity post	TH	Trialhole
R:	Ridge Level	Ti	Traffic light	BH	Borehole
E:	Eaves Level	Bus	Bus stop	ELC	Electric
F:	Flat Roof Level	Sv	Stop valve	BT	British Telecom
	Gate	St	Stop tap	Cbox	Control box
Fence types:		Er	Earth rod	TT	Tactile
IW	Interwoven	Wm	Water meter	BP	Brick paved
IR	Iron Railings	Gas	Gas valve	CPS	Concrete paving slabs
WM	Wire Mesh	Av	Air valve	CVR	Cover
PR	Post & Rail	ICU	Unidentified inspection	RWall	Retaining wall
PW	Post & Wire	Wo	Wash out	TWL	Top of Wall Level
CL	Chain Link	Re	Rodding eye	TCL	Tree canopy level
WF	Wooden Panels	BB	Bellsha beacon	G:	Girth
CB	Close Boarded	CTV	Cable tv	MG	Multi girth
SP	Steel Palisade	Mkr	Marker post	IC	Inspection chamber
		Gmkr	Gas marker post	CL:	Cover level
		So	Soffit	IL:	Invert level
		Fh	Fire hydrant	UTR	Unable to raise

Rev	Date	Description	Drawn	Q. Ref

greenhatch group

- Topographical Surveys
- Site Engineering
- Utility / CCTV Surveys
- Measured Building Surveys
- 3D Laser Scanning
- Revit & BIM Models

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Newcastle: 24 Riverside Studios, Amethyst Road, Newcastle Bus. Park, Newcastle-U-Tyne, NE4 7YL, t. (01912) 736391

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CLIENT

SEGRO

PROJECT

EMG 2, Watercourse Sections
Hemington Hill
DE74 2RA

TITLE

Watercourse Section Survey

SCALE	DATE
A0@ 1: 200	16.12.24
DRAWN	QUALITY REF.
JOS	GH23225

Level datum	See note
Grid orientation	See note
Job number	34529A

Drawing No.	Rev.
34529A_SECTION	0

Comments

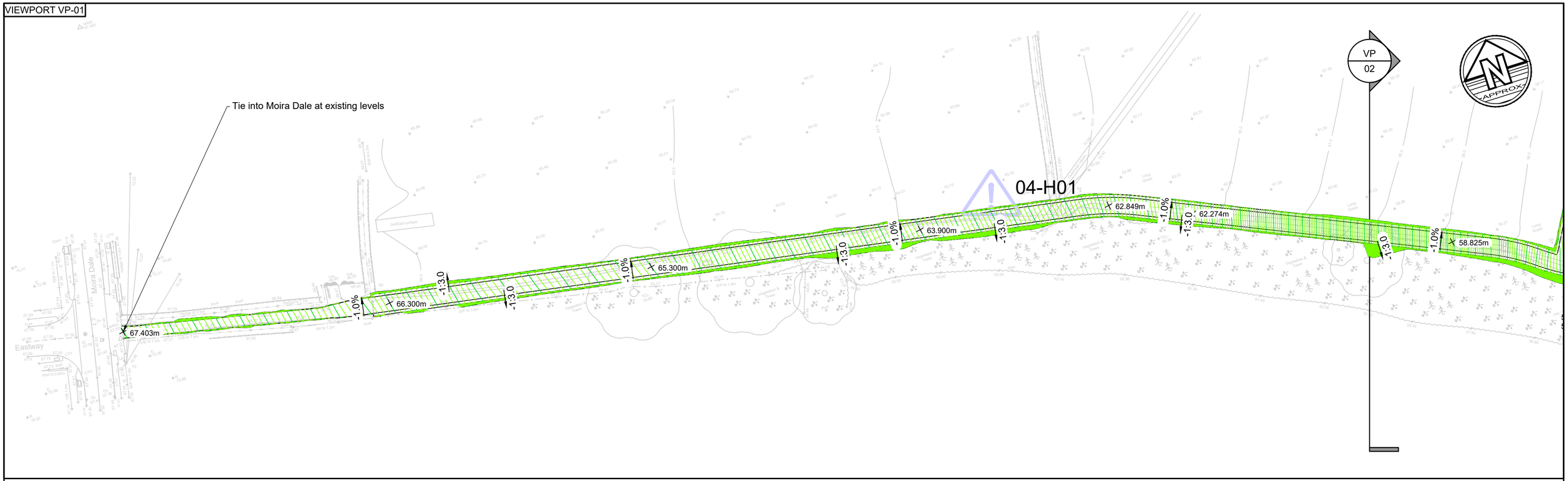
This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.

All dimensions should be checked on site prior to design and construction.

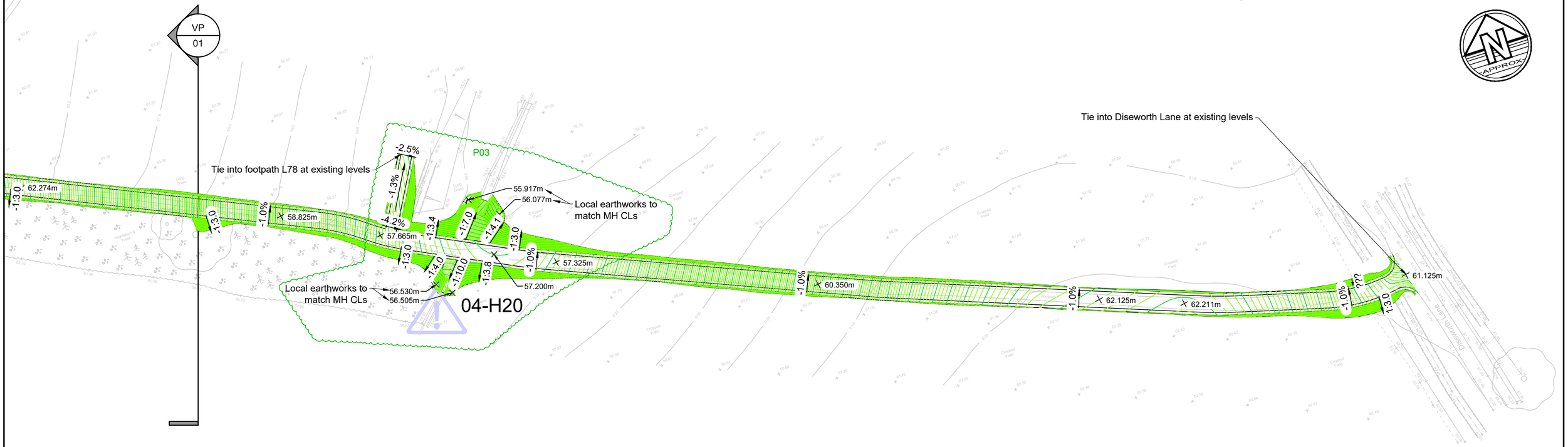
Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:

VIEWPORT VP-01



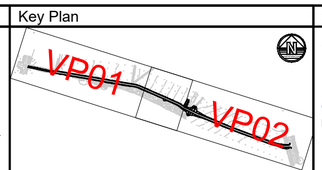
VIEWPORT VP-02



Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in metres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.

Key Plan



Legend

- Major contour 0.100m interval
- Minor contour 0.025m interval
- 1:3.0 Gradient as 1:X
- 3% Gradient as X%
- Bagwork Headwall

Hazards

04-HXX

Significant Construction Hazard. To be read in conjunction with; EMG-BWB-HGN-04-SH-H-0100_L57 Footpath DRA

Issues & Revisions

Rev	Date	Details of issue / revision	Drw	Rev
P01	14.01.25	Preliminary Issue	JB	RAL
P02	16.01.25	Note to refer to drainage drawings	JB	RAL
P03	12.02.25	L78 Link and culvert earthworks updated	JB	RAL

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Leeds | 0113 233 8000
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Nottingham | 0115 924 1100
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Client: SEGRO

Project Title: EAST MIDLANDS GATEWAY 2 L57 FOOTPATH

Drawing Title: FINISHED LEVEL CONTOURS

Drawn:	J. Bethell		Reviewed:	R. Leyland	
BWB Ref:	233445	Date:	14.01.25	Scale@A2:	1:500

Drawing Status: PRELIMINARY

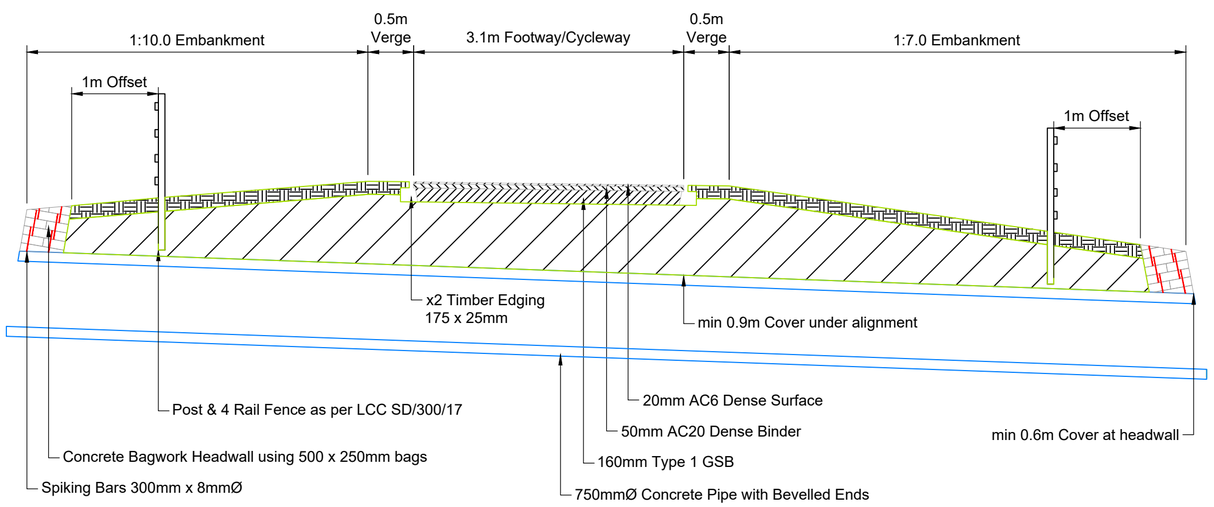
Project - Originator - Zone - Level - Type - Role - Number: EMG2-BWB-HGT-04-DR-C-0600

Status: S3

Rev: P03

J:\2023\233445-EMG\ProjectDelivery\01-WIP\Drawings\EMG2-BWB-HGT-04-DR-H-0600_L57 Footpath Finished Level Contours.dwg

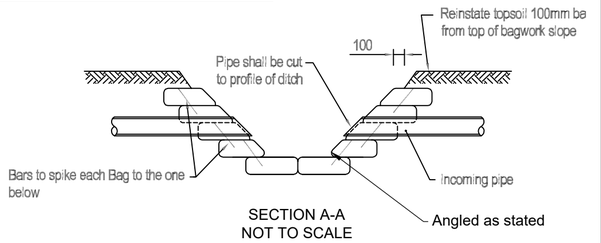
CROSS SECTION; 1:50



Chainage 285.00m

Culvert cross-section
Facing North-West

SECTION A-A, PLAN A; NOT TO SCALE



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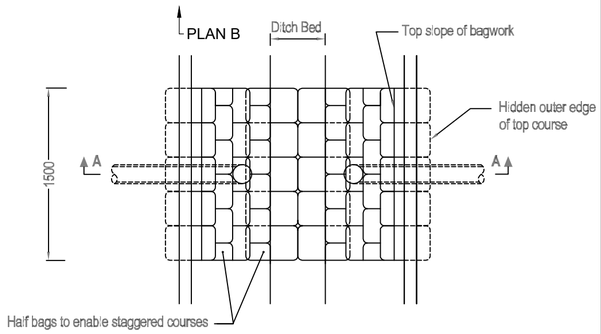
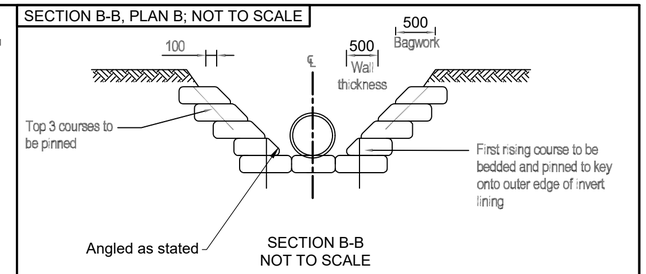


PLAN A
NOT TO SCALE

SECTION B-B, PLAN B; NOT TO SCALE



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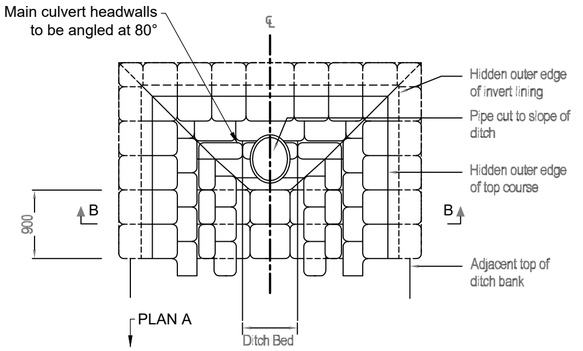
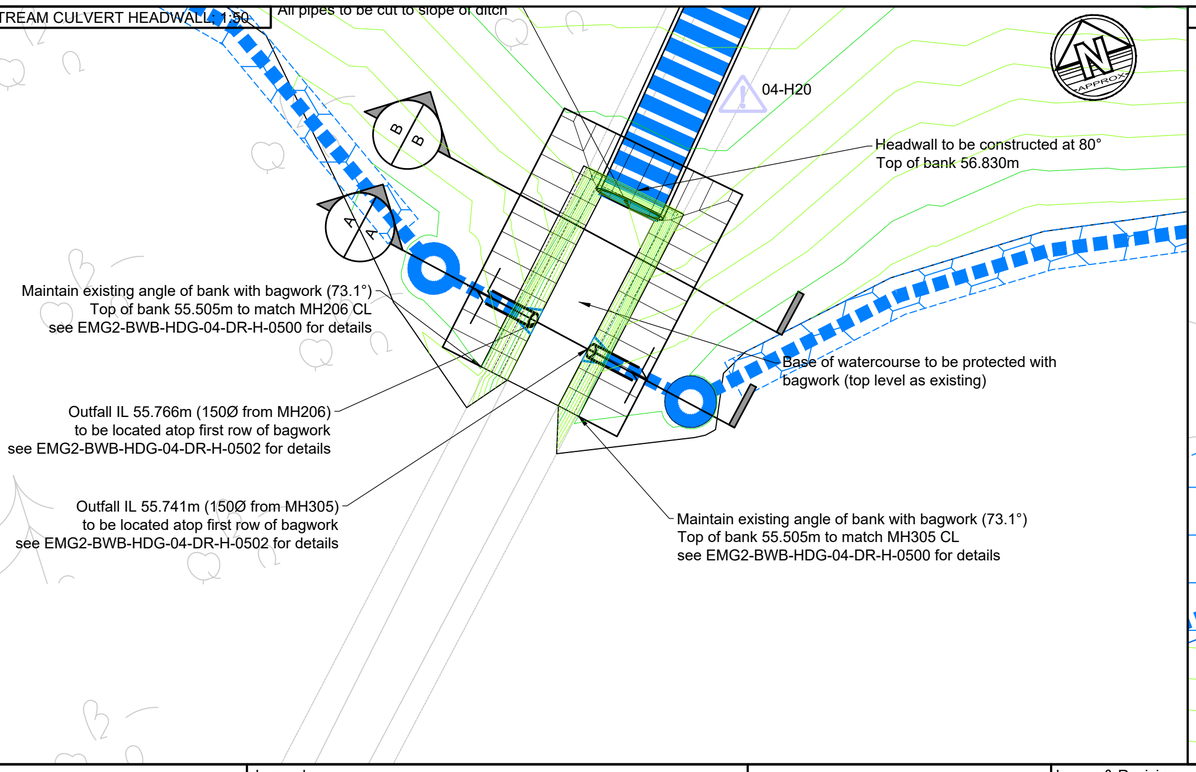
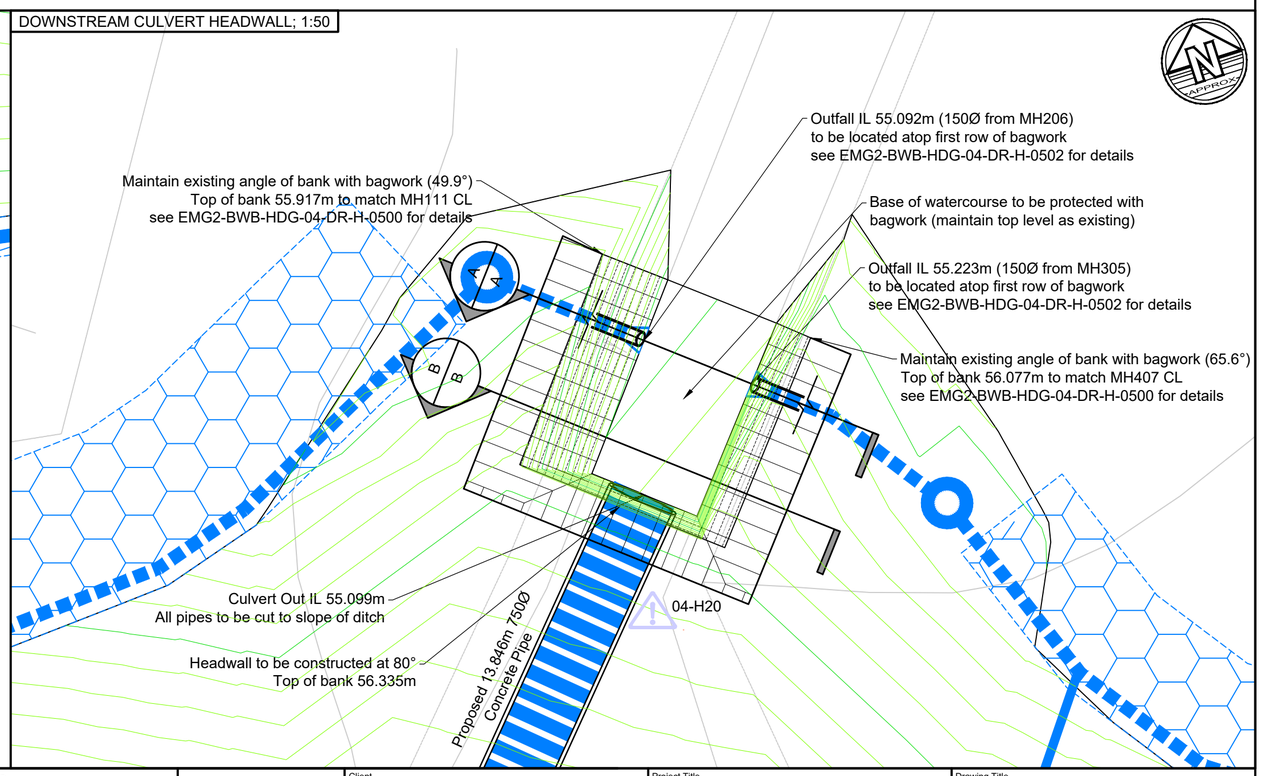


PLAN B
NOT TO SCALE

UPSTREAM CULVERT HEADWALL; 1:50



DOWNSTREAM CULVERT HEADWALL; 1:50



Notes

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Legend

Hazards

04-HXX

Significant Construction Hazard. To be read in conjunction with;
EMG-BWB-HGN-04-SH-H-0100_L57 Footpath DRA

Issues & Revisions

Rev	Date	Details of issue / revision	Drw	Rev
P01	17.01.25	Preliminary issue	JB	RAL
P02	12.02.25	Culvert upsized to 750mm, general edits	JB	RAL

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Manchester | 0161 233 4260
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Client: SEGRO

Project Title: EAST MIDLANDS GATEWAY 2 L57 FOOTPATH

Drawing Title: PROPOSED CULVERT

Drawn:	J. Bethell	Reviewed:	R. Leyland	
BWB Ref:	233445	Date:	17.01.25	Scale@A2: As Shown

Drawing Status: PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
EMG2-BWB-HDG-04-DR-W-0501	S3	P02

J:\2023\233445-EMG\ProjectDelivery\01-WIP\Drawings\EMG2-BWB-SMN-04-DR-H-0501_L57 Footpath Proposed Culvert.dwg

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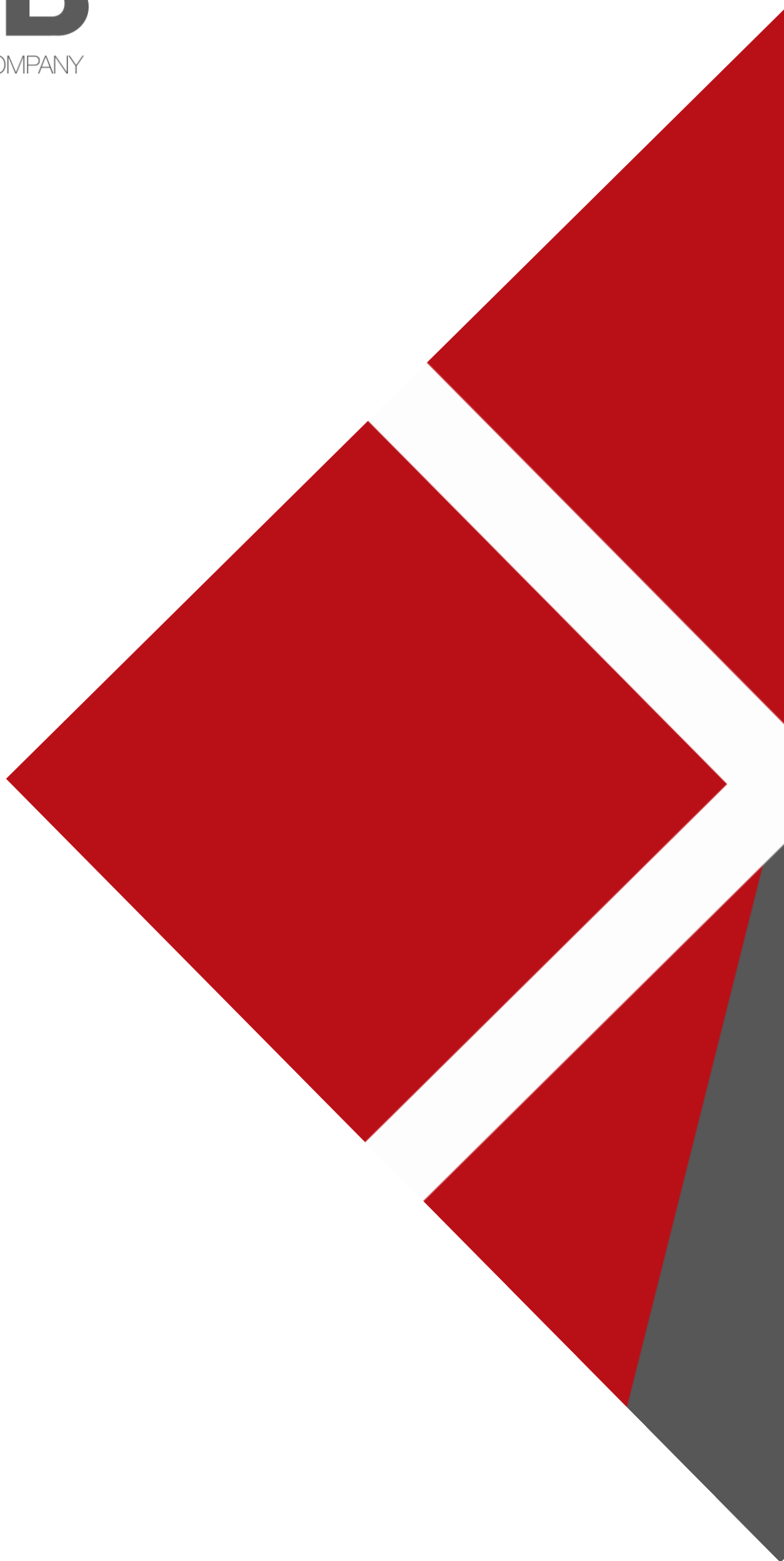

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