Level 2 Strategic Flood Risk Assessment – Site LPR107

Final Report

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Prepared for:
Hinckley and Bosworth Borough Council

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Hinckley & Bosworth Borough Council

Contents

1 Background

This is a Level 2 Strategic Flood Risk Assessment (SFRA) site screening report for LPR107. The content of this Level 2 SFRA site screening report assumes the reader has already consulted the Hinckley and Bosworth Level 1 SFRA and read the Hinckley and Bosworth Level 2 SFRA Main Report and is therefore familiar with the terminology used in this report.

1.1 Site details

- Location: Located to the west of Ratby, a settlement south of the M1
- Site area: 32.4ha
- Existing site use: Greenfield
- Proposed site use: Residential

1.2 Topography

Figure 1-1 shows the topography of the site represented by the Environment Agency (EA) 1m resolution LiDAR.

The site is divided into an eastern and western parcel, which are divided by an area of lower elevation where a watercourse flows between the two parcels.

The western parcel slopes downhill from southwest to northeast with maximum elevation of 110.1mAOD in the southwest corner of the site and minimum elevation of 93.2mAOD along the eastern site boundary.

The eastern parcel slopes downhill from north to south with maximum elevations of 112.3mAOD along the northern site boundary. Minimum elevations are 83.5mAOD along the southern site boundary.

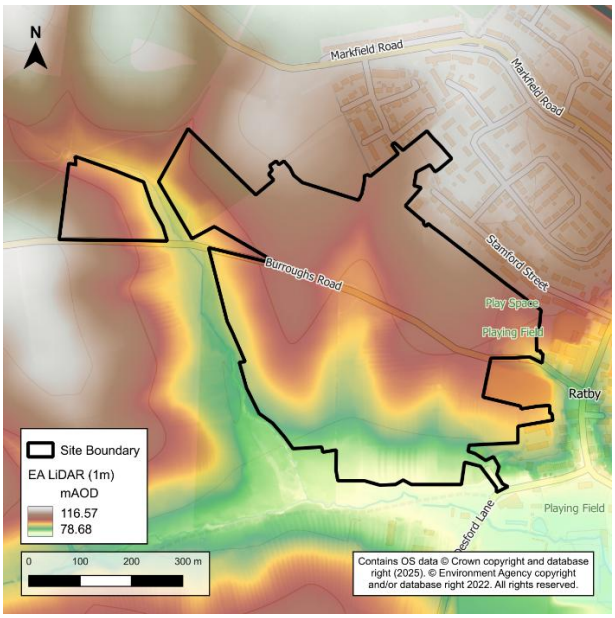


Figure 1-1: Topography of the site.

1.3 Geology and soils

Geology at the site consists of:

- Bedrock:
    - The western parcel is entirely Edwalton Member bedrock comprised of mudstone.
    - The eastern parcel is mostly Edwalton Member bedrock comprised of mudstone. A band of Gunthorpe Member, comprised of mudstone, bordered by Cotgrave Sandstone Member, comprised of sandstone, extends from the southeast corner of the site in a northerly direction.
- Superficial deposits:
    - The western parcel has glaciofluvial deposits (mid Pleistocene comprised of sand and gravel) to the west and Oadby Till Member comprised of Diamicton to the east.
    - The eastern parcel is underlain by a vertical band of alluvium comprised of clay, silt sand and gravel to the south. Silt, sand and gravel deposits continue in a northerly direction and branch out to the west. There are four bands of sand and gravel River Terrace Deposits in the south of the site. The north of the site is underlain by Thrussington Till Member comprised of diamicton.

Soils in both the western and eastern parcels mainly consist of slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils with slightly acid loamy and clayey soils with impeded drainage to the north of the site in both parcels.

2 Sources of flood risk

2.1 Location of site within the catchment.

The site is located in the centre of the 'Rothley Brook Catchment (tributary of Soar)'. The Rothley Brook is located approximately 700m south of the site flowing west to east through the catchment at this point. The catchment upstream of the site is predominantly rural but includes the settlements of Markfield, Bagworth, and Desford.

2.2 Existing drainage features

Online mapping shows there are no watercourses present within the site boundary. However, there is an unnamed watercourse which flows from north to south between the western and eastern site parcels where it joins another unnamed watercourse which flows in an easterly direction approximately 60m south of the eastern parcel.

2.3 Fluvial

2.3.1 Available data

The EA's Flood Map for Planning (FMfP) has been used within this assessment to inform Flood Zones 2 and 3a. Flood Zone 3b has been defined using the EA's Rivers and Sea 3.3% AEP defended flood risk extent.

There is currently no available depth, hazard, or velocity information available within the EA FMfP, therefore, detailed hydraulic modelling is likely to be required during a site-specific Flood Risk Assessment.

2.3.2 Description of risk to the site

Most of the site is within Flood Zone 1 and not shown to be at fluvial risk.

Fluvial flood risk follows the unnamed watercourse that flows north the south through the site between the western and eastern parcels. Neither site is within Flood Zone 3b. Flood Zones 3a and 2 slightly encroach on the eastern boundary of the western parcel. Flood Zone 2 also slightly encroaches on the southern boundary of the eastern parcel by the confluence of the two watercourses.

Table 2-1: Existing fluvial flood risk based on EA FMfP *.

Flood Zone 1 (%)	Flood Zone 2 (%)	Flood Zone 3a (%)	Flood Zone 3b (%)
99	<1	<1	0

**The percentage flood zones quoted show the percentage of the site at flood risk from that particular flood zone or event, excluding the percentage of the site at flood risk at a higher risk zone, e.g. Flood Zone 2 does not include the Flood Zone 3 percentage.*

2.4 Surface water

2.4.1 Available data

The EA's Risk of Flooding from Surface Water (RoFSW) map has been used within this assessment.

2.4.2 Description of risk to the site

The western parcel is not shown to be at risk of surface water flooding.

There is a surface water flow path which runs from the north to the south boundary of the eastern parcel across Burroughs Road before converging with a tributary of the Rothley Brook approximately 50m south of the site. This flow path is present in the 3.3% AEP, 1% AEP and 0.1% AEP events. The flood extents widen upstream of Burroughs Road showing the flow backing up before overtopping onto the road in the 1% and 0.1% AEP events. There is also a flow path along the northwestern boundary, which is present in all modelled AEP events, which flows towards the watercourse between the two site parcels.

In the 0.1% AEP event, further smaller flow paths develop in the northeast and southeast of the site.

Table 2-2 shows the maximum surface water depths, velocities, and hazards on the site. The maximum depths and hazards are associated with the main flow path in the centre of the site, where the flood extent widens upstream of Burroughs Road, whilst the maximum velocities are also along this flow path. Across the rest of the site surface water depths remain below 0.2m and are classified as 'Very Low Hazard'.

Table 2-2: Existing surface water flood risk based on the RoFSW map.

Event	3.3% AEP	1% AEP	0.1% AEP
Percentage of site at risk* (%)	1.5	1.0	3.2
Maximum depth (m)	Exceeds 0.6m but does not exceed 0.9m	Exceeds 0.6m but does not exceed 0.9m	Exceeds 0.6m but does not exceed 0.9m
Maximum velocity (m/s)	Exceeds 1.0m/s but does not exceed 2.0m/s	Exceeds 1.0m/s but does not exceed 2.0m/s	Exceeds 2.0m/s
Maximum hazard classification	Danger for Most	Danger for Most	Danger for Most

** The percentage surface water extents quoted show the percentage of the site at surface water risk from that particular event, excluding the percentage of the site at flood risk at a higher risk zone (e.g. the 1% AEP does not include the 3.3% AEP percentage).*

2.5 Reservoir

The site is not shown to be at risk of reservoir flooding during the 'dry day' or 'wet day' scenario from the EA reservoir flood maps.

2.6 Groundwater

The JBA Groundwater Emergence Map shows most of the site is not shown to be at risk of groundwater emergence due to the nature of the local geological deposits.

There is a band in the west of the western parcel where groundwater levels are between 0.025m and 0.5m below the ground surface. There is also a band extending through the centre of the eastern parcel where groundwater levels are between 0.025m and 0.5m below the ground surface. This area of land corresponds with the band of Cotgrave Sandstone which runs through the site.

Areas to the eastern and western banks of the unnamed watercourse show groundwater levels either at or very near (within 0.025m of) the ground surface. These areas include a small area in the southeast corner of the western parcel and the west boundary and southern boundary of the eastern parcel.

Based on the EA RoFSW mapping and topography of the site it is likely that any groundwater that emerges will flow in a north-easterly direction in the western parcel and in a southerly direction through the eastern parcel towards the lowered topography of the unnamed watercourses surrounding the site.

This assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific Flood Risk Assessment (FRA) stage.

2.7 Sewers

Severn Trent Water were consulted as part of the Regulation 18 process and each of the Strategic Housing and Employment Land Availability Assessment reports to provide comments on known issues of sewer flooding within or surrounding the site. The site is identified to have a potential high impact on the sewerage network. There is some model predicted flooding downstream of the size, so given the large size of the development it is likely have an adverse impact on the sewer network.

This assessment does not negate the requirement that drainage at the site should be in line with the drainage hierarchy (see Section 6.1).

2.8 Flood history

The EA's Historic Flood Map shows no records of flooding at the site.

Information provided by Leicestershire County Council shows no recorded flood incidents within the site. However, an incident was recorded on Markfield Road approximately 110m north of the site. The cause of this incident was highway flooding due to issues with the highway culvert.

3 Climate change

Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. Please see Section 4.6 of the Hinckley and Bosworth Level 2 SFRA report for information on climate change allowances.

Development proposals at the site must address the potential changes associated with climate change and be designed to be safe for the intended lifetime. The provisions for safe access and escape must also address the potential increase in severity and frequency of flooding.

3.1 Fluvial

3.1.1 Available data

The EA's FMfP Flood Zones plus Climate Change layer has been used to indicate areas of the site likely to be at increased flood risk in future.

There is currently no available depth, hazard, or velocity information available within the EA FMfP, therefore, detailed hydraulic modelling is likely to be required during a site-specific Flood Risk Assessment including modelling of the latest climate change uplifts.

3.1.2 Description of risk to the site

The site is not shown to be sensitive to increased fluvial risk. However, there is a minimal increase in extent on the eastern boundary of the western parcel where climate change flood extent is greater than the current extent of Flood Zone 2. In the eastern parcel, the climate change extent shows the same extent as Flood Zone 2.

3.2 Surface water

3.2.1 Available data

In the absence of suitable climate change data, the 0.1% AEP extent from the EA's RoFSW mapping has been used as a proxy to indicate areas likely to be at risk during the 1% AEP plus climate change event.

3.2.2 Description of risk to the site

The risk associated with surface water flooding is likely to increase with climate change. Key areas of risk include the northeast and southeast of the site due to the emergence of new flow paths in the 0.1% AEP. The main flow path in the centre of the site also increases in extent between the 1% AEP and 0.1% AEP events and the velocity and hazard classification also increases.

4 Flood risk management infrastructure

4.1 Defences

The EA AIMS dataset shows that the site is not protected by any formal flood defences.

4.2 Residual risk

The unnamed watercourse running west to east to the south of the site is culverted beneath Desford Lane. The EA FMfP shows this culvert causes a flow constriction with water backing up upstream of the culvert and overtopping onto Desford Lane within close proximity of the site boundary. There is a residual risk of blockage of the culvert resulting in increased upstream flood risk which could encroach onto the site.

The unnamed watercourse which runs between the two site parcels is also presumed to be culverted beneath Burroughs Road which presents a residual risk of water backing up onto the site in the event of a blockage.

5 Emergency planning

5.1 Flood warnings and alerts

The site is not located in an EA Flood Warning or Flood Alert Area.

5.2 Access and escape

Safe access and escape routes will need to be demonstrated in the 1% AEP plus climate change fluvial and surface water events. Site drainage proposals should address the requirements for access routes, avoid impeding surface water flows and preserve the storage of surface water to avoid exacerbation of flood risk elsewhere on the site and in the wider catchment.

5.2.1 Potential access

As the site is divided into two parcels, access and escape should be considered to both the western and eastern parcels.

The western parcel can be accessed via Burroughs Road to the south. Burroughs Road is not a through road and can only be accessed from the east.

The eastern parcel of the site can be accessed via Burroughs Road which runs through the centre of the site via the village of Ratby to the east. Groby Road provides access to two side streets which provide potential access routes to the north of the site: Stamford Street and Markfield Road. There is also potential access via Desford Lane from the southeast.

5.2.2 Fluvial

The Flood Zones plus Climate Change dataset shows that access to the western parcel of the site via Burroughs Road is impeded by the unnamed watercourse which flows between the two site parcels and results in flood risk on the road. This would also potentially impede a new access road from the north via Markfield Road. Detailed hydraulic modelling of this watercourse would be required including survey of the channel and any culverts under the road to confirm the predicted depths, velocities and hazards of the flood risk and demonstrate how safe access and escape can be provided.

Access and escape to the eastern parcel via Desford Lane is shown to be impeded within the Flood Zones plus Climate Change dataset but the other potential access and escape routes are shown to remain free from risk.

5.2.3 Surface water

The eastern parcel is bisected by a surface water flow path. In all modelled AEP events velocities exceed 0.5m/s along this flow path, with significant areas exceeding 1m/s in the 0.1% AEP event. In the 3.3% AEP and 1% AEP events the flow path is classified predominantly as 'Very Low Hazard' however in the 0.1% AEP event this increases to 'Danger for Some' so access and escape to each side of the parcel may need to be considered separately.

Access through the site along Burroughs Road may be impacted in all modelled AEP events. There is a flow path which originates within the site and flows along Burroughs Road to the east of the site. Depths are shown for each between 0.3m and 0.6m, with velocities which exceed 1.0m/s in the 3.3% and 1% AEP events and exceed 2.0m/s in the 0.1% AEP event, with a hazard classification of 'Danger for Most'.

Access to the western side of the site may be possible via a new access route from Markfield Road from the north. Although surface water flow paths are shown to form along Markfield Road, depths are not shown to exceed 0.3m when accessed from Ratby to the east, with maximum hazard classification of 'Danger for Some' in the 0.1% AEP event, so access and escape are likely to still be possible. There is a surface water flow path which develops just west of the site which may impede access and escape along Markfield Road from the west.

Access to the eastern side of the site is likely to be possible via Stamford Street, with depths not shown to exceed 0.2m and a maximum hazard classification of 'Danger for Some' in the 0.1% AEP event.

5.3 Dry islands

The site is not located on a dry island.

6 Requirements for drainage control and impact mitigation

6.1 Broadscale assessment of possible SuDS

Surface water at the site should be discharged in accordance with the drainage hierarchy as set out in the National standards for SuDS (gov.uk). SuDS that provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity, should be prioritised. SuDS proposals should be discussed with relevant stakeholders (Local Planning Authority, Lead Local Flood Authority, and the EA) at an early stage to understand possible constraints.

Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.

The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.

The following factors should be considered when assessing whether infiltration is suitable at the site:

- Groundwater levels are indicated to be at or very near (within 0.025m) ground level along the western and southern boundaries of the eastern parcel and there is a risk of groundwater flooding at the surface during a 1% AEP event, which may flow to and pool within topographic low spots. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Additional site investigation work may be required to support the detailed design of the drainage system. This may include groundwater monitoring to demonstrate that a sufficient unsaturated zone has been provided above the highest occurring groundwater level. Below ground development such as basements are not appropriate in these areas of the site.
- BGS data indicates that the underlying geology is mudstone and is likely to be poorly draining. Any proposed use of infiltration should be supported by infiltration testing. Off-site discharge in accordance with the SuDS hierarchy is required to discharge surface water runoff.
- The site is not located within a Groundwater Source Protection Zone and there are no restrictions over the use of infiltration techniques with regard to groundwater quality.
- The site is not located within a historic landfill site.

If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner (see Section 2.7).

The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 3.3% AEP, 1% AEP and 0.1% AEP event. The main flow path in the eastern parcel of the site should be integrated into the site drainage strategy as blue-green infrastructure.

6.2 Opportunities for wider sustainability benefits and integrated flood risk management

The following are opportunities for wider sustainability benefits and integrated flood risk management at the site:

- Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.
- Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered.
- Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The site is in close proximity of a tributary of Rothley Brook, which is currently classified as having moderate ecological status. The use of multistage SuDS treatment will improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies.

7 NPPF and planning implications

7.1 Exception Test requirements

The Local Planning Authority will need to confirm that the Sequential Test has been carried out in line with national guidelines. The Sequential Test will need to be passed before the Exception Test is applied.

The NPPF classifies residential development as ‘More Vulnerable’

Should ‘More Vulnerable' development be proposed within the extent of Flood Zone 3a, the Exception Test will be required for this site.

7.2 Requirements and guidance for site-specific Flood Risk Assessment

At the planning application stage, a site-specific FRA will be required as the proposed development site is:

- greater than 1 hectare.
- in Flood Zones 2 and 3a.
- at risk of flooding from surface water.
- identified as being at increased flood risk in the future.

All sources of flooding should be considered as part of a site-specific FRA.

Consultation with the Local Authority, Lead Local Flood Authority, Water Company, and the EA should be undertaken at an early stage.

Any FRA should be carried out in line with latest guidance including the National Planning Policy Framework (NPPF), Flood Risk and Coastal Change Planning Practice Guidance (PPG), and Hinckley and Bosworth Local Plan Policies.

The development should be designed with mitigation measures in place where required.

7.3 Guidance for site design and making development safe

The site layout must adopt a sequential approach by steering more vulnerable aspects of the development away from the areas of highest risk of the main flow path in the eastern parcel of the site. Developers should consider utilising this area as a green corridor or as a location for SuDS. The sequential approach should also consider steering more vulnerable aspects of the development away from the small areas of fluvial risk on the eastern boundary of the western site parcel and the southern boundary of the eastern site boundary.

The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as

possible to pre-development greenfield rates, with areas of surface water ponding used as open space and SuDS or water compatible/essential infrastructure uses only.

Arrangements for safe access and escape will need to be provided for the 1% AEP fluvial and surface events with an appropriate allowance for climate change, considering depth, velocity, and hazard. Design and access arrangements will need to incorporate measures, so development and occupants are safe. A detailed hydraulic model of the unnamed watercourse which runs between the site parcels may be required at FRA stage, including its interaction with Burroughs Road, to accurately represent the risk from this watercourse and demonstrate that safe access and escape to the western site parcel can be achieved.

Provisions for safe access and escape should not impact on surface water flow routes or contribute to loss of floodplain storage. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.

Finished Floor Levels should be raised above the expected height of flooding in line with the EA's guidance and any raising of ground levels should ensure that flood risk is not increased elsewhere.

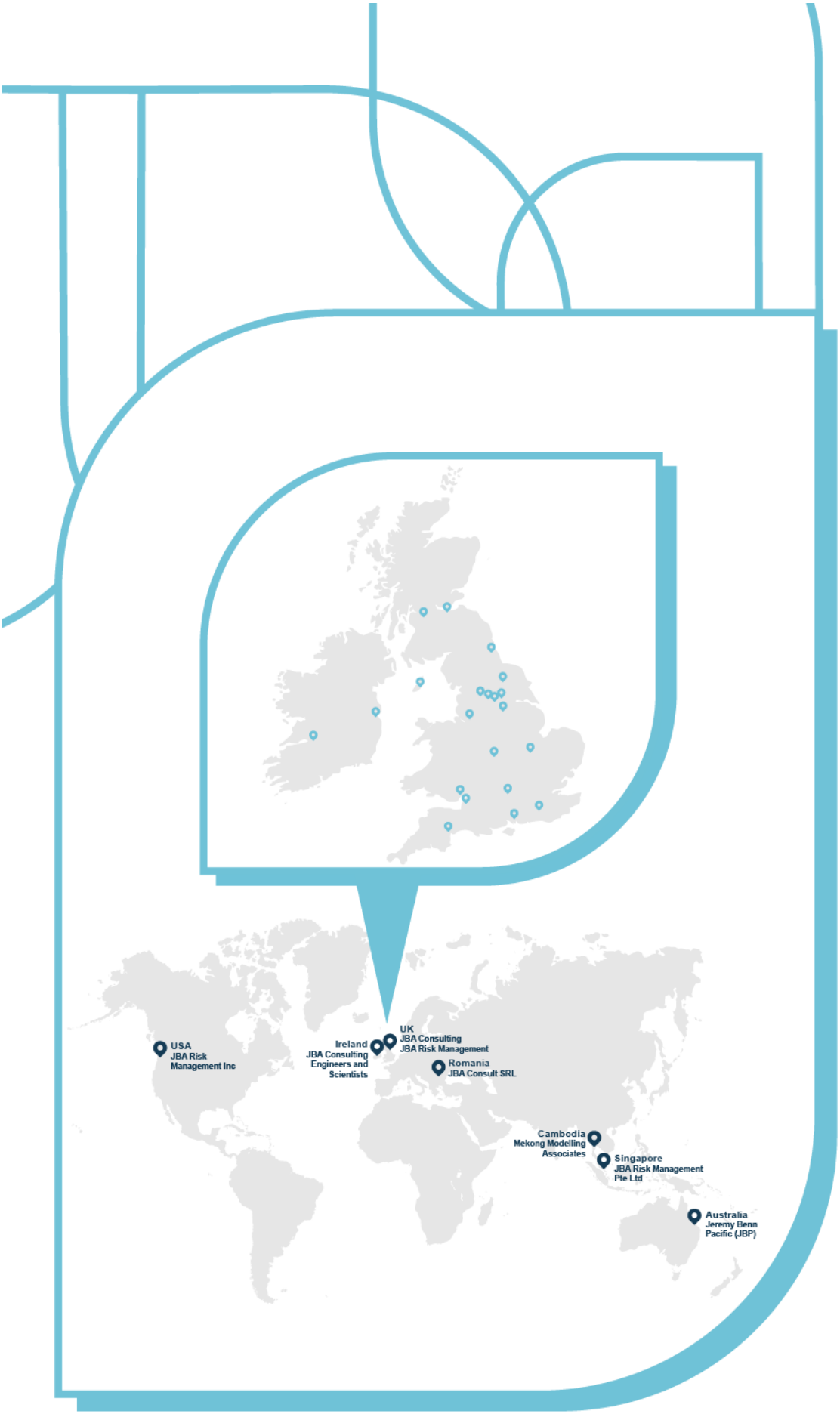
8 Conclusions

The predominant risk is from a surface water flow path which bisects the eastern site parcel in all AEP events, with a second flow path along the northwestern boundary. The site is split into an eastern parcel and a western parcel with an unnamed watercourse which runs between them joining a second watercourse which flows to the south of the eastern parcel. There are small areas of fluvial risk to the eastern boundary of the western site parcel and the southern boundary of the eastern site parcel and access and escape to the western site parcel is likely to be impeded by the fluvial risk. There is also a residual risk of further fluvial risk on the site as a result of culvert blockages where the watercourses cross Burroughs Road and Desford Lane.

Should ‘More Vulnerable' development be proposed within the extent of Flood Zone 3a, the Exception Test will be required for this site. A site-specific FRA will be required as the proposed development site is greater than 1 hectare, at fluvial and surface water risk, and identified as being at increased flood risk in the future.

The following points should be considered in development of this site:

- The site layout must adopt a sequential approach by steering more vulnerable aspects of the development away from the areas of highest risk by the surface water flow paths in the centre and northwestern boundaries of the eastern parcel, and the areas of fluvial risk along the southern boundary of the eastern parcel and the eastern boundary of the western parcel. Developers should consider utilising these areas as green corridors and public open space.
- Safe access and escape routes should be demonstrated in the 1% AEP plus climate change fluvial and surface water events. This initial assessment has shown that the unnamed watercourse may impede access and escape to the western site parcel. A detailed hydraulic model of the unnamed watercourse which runs between the site parcels may be required at FRA stage, including its interaction with Burroughs Road, to accurately represent the risk from this watercourse and demonstrate that safe access and escape to the western site parcel can be achieved.
- A carefully considered and integrated flood resilient and sustainable drainage design should be put forward, including a site-specific Surface Water Drainage Strategy, and SuDS maintenance and management plan and supported by detailed modelling with development to be steered away from the areas identified to be at highest risk of surface water flooding within the site.
- Flood mitigation measures should be implemented then tested to check that they will not displace water elsewhere (for example, if land is raised to permit development in one area, compensatory flood storage will be required in another).



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1 Broughton Park
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North Yorkshire
BD23 3FD
United Kingdom

+44(0)1756 799919
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