# Level 2 Strategic Flood Risk Assessment – Site LPR16 B

## 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 LPR16 B. 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: Land situated to the south of Burbage.
- Site area: 71.01ha
- Existing site use: Greenfield, existing buildings onsite
- Proposed site use: not currently confirmed, may be promoted for residential or employment use

## 1.2 Topography

Figure 1-1 shows the topography of the site represented by the Environment Agency (EA) 1m resolution LiDAR. The EA 1m resolution LiDAR shows that the site is predominantly at a lower elevation, with an area of higher elevation to the western site boundary. The site generally slopes from west to east, with the maximum elevation being approximately 110.38mAOD at the western site boundary, and the minimum elevation being approximately 88.46mAOD to the southeastern corner site boundary.

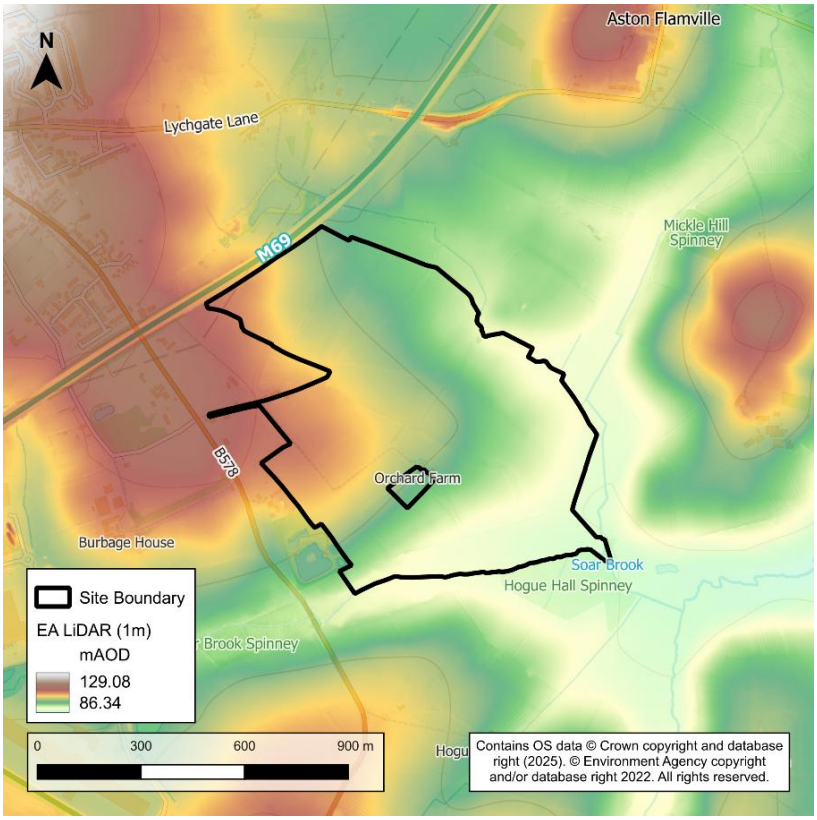



Figure 1-1: Topography of the site.

## 1.3 Geology and soils

Geology at the site consists of:

- Bedrock - Mercia Mudstone Group comprising of mudstone.
- Superficial:
  - Oadby Till Member consisting of diamicton to the centre and northwest of the site.
  - Wolston sand and gravel in centre and northeast of the site.
  - Bosworth Clay Member, comprised of clay and silt, to the east of the site.

Soils at the site consist of:

- Slightly acid loamy and clayey soils with impeded drainage in the western half of the site.
- Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils to the eastern half of the site.

# 2 Sources of flood risk

## 2.1 Location of site within the catchment

The site is in the upstream end of Soar Brook within Source to Soar Water Body catchment, in Burbage. The catchment draining to the site is approximately an area of 0.6km$^2$. There is an unnamed watercourse flowing south along the eastern border of this site, where it joins Soar Brook, which flows easterly along the southern site boundary. The upstream catchment is predominantly rural but encompasses the western side of Burbage.

## 2.2 Existing drainage features

Running along the southern site boundary from a suspected culvert under the B578 is the Soar Brook, which flows in an easterly direction before joining the River Soar. Running along the eastern site boundary from a suspected culvert under the M69 is an unnamed watercourse which flows in a southerly direction before joining Soar Brook at the southeastern corner of the site. Within the site, there are depressions in the topography which surface water flow paths follow, leading from the centre of the site to the eastern boundary. Online imagery confirms these are ditches under lines of hedgerows in the fields to the north of the site. Situated just outside the site at the southwestern border is Parkland Farm Fishery, which is a two-acre lake.

## 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 to inform a site-specific Flood Risk Assessment.

### 2.3.2 Description of risk to the site

Most of the site is shown not to be at fluvial flood risk.

Flood Zone 2, Flood Zone 3a, and Flood Zone 3b are shown to follow the path of Soar Brook along the southern site boundary, flowing west to east, and an unnamed watercourse flowing along the southeastern site boundary, flowing north to south. The topography of the site means that fluvial risk is confined to the low-lying areas along the banks of the watercourses in the southeastern part of the site.

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

| Flood Zone 1 (%) | Flood Zone 2 (%) | Flood Zone 3a (%) | Flood Zone 3b (%) |
|---|---|---|---|
| 92.7 | 1.1 | 3.3 | 2.9 |

**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

Most of the site is not shown to be at risk of surface water flooding.

The RoFSW mapping indicates that surface water flooding extents are primarily aligned with the existing watercourses and low-lying areas in the north and centre of the site. In all AEP events, there is a surface water flow path that follows the existing watercourse flowing south along the eastern site boundary and then east along the southern boundary of the site. Similarly, in all AEP events, there is surface water ponding in the LiDAR depressions under the hedgerows in the fields in the northern section of the site.

The greatest surface water depths, velocities, and hazard on the site are associated with the unnamed watercourse (Table 2-2).

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* (%) | 1.2 | 0.7 | 2.2 |
| 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 0.5m/s but does not exceed 1.0m/s | Exceeds 1.0m/s but does not exceed 2.0m/s | Exceeds 1m/s but does not exceed 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 an area in the centre of the site and another in the north that are at risk of groundwater emergence. To the centre of the site, groundwater is shown to be between 0.5m and 5m below the ground surface, with a small area where groundwater levels are between 0.25 and 0.5m below the ground surface to the south of the area. To the north of the site, groundwater is shown to be between 0.025m and 0.5m below the ground at the northern site boundary, and 0.5 to 5m below the ground surface further towards the centre of the site. Towards the northern boundary, there is a path where groundwater is shown to be within 0.25m of the ground surface.

Based on the EA RoFSW mapping and topography of the site it is likely that any groundwater that emerges will flow to the area of lower elevation towards the eastern and southern site boundaries.

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.

Severn Trent Water has not been consulted on this site however, an assessment was provided for LPR16 this site was previously combined with LPR16A. For the combined site, Severn Trent Water predict a high overall impact on sewer infrastructure and state that drainage could connect to Aston Flamville Sewage Pumping Station (SPS) to the north of the site. Known network constraints include model predicted flooding at Aston Flamville Road SPS. Ongoing consultation with Severn Trent Water should be undertaken throughout the development process, as the size of the site will likely have an adverse impact on the SPS performance.

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 on or surrounding the site.

# 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 EA's FMfP Flood Zones plus Climate Change layer shows that there is minimal increased fluvial risk in the future at this site. The extent of flooding increases slightly along Soar Brook at the southern site boundary, and just outside the eastern site boundary along the unnamed watercourse. The data shows that the site is not particularly sensitive to climate change.

## 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 RoFSW mapping shows that the site is sensitive to increased risk with climate change. The main difference between the 1% and 0.1% AEP events is the increase in extent along the unnamed watercourse at the eastern site boundary, and along Soar Brook to the south of the site. Similarly, instances of surface water ponding within the site increase during the 0.1% AEP event, particularly in the areas of elevation depressions under hedgerows along the field borders within the site.

Within and surrounding the site maximum depths, velocities and hazard classification remain unchanged between the AEP events, indicating only limited additional surface water hazard under future climate conditions.

# 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

Soar Brook is culverted just before it enters the site beneath the B578, creating potential residual risk from a blockage resulting in water backing up within the site. The topography of the site means any water is likely to remain confined to the floodplain of Soar Brook along the southern site boundary.

Located just outside the site under the M69 is another suspected culvert, increasing the risk that water would back up, overtop onto the road, and flow to a lower elevation, potentially entering the site.

# 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

Potential access to the site may be possible from:

- The B578 to the west of the site.
- The unnamed track leading to Orchard Farm, accessible from the B578 to the west of the site.

### 5.2.2 Fluvial

Access and escape are not shown to be impacted during any of the available fluvial flood events, including the 1% AEP plus climate change dataset. The FMfP Flood Zone 2 layer shows that access from the B578 is cut off when approaching from the south, but access would still be possible when approaching from the north.

### 5.2.3 Surface water

Access and escape via the B578 and the unnamed track leading to Orchard Farm remains passable during all AEP surface water events. Along the B578, surface water pools beside the highway in areas of lower elevation and within the waterbody to the western site boundary.

During the 3.3% AEP event, this surface water ponding has a depth of 0.2m, a velocity of 0.25m/s, and a hazard classification of ‘Very Low’.

During the 1% AEP event, surface water extents increase slightly, with maximum depths reaching 0.3m, a maximum velocity of 1.0m/s, and a hazard classification of ‘Danger for Some’.

During the 0.1% AEP event, surface water extents increase again, with a maximum depth of 0.3m, a maximum velocity of 1.0m/s, and a hazard classification of ‘Danger for Some’.

## 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 less than 0.5m below ground level during a 1% AEP event. 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 at this site.
- BGS data indicates that the underlying geology is Mercia Mudstone Group-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 following the SuDS/drainage hierarchy, 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).

Where possible, proposed attenuation features such as basins, ponds and tanks should be located outside of Flood Zone 2 and 3 to avoid the potential risks to the hydraulic capacity or structural integrity of these features. Surface water outfalls that discharge into Soar Brook may be susceptible to surcharging due to water levels in Soar Brook. The impacts of flood flows will need to be considered in terms of the attenuation storage requirements of the site and placement of the outfalls.

The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 3.3%, 1%, and 0.1% AEP events. Soar Brook, the unnamed watercourse to the east, and the depressions in elevation in the north 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 should be considered.
- Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. 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.

This site may be promoted for residential or employment use. The NPPF classifies 'Employment' development as 'Less Vulnerable' and residential development as 'More Vulnerable'

The Exception Test is not required for 'Less Vulnerable' development. Should 'More Vulnerable' development be proposed within the extent of Flood Zone 3a, the Exception Test will be required for this site. Neither 'More Vulnerable' or 'Less Vulnerable' development will be permitted within the extent of Flood Zone 3b.

## 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, 3a, and 3b
- at risk of flooding from ordinary watercourse and surface water
- identified as being at increased flood risk in 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 by the low-lying areas surrounding Soar Brook and the unnamed watercourse, and the low-lying areas to the north, south, and east of the site where significant surface water risk is evident. Developers should consider utilising the land around the watercourses as a green corridor or as a location for SuDS and integrate this into a drainage strategy for the site.

A detailed hydraulic model of the unnamed watercourse to the east of the site may be required at FRA stage to accurately represent the risk from this watercourse.

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.

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.

If proposed works affect an ordinary watercourse, Leicestershire County Council as the Lead Local Flood Authority should be contacted respectively to obtain prior written consent. Any watercourses should be accommodated within the site layout and should not be culverted except for where access is required. The site layout should allow for access to any watercourse for maintenance and they should generally be located within publicly accessible areas. A buffer of at least 8 metres should be maintained between the watercourses and any built development.

# 8 Conclusions

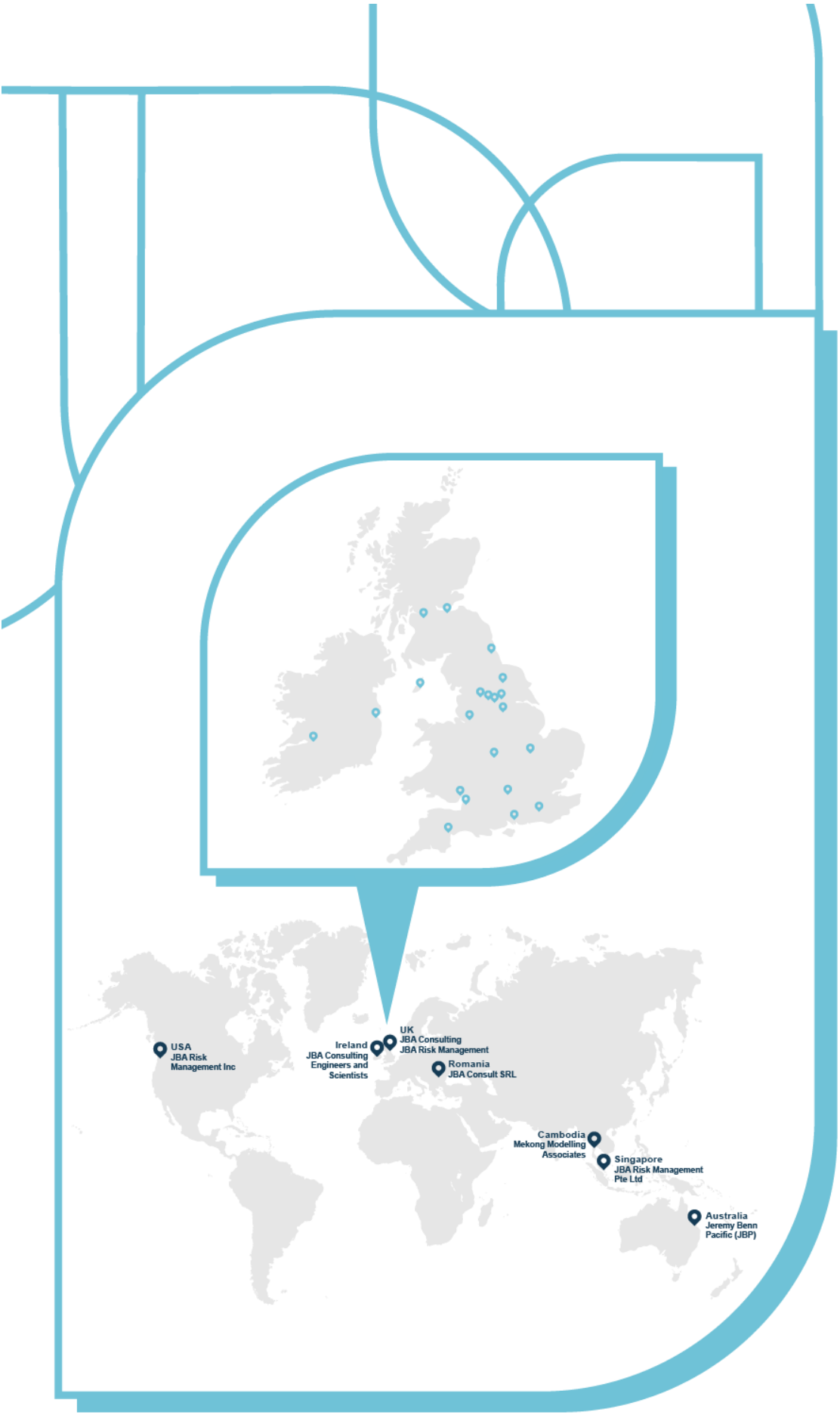
The site is affected by fluvial and surface water flooding, however this is mostly along the southern and eastern boundaries and much of the site is shown to not be at risk of flooding. The south of the site and just outside the eastern border are at risk of fluvial flooding along Soar Brook and the unnamed watercourse. Similarly, surface water flooding is primarily in the low-lying areas around these watercourses, with instances of surface water ponding in the ditches to the north and centre of the site.

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

A site-specific FRA will be required, because the proposed development site is greater than 1 hectare, in Flood Zones 2, 3a and b, subject to ordinary watercourse and surface water flooding, and identified as being at increased flood risk in the future.

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

- A buffer of at least 8 metres should be maintained between the watercourses and any built development.
- The site layout must adopt a sequential approach by steering more vulnerable aspects of the development away from the areas of highest risk in the south and east of the site. Developers should consider utilising these areas as green corridors.
- A detailed hydraulic model of the unnamed watercourse to the east of the site may be required at FRA stage to accurately represent the risk from these watercourses. Detailed survey of the culverts within and surrounding the site is likely to be required to ensure these are properly represented within the modelling as the available flood risk mapping shows these are likely to significantly impact the flood extents within the site.
- Safe access and escape routes should be demonstrated in the 1% AEP plus climate change fluvial and surface water events.
- 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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