Level 2 Strategic Flood Risk Assessment – Site LPR235 A

Final Report

April 2026

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 LPR235 A. 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: New settlement at Lindley Meadows, east of Fenny Drayton.
- Site area: 241.70ha
- Existing site use: Predominantly greenfield with existing buildings central and to the south of the site.
- Proposed site use: Mixed use (option for a new settlement)

1.2 Topography

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

The site slopes downhill from the east to the west with maximum elevations of 113.6mAOD to the northeast in Lindley Wood and minimum elevations of 77mAOD in the southwest corner of the site. An unnamed watercourse flows east to west through the site and lowest elevations are shown downstream of this watercourse in the southwest.

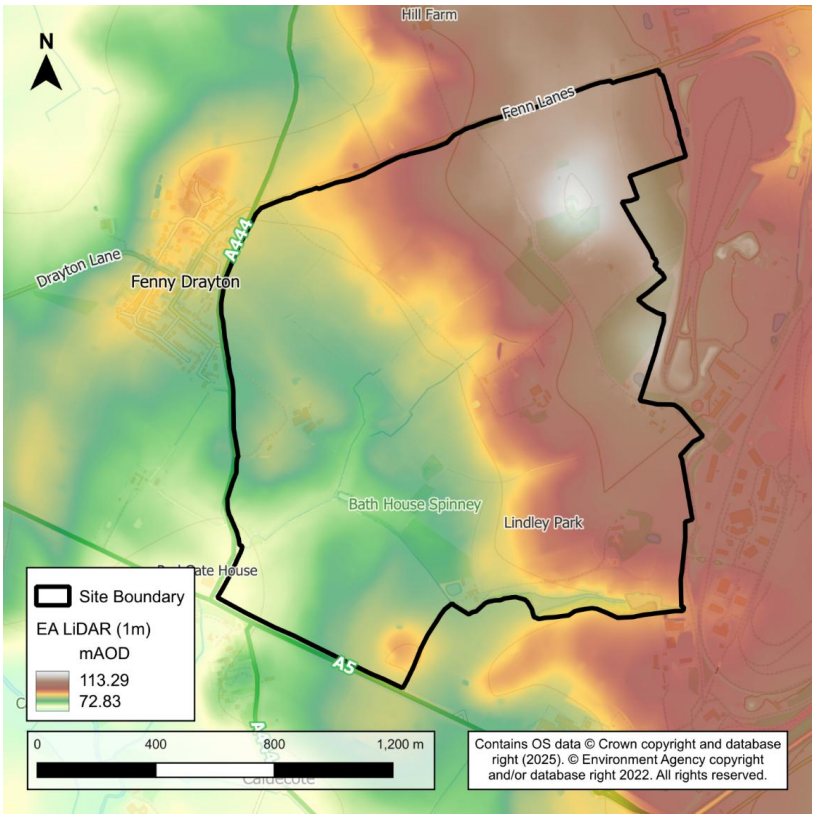


Figure 1-1: Topography of the site.

1.3 Geology and soils

Geology at the site consists of:

- Bedrock - Mercia Mudstone Group bedrock comprised of mudstone. There are vertical bands of Gunthorpe Member bedrock comprised of dolomitic siltstone to the east of the site.
- Superficial deposits
    - The southwest of the site is underlain by a band of Anker Sand and Gravel, alluvium comprised of clay and silt.
    - The northeast of the site is underlain by a band of Thrussington Till Member comprised of diamicton.

Soils at the site mostly consist of slightly acid loamy and clayey soils with impeded drainage. Soils to the northeast of the site are slowly permeable, seasonally wet, slightly acidic but base-rich loamy and clayey soils.

2 Sources of flood risk

2.1 Location of site within the catchment

The site is in the 'Anker from Wem Brook to River Sence' catchment. The River Anker is located approximately 600m south of the site flowing in a north-westerly direction through the catchment. The catchment upstream of the site is predominantly rural but includes the settlements of Atterton and Witherley. The site borders the settlements of Fenny Drayton to the west and Lindley to the east.

2.2 Existing drainage features

An unnamed ordinary watercourse runs from the east of the site in a westerly direction. The watercourse follows the topography of the site, flowing to the southwest of the site before converging with the River Anker approximately 600m south of southern site boundary. Online imagery shows a small pond adjacent to Rowden Lodge and a further two large waterbodies in the west of the site.

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.

2.3.2 Description of risk to the site

The site is not shown to be at fluvial flood risk based on the EA's FMfP.

The unnamed watercourse along the eastern site boundary is not represented within the EA's FMfP. The risk from this watercourse has been assessed using the EA's Risk of Flooding from Surface Water Map (see Section 2.4).

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

RoFSW mapping shows that if surface water were to emerge at the site, it would flow from the northeast and follow the unnamed watercourse to the low-lying land in the southwest.

Mapping shows three surface water flow paths which follow the unnamed watercourse flowing from the northeast to the southwest of the site. During the 3.3% AEP, flood extent follows these watercourses. Flood depths exceed 1.2m, maximum velocities reach 1m/s, and the maximum hazard classification is 'Danger for All' downstream of the watercourse. The southwest corner of the site is completely inundated, as are all low-lying areas situated on the left and right banks of the watercourse.

The 1% AEP shows flooding in similar areas but at a greater extent, with maximum depth, velocity and hazard along the immediate banks of the watercourse. The 1% AEP shows similar depth and hazard but maximum velocity increases to reach 2m/s.

During the 0.1% AEP, flood extent increases along the banks of the watercourse to encroach the northern and southern site boundaries. A new flow path runs parallel to the southeast site boundary, which joins the main watercourse. Ponding increases considerably in the southwest corner of the site. Flood extent shows similar maximum depth, velocity and hazard to the 1% AEP.

Table 2-1: Existing surface water flood risk based on the RoFSW map.

Event	3.3% AEP	1% AEP	0.1% AEP
Percentage of site at risk* (%)	3.9	1.3	4.7
Maximum depth (m)	Exceeds 1.2m	Exceeds 1.2m	Exceeds 1.2m
Maximum velocity (m/s)	Exceeds 1m/s but does not exceed 2m/s	Exceeds 2m/s	Exceeds 2m/s
Maximum hazard classification	Danger for All	Danger for All	Danger for All

** 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 that 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 risk of groundwater flooding to both surface and subsurface assets in the low-lying areas to the southwest of the site. Most of the southwest corner of the site has groundwater levels either at or very near (within 0.025m of) the ground surface. Areas along the southeast and southwest site boundary have groundwater levels between 0.025m and 0.5m below the ground surface.

Based on the EA RoFSW mapping and the topography of the site, it is likely that any groundwater that emerges will flow/pool in the southwest. Groundwater emerging at higher elevations to the east will likely drain to the unnamed watercourse.

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 considered to have a potentially high impact on sewerage infrastructure and the existing pumping station given its large size. There is some model predicted flooding in the sewer network of the settlement to the west of the site.

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 a record of internal property flooding at a property approximately 59m west of the southwest site boundary on Atherstone Road. The source of this flooding is not known.

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.

3.1.2 Description of risk to the site

The EA's FMfP Flood Zones plus Climate Change layer shows the site is unlikely to be at increased fluvial flood risk in future.

The unnamed watercourse is not represented by the EA's FMfP within the site. The future risk from this watercourse has been assessed using the EA's Risk of Flooding from Surface Water Map (see Section 3.2).

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 flood extent in the 1% AEP and 0.1% AEP is largely confined to the left and right banks of the unnamed watercourse which flows from the northeast to the southwest of the site. Urban settlements within the site such as Lindley House, Rowden House Farm and Lodge Farm are at risk of surface water ponding in the 1% AEP. An increase in flood extent in the 0.1% AEP results in the inundation of Lindley House and Rowden House Farm. The 1% AEP shows defined surface water flow paths downstream of the watercourse at low elevations with isolated spots of ponding upstream of the watercourse at higher elevations. However, in the 0.1% AEP, flow paths are well defined both upstream and downstream of the watercourse. The 0.1% AEP also shows a flow path in Lindley Park which does not

follow the unnamed watercourse but converges with other surface water flow paths downstream, therefore exacerbating flood risk in the southwest.

It can be expected that given the increase in 0.1% AEP flood extent, risk associated with all major flow paths is likely to increase with climate change. Maximum depth exceeds 1.2m and maximum velocity is 2m/s in both the 1% AEP and 0.1% AEP flood extents. However, these classifications are confined to small areas of ponding during the 1% AEP in small areas downstream of the watercourse and upstream approximately 100m north of the culvert (see Section 4.2). In the 0.1% AEP, these areas become defined flow paths flowing to the southwest. Hazard classification increases to 'Danger for All' in the 0.1% AEP across these main flow paths.

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

LCC's asset register indicates that the unnamed watercourse is likely to be culverted from Fenn Lanes to Lindley Hall Farm. This could result in water backing up or flowing overland down the site following the elevation gradient. As shown in RoFSW mapping, flood extents are likely to follow this watercourse and pond in the southwest.

Additionally, there is a suspected culvert approximately 4m west of the south site boundary. This culvert is located east of the A444 Junction under the Royal Redgate Pub carpark. The surface water mapping shows a considerable increase in extent in the area upstream of this culvert as a result of flow constriction at the culvert resulting in water backing up upstream. There is a residual risk of a blockage of this culvert further increasing this risk on 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

The site can be accessed via Atherstone Road (A444) which runs along the western site boundary and Fenn Lanes which runs along the norther site boundary. Alternatively, Watling Street (A5) runs along the south boundary providing access from the east and west via the A444 junction. There are several existing access tracks which enter the site.

5.2.2 Fluvial

Access and escape are not shown to be impacted during any of the available fluvial flood events, including within the Flood Zones plus Climate Change dataset.

5.2.3 Surface water

Site access via Atherstone Road (A444) from the south is affected in the 3.3% AEP, 1% AEP and 0.1% AEP events by the larger area of risk which builds up upstream of where the unnamed watercourse is culverted beneath the A5. Depths exceed 0.3m in all modelled AEP events. The 0.1% AEP event shows flooding on both Watling Street and Atherstone Road with a maximum velocity of 2.0m/s, a maximum hazard classification of ‘Danger for All’ and flood depth exceeding 0.9m.

However, access to the site from the north is likely to be possible. There are only small areas of ponding which develop along Fenn Lanes which depths remaining below 0.2m. There is a flow path which crosses Atherstone Road (A444) to the north of the site. However, depths on the road are also not shown to exceed 0.2m in this area, in any of the modelled AEP events. Hazard classification of a small area reaches ‘Danger for Some’ in the 0.1% AEP event, with velocity exceeding 1.0m/s, but remains at ‘Very Low Hazard’ in the 3.3% and 1% AEP events, so access and escape are likely to still be possible via this route.

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 in the southeast and southwest corners of the site 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 will 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 mudstone and siltstone which is likely to be with highly variable permeability. This should be confirmed through infiltration testing. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff from the site.
- 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.

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. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space. The unnamed watercourse 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 must 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.
- The unnamed watercourse should be integrated into the site drainage strategy as blue-green infrastructure.
- 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 proximity of the River Anker, 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 site is a potential new settlement and will therefore be mixed use, however, the Exception Test will not be required for this site as the entire site is located within Flood Zone 1 of the EA FMfP.

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 one hectare
- At risk of flooding from ordinary watercourse and 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 highest areas of risk in the southwest corner and the southern site boundary. The unnamed watercourse should be integrated into the site drainage strategy as blue-green infrastructure.

A detailed hydraulic model of the unnamed watercourse may be required at FRA stage to accurately represent the risk from this watercourse. Modelling should also look at the residual risk from the culvert to the south of the site and include blockage scenarios.

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.

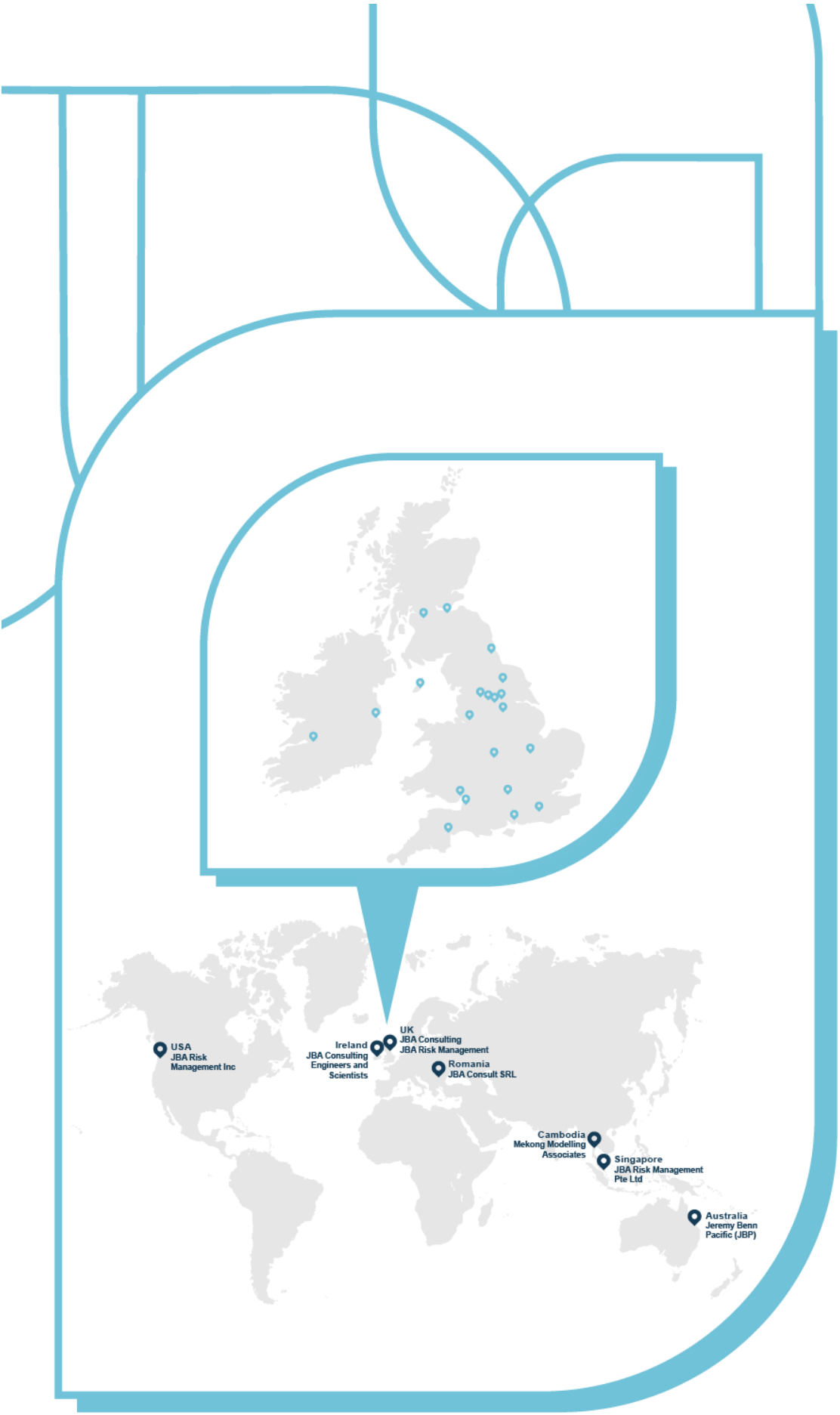
If proposed works affect an ordinary watercourse, Leicestershire County Council as the Lead Local Flood Authority should be contacted respectively to obtain prior written consent. Any watercourses should be accommodated within the site layout and should not be culverted except for where access is required. 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 predominant risk is from a surface water flow path which flows from the northeast in a southerly direction in all AEP events, following the path of an unnamed watercourse. The site is not shown to be at risk of flooding from the EA's FMfP. Access and escape is likely to be impeded by surface water flooding in the southwest via Watling Street and Atherstone Road. However, access and escape from the north via Fenn Lanes is not likely to be impeded. There is residual risk due to culvert blockages where the watercourse crosses Watling Street and a side street of Fenn Lanes, in the centre of the site.

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 along the watercourse, southwest corner and south boundary of the site. Developers should consider utilising these areas as green corridors.
- A detailed hydraulic model of the unnamed watercourse may be required at FRA stage to accurately represent the risk from this watercourse. Modelling should also look at the residual risk from the culvert to the south of the site and include blockage scenarios.
- Safe access and escape routes should be demonstrated in the 1% AEP plus climate change fluvial and surface water events, taking into account that access to the north and south of the site is compromised via flooding on Atherstone Road.
- 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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