Level 2 Strategic Flood Risk Assessment – Site LPR94 A

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 LPR94 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: Land to the southwest of the residential area of Markfield
- Site area: 9.53ha
- 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 EA 1m resolution LiDAR shows that higher elevation is concentrated in the northeast of the site, with elevations sloping downhill to the site boundaries in the south and west. The maximum elevation is 160.9mAOD at the northeastern boundary, and the minimum elevation is 144.9mAOD at the western boundary of the site.

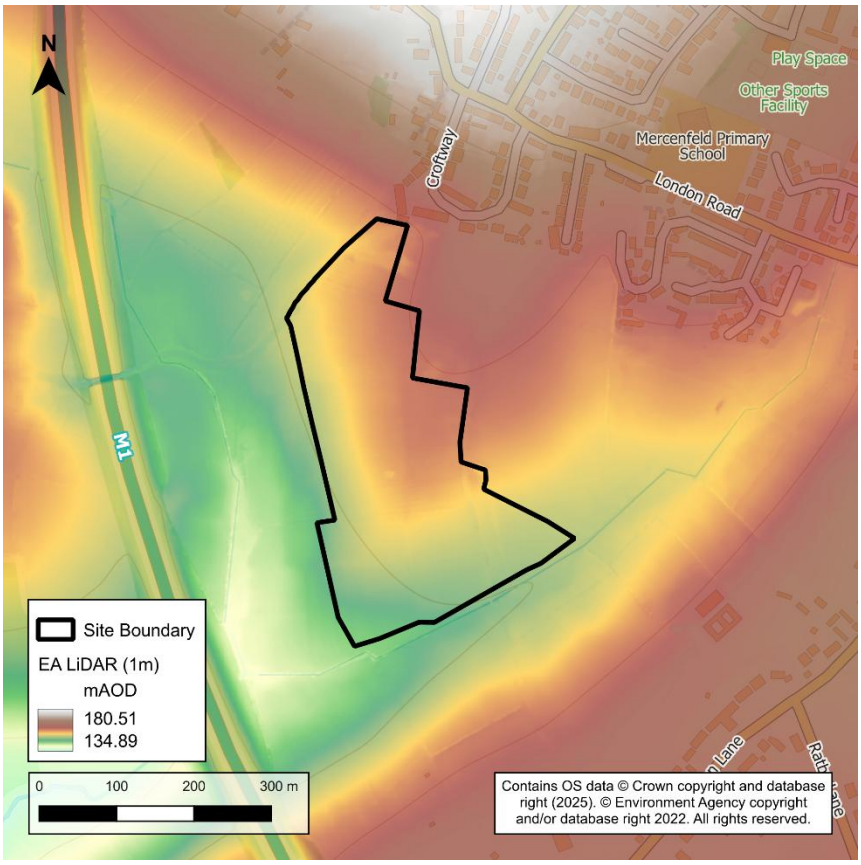


Figure 1-1: Topography of the site.

1.3 Geology and soils

Geology at the site consists of:

- Bedrock: Edwalton Member comprising of mudstone
- Superficial deposits: Oadby Till Member comprising of diamicton

Soils at the site consist of slightly acid loamy and clayey soils with impeded drainage.

2 Sources of flood risk

2.1 Location of site within the catchment

The site is in the northern most point and upstream end of the 'Rothley Brook Catchment (trib of Soar) Water Body' catchment, in Markfield. The catchment draining to the site is approximately an area of 0.5km^2. An unnamed watercourse flows along the southern site boundary, flowing southwest for 2.85km before converging with Rothley Brook. The catchment upstream of the site is predominantly urban covering the southern side of the settlement Markfield.

2.2 Existing drainage features

An unnamed watercourse flows in a south-westerly direction along the southern border of the site, before exiting the site where it is culverted under the M1 approximately 200m southwest 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 southern 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

Most of the site is not shown to be at flood risk based on the RoFSW.

The RoFSW mapping indicates that surface water flooding extents are primarily aligned with existing watercourses and low-lying areas within the site. In all AEP events, there is a surface water flow path that flows south-westerly along the southern boundary of the site.

In the 3.3% AEP event, surface water is largely confined to the low-lying areas to the south boundary of the site, with one minor instance of surface water pooling forming on the eastern boundary of the site. During the 1% AEP event, the areas of risk are similar to the 3.3% AEP event, slightly increasing in extent, with a new surface water flow path forming at the northern tip of the site. During the 0.1% AEP event, surface water flood risk largely follows the same flow paths, with a couple of new areas of risk to the southeast of the site.

The greatest depths, hazards, and velocities at the site are associated with the ordinary watercourse along the southern boundary (shown in Table 2-1). The smaller areas of risk within the site generally remain below 0.2m in depth. Velocities in the flow path in the north of the site are shown to exceed 1.0m/s in the 0.1% AEP event, giving this area a hazard classification of 'Danger for Some'. The remainder of these areas are predominantly 'Very Low Hazard'.

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* (%)	<1	<1	2.7
Maximum depth (m)	Less than 0.2m	Exceeds 0.3m but does not exceed 0.6m	Exceeds 0.6m but does not exceed 0.9m
Maximum velocity (m/s)	Exceeds 0.5m/s	Exceeds 1.0m/s but does not exceed 2.0m/s	Exceeds 2.0m/s
Maximum hazard classification	Very Low Hazard	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 that the entire site has negligible groundwater emergence risk due to the nature of the underlying geology.

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. At this site there is predicted flooding downstream, and the site is considered to have a medium potential impact on the sewerage infrastructure.

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.

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 at the southern site border is not represented within 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 RoFSW mapping shows that most of the site is not 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 southern site boundary, and an increase in extent to the flow path at the northern site boundary. During the 0.1% AEP, a new surface water flow path appears to the east of the southern section of the site.

Within and surrounding the site maximum depths, velocities and hazard classification increase between the AEP events, indicating 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

Approximately 200m southwest of the site, the watercourse is believed to pass through a culvert beneath the M1. This arrangement presents a potential residual risk of blockage, which could cause water to back up within the south of the site. The topography of the site means any water is likely to be confined to the low-lying areas at the south of 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

Access routes are likely to be from Forest Road/London Road to the north or east of the site, or from Thornton Lane to the south.

The site can be accessed from an existing track off London Road that leads to the eastern site boundary, situated between Croftway and Birchfield Avenue, and another unnamed track leading off Forest Road to the northern site boundary.

5.2.2 Fluvial

Access and escape along the unnamed track leading off London Road is not shown to be impacted during any of the available fluvial flood events, including within the Flood Zones plus Climate Change dataset. Therefore, safe access and escape from this route is possible if approaching from the south, providing access to the site.

5.2.3 Surface water

Access and escape along the unnamed track leading off London Road is not shown to be impacted during any of the AEP events. The unnamed track off Forest Road is impacted in the 0.1% AEP event, with a surface water depth of 0.2m, a velocity of between 0.5m/s and 1.0m/s, and a hazard classification of ‘Danger for Some’. Along London Road, to the east of the unnamed tracks, the road is impacted by surface water in all AEP events where the unnamed watercourse is suspected to be culverted. Surface water depths here exceed 0.3m, with velocities exceeding 1.0m/s, and a hazard classification of ‘Danger for Most’. Therefore, access and escape are only possible from the unnamed tracks if approaching from the west.

Access and escape from Thornton Road to the south is likely to be impeded due to the presence of the ordinary watercourse along the southern boundary.

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:

- The site is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions. This should be confirmed through additional site investigation work.
- 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%, 1%. And 0.1% AEP events. The unnamed watercourse at the south site boundary 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 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'.

The Exception Test is not required for this site because the 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 1 hectare
- at risk of flooding from ordinary watercourse and surface water

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 to the south of the site along the unnamed watercourse, and the flow path in the north of the site.

A detailed hydraulic model of the unnamed watercourses along the southern site boundary may be required at FRA stage to accurately represent the risk from these watercourses. Detailed survey of the culverts under the M1 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.

Developers should consider utilising the land around the southern site boundary as a green corridor or as a location for SuDS.

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

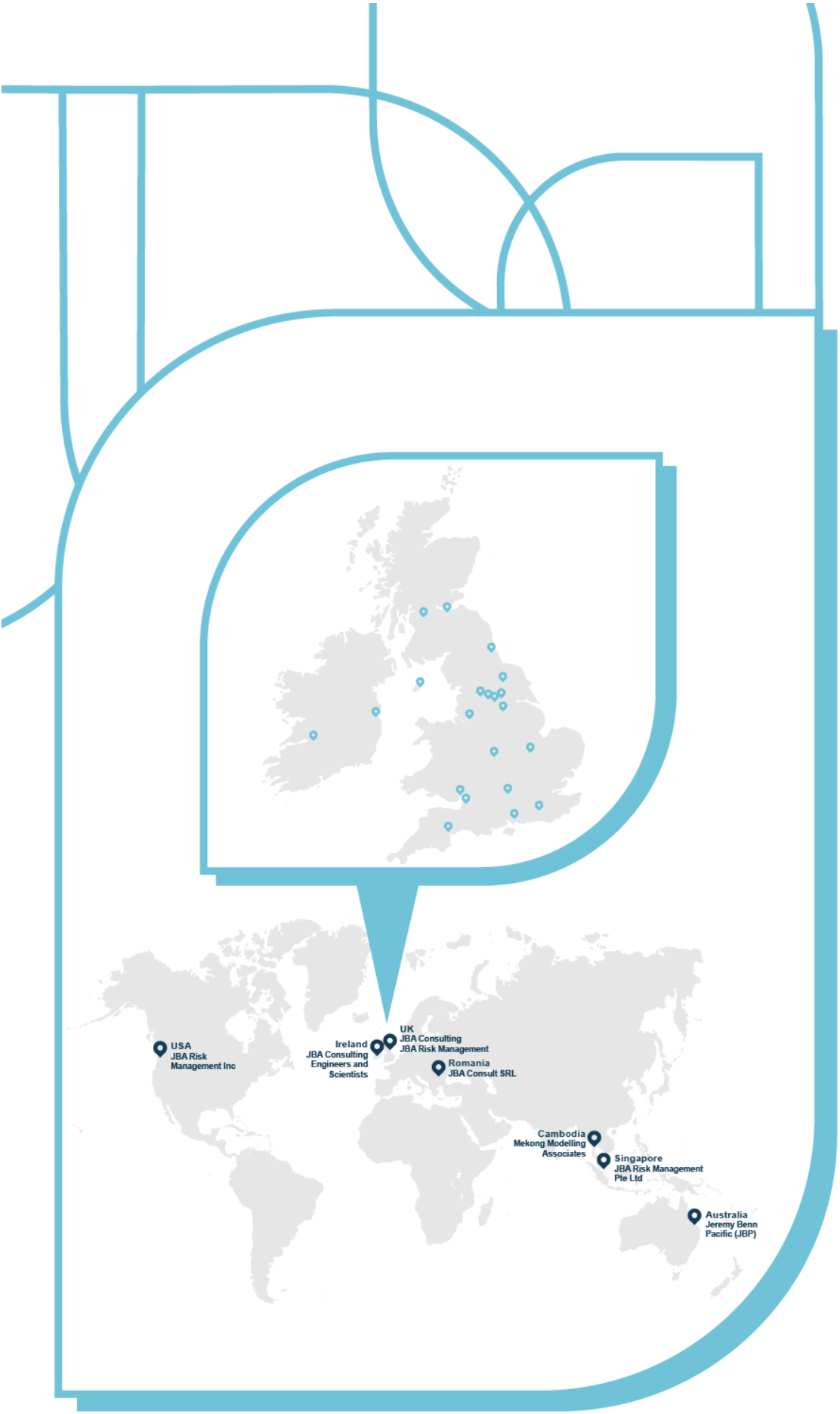
Most of the site is not shown to be at flood risk. The flood risk is largely confined to the low-lying areas in the south of the site alongside the unnamed watercourse, which are at risk of flooding from this watercourse, represented within the surface water mapping. There is a culvert downstream of the site under the M1 which presents a residual flood risk. Surface water and fluvial flooding impede access and escape routes to the site from London Road from the east but is possible if approaching from the west.

The Exception Test is not required, because the site is not shown to be at fluvial flood risk within the EA Flood Map for Planning. However, a site-specific FRA will be required, because the proposed development sites are one hectare or greater in Flood Zone 1 and subject to ordinary watercourse and surface water flooding.

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

- A buffer of at least 8 metres should be maintained between the watercourse 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 north. Developers should consider utilising these areas as green corridors.
- A detailed hydraulic model of the unnamed watercourse along the southern site boundary 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. Access along the unnamed track off London Road is unaffected in all AEP events. The unnamed track off Forest Road becomes impacted in the 0.1% AEP event, experiencing 0.2 m surface water depth, velocities of 0.5–1.0m/s, and a hazard level of Danger For Some. London Road, east of the unnamed tracks, is affected in all AEP events where the nearby watercourse is likely culverted, with surface water depths over 0.3 m, velocities over 1 m/s, and a hazard level of ‘Danger for Most’. As a result, safe access and escape from the unnamed tracks is only possible when approaching from the west.
- 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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