Level 2 Strategic Flood Risk Assessment – Site LPR121

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 LPR121. 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: In the east of Bardon, north of Cliffe Hill Quarry and adjacent to South Lane
- Site area: 3.33ha
- Existing site use: Greenfield
- Proposed site use: Employment

1.2 Topography

Figure 1-1 shows the topography of the site represented by the Environment Agency (EA) 1m resolution LiDAR. There is higher ground in the north and east of the site, with the maximum elevation found by the northern boundary, near South Lane, at 186.1mAOD. The site slopes downwards towards the south. Particularly the southwest is at a lower elevation and there are two unnamed watercourses in this part of the site flowing west. The minimum elevation is found in the southwest of the site, at 177.1mAOD.

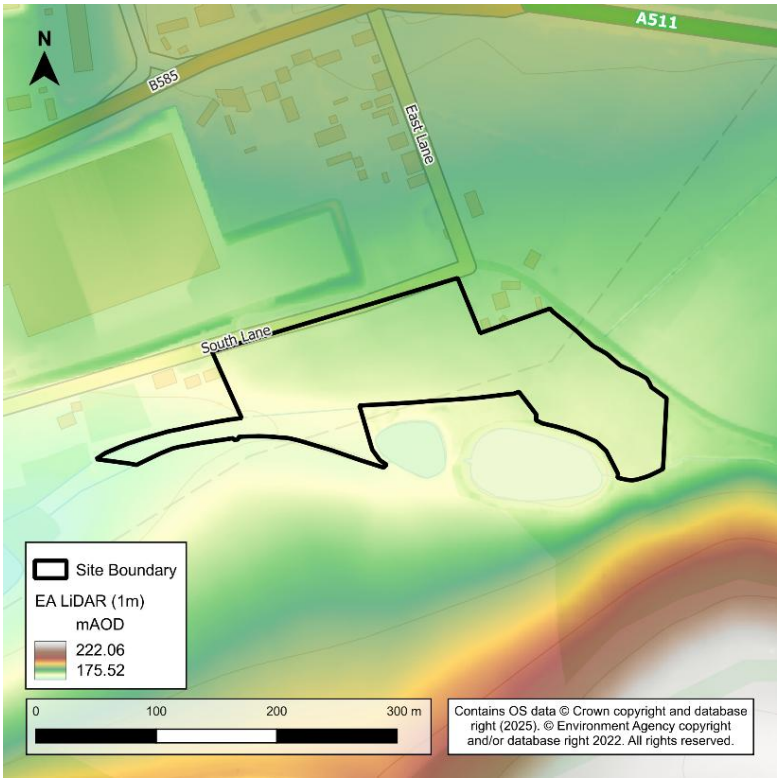


Figure 1-1: Topography of the site.

1.3 Geology and soils

Geology at the site consists of:

- Bedrock: Edwalton Member comprised of mudstone.
- Superficial deposits: The site is underlain predominantly by Oadby Till Member consisting of diamicton. In the southeastern corner of the site, as well as by part of the southern boundary, the site is underlain by alluvium, comprising clay, silt, sand, and gravel.

Soils at the site consist of slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.

2 Sources of flood risk

2.1 Location of site within the catchment

The site is located in the River Sence (from Source to Ibstock Brook) catchment. The site is in the upper reaches of the catchment and lies approximately 2km southeast of the source of the River Sence. Upstream of the site is Bardon Hill Quarry and Kellham Farm Quarry, surrounded by rural land, as well as parts of Bardon and Agar Nook.

2.2 Existing drainage features

There are two unnamed watercourses that cross the site, flowing in a westerly direction. The northernmost watercourse flows from Kellam Farm Quarry and is partly culverted through the site. The watercourse is in a culvert from the eastern boundary to the southern boundary where it opens up and then continues flowing west, including along parts of the southern and western boundaries. The southernmost watercourse flows along the southern boundary 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 two unnamed watercourses that flow west across the western and southern boundary of the site are not represented within the EA's FMfP. The risk from these watercourses 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

In the 3.3% AEP event, 3.4% of the site is at risk including along the southern boundary, associated with the unnamed watercourses. Maximum flood depths here exceed 0.9m along parts of the watercourse by the southwestern boundary. The maximum velocity exceeds 1.0m/s but does not exceed 2.0m/s and the maximum hazard classification is 'Danger for Most'. There are also areas of ponding, in the north of the site and in the southeast. Aside from the southeastern boundary, in these areas of ponding the velocity predominantly does not exceed 0.25m/s, the hazard classification is 'Very Low' and depths do not exceed 0.2m.

In the 1% AEP event, the percentage of the site at risk increases by 1.9% in the aforementioned areas with similar velocity and hazard as the 3.3% AEP. However, maximum depths exceed 1.2m in a small area by watercourse along the southwestern boundary.

During the 0.1% AEP event, the increase in risk is substantially greater, rising by 13%. In this event, much of the southeast of the site is at risk from a significant flow path that continues west, travelling along the path of the watercourse by the southwestern boundary. By the southwest boundary, maximum velocity exceeds 2.0m/s and the maximum depth exceeds 1.2m. However, the velocity is lower for most of the site, especially in the southeast of the site, exceeding 0.5m/s. The depths are also lower outside of the path of the watercourses, exceeding 0.3m in the southeast. The maximum hazard classification is 'Danger for All' along the watercourse across the southern boundary, but a large area of the site has a 'Very Low' hazard classification, particularly in the southeast.

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* (%)	3.4	1.9	13.0
Maximum depth (m)	Exceeds 0.9m but does not exceed 1.2m	Exceeds 1.2m	Exceeds 1.2m
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 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 the site has a negligible risk from groundwater flooding due to the nature of the local geological deposits.

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 potential medium impact on the sewerage infrastructure. There is model predicted flooding downstream of the site from the combined system. The development will also join at a junction which may have an impact on flow.

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 two unnamed watercourses that flow west across the centre and southern boundary of the site are 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 flood extent in the 1% AEP event is confined to the southwest site boundary along the unnamed watercourse and ponding in the southeast corner of the site. The percentage of the site at risk increases significantly from 1.9% in the 1% AEP event to 13.0% in the 0.1% AEP event.

Maximum depths in both events exceed 1.2m. Maximum velocity increases to exceed 2m/s in the 0.1% AEP event, and the maximum hazard classification increases from 'Danger for Most' to 'Danger for All' along the western site boundary, with a marginal increase in extent. Ponding in the southeast of the site has maximum depths exceeding 0.6m, a maximum

velocity of 1m/s, and a maximum hazard classification of ‘Danger for All’ in both the 1% and 0.1% AEP events.

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 northernmost unnamed watercourse from Kellam Farm Quarry is culverted just before entering the site, by the eastern boundary. This culvert could pose a residual risk to the site in the event of a blockage, which could cause water to back up and overtop, flowing southwest onto the site. Due to the topography of the site, any water that flows into the site is likely to flow towards the south.

This residual risk from this unnamed watercourse should be investigated further at the site-specific stage.

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 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 is currently accessed via South Lane, which runs along its northern boundary. From this point, South Lane continues west to connect with West Lane (B585), or east to meet East Lane. East Lane then travels northwards, where it joins Beveridge Lane (B585) which is a dual carriage way travelling west.

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

In the all surface water events, there is an area of isolated ponding on the junction between East Lane and Beveridge Lane (B585). However, depths here do not exceed 0.2m, the hazard classification is 'Very Low Hazard', and the velocity exceeds 0.25m/s, but not 0.5m/s.

Access and escape via South Lane towards West Lane (B585) remain clear in all events.

Travelling further south on West Lane (B585), there is a large area of pooling in all events across the road. There is also an area of ponding on the roundabout north of West Lane in all events. During the 1% AEP, maximum depths exceed 0.3m, maximum velocity is 0.5 m/s and the maximum hazard classification is 'Danger for Some'. In the 0.1% AEP, maximum depths exceed 0.3m, maximum velocity is 1m/s and the maximum hazard classification of 'Danger for Some'. However, access and escape via West Lane to the north remains clear.

5.3 Dry islands

The site 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 along the southern boundary of the site. The two unnamed watercourses that flow west across the southern and western boundaries 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 unnamed watercourses discharge to River Sence (from Source to Ibstock Brook), which has a 'Poor' ecological classification. 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 employment development as 'Less Vulnerable'.

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.

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 watercourses 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 areas of highest risk where the two unnamed watercourses flow west across the western and southern boundary of the site. Developers should consider utilising these areas as a green corridor.

A detailed hydraulic model of the two unnamed watercourses may be required at FRA stage to accurately represent the risk from this watercourse. Detailed survey of the culvert in the northeast of the site is likely to be required to ensure it is properly represented within the modelling.

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 surface water 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.

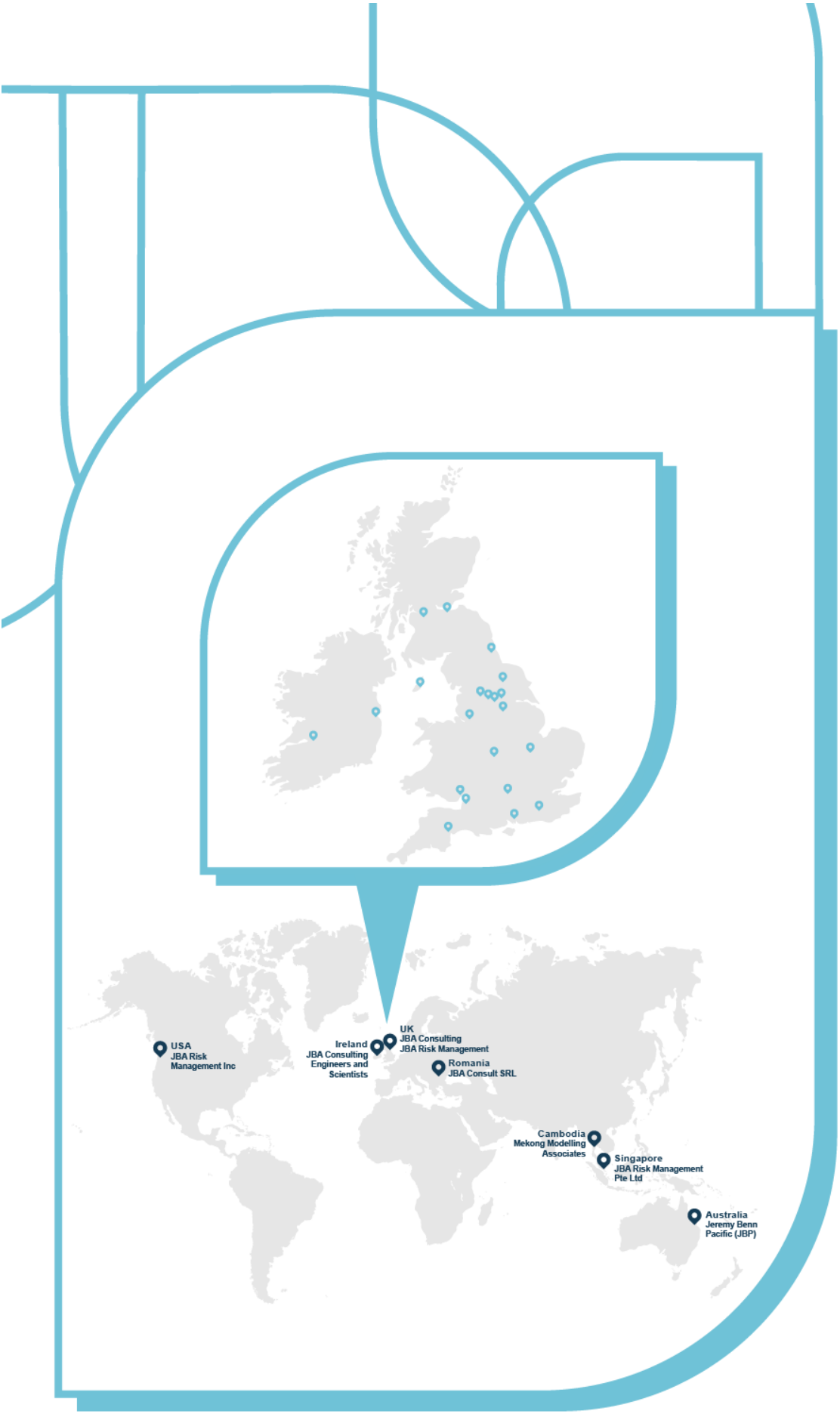
8 Conclusions

There are two unnamed watercourses that flow west across the western and southern boundary of the site. The northernmost watercourse is culverted in the northeast of the site. These are not represented within the EA's FMfP. However, the EA surface water map shows that there is a large surface water flow path associated with these watercourses along the southern boundary of the site. There is also surface water risk in the southeast of the south and ponding in the north in all events.

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, 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 unnamed watercourses and any built development on the site.
- 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 southeast of the site and along the southern boundary.
- Developers should consider utilising the two unnamed watercourses that flow west across the western and southern boundary of the site as a green corridor.
- A detailed hydraulic model of the two unnamed watercourses may be required at FRA stage to accurately represent the risk from this watercourse and set the height of any mitigation measures. Detailed survey of the culvert in the northeast of the site is likely to be required to ensure it is properly represented within the modelling.
- Further assessment of the surface water risk to the sites should be undertaken as part of a site-specific FRA to quantify the volume of surface water risk at the sites and ensure that any modification of ground levels required as part of the site design will not displace surface water and increase flood risk off the sites.
- Safe access and escape routes should be demonstrated in the 1% AEP plus climate change surface water event. This initial assessment has shown that access and escape will likely be possible.
- 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.
- 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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