

Level 2 Strategic Flood Risk Assessment – Site LPR231

Final Report

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Prepared for:
Hinckley and Bosworth Borough Council

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1 Background

This is a Level 2 Strategic Flood Risk Assessment (SFRA) site screening report for LPR231. 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: Land off Atherstone Road (A444) and Ashby Road (B4116), 'Norton Heath'
- Site area: 700.08ha
- Existing site use: Predominantly greenfield with some existing roads and farm properties
- Proposed site use: Mixed use- new settlement option

1.2 Topography

Figure 1-1 shows the topography of the site represented by the Environment Agency (EA) 1m resolution LiDAR. The highest elevations in the site are in the west and along the southern boundary. The site generally slopes downhill towards the northeast. There is an isolated area of higher elevation in the centre of the northern site boundary. The maximum elevation on the site is 133.9mAOD along the western site boundary and with minimum elevation of 84.7mAOD in the northeast corner of the site.

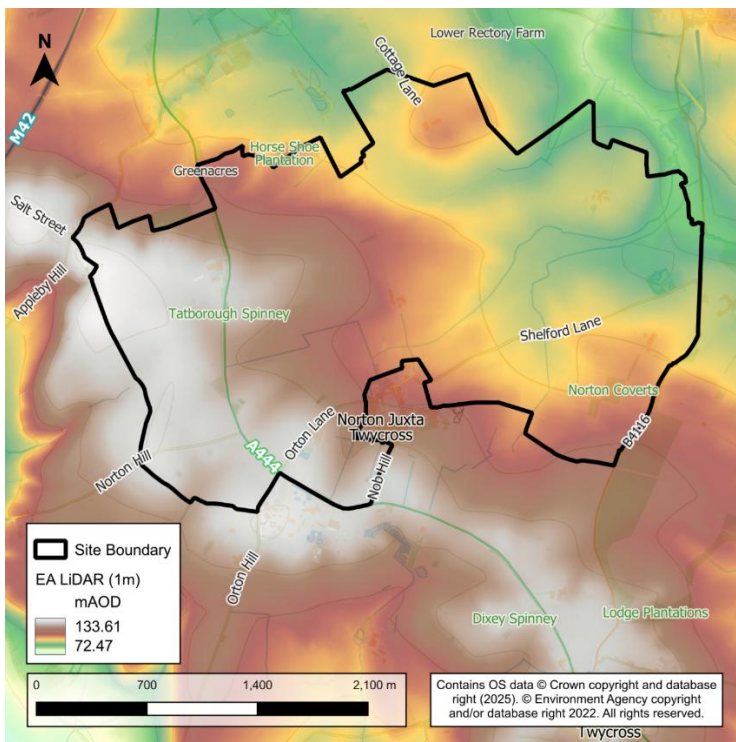


Figure 1-1: Topography of the site.

1.3 Geology and soils

Geology at the site consists of:

- Bedrock:
 - Most of the site is underlain by Gunthorpe Member comprised of mudstone with vertical bands of dolomitic siltstone running parallel to the western site boundary. There is also a horizontal band of dolomitic siltstone running through the centre of the site and several vertical bands in the northeast.
 - A band of Radcliffe member mudstone bisects the site from the northwest to the southeast.
 - The east of the site is underlain with Tarporely siltstone formation comprising a large band of siltstone, mudstone and sandstone across the northern and eastern boundaries. Vertical bands of sandstone run from the northern site boundary to the centre of the site. Three horizontal bands of sandstone, mudstone and siltstone run parallel to the northern site boundary.
- Superficial deposits are present throughout most of the site:
 - The east of the site is underlain by horizontal bands of Thrussington Till Member comprised of diamicton and alluvium comprised of clay silt, sand and gravel.
 - The west of the site is underlain by horizontal bands of glaciofluvial deposits consisting of Mid Pleistocene comprised of sand and gravel.

Soils at the site consist of:

- Mainly slowly permeable seasonally wet slightly acidic but base-rich loamy and clayey soils.
- A band of loamy and clayey floodplain soils with naturally high groundwater is present at the eastern boundary and extends to the centre of the site along the path of a watercourse. There is also a band of freely draining slightly acidic loamy soils to the north of the site.

2 Sources of flood risk

2.1 Location of site within the catchment

The site is located downstream of the 'Mease from Source to Gilwiskaw Brook' catchment. The Gilwiskaw Brook is located along the eastern site boundary flowing south to north through the catchment. The catchment upstream of the site is predominantly rural but includes the settlements of Snarestone and Newton Burgoland.

Existing drainage features

There are three main watercourses which flow from high elevations in the southwest of the site to the low-lying areas in the northeast.

The Gilwiskaw Brook flows from the southwest of the site to the northeast and there are two other unnamed tributaries to the north and south. These tributaries converge with the River Mease, which intersects the northeast site boundary.

A further unnamed watercourse is present in the west of the site and joins the Gilwiskaw Brook in the southwest.

2.3 Fluvial

2.3.1 Available data

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

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

2.3.2 Description of risk to the site

Most of the site is shown to be in Flood Zone 1 of the EA's FMfP.

The Flood Zones are present along the River Mease which flows in a northerly direction along the site boundary and intersects a small section of the northeastern site boundary.

Flood Zone 3b is shown to be mostly confined to the channel, whilst Flood Zones 3a and 2 extends slightly further into the site on the northeast boundary of the site around the confluence of Gilwiskaw Brook and the River Mease.

The Gilwiskaw Brook and other unnamed watercourses within the site are 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).

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

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

**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

During the 3.3% AEP, the flood risk is largely confined to the channels of the Gilwiskaw Brook and two other tributaries of the River Mease which runs through the site. There are several areas of isolated ponding throughout the site, particularly to the southwest. Maximum depth, velocity and hazard are associated with these watercourse channels (Table 2-2). However, a lot of the surface water flood extent has depths exceeding 0.3m, including areas of ponding, with velocities reaching up to 0.5m/s and a hazard classification of 'Danger for Some' across all three return periods.

The 1% AEP shows similar maximum depth, velocity and hazard with a marginal increase in flood extent, which the largest increase in risk in the east of the site. The risk along the watercourses within the site becomes more defined which bisects the site into three main parcels.

Flood extent in the 0.1% AEP shows a significant increase in flood risk along the watercourses. Flood extent increases along the left and right banks of the northernmost tributary to bisect the site into four parcels. Ponding in the southwest increases in extent and creates several minor flow paths flowing towards the main flow path along the Gilwiskaw Brook.

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* (%)	1.8	1.4	3.8
Maximum depth (m)	Exceeds 1.2m	Exceeds 1.2m	Exceeds 1.2m
Maximum velocity (m/s)	Exceed 1.0m/s but do not exceed 2.0m/s	Exceed 1.0m/s but do not exceed 2.0m/s	Exceed 2.0m/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 most of the site is not deemed to be at risk of groundwater emergence due to the nature of the local geological deposits.

However, there are several bands of sandstone in the northeast of the site which correspond with groundwater levels between 0.025m and 0.5m below the ground surface showing risk of groundwater flooding to both surface and subsurface assets. There are also areas in the northeast where groundwater levels are at or within 0.025m of the ground surface showing increased risk of groundwater flooding, mainly on the left bank of the Gilwiskaw Brook.

Based on the EA RoFSW mapping and topography of the site it is likely that any groundwater that emerges will flow towards the lower elevations in the northeast corner of the site along the path of the River Mease or flow north away from the site.

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

2.7 Sewers

Severn Trent Water were consulted as part of the Regulation 18 process and each of the Strategic Housing and Employment Land Availability Assessment reports to provide comments on known issues of sewer flooding within or surrounding the site. No previous flooding has been reported within the vicinity of this site, and no flooding has been predicted. However, given the size of the site it is considered to have a high 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.

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 northeast corner of the site is at risk of fluvial flooding under climate change. However, there is only a small increase in extent between Flood Zone 2 and the Flood Zones plus Climate Change layer and the risk is confined to the northeast site boundary.

The Gilwiskaw Brook and other unnamed watercourses within the site are not represented within the EA's FMfP. The future risk from these watercourses 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 increases considerably in the 0.1% AEP to create new flow paths in the southwest of the site. In the north of the site, the flood extent from the northernmost watercourse extends to the northern boundary which bisects the site into four parcels. Areas which have significant increases in depth, velocity and hazard in the 0.1% AEP are confined to the northeast of site on the right bank of the Gilwiskaw Brook, where depths

increase from mostly exceeding 0.9m to exceed 1.2m. Additionally, flood depths increase from exceeding 0.6m to exceed 0.9m along Atherstone Road and the southwest boundary. Velocities mostly reach 0.5m/s across all flow paths in the 1% AEP. However, most of the flood extent in the 0.1% AEP reaches velocities of 1.0m/s.

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

There are a number of culverts present along the watercourses within the site.

- The northern tributary of Gilwiskaw Brook is potentially culverted beneath Atherstone Road (A444).
- The southern tributary of of Gilwiskaw Brook is culverted under Orton Lane at its junction with Cock Lane on the southern site boundary.
- Gilwiskaw Brook is culverted in the southwest of the site beneath Cottage Lane.
- The unnamed watercourse to the south of Gilwiskaw Brook is culverted beneath Shelford Lane.
- Both Gilwiskaw Brook and the unnamed watercourse to the south are culverted beneath the access track to Culloden Farm.

There is significant surface water ponding shown in the surface water mapping where the watercourse to the south of Gilwiskaw Brook is culverted beneath Shelford Lane. This is also the case at the culverts under the access track to Culloden Farm. This shows these culverts are already constricting the flow and presenting a risk of water backing up with both roads being overtopped in the 3.3% AEP event. This flood risk is likely to be exacerbated by any blockages.

The remainder of the culverts also present a residual risk of water backing up and overtopping on the roads and surrounding areas of the site in the event of culvert blockages.

5 Emergency planning

5.1 Flood warnings and alerts

The small part of the eastern area of the site is located in the River Mease Flood Alert Area (033WAF308).

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

There are several roads surrounding and within the site that can provide potential access into different areas of the site:

- Snarestone Road/Appleby Lane runs parallel to the northern site boundary.
- Ashby Road (B4116) runs along the eastern site boundary.
- Atherstone Road (A444) runs through the west of the site. Norton Hill bisects the western site boundary and joins the A444 within the site.
- Norton Juxta Twycross settlement is located immediately south of the site and is accessed from the south from the A444 via Nob Hill.
 - Orton Hill runs through the west of the site connecting the A444 to the settlement.
 - Shelford Lane runs through the east of the site connecting the settlement with the B4116.
 - Cottage Lane runs north through the site from the settlement to Snarestone Road/Appleby Lane.

5.2.2 Fluvial

Access and escape via Ashby Road (B4116) are shown to be impacted during the available fluvial flood events, including within the Flood Zones plus Climate Change dataset. The River Mease also impacts Snarestone Road/Appleby Lane to the north of the site where it crosses the road which may impede access to the site from the east along this road. However, all other access routes around and through the site remain unimpeded.

5.2.3 Surface water

Access and escape across the site is likely to be possible during the 1% AEP plus climate change surface water event but this will need to be carefully assessed within a site-specific FRA, likely through the use of detailed hydraulic modelling given the number of ordinary watercourses and surface water flow paths present throughout the site.

The points below provide an overview of each of the potential access routes identified in Section 5.2.1. For this assessment roads have been assumed to be unimpeded if depths are predicted to remain below 0.3m and are classified as 'Very Low Hazard'.

- Snarestone Road/Appleby Lane runs parallel to the northern site boundary. There is a small area of ponding on the east side of Appleby Lane which develops in all modelled AEP events where depths exceed 0.3m, velocity exceeds 0.5m/s and the hazard classification is 'Danger for Most'. Access from the west along Snarestone Road remains unimpeded.
- Ashby Road (B4116) runs along the eastern site boundary. Access to this road from the south and along the entire eastern boundary remains unimpeded. There is an area of surface water ponding which develops to the north of the site boundary at Sharestone where depths exceed 0.3m, velocities exceed 0.5m/s and hazard reaches 'Danger for Most'.
- Atherstone Road (A444) runs through the west of the site. Norton Hill bisects the western site boundary and joins the A444 within the site. Both roads remain unimpeded within the site and when accessed from the south. Access to the A444 from the north may be impeded due to a significant flow path which crosses the road where it is joined by Austrey Road. In this area depths exceed 0.6m, velocities exceed 1.0m/s and the maximum hazard classification is 'Danger for Most'.
- Norton Juxta Twycross settlement is located immediately south of the site and is accessed from the south from the A444 via Nob Hill.
 - Orton Hill runs through the west of the site connecting the A444 to the settlement. Access to Orton Hill from the south and from the A444 remains unimpeded but access from Norton Juxta Twycross may be impeded by an area of risk which develops at the junction of Cottage Lane and Orton Lane. In this area, depths are predicted to exceed 0.3m in the 1% AEP and 0.1% AEP events, with velocities with exceed 1.0m/s and a hazard classification of 'Danger for Most'.
 - Shelford Lane runs through the east of the site connecting the settlement with the B4116. There is an area of risk halfway along Shelford Lane where it is crossed by an unnamed watercourse. Depths along the road remain below 0.3m in all modelled AEP events, however, in the 0.1% AEP event velocities are shown to exceed 1.0m/s with a hazard classification of 'Danger for Some'. There is also a residual risk that blockage of the culvert under the road could exacerbate the risk on the road. Access to Shelford Lane from Norton Juxta

Twycross may be impeded by the area of risk which develops at the junction of Cottage Lane and Orton Lane as detailed above.

- Cottage Lane runs north through the site from the settlement to Snarestone Road/Appleby Lane. Access to this lane from the north remains unimpeded but access to the south may be impeded by the risk at its junction with Orton Lane as detailed above.

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 \(gov.uk\)](https://www.gov.uk/national-standards-for-suds). 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 considered to be at negligible risk of 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 located within a Groundwater Source Protection Zone in the northeast corner of the site. Infiltration techniques may not be suitable and should only be used following the granting of any required environmental permits from the Environment Agency for Zones 2, 3 and 4 although it is possible that infiltration may not be permitted. Proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible opportunities and constraints.
- 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).

Where possible, proposed attenuation features such as basins, ponds and tanks should be located outside of Flood Zone 2 and Flood Zone 3 to avoid the potential risks to the hydraulic capacity or structural integrity of these features. Surface water outfalls that

discharge into the River Mease may be susceptible to surcharging due to water levels. 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% AEP, 1% AEP and 0.1% AEP events. Gilwiskaw Brook and all watercourses within 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 Gilwiskaw Brook has a 'moderate ecological status'. The use of multistage SuDS treatment will improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies.

7 NPPF and planning implications

7.1 Exception Test requirements

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

The NPPF classifies residential development as 'More Vulnerable'.

The Exception Test will be required for this site if 'More Vulnerable' development is proposed within areas of Flood Zone 3a. 'More Vulnerable' development is not permitted within 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 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. The northern site boundary crosses into the North West Lincolnshire authority area. North West Lincolnshire council will also need to be consulted.

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 in the northeast and along the paths of the watercourses within the site. Developers should consider utilising these areas as green corridors or as a location for SuDS.

A detailed hydraulic model of Gilwiskaw Brook and other watercourses within the site may be required at FRA stage to accurately represent the risk from these watercourses. This should include detailed topographic and culvert surveys across the site so that these are correctly represented. Blockage scenarios may also need to be tested to understand the

residual risk of culvert blockages. The modelling should be used to inform the site layout and the arrangements for access and escape.

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.

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.

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 flooding from the River Mease, represented within the EA FMfP, and several watercourses within the site which are represented within the EA's surface water mapping. There are several culverts within the site which present a residual risk should they become blocked. A number of the culverts are also shown to constrict the flow and result in overtopping onto the roads during the present day scenarios.

Should 'More Vulnerable' development be proposed within the extent of Flood Zone 3a, the Exception Test will be required for this site. 'More Vulnerable' development is not permitted within Flood Zone 3b. A site-specific FRA will be required as the proposed development site is greater than 1 hectare, at fluvial and surface water risk, and identified as being at increased flood risk in the future.

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

- A buffer of at least 8 metres should be maintained between the watercourses and any built development.
- A detailed hydraulic model of the Gilwiskaw Brook and unnamed tributaries of the River Mease flowing through 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. This initial assessment has shown that safe access and escape is likely to be possible but will need to be carefully assessed within a site-specific FRA, likely through the use of detailed hydraulic modelling to inform the site layout.
- 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 northeast and along the paths of the watercourses within the site. Developers should consider utilising these areas as green corridors or as a location for SuDS.
- 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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