

Level 2 Strategic Flood Risk Assessment – Site LPR44

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 LPR44. 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: Burbage West
- Site area: 10.64ha
- Existing site use: Brownfield (Hinckley Sewage Treatment Works)
- 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.

The EA LiDAR shows low elevations across the site compared to the surrounding ground to the north, east, and south. The site is mostly flat with a gradual slope downhill from east to west. Minimum elevations are 89.2mAOD in the west of the site and maximum elevations are 97.8mAOD along the eastern site boundary.

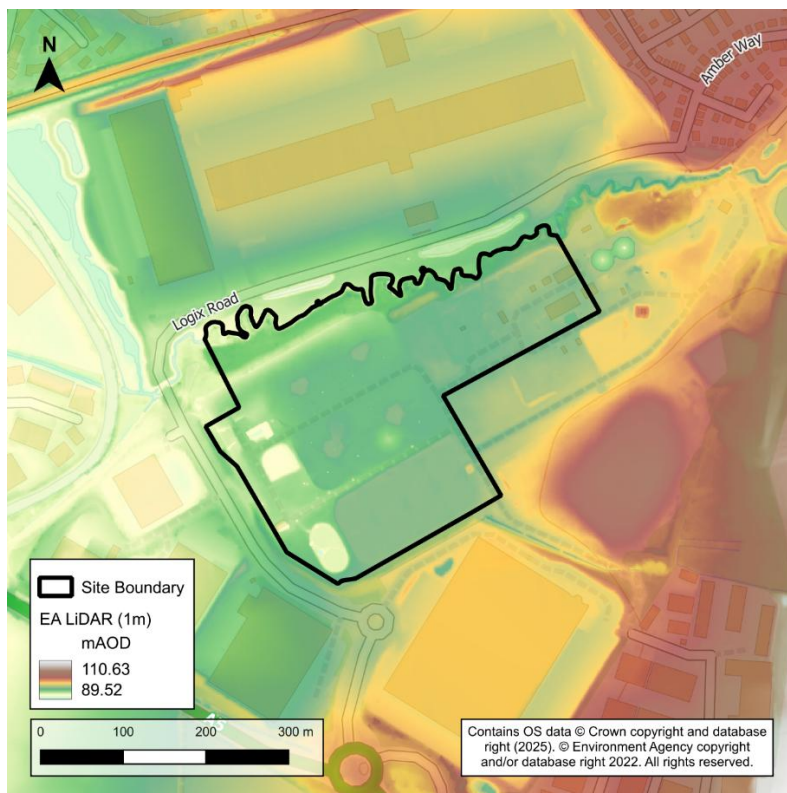


Figure 1-1: Topography of the site.

1.3 Geology and soils

Geology at the site consists of:

- Bedrock – Mercia Mudstone Group bedrock comprised of mudstone.
- Superficial – Superficial deposits are present throughout the site.
The west of the site is underlain with Bosworth Clay Member comprised of clay and silt and the east of the site is underlain with Wolston 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 upstream reaches of the Sketchley Brook from Source to River Anker Water Body catchment. Sketchley Brook runs along the northern boundary of the site. The catchment draining to the site is approximately 3.8km² and is heavily urbanised, encompassing much of the settlement of Hinckley. The site is located south of Hinckley with the settlement of Sketchley situated proximal to the eastern site boundary.

2.2 Existing drainage features

Sketchley Brook flows along the northern boundary of the site in a westerly direction. Approximately 100m west of the site, the watercourse is culverted beneath the Ashby-de-la-Zouch Canal downstream of the site. There is a large waterbody situated approximately 250m east 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.

A detailed hydraulic model for Sketchley Brook undertaken in 2013 was provided by the EA. This was formerly within the FMfP but was removed at the time of the NaFRA2 update. As the EA FMfP shows slightly larger extents and is more aligned with the topography of the site, this has been used to inform the Flood Zones. However, the hydraulic modelling has been used to inform the likely depth, hazard, and velocity within the site as this information is not currently available within the EA FMfP. An update of the detailed hydraulic modelling is likely to be required during a site-specific Flood Risk Assessment including updated hydrology.

2.3.2 Description of risk to the site

Flood Zones 3b and 3a are shown to remain close to the northern boundary of the site. Flood Zone 2 shows a considerable increase in flood extent across the site. The waterbody upstream of the site is shown to overtop with the resulting flow path flowing across the main area of the site.

In the 0.1% AEP extent, the maximum depths on the site reach approximately 0.75m in localised depressions, with a maximum velocity of 0.85m/s and a hazard classification of 'Danger for Most'. However, across most of the site, depths are shown to remain below 0.3m and have a hazard classification of 'Very Low Hazard'. The depth, hazard, and

velocity data from the Sketchley Brook hydraulic model is shown in Figure 2-1, Figure 2-2, and Figure 2-3 respectively.

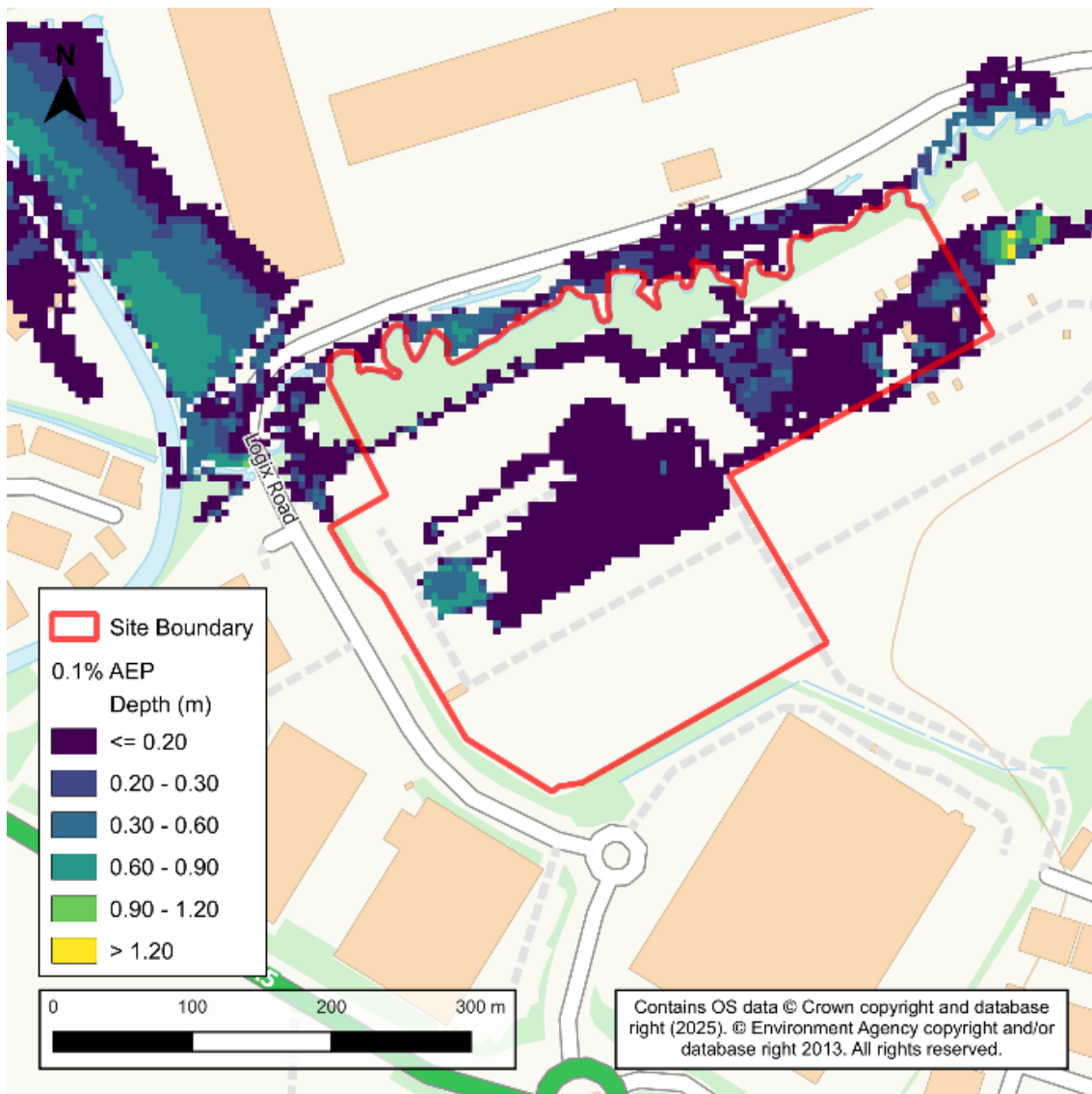


Figure 2-1: Depths on the site informed by the EA's Sketchley Brook detailed hydraulic model.

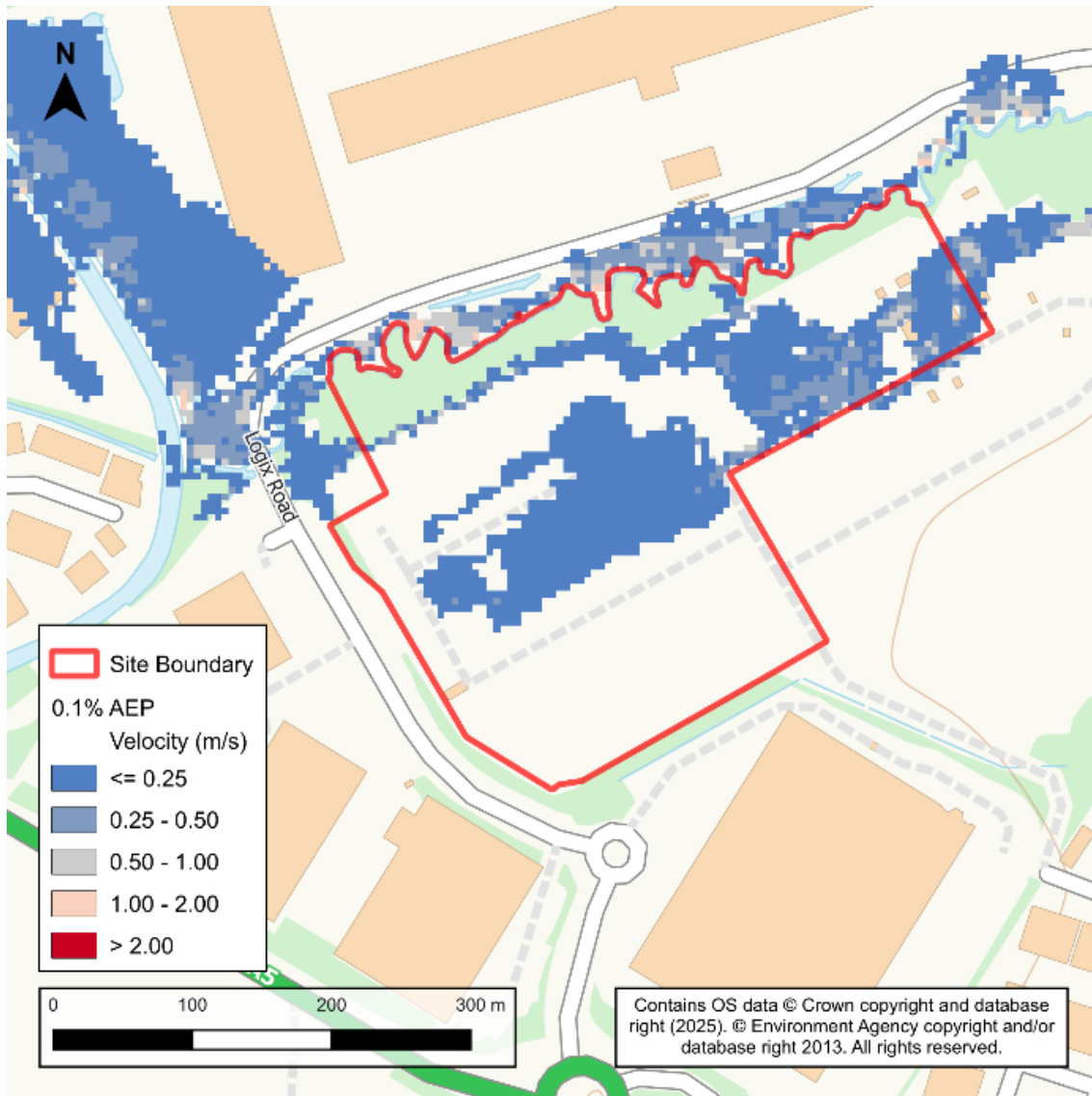


Figure 2-2: Velocity on the site informed by the EA's Sketchley Brook detailed hydraulic model.

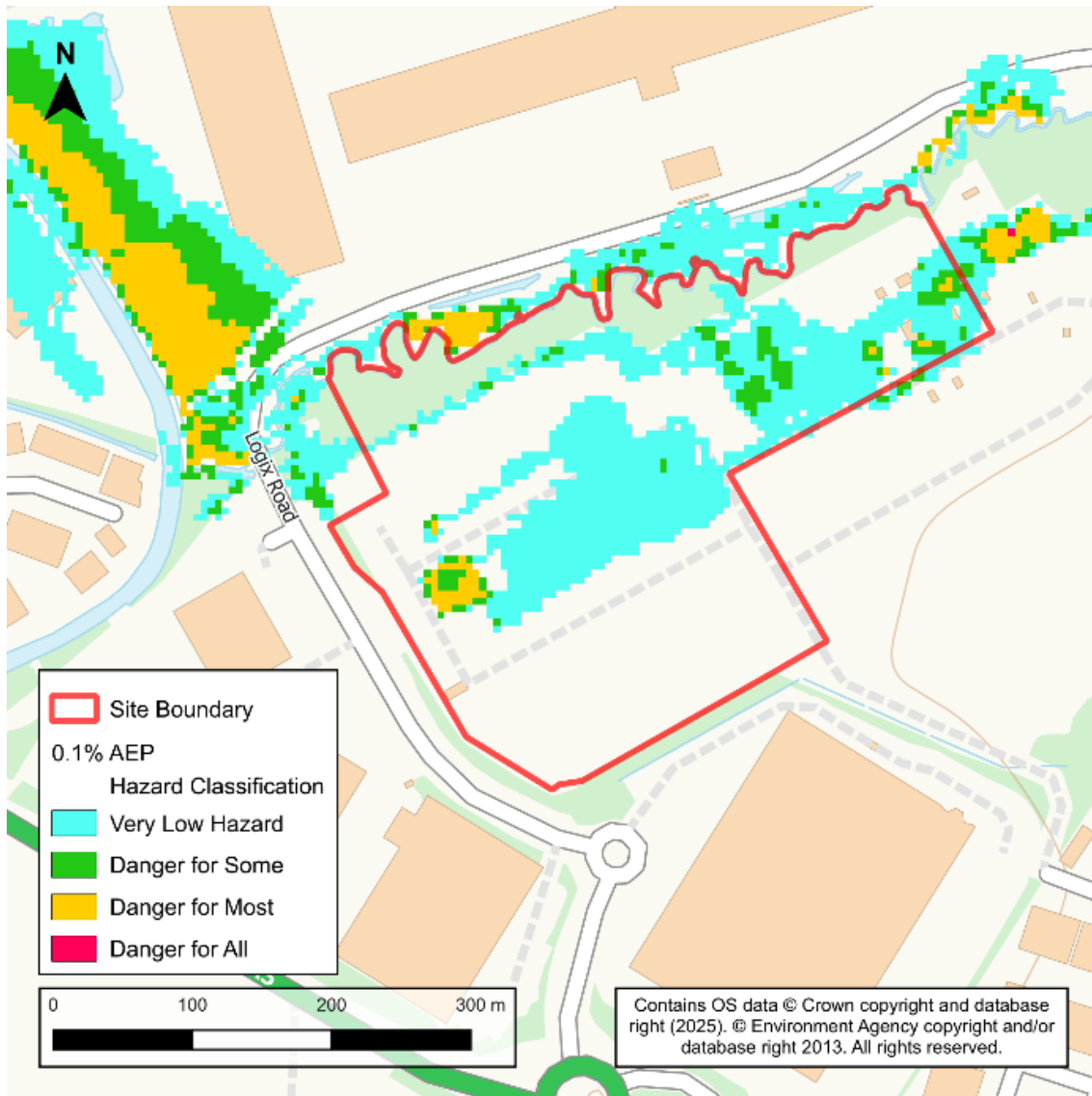


Figure 2-3: Hazard on the site informed by the EA's Sketchley Brook detailed hydraulic model.

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

Flood Zone 1 (%)	Flood Zone 2 (%)	Flood Zone 3a (%)	Flood Zone 3b (%)
65.9	30.4	0.2	3.5

*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

The surface water risk around the site is affected by the existing land use at the site, which is clearly defined in the topographic data.

In the 3.3% AEP event there are isolated areas of ponding and surface water flow paths which develop along access tracks within the site, particularly in the southwest of the site.

In the 1% AEP and 0.1% AEP events, no new flow paths develop but the areas of surface water ponding increase in extent. In the 0.1% AEP event there is a considerable increase in surface water risk in the south of the site.

The maximum depths, velocities, and hazard, shown in Table 2-2, are associated with a topographic depression in the southwest of the site and other isolated areas of ponding. Depths along the access road and in areas of ponding exceed 0.3m in all AEP events, but the new areas of risk in the 0.1% AEP event are shallow, remaining below 0.2m. Velocities along the access road are shown to exceed 0.5m/s but not 1.0m/s and velocities across the rest of the site remain below 0.5m/s. The access road and several areas of ponding within the site have a hazard classification of 'Danger for Most'.

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* (%)	4.9	3.7	16.2
Maximum depth (m)	Exceeds 1.2m	Exceeds 1.2m	Exceeds 1.2m
Maximum velocity (m/s)	Exceeds 1.0m/s but does not exceed 2.0m/s	Exceeds 2.0m/s	Exceeds 2.0m/s
Maximum hazard classification	Danger for Most	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 the site is not deemed to be at risk of groundwater emergence 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 deemed to have a high potential impact on the existing sewerage infrastructure, therefore, early consultation with Severn Trent Water will be required. The topography of the site means the network will require pumping from some areas of the site and is likely to impact on the existing pumping station.

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.

A detailed hydraulic model for Sketchley Brook was provided by the EA. This was formerly within the FMfP but was removed at the time of the NaFRA2 update. Given the age of the model (see Section 2.3.1) and the fact that the EA FMfP shows slightly larger extents and is more aligned with the topography of the site, the EA FMfP has been used to inform the Flood Zones. However, the hydraulic modelling has been used to inform the likely depth, hazard, and velocity within the site as this information is not currently available within the EA FMfP. An update of the detailed hydraulic modelling is likely to be required during a site-specific Flood Risk Assessment including updated hydrology.

3.1.2 Description of risk to the site

The EA's FMfP Flood Zones plus Climate Change layer shows considerable fluvial risk across the site. This is similar in extent to Flood Zone 2 but with some increases in extent in the centre and west of the site.

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

There is a considerable increase in flood risk extent between the 1% AEP and 0.1% AEP events suggesting that the site is sensitive to climate change, mostly in the south of the site, but also in the east of the site with the areas of ponding increasing in extent.

The new areas of risk in the south of the site are shown to be shallow with hazard classification of 'Very Low Hazard', but the areas of ponding across the site are shown to increase in depth and hazard between the 1% AEP 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

Sketchley Brook is culverted beneath Logix Road and then the Ashby-de-la-Zouch Canal to the west of the site. The available fluvial flood mapping shows that both culverts restrict the flow resulting in floodwater backing up upstream of both culverts. This area of increased risk predominantly lies outside the western site boundary but does start to encroach on the site in Flood Zone 2 and when climate change is considered. There is a residual risk of blockage of the culverts increasing this risk within the western side of the site.

There is a residual risk of breach or overtopping of the Ashby-de-la-Zouch Canal which runs to the west of the site. The Canal and River Trust provided historic records of breach or overtopping incidents which did not include any records within the vicinity of the site.

5 Emergency planning

5.1 Flood warnings and alerts

Large areas of the site are located in the River Anker and River Sence Flood Alert Area (033WAF307).

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

Logix Road runs along the north and west of the site, accessed via the A5 to the south of the site or from the residential estate to the east of the site.

As the site is brownfield there are also several access tracks which enter the site from the south via Sketchley Meadows and from the north via Brookfield Road.

5.2.2 Fluvial

Access and escape are shown to be impeded in all events from the north due to overtopping of Sketchley Brook onto Logix Road to the west of the site and fluvial risk along the track from Brookfield Road. However, in the 3.3% AEP and 1% AEP events (Flood Zones 3b and 3a), access and escape to the entire site is possible via the A5 and Logix Road accessing from the site. The existing track from Sketchley Meadows also remains unimpeded.

In the 0.1% AEP event (Flood Zone 2) and in the Flood Zones plus Climate Change event, access and escape to the south of the site is possible via the routes outlined above. However, the fluvial risk within the site bisects the site from east to west and causes a number of dry islands to form within the site. Detailed modelling at site-specific FRA stage will be required to inform the site layout and access and escape to all areas of the site.

5.2.3 Surface water

Flow paths form along the access tracks within the site in all modelled AEP events. In the 3.3% and 1% AEP events, depths are shown to remain below 0.3m. However, in the 0.1% AEP event depths exceed 0.3m which may impede access and escape along these routes.

When accessing Logix Road via the A5 to the south, there is an area of ponding which forms around the mini roundabout immediately south of the site in all AEP events. Whilst depths are shown to exceed 0.3m within this area of ponding, the area along the road is only shown to exceed 0.2m with a maximum hazard classification of 'Danger for Some' so

is likely to remain passable in all AEP events. There may also be options to utilise the existing track which extends from the mini-roundabout east towards Sketchley Meadows which is also shown to remain unimpeded. Any access tracks which enter the site from Logix Road will need to be designed with consideration of the areas of surface water risk within the site itself, which are shown to exceed 0.3m in some of the localised topographic depressions and along some of the access tracks within the site.

5.3 Dry islands

The site itself is not located on a dry island, but as noted above there are several dry islands that form within the site in the 0.1% AEP event (Flood Zone 2) and in the Flood Zones plus Climate Change event.

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/government/uploads/system/uploads/attachment_data/file/616222/national_standards_for_suds.pdf). 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 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. However, given the site is brownfield and its current land use as a Sewage Treatment Works consideration of land contamination will be required in determining the potential suitability for infiltration at the site.
- 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.

Proposed attenuation features such as basins, ponds and tanks should be located outside of Flood Zone 2 to avoid the potential risks to the hydraulic capacity or structural integrity of these features. Surface water outfalls that discharge into Sketchley Brook may be susceptible to surcharging due to water levels in the watercourse. 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.

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 pre-development discharge rates for the site and should be designed to be as close to greenfield runoff rates as reasonably practical in consultation 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, especially considering the site's historic use. 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. Sketchley Brook is currently classified to be in moderate ecological status.

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 as 'Less Vulnerable'.

The Exception Test is not required 'Less Vulnerable' development. 'Less Vulnerable' development will not be permitted in 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 one hectare in area
- in Flood Zones 2, 3a and 3b
- within the EA FMfP Flood Zones plus Climate Change extent showing it is at increased risk of flooding from rivers in future
- at risk of flooding from surface water
- will be at increased risk of flooding during its lifetime

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 Canal and River Trust should also be consulted given the close proximity of the Ashby-de-la-Zouch Canal to the site.

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 along the northern site boundary.

At FRA stage, an updated or new model of Sketchley Brook is likely to be required to accurately represent the risk from this watercourse. Given the age of the model this is likely to require updates to the topography and hydrology. The modelling should consider the interaction with the culverts in the vicinity of the site including the residual risk of a culvert blockage. The modelling should be used to inform the site layout and consider options for safe access and escape to all areas of the site.

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. It may be possible to re-use aspects of the existing surface water drainage system, subject to surveys of its condition and capacity.

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. As noted in Section 5.2.2 the fluvial risk within the site bisects the site from east to west in the 0.1% AEP event and Flood Zones plus Climate Change extent and causes a number of dry islands to form within the site. Detailed modelling at site-specific FRA stage will be required to inform the site layout and access and escape to all areas of the site.

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.

Finished Floor Levels should be raised above the expected height of flooding in line with the EA's guidance and any raising of ground levels should ensure that flood risk is not increased elsewhere.

If proposed works affect an ordinary watercourse, Leicestershire County Council as the Lead Local Flood Authority should be contacted 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 shown to be at fluvial risk. Flood Zones 3b and 3a are shown to remain confined to the northern boundary, but a considerable area of the site is at risk in Flood Zone 2 and when considering future flood risk. Sketchley Brook is culverted to the west of the site with a residual risk of increased risk due to culvert blockages. There is also considerable surface water risk on the site, although this is largely dictated by the current land use which is clearly represented within the EA's LiDAR for the site. The site is also in close proximity of a canal.

The Exception Test will not be required for this site as the proposed land use is 'Less Vulnerable', however 'Less Vulnerable' development will not be permitted in areas of Flood Zone 3b. A site-specific FRA will be required for the site as it is greater than one hectare and at both fluvial and surface water risk in both the present day and climate change scenarios.

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 northern site boundary.
- At FRA stage, an updated or new model of Sketchley Brook is likely to be required to accurately represent the risk from this watercourse. Given the age of the model this is likely to require updates to the topography and hydrology. The modelling should consider the interaction with the culvert downstream of the site including the residual risk of a culvert blockage. The modelling should be used to inform the site layout and consider options for safe access and escape to all areas of the site.
- Further assessment of the surface water risk to the sites should be undertaken as part of a site-specific FRA. This is likely to include a requirement for detailed modelling and topographic survey 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 site.
- Finished Floor Levels should be raised above the expected height of flooding in line with the EA's guidance and any raising of ground levels should ensure that flood risk is not increased elsewhere. The site should be designed so that the more vulnerable parts of the development are steered outside of the areas of surface water ponding.
- Safe access and escape routes should be demonstrated in the 1% AEP plus climate change fluvial and surface water event. This should consider all parts of the site as this initial assessment has shown that several dry islands are likely to form within the site during larger fluvial flood events.
- A carefully considered and integrated flood resilient and sustainable drainage design should be put forward, including a site-specific Surface Water Drainage Strategy, and SuDS maintenance and management plan and supported by

detailed modelling. Given the site is brownfield and its current land use as a Sewage Treatment Works consideration of land contamination will be required in determining the potential suitability for infiltration and other SuDS techniques at 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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