Level 2 Strategic Flood Risk Assessment - Site TB19

A1-C01

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Prepared for:

Newcastle-under-Lyme Borough Council

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Contents

1 Background

This is a Level 2 Strategic Flood Risk Assessment (SFRA) site screening report for TB19. The content of this Level 2 SFRA site screening report assumes the reader has already consulted the 'Newcastle-under-Lyme Level 1 SFRA' and read the 'Newcastle-under-Lyme Level 2 SFRA Main Report' and is therefore familiar with the terminology used in this report.

1.1 Site details

- **Location:** Land south of Newcastle Golf club, Whitmore Road, located on the western boundary of Clayton in the southwest of Stoke-on-Trent.
- **Site area:** 45.44ha.
- **Existing site use:** Greenfield.
- **Proposed site use:** Residential.

1.2 Topography

The Environment Agency (EA) 1m resolution LiDAR shows the highest elevations in the site are in the central, northern, and north-eastern areas. The site slopes downhill towards the north-eastern, south-western, and southern site boundaries. The highest elevation in the site is in the centre of the north-western site boundary at 168.29mAOD, with the lowest elevations of 129.39mAOD along the path of Park Brook where it flows across the southwest corner of the site.

1.3 Geology and soils

Geology at the site consists of:

- Bedrock - largely comprised of Halesowen Formation which consists of mudstone, siltstone, and sandstone. There are two small sections in the western side of the site which comprise of Butterton Swynnerton Dykes (Microgabbro) and a small section of Etruria Formation in the centre of the site, which comprises of mudstone, siltstone, and sandstone.
- Superficial - there is no information available for superficial deposits across large parts of the site. The northeast area of the site, north-western border and southern border have superficial deposits comprising of Till (Diamicton).

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 within the upstream end of the 'Park Brook Catchment (trib of Trent)'. The catchment is approximately 14.57km^2 in area and Park Brook flows in a south-easterly direction through the catchment to join the River Trent to the south of Stoke-on-Trent. Upstream of the site the wider catchment is predominantly rural. Downstream of the site there are a number of small settlements, and the catchment also includes the southwest urban area of Stoke-on-Trent.

Park Brook originates at a pond approximately 650m northwest of the site, to the south of the Keele University campus.

2.2 Existing drainage features

Approximately 20m upstream of the site, Park Brook, which approaches the site in a southerly direction, is joined by an unnamed watercourse approaching from the west. Park Brook flows across the southwest corner of the site in a south-easterly direction before entering a culvert beneath the M6, which runs along the southern boundary of the site.

There is also an ordinary watercourse which flows in a south-westerly direction along the north-eastern boundary of the site before entering a culvert beneath Whitmore Road (A53) which runs along the south-eastern site boundary.

2.3 Fluvial

2.3.1 Available data

The EA's Flood Map for Planning (FMfP) has been used within this assessment.

2.3.2 Description of risk to the site

The EA FMfP does not show the site to be at fluvial flood risk, as the entire site is located within Flood Zone 1. The modelled flood extent for Park Brook (which is included within the FMfP) has its upstream extent 350m downstream of the site. The ordinary watercourse along the north-eastern site boundary is also not included within the FMfP. Instead, the flood risk from these watercourses is assessed using the EA RoFSW map (Section 2.4.1).

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

Table 2-1 shows the extent of the site at risk in the 3.3%, 1%, and 0.1% AEP events, and the maximum depths, velocities, and hazards within the site boundary.

In the 3.3% AEP event, most of the site is not shown to be at surface water risk. The risk is largely confined to the channels of Park Brook in the southwest of the site and the ordinary watercourse along the north-eastern site boundary. Depths along both channels exceed 1.20m in places, with velocities exceeding 2.00m/s, and a maximum hazard classification of 'Danger for most'. There are a couple of small, isolated areas of ponding in the centre of the site. There is also a more considerable area of ponding at the centre of the south-eastern boundary in a topographic low spot. Water is shown to accumulate to the west of Whitmore Road (A53), with depths of up to between 0.90m and 1.20m, velocities of up to between 0.25 and 0.50m/s, and a maximum hazard classification of 'Danger for most'.

In the 1% AEP event, most of the site is still shown to remain free from surface water risk. The flow paths along the watercourses in the north and southwest of the site increase slightly in extent, depth, and velocity, with maximum hazard classifications now reaching 'Danger for all' in places. The isolated areas of ponding across the remainder of the site increase slightly in extent, with a couple of new areas of ponding forming. A small flow path starts to develop through the forested area in the northwest part of the site.

In the 0.1% AEP event, large areas of the site are still shown to remain free from surface water risk, however there is an increase in risk from the 1% AEP event, particularly in the centre of the site. There are a number of small flow paths which develop alongside the flow path from the forested area in the northwest which further extends across most of the site width but does not fully bisect the site. The hazard classification along most of these flow paths remains 'Very low hazard', with the exception of the flow path through the forested area and some of the isolated areas of ponding with have hazard classifications of up to 'Danger for most'.

The flow paths along both watercourses are shown to increase in extent between the 1% AEP and 0.1% AEP events. Both watercourses are shown to back up within the site boundary upstream of their respective culverts downstream of the site. Along the unnamed watercourse in the north of the site, an area of pooling develops in the eastern-most corner of the site upstream. However, the topography of the site means this risk is shown to remain confined to the eastern corner and does not extend further into the site. Along Park Brook, water is shown to back up along its entire length through the site boundary and upstream of the boundary around its confluence with an unnamed tributary. However, the topography of the site means the risk is confined to the southwest corner of the site.

The RoFSW mapping may not fully represent the capacity of these culverts, so it could be that the risk on the site in these areas is overestimated if the culvert capacity is larger than what is represented within the mapping. However, if the capacity of the culverts is reduced or blocked for any reason then this could increase the risk to the site in these areas. This is discussed further in Section 4.2.

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	2	6
Maximum depth (m)	Greater than 1.20	Greater than 1.20	Greater than 1.20
Maximum velocity (m/s)	Greater than 2.00	Greater than 2.00	Greater than 2.00
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, including the percentage of the site at flood risk at a higher risk zone (e.g. 1% AEP includes 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 EA Areas Susceptible to Groundwater Flooding (AStGWF) dataset (1km resolution) suggests that the site generally has a low susceptibility to groundwater flooding. The northern half of the site has less than a 25% susceptibility to groundwater flooding and the southern half of the site has between a 25% and 50% susceptibility to groundwater flooding.

The JBA Groundwater Emergence Map (5m resolution) emulates this, showing that the majority of the site has a negligible risk of groundwater emergence due to underlying geological deposits at the site. There is a small area in the eastern-most corner of the site where groundwater emergence levels are predicted to be between 0.025 and 0.5m below the ground surface. The topography of the site suggests any groundwater emerging in this area will be confined to the eastern corner of the site and follow the path of the ordinary watercourse.

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

2.7 Sewers

The site is predominantly located in postcode area ST5 2, with the south-western corner of the site located within postcode area ST5 5. Severn Trent Water provided historical flooding data for reports of external and internal sewer flooding between 1 January 2004 and 19 March 2024, including locations with repeat incidents This included 11 properties within ST52 and 1 property within ST5 5, however, none of these properties are noted to be within close proximity of the site.

Severn Trent Water provided a review of the sites in relation to their impact to the existing public sewerage system ranking the sites as high, medium, or low risk. This site was ranked as medium due to the size of the development.

2.8 Flood history

The EA's historic flooding and recorded flood outline datasets do not have a record of any flooding 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 3.5 of the main Level 2 SFRA report for information on fluvial models and 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 routes must also address the potential increase in severity and frequency of flooding.

3.1 Fluvial

3.1.1 Available data

In the absence of detailed hydraulic modelling with climate change uplifts, the Flood Map for Planning Flood Zone 2 extent (0.1% AEP) has been used as an indicative 1% AEP event plus climate change flood extent. This can be compared within Flood Zone 3a (1% AEP) to give an indication of areas most sensitive to the impacts of climate change.

3.1.2 Description of risk to the site

The EA FMfP does not show the site to be at fluvial flood risk in the future, as the entire site is located within Flood Zone 1. However, the flood risk from the ordinary watercourses on the site is assessed using the EA RoFSW map (Section 3.2).

3.2 Surface water

3.2.1 Available data

The latest climate change allowances have been applied to the RoFSW map to indicate the impact on pluvial flood risk.

The design event for rainfall intensities is the 1% AEP event with the upper end climate allowance for the 2070s epoch, which is the 1% AEP plus 40% climate change for the Trent Valley Staffordshire Management Catchment which this site falls within.

3.2.2 Description of risk to the site

Whilst most of the site is shown to not be at risk during the 1% AEP plus 40% climate change extent, the site is sensitive to increased risk as a result of climate change. Between the 1% AEP and 1% AEP plus 40% climate change events there is an increase in extent along both watercourses on the site and further areas of risk which develop in the centre of the site. Table 3-1 compares the extents and maximum depths, velocities, and hazards in the 1% AEP and 1% AEP plus 40% climate change events.

The 1% AEP plus 40% climate change extent shows a similar extent to that of the 0.1% AEP event (Section 2.4.2), however, in the climate change event the flow path which develops in the centre of the site is shown to fully bisect the site from north-west to south-east.

Table 3-1: Comparison of surface water flood risk to the site between the 1% AEP and 1% AEP plus 40% (2070s Upper End) climate change extents.

Event	1% AEP	1% AEP plus 40% climate change
Percentage of site at risk (%)	2	7
Maximum depth (m)	Greater than 1.20	4.59
Maximum velocity (m/s)	Greater than 2.00	3.77
Maximum hazard classification	Danger For All	Danger For All

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

Park Brook is culverted underneath the M6 to the south of the site, and the unnamed watercourse in the north of the site is culverted under Whitmore Road (A53) to the east of the site. These could pose a residual risk to the site in the event of a blockage, which could cause water to back up and encroach on the site.

Due to the topography of the site any water backing up along Park Brook is likely to be confined to the area of lower topography in the southwest corner of site whilst any water backing up along the unnamed watercourse is will likely remain confined to the areas of lower topography in the eastern-most corner of the site. Therefore, the residual risk to the main part of the site is considered to be low.

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 routes

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 Existing access

Existing access to the site is from Whitmore Road (A53) which runs along the south-eastern boundary of the site.

Park Brook bisects the southwest corner of the site. Currently the only existing access to this corner of the site would be on foot, via the footpath which extends through Springpool Woods from Lyme Road to the west of the site and then passes under the M6 to the south of the site.

5.2.2 Fluvial

The EA FMfP shows that Whitmore Road (A53) and the footpath from the west are shown to remain clear from fluvial risk in both Flood Zones 2 and 3a within the vicinity of the site. However, the risk from Park Brook and the unnamed watercourse in the north of the site are discussed in Section 5.2.3.

5.2.3 Surface water

In the 3.3% AEP event Whitmore Road (A53) is shown to remain largely clear of surface water risk within the vicinity of the site. There are two small flow paths which cross the road along the paths of Park Brook and the unnamed watercourse, however, these appear to represent the culverts crossing beneath the road rather than representing a surface water risk along the road itself.

The 1% AEP event shows some additional small areas of ponding along Whitmore Road (A53) within the vicinity of the site, however, predicted depths remain below 0.30m, with velocities of up to 1.00m/s and a maximum hazard classification of 'Very low hazard' so it is unlikely that access and escape routes will be impacted.

During the 1% AEP plus 40% climate change event, there is a considerable increase in surface water risk throughout the site and along Whitmore Road (A53).

There is a flow path which develops through the centre of the site, flowing in a south-easterly direction through the site, bisecting the site and then flowing across Whitmore Road (A53). Depths along this flow path reach a maximum of 0.77m, with velocities of up to 1.52m/s, and a hazard classification of 'Danger for most'. However, depths along large parts of the flow path are shown to remain below 0.25m with a hazard classification of 'Very low hazard', therefore it is likely that access will be possible between the two sides of the site during this event.

There is a flow path which develops to the north of the site, flowing along the road towards the site, before deflecting south along Leys Drive. Depths along Whitmore Road (A53) reach a maximum of 0.46m, with velocities of up to 2.02m/s, and a maximum hazard classification of 'Danger for most'. Therefore, access and escape routes from the north may be impacted during this event.

Where both the unnamed watercourse and Park Brook are culverted beneath Whitmore Road (A53), the surface water map does not give any indication of the watercourses overtopping onto the road, therefore it is unlikely that these watercourses will impact access to the site along the road.

To the south of the site there are further flow paths which develop both along and crossing Whitmore Road (A53). Depths reach a maximum of 0.36m, with maximum velocities of 1.97m/s, and a maximum hazard classification of 'Danger for most' to the south of the site. Therefore, there is potential that access and escape routes from the south may also be impacted during this event.

The 0.1% AEP event shows a very similar extent to the 1% AEP plus 40% climate change event.

Access to the southwest corner of the site is shown to be impacted in all modelled surface water events. The underlying topography data shows the path is low-lying both west and south of the site and at significant surface water risk. Depths are up to between 0.60 and 0.90m and greater than 1.20m in the 3.3% AEP event to the west and south of the site respectively. If access is required to the southwest corner of the site, this will need to be assessed further within a site-specific FRA, including the option to provide a crossing over Park Brook if required.

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

- The site is considered to have a low susceptibility to groundwater. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Groundwater monitoring is recommended to determine the seasonal variability of groundwater levels, as this may affect the design of the surface water drainage system. Below ground development such as basements may not be appropriate at this site.
- BGS data indicates that the underlying geology is largely comprised of mudstone, siltstone, and sandstone. This is likely to have highly variable permeability which should be confirmed through infiltration testing. The local soils are identified to be slowly permeable seasonally wet acid loamy and clayey soils which may limit infiltration potential within the winter months. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff from the site.
- The site is not located within a Groundwater Source Protection Zone and there are no restrictions over the use of infiltration techniques with regard to groundwater quality.
- The site is located within a Nitrate Vulnerable Zone. Therefore, early engagement with the LLFA and the EA is recommended to determine requirements for the site to manage the impact to surrounding watercourses. Consideration of water quality is likely to be of high importance and demonstrated through the use of the Simple Index Approach.
- The site is not located within a historic landfill 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.
- The RoFSW mapping indicates the presence of surface water flow paths during all modelled surface water events along the paths of the watercourses in the north and southwest of the site. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.
- 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.

6.2 Opportunities for wider sustainability benefits and integrated flood risk management

- Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity, helping meet requirements for the Nitrate Vulnerable Zone. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (Local Planning Authority, Lead Local Flood Authority, and the EA) at an early stage to understand possible constraints.
- The southwest corner of the site, where Park Brook bisects the site, and the north-eastern boundary along the unnamed watercourse should be integrated into the site drainage strategy as blue-green infrastructure.
- Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. This site is shown to be quite susceptible to increased surface water risk with climate change, with new areas of risk developing throughout the centre of the site between the 1% AEP and 1% AEP plus 40% climate change events.
- 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 (Park Brook) 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. Park Brook is currently assessed to be in moderate ecological status.
- 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.

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 entire site is located within Fluvial Flood Zone 1.

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 one hectare or greater in Flood Zone 1.
- Is subject to surface water flooding.
- Is identified as being at increased flood risk in the future, due to climate change.

All sources of flooding should be considered as part of a site-specific FRA.

Guidance on the requirements for site-specific FRAs can be found in the accompanying Level 2 SFRA report.

7.3 Guidance for site design and making development safe

Development should be steered outside of the path of Park Brook in the southwest corner of the site and along the path of the unnamed watercourse along the north-eastern site boundary. The Lead Local Flood Authority should be consulted to determine requirements for buffer zones either side of the watercourses and necessary permits.

The flow path which develops through the centre of the site during the 1% AEP plus 40% climate change event should be considered within the design of the site. Developers should consider utilising this area as a green corridor or as a location for SuDS.

A detailed hydraulic model of both Park Brook and the unnamed watercourse along the north-eastern site boundary may be required at FRA stage to accurately represent the risk from these watercourses and set the height of any mitigation measures. This should include an assessment of culvert capacity and blockage scenarios.

The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to pre-development greenfield rates, with areas of surface water ponding used as open space and SuDS or water compatible/essential infrastructure uses only.

Given the high likelihood of groundwater emergence in the east of the site, additional site investigation work may be required to support the detailed design of the drainage system if development is proposed in this location. Infiltration may not be appropriate in this area but should be confirmed through site-specific assessment. Below ground development such as basements are not appropriate in this part of the site.

Arrangements for safe access and escape routes 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 routes 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.

8 Conclusions

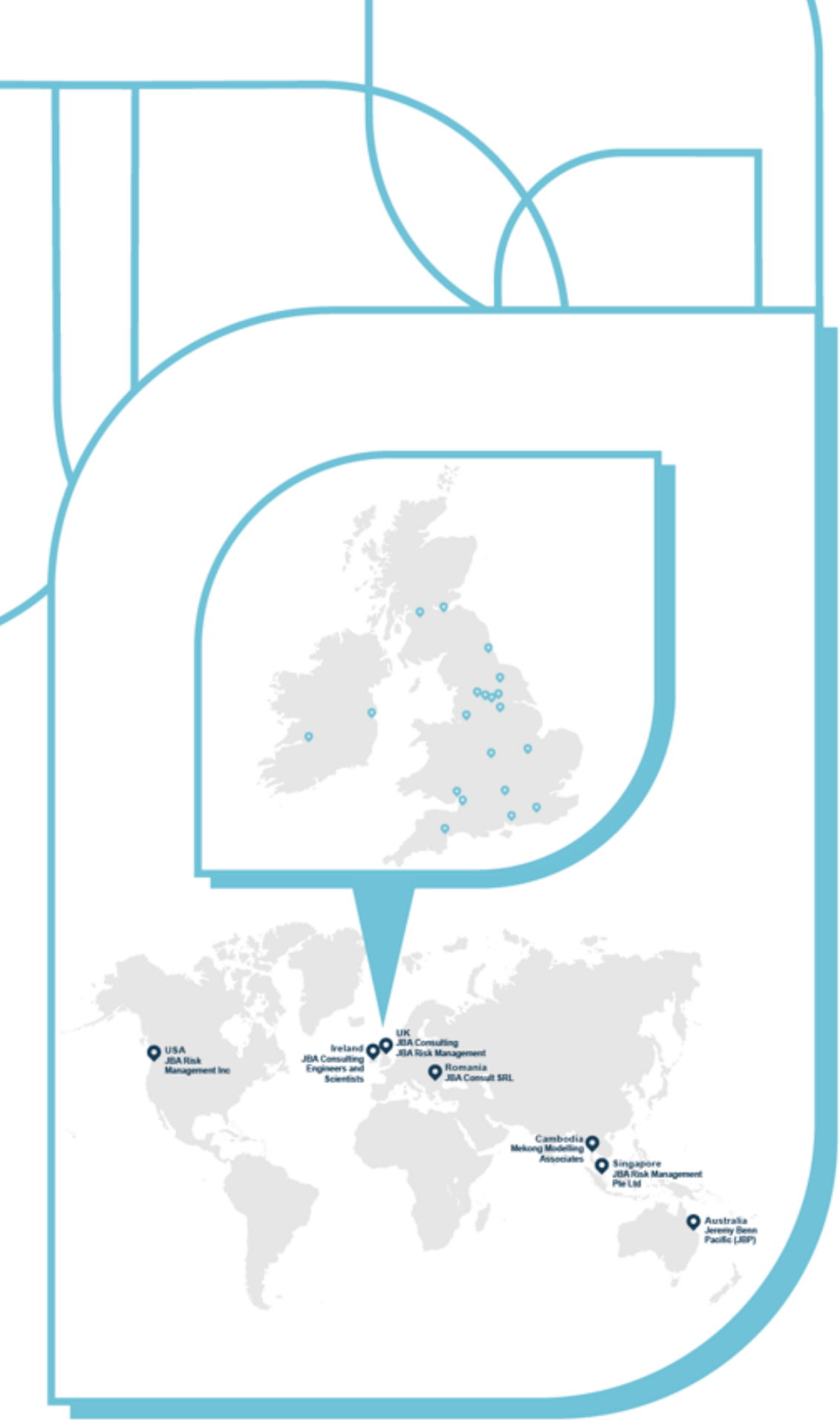
The site is generally shown to be at low risk. However, the site has some flood risk from two ordinary watercourses: Park Brook in the southwest of the site, and an unnamed watercourse along the north-eastern site boundary. Neither watercourse is large enough to be included within the EA FMfP, however, the EA RoFSW mapping shows the risk from the watercourses to be largely confined within either end of the site. The surface water risk to the site is shown to increase as a result of climate change. Surface water flooding may impede access and escape routes to the site during the 1% AEP plus 40% climate change event.

The exception test is not required for this site because the entire site is located within Fluvial Flood Zone 1. However, a site-specific FRA will be required, because the proposed development site is one hectare or greater in Flood Zone 1, subject to 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:

- All development should be steered away from the areas of highest risk along the north-eastern boundary and southwest corner of the site where Park Brook and the unnamed watercourse flow.
- A detailed hydraulic model of both Park Brook and the unnamed watercourse along the north-eastern site boundary may be required at FRA stage to accurately represent the risk from these watercourses and set the height of any mitigation measures. This should include an assessment of culvert capacity and blockage scenarios. However, given the underlying topography of the site and assessment of flood risk from these watercourses based on the RoFSW mapping, it is unlikely that modelled risk will considerably change the developable area of the site.
- Safe access and escape routes should be demonstrated in the 1% AEP fluvial and surface water climate change events. This should consider any areas of the site that may be cut off by existing watercourses, or flow paths which are shown to develop within the surface water event. Currently, this Level 2 assessment has shown there is potential for access to the site along Whitmore Road (A53) to be impacted from both the north and south during the 1% AEP plus 40% climate change event.
- 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.
- Severn Trent Water should be consulted at an early stage regarding the proposed site drainage due to the potential implications on the public sewerage

as a result of the size of the site and hydraulic and pollution incidents recorded within the vicinity of the site.



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