Sheffield Level 2 Strategic Flood Risk Assessment Update Site S02502

Final

May 2025

Prepared for:

Sheffield City Council

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This report describes work commissioned by Sheffield City Council (SCC) by an instruction dated 23 January 2025. The Client's representative for the contract was Chris Hanson of SCC. Freya Nation of JBA Consulting carried out this work.

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Acknowledgements

We would like to thank the Environment Agency for their assistance with this work.

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1 Background

This is a Level 2 Strategic Flood Risk Assessment (SFRA) site screening report for the Sheffield City Council (SCC) Local Plan Site S02502. The content of this Level 2 SFRA site screening report assumes the reader has already consulted the 'SCC Level 1 SFRA' (2022) and read the 'SCC Level 2 SFRA Main Report' (2024) and is therefore familiar with the terminology used in this report.

1.1 Site S02502

- Location: Beaver Hill Road
- Existing site use: Open green space
- Existing site use vulnerability: Water compatible
- Proposed site use: Housing
- Proposed site use vulnerability: More vulnerable
- Site area: 2.4 ha
- Proposed development impermeable area: 2.12 ha
- Watercourse: Unnamed tributary of Shirtcliff Brook
- Environment Agency (EA) river model: N/A
- Summary of requirements from scoping stage:
    - Assessment of surface water flood depths and hazards based on the EA's national Risk of Flooding from Surface Water dataset
    - Assessment of all other sources of flood risk
    - Modelling of latest EA climate change allowances for peak river flows and peak rainfall intensities

Figure 1-1: Existing site location boundary

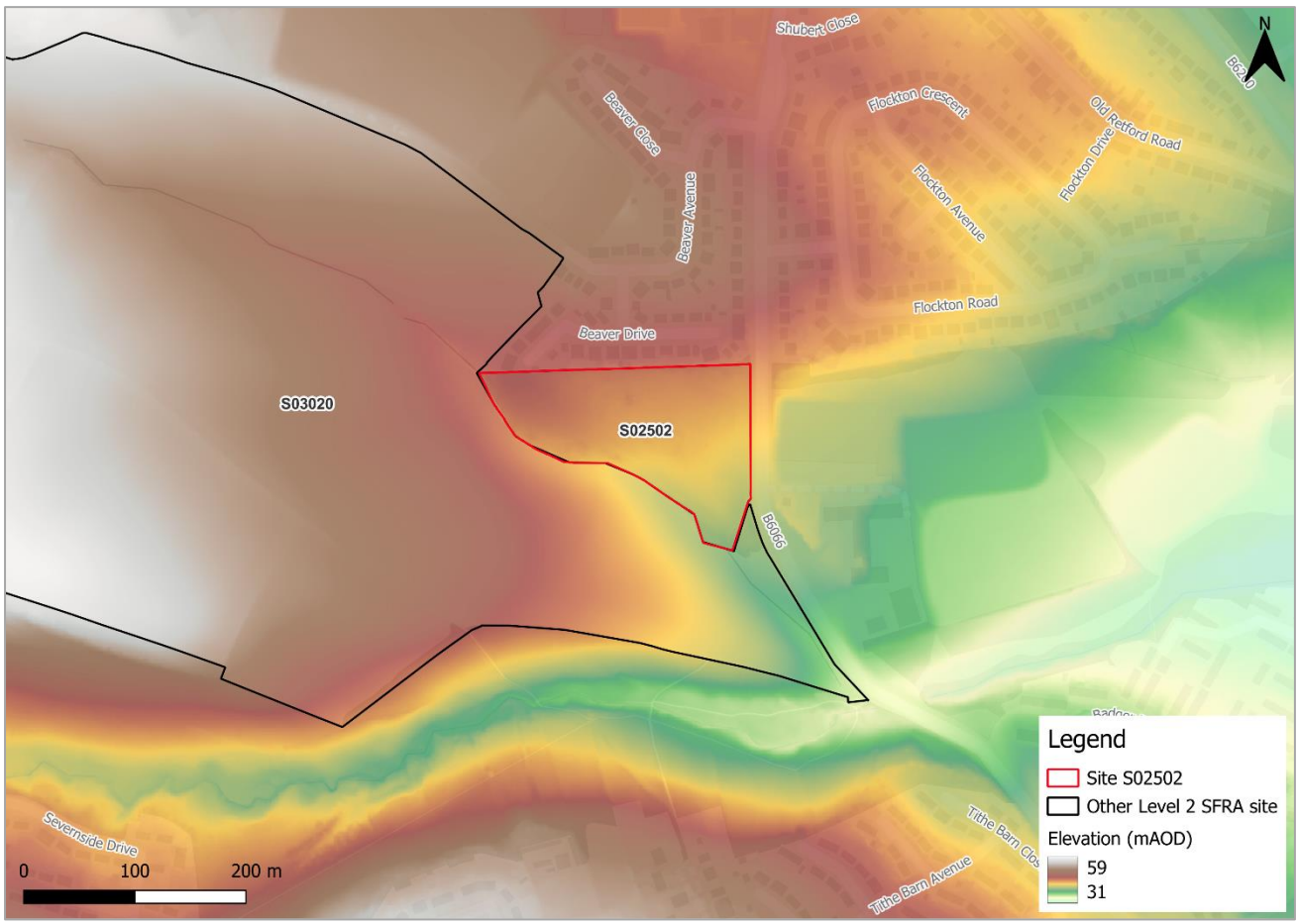

Figure 1-2: Topography

Figure 1-3: Soils and geology

2 Flood risk from rivers

2.1 Existing risk

2.1.1 Flood Map for Planning and functional floodplain

Based on the EA's Flood Map for Planning (February 2025) and Flood Zone 3b (functional floodplain), as updated in the Level 2 SFRA finalised in 2024, the percentage areas of the site within each fluvial flood zone are stated in Table 2-1 and can be viewed on Figure 2-1. This version of the Flood Map for Planning does not consider flood defence infrastructure (Section 2.2) or the impacts of climate change.

The site is entirely located within Flood Zone 1 indicating it is at low risk of flooding from rivers. OS mapping and topography data indicates that there is an unmodelled watercourse present within the site, namely an unnamed tributary of Shirtcliff Brook running along the southern boundary of the site. Section 2.1.2 discusses the potential risk to the site from this ordinary watercourse, using the third generation Risk of Flooding from Surface Water (RoFSW) dataset to inform this.

Table 2-1: Existing fluvial flood risk based on percentage area of site at risk

Flood Zone 1 (% area)	Flood Zone 2 (% area)	Flood Zone 3a (% area)	Flood Zone 3b (% area)
100	0	0	0

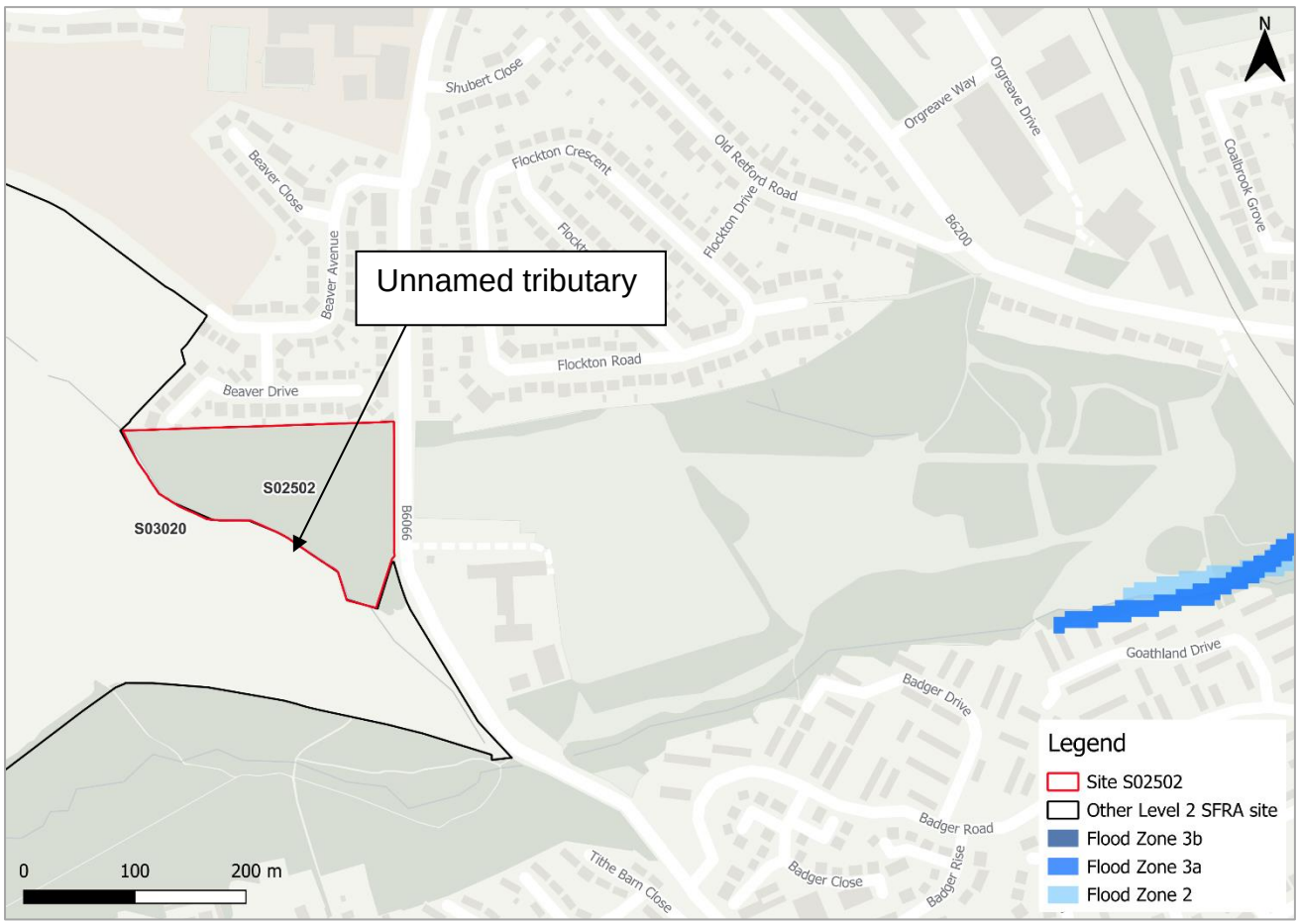

Figure 2-1: Existing risk from rivers to the site

2.1.2 Unmodelled watercourse risk

As documented in Section 2.1.1, an unnamed tributary of Shirtcliff Brook is present within the site. There is no existing model for this watercourse, therefore the fluvial risk it poses to the site is currently unknown. Given the timescales for the local plan, new modelling for this watercourse to inform this SFRA will not be feasible. Therefore, the 0.1% AEP event of the third generation RoFSW dataset is used as a proxy to inform this risk. Any site-specific FRA should develop a model of this tributary to fully understand the onsite fluvial risk.

Figure 2-2 shows the modelled flood depths for the 0.1% AEP surface water event, as a proxy for onsite fluvial risk. Risk is modelled to remain largely confined to the areas immediately adjacent to the channel. Development would ideally avoid the area modelled to be at risk, as confirmed through the site-specific FRA.

Figure 2-2: Low risk event surface water flood extent (Risk of Flooding from Surface Water map) as a proxy for onsite fluvial risk

2.2 Impacts from climate change

The impacts of climate change on flood risk from the unnamed tributary have not been modelled for this SFRA, as a model covering the ordinary watercourse is not available. The impacts of climate change must be modelled using the EA's latest allowances for peak river flows to inform whether the site can be safe for its lifetime. Any site-specific FRA should produce a detailed model of the unnamed tributary and include for the most up to date climate change allowances.

2.3 Flood risk management

2.3.1 Flood defences

The site does not benefit from any formal engineered flood defences, according to the EA's spatial flood defences dataset.

2.3.2 Working with Natural Processes

The EA's Working with Natural Processes (WwNP) dataset has been interrogated to identify opportunities for Natural Flood Management (NFM) that may help to reduce flood risk to the

site and surrounding areas. Upstream of, and within the site, along the unnamed tributary of Shirtcliff Brook, as well as along Shirtcliff Brook itself, mapping shows potential for riparian woodland planting (Figure 2-3). Riparian woodland can slow down and hold back flood flows within watercourses, reducing flood risk downstream. It can also reduce sediment delivery and bankside erosion. Further investigation is required for any land shown to have potential for WwNP.

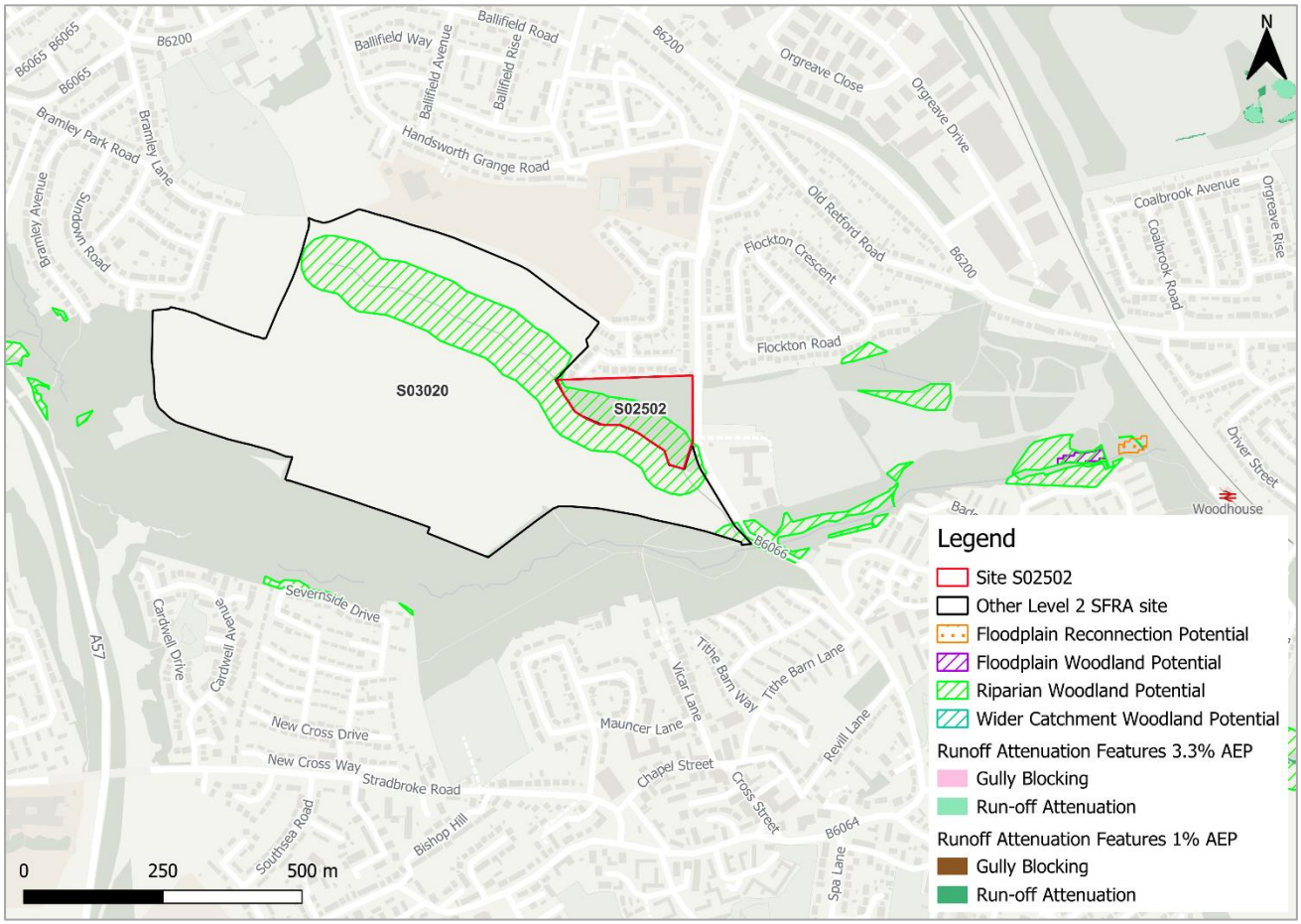

Figure 2-3: NFM potential mapping

2.4 Historic flood incidents

The EA's Historic Flood Map (HFM) has been considered. The site is not recorded to have experienced historic flooding. The EA's Recorded Flood Outlines (RFO) dataset shows record of a flood incident on Beaver Hill Road, near where Shirtcliff Brook is culverted under the road, in November 2019.

2.5 Flood warning and access and escape routes

The EA operates a Flood Warning Service for properties located within a Flood Warning Area (FWA) for when a flood event is expected to occur. The site is not located within a FWA.

Flood alerts may be issued before a flood warning for properties located within a Flood Alert Area (FAA) to provide advance notice of the possibility of flooding. A flood alert may be

issued when there is less confidence that flooding will occur in a FWA. The site is not located within a FAA.

Based on available information, safe access and escape routes could be achieved via Beaver Hill Road (the B6066) to the east of the site, or via Beaver Drive to the north of the site.

2.6 Observations, mitigation options and site suitability - fluvial

- The proposed development of the site would see a change in the risk classification from water compatible open space to more vulnerable, according to the NPPF.
- Given the change in use and therefore vulnerability of the site, the FRA must show that the development can be designed to be safe and that there is adequate emergency planning provision (para 014 FRCC-PPG).
- The site is wholly located within Flood Zone 1 and is therefore modelled to be at low risk of flooding from rivers.
- Potential flood risk from Shirtcliff Brook, and its unnamed tributary which flows along the southern site boundary, should be ascertained through appropriate modelling, at the FRA stage. The channel and risk area should be included within a blue green corridor.
- An 8 metre no development buffer of the watercourse is advised.

3 Flood risk from surface water

3.1 Existing risk

Based on the EA's national scale third generation Risk of Flooding from Surface Water (RoFSW) map (November 2023), surface water risk to the site is predominantly very low. Approximately 1% of the site is at high surface water risk. A further 1% of the site is at medium risk and a further 4% is at low surface water risk, as shown in Table 3-1.

In the high and medium risk event, surface water risk is confined to the channel of the unnamed tributary of Shirtcliff Brook, along the western site boundary. In the low risk event additional ponding forms along the eastern site boundary.

Greatest surface water depths in the medium risk event are between 0.3 and 0.6 m (Figure 3-1) with some areas of significant hazard (Figure 3-2). Safe access and escape routes may be achievable via Beaver Hill Road, leading to Flockton Road.

Table 3-1: Existing surface water flood risk based on percentage area at risk using the RoFSW map

Very low risk (% area)	Low risk (% area)	Medium risk (% area)	High risk (% area)
94	4	1	1

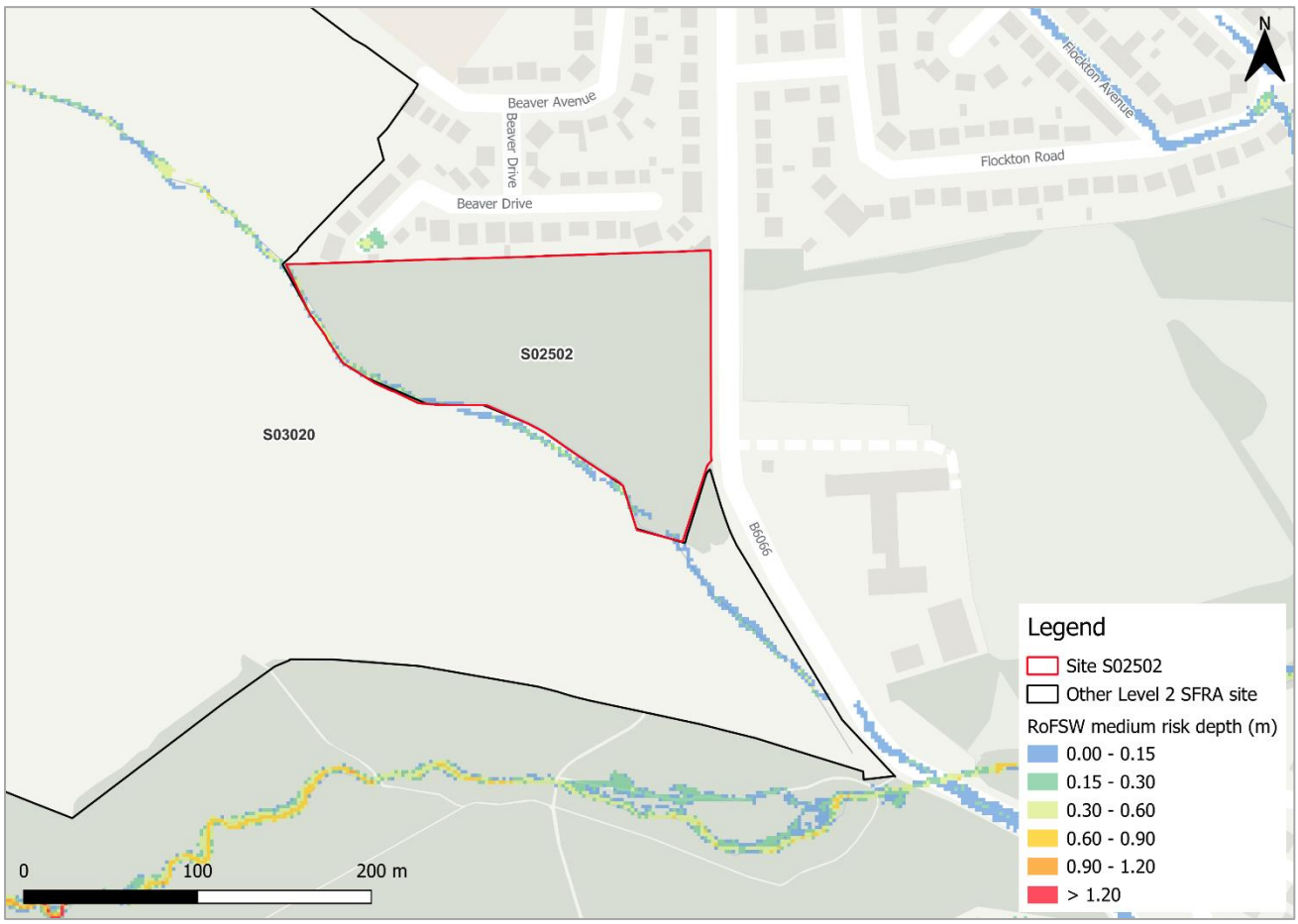

Figure 3-1: Medium risk event surface water flood depths (Risk of Flooding from Surface Water map)

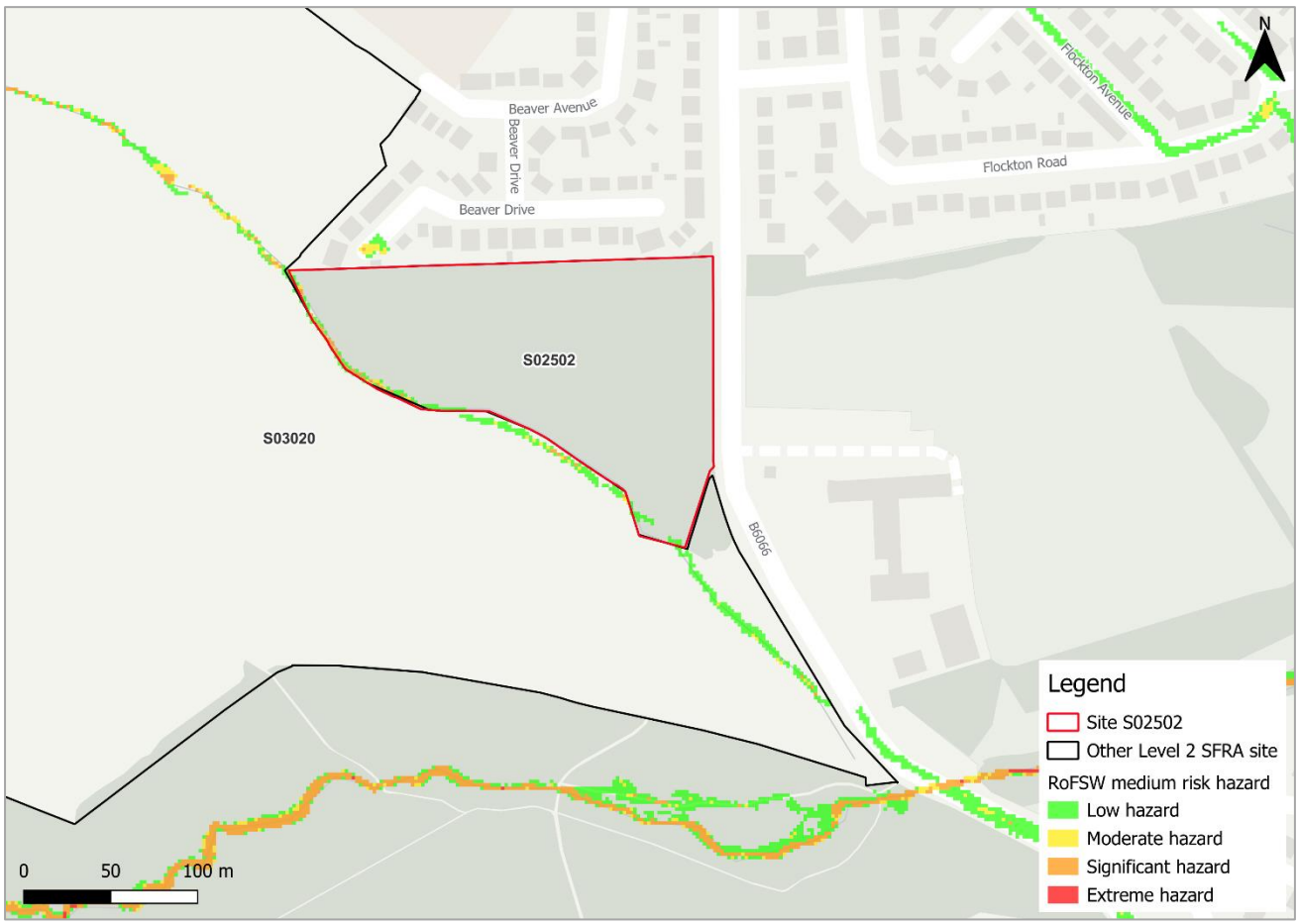

Figure 3-2: Medium risk event surface water flood hazard[1] (Risk of Flooding from Surface Water map)

3.2 Impacts from climate change

The impact of climate change on surface water flood risk has been modelled. This allows for direct comparison with the RoFSW map. With consideration of the EA's SFRA guidance, the latest climate change allowances have been modelled as shown in Table 3-2.

Table 3-2: Modelled climate change allowances for rainfall for the Don and Rother management catchment

Return period	Central allowance 2070s (% increase)	Upper end allowance 2070s (% increase)
3.3% (high risk)	25%	35%
1% (medium risk)	25%	40%

1 Based on Section 7.5 Hazard rating. What is the Risk of Flooding from Surface Water map? Report version 2.0. April 2019. Environment Agency

Figure 3-3 shows the modelled surface water flood depths for the medium risk event plus 40% climate change. Risk is modelled to be slightly greater than present day conditions, with the medium risk climate change event modelled to be similar to the present day low risk event. An additional flow path forms along the eastern site boundary, in comparison to the present day event. Maximum flood depths are modelled to increase to between 0.6 and 0.9 m, with some areas of extreme hazard (Figure 3-4). Safe access and escape routes may be achievable via Beaver Hill Road, leading to Flockton Road, though there is flooding to this road during the climate change event.

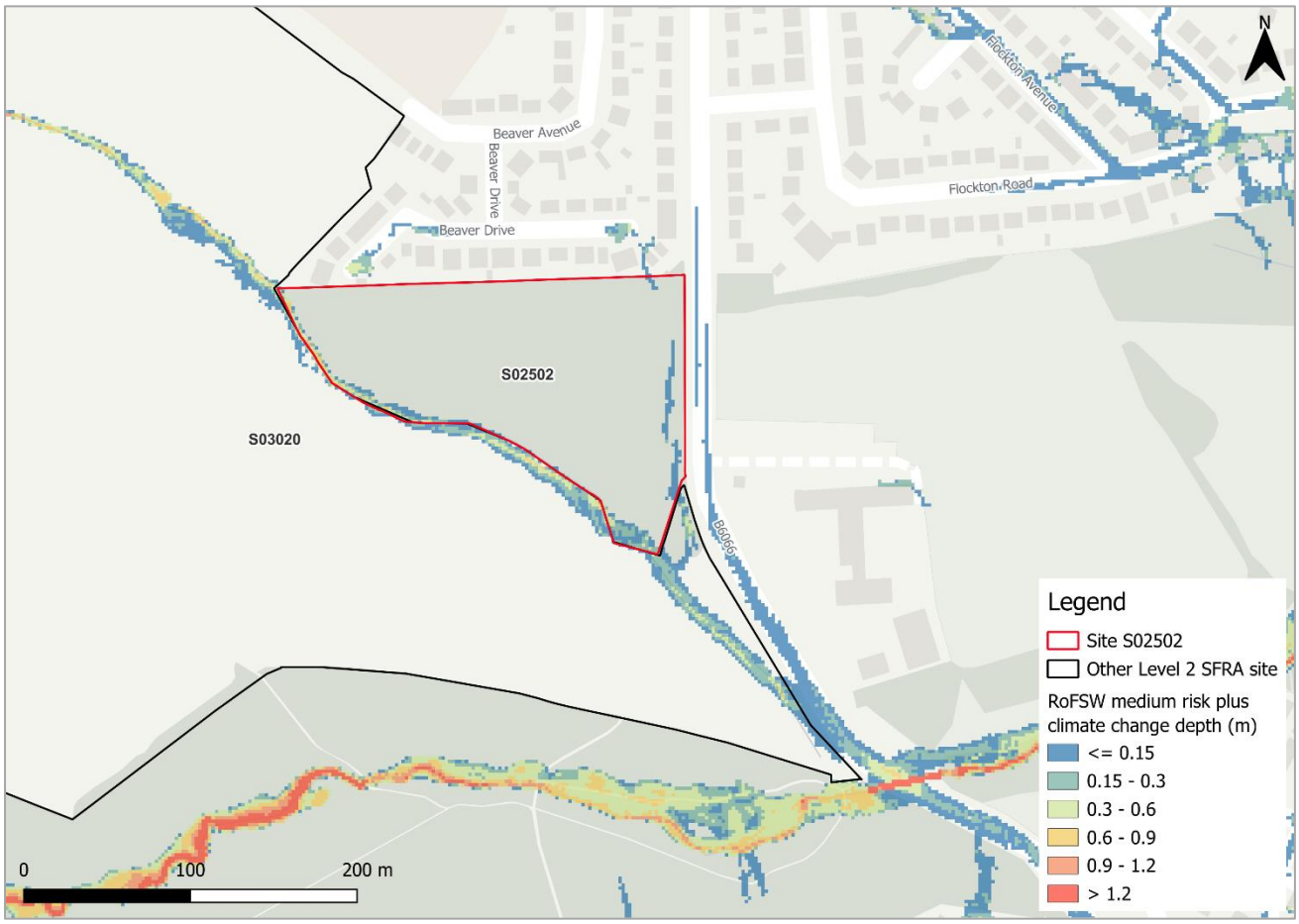

Figure 3-3: Medium risk event surface water flood depths plus 40% climate change (based on Risk of Flooding from Surface Water map)

Figure 3-4: Medium risk event surface water flood hazards plus 40% climate change (based on Risk of Flooding from Surface Water map)

3.3 Risk of runoff from site post development

Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on the estimated impermeable area (assumed 85% of site area where this information was not available) and limiting greenfield runoff rate of Qbar (l/s).

Table 3-3: Surface water flood risk from proposed development

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m^3	Outflow volume m^3	Attenuation required m^3	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (Ha) and % of site area
30yr Rainfall+25%	12	1858	151	1707	135.1	0.11 Ha 4.8%
30yr Rainfall+35%	12	2007	151	1855	146.8	0.12 Ha 5.2%
100yr Rainfall+25%	12*	4453	1512	2941 (1234 exceedance storage)	232.8	0.2 Ha 8.3%
100yr Rainfall+40%	12*	4988	1512	3476 (1620 exceedance storage)	275.1	0.23 Ha 9.8%
Surface water flood risk impacts from development site, mitigation & SuDS options	As part of this Level 2 SFRA we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. Attenuation volumes are presented for the critical storm duration for the 3.33% AEP event with exceedance flows quantified up to the 1% event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.					
*critical storm duration limited to 12 hours						

Note: Proposed development limiting runoff rate: (l/sec). Qbar (FEH Statistical) – 4.89 (assume 5l/s minimum discharge), Q30 – 8.56, Q100 – 10.17.

3.4 Observations, mitigation options and site suitability - surface water

- Current risk in the medium risk surface water event is confined to the unnamed tributary of Shirtcliff Brook along the southern site boundary. The channels onsite should be kept in place and remain unobstructed. They should be maintained and included within the landscaping design of the residential development.
- The unnamed tributary should be included in a blue green corridor mitigating both fluvial and surface water risk.
- Any regrading of land must include like for like volumes to ensure risk is contained safely onsite for the lifetime of development. A full drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require surface water modelling based on layout plans and detailed design and full consultation with the LLFA.

- For the 1% AEP event plus 40% climate change, approximately 9.8% of the total area of the site would be required for flood storage based on a 1.5m deep pond to ensure runoff volumes do not exceed existing rates.
- The drainage strategy should consider the surrounding roads and access routes in terms of drainage capacities, network conditions and maintenance.
- The NaFRA2 release of the RoFSW should be considered at the FRA stage.
- Note that the RoFSW map is not suitable for identifying whether an individual property will flood and is therefore indicative. The RoFSW map is not appropriate to act as the sole evidence for any specific planning or regulatory decision or assessment of risk in relation to flooding at any scale without further supporting studies or evidence.

4 Risk from groundwater

Risk of groundwater emergence is assessed in this SFRA using JBA's 5m Groundwater Emergence Map. This dataset is recommended for use by the EA in the SFRA Good Practice Guide[2]. Figure 4-1 shows the map covering this site and the surrounding areas and. Table 4-1 explains the risk classifications.

The northeastern side of the site is within an area where there is no risk of groundwater emergence. Groundwater conditions on the northeastern half of the site may be suited to infiltration SuDS. The southwestern side of the site is within an area where there is a risk of groundwater flooding to surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally. In the far southern corner, groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots. Infiltration SuDS may be unsuitable in these areas though further investigations will be required at the FRA stage.

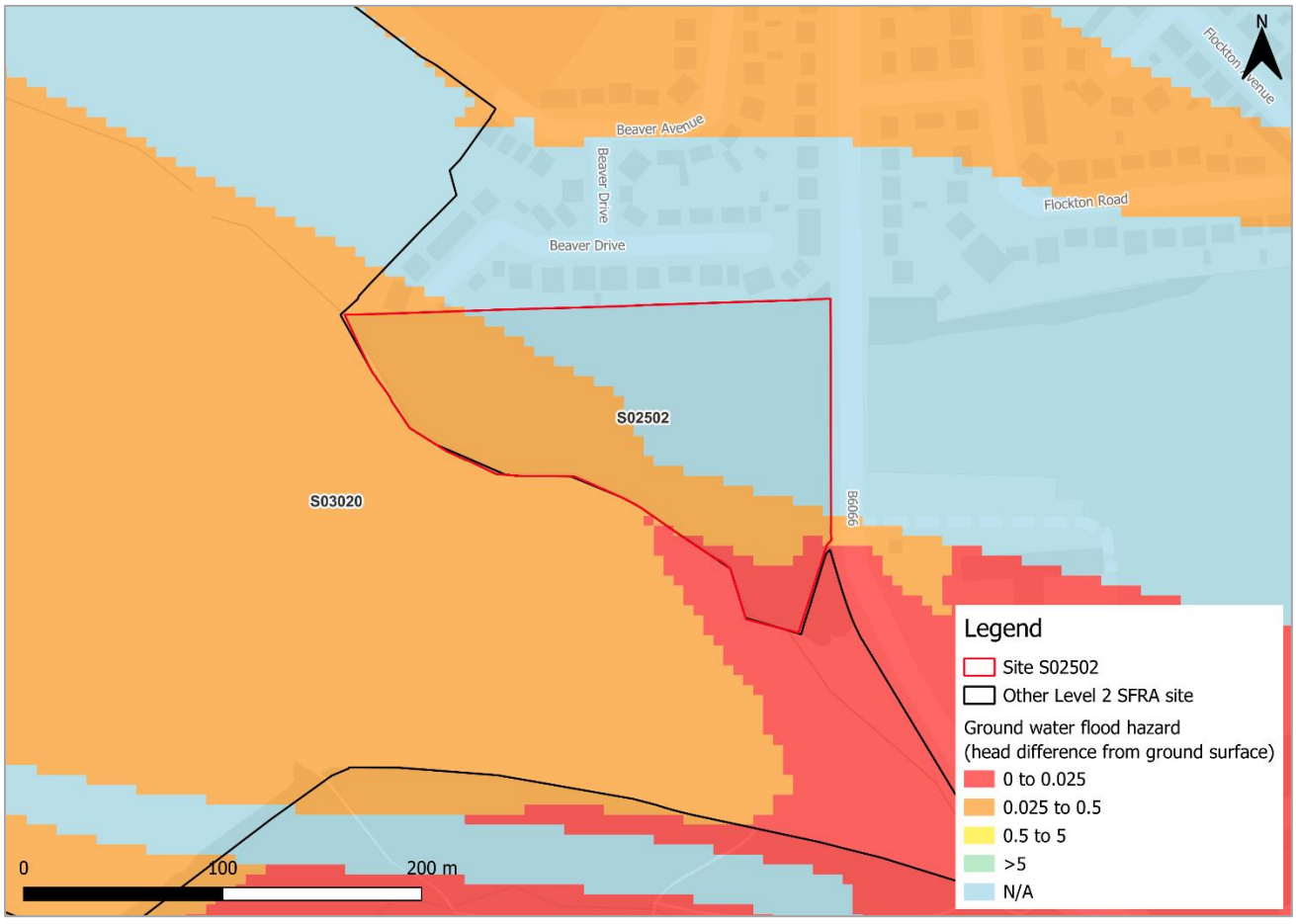

Figure 4-1: JBA 5m Groundwater Emergence Map

2 Strategic flood risk assessment good practice guide. ADEPT. December 2021.

Table 4-1: Groundwater Hazard Classification

Groundwater head difference (m)*	Class label
0 to 0.025	Groundwater levels are either at very near (within 0.025m of) the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
0.025 to 0.5	Groundwater levels are between 0.025m and 0.5m below the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
0.5 to 5	Groundwater levels are between 0.5m and 5m below the ground surface in the 100-year return period flood event There is a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely.
>5	Groundwater levels are at least 5m below the ground surface in the 100-year return period flood event. Flooding from groundwater is not likely.
N/A	No risk. This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.
*Difference is defined as ground surface in mAOD minus modelled groundwater table in mAOD.	

5 Residual risk

5.1 Flood risk from reservoirs

The EA's Reservoir Flood Maps (RFM) (2021) show where water may go in the unlikely event of a reservoir or dam failure. A 'dry day' scenario assumes that the water level in the reservoir is the same as the spillway level or the underside of the roof for a service reservoir and the watercourses upstream and downstream of the reservoir are at a normal level. A 'wet day' scenario assumes a worst-case scenario where a reservoir releases water held on a 'wet day' when local rivers have already overflowed their banks.

The site is not modelled to be at risk from reservoir flooding.

5.2 Observations, mitigation options and site suitability - residual risk

- There is no known residual risk to the site based on current information.

6 Overall site assessment

6.1 Can part b) of the exception test be passed?

This site is not required to pass part b) of the exception test[3] as it is located within Flood Zone 1, however it must still be proven that the development can be safe for its lifetime, which is 100 years for residential development.

Were any future modelling of the unnamed watercourse to indicate that the site at risk in the 1% AEP undefended event, the site may then be subject to the exception test, assuming the sequential test has been passed.

6.2 Recommendations, FRA requirements, and further work

Based on the evidence presented in the Level 1 SFRA (2022) and this Level 2 SFRA:

- Current and future risk from the unnamed watercourse must be fully modelled to ascertain the fluvial risk to the site. Assuming built development can avoid the modelled 1% AEP event plus climate change flood extent, it should be possible for the site to pass the exception test. No development should take place within 8 metres of the channel bank of Tinker Brook.
- A drainage strategy will be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This may require surface water modelling based on layout plans and detailed design and consultation with the LLFA on required runoff rates, likely to be greenfield or betterment. The use of infiltration SuDS should be investigated.
- Any FRA should be carried out in line with the latest versions of the NPPF; FRCC-PPG; EA online guidance; the SCC Local Plan and national and local SuDS policy and guidelines.
- Throughout the FRA process, consultation should be carried out with the following, where applicable, the local planning authority; the lead local flood authority; emergency planning officers; the Environment Agency; Yorkshire Water; the highways authorities; and the emergency services.

3 Para 178 National Planning Policy Framework 2024

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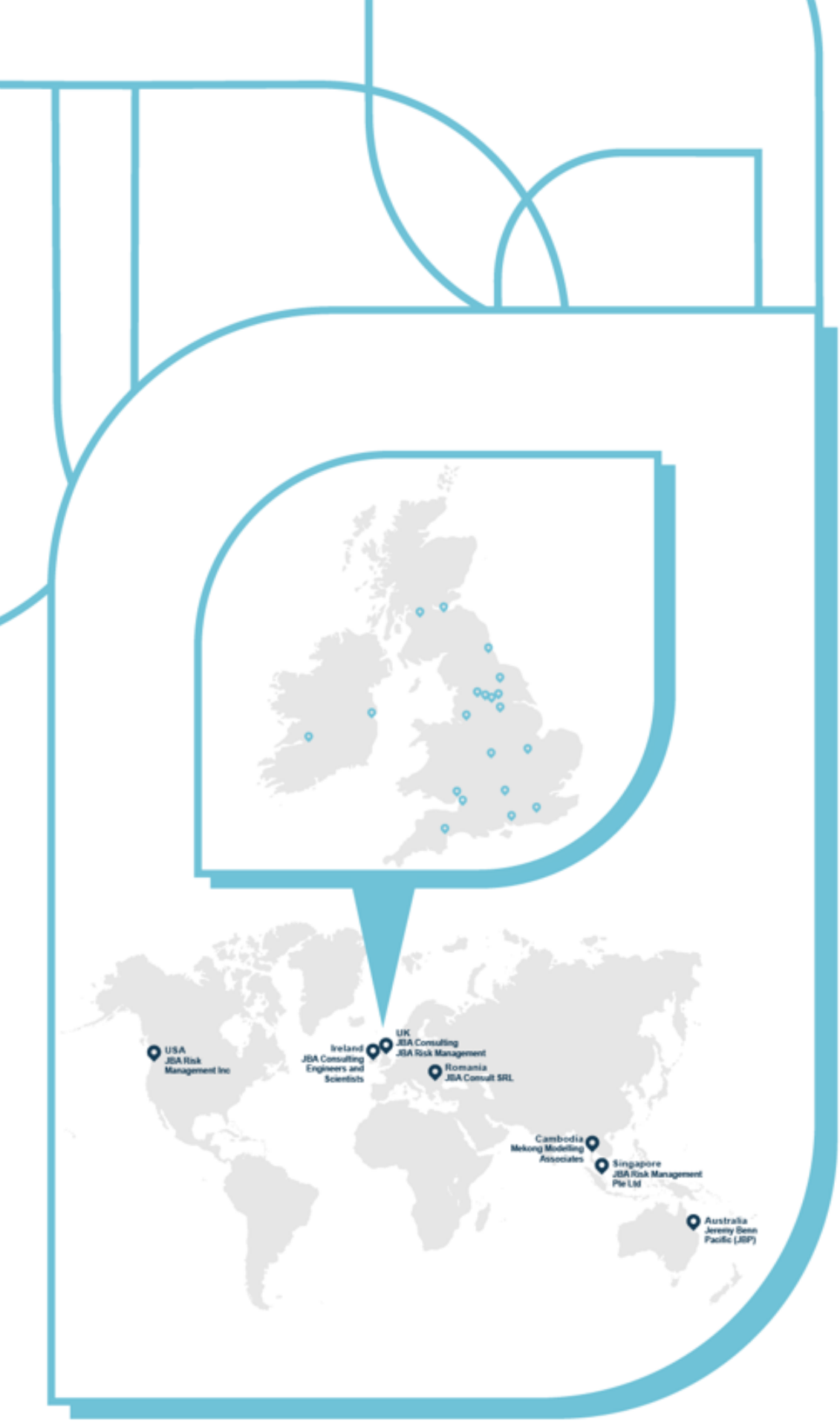

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