Sheffield Level 2 Strategic Flood Risk Assessment Update - Site S03032

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 S03032. 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 S03032

- Location: Land at Forge Lane, S35 0GG
- Existing site use: Agriculture
- Existing site use vulnerability: Less vulnerable
- Proposed site use: Housing
- Proposed site use vulnerability: More vulnerable
- Site area: 3.2 ha
- Proposed development impermeable area: 2.3 ha
- Watercourse: River Don
- Environment Agency (EA) river model: SCFR model (2012)
- Summary of requirements from scoping stage:
    - Assessment of modelled fluvial flood depths, velocities and hazards
    - 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

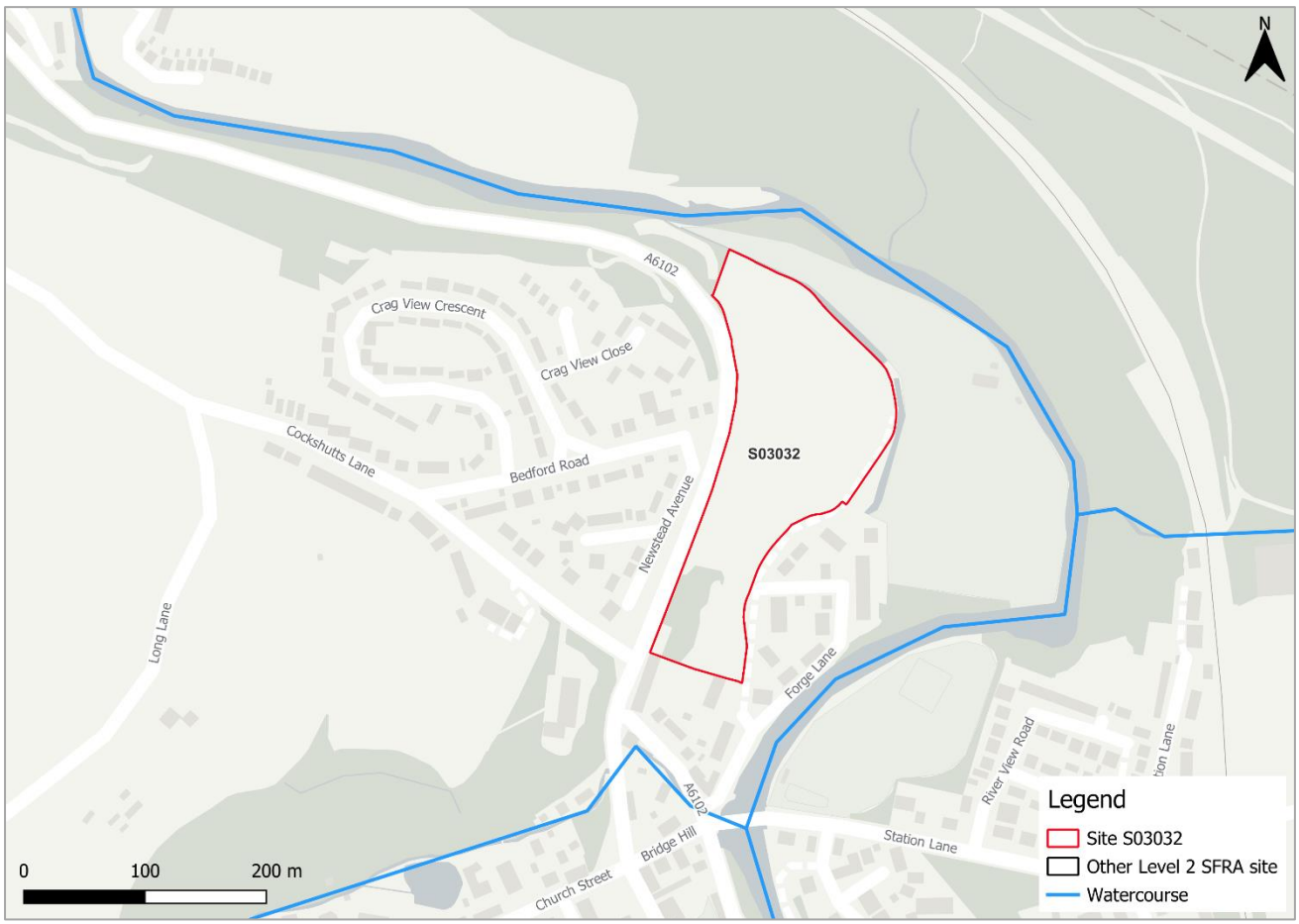

Figure 1-1: Existing site location boundary

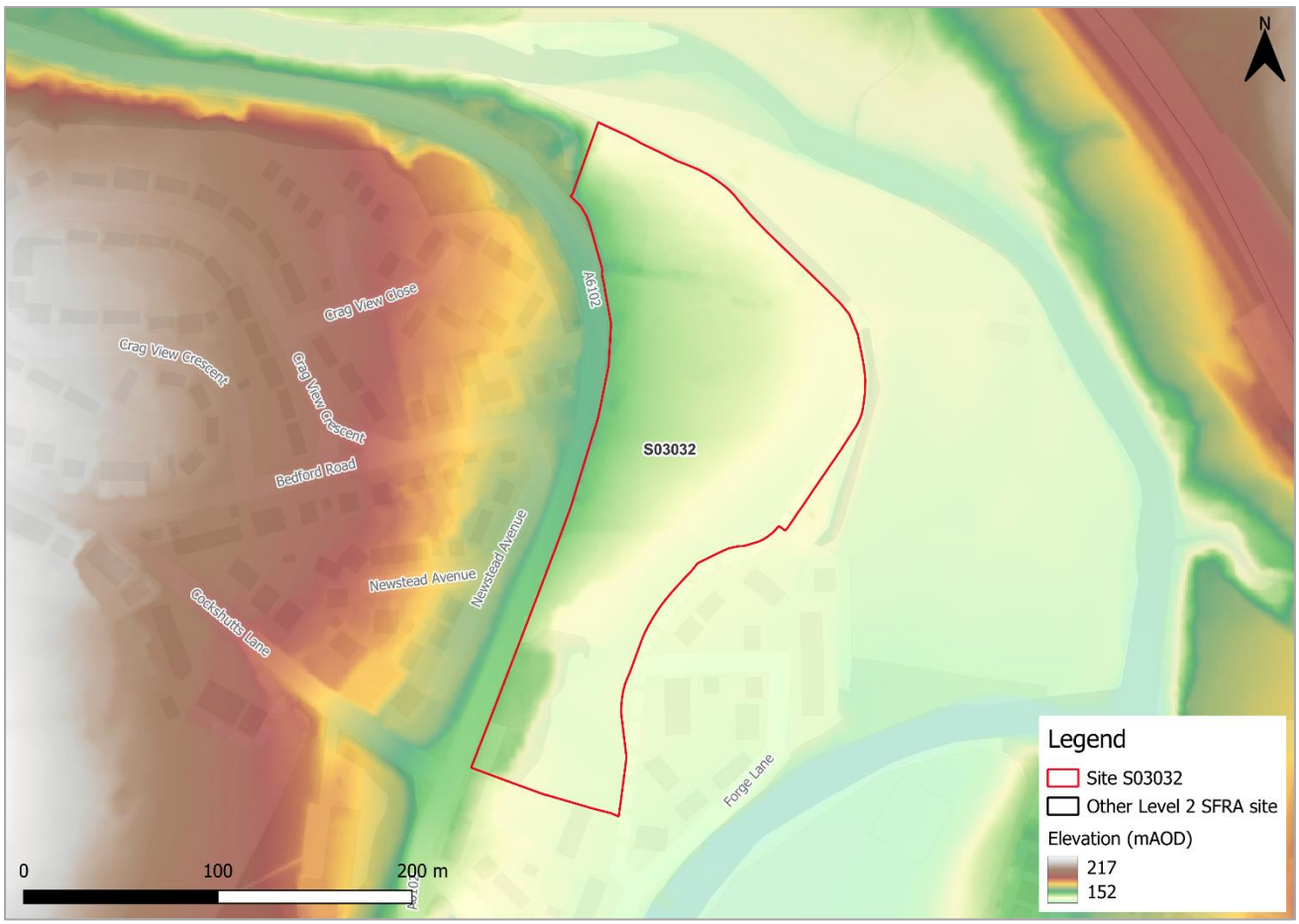

Figure 1-2: Topography

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 2.3) or the impacts of climate change (Section 2.2).

Part of the northern site boundary is within Flood Zone 3b, indicating it is at high risk of flooding. This is due to the presence of a tributary of the River Don being located along this boundary. Flood Zone 3b is based on Flood Zone 3a of the Flood Map for Planning in this area. Slightly more land along the northeastern boundary is within Flood Zone 2 indicating it is at medium risk of flooding from rivers.

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)
98	1	0	1

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

2.1.2 SCFR undefended model outputs

Figure 2-2 shows the modelled flood depths for the 0.1% AEP undefended event from the SCFR model. The Don is shown to impact part of the northern site boundary with maximum depths of between 0.6 and 0.9 m (Figure 2-2). Modelled flood velocities could not be generated due to this section of the watercourse only being modelled in the 1d domain.

Section 2.3.1 discusses the defended model outputs.

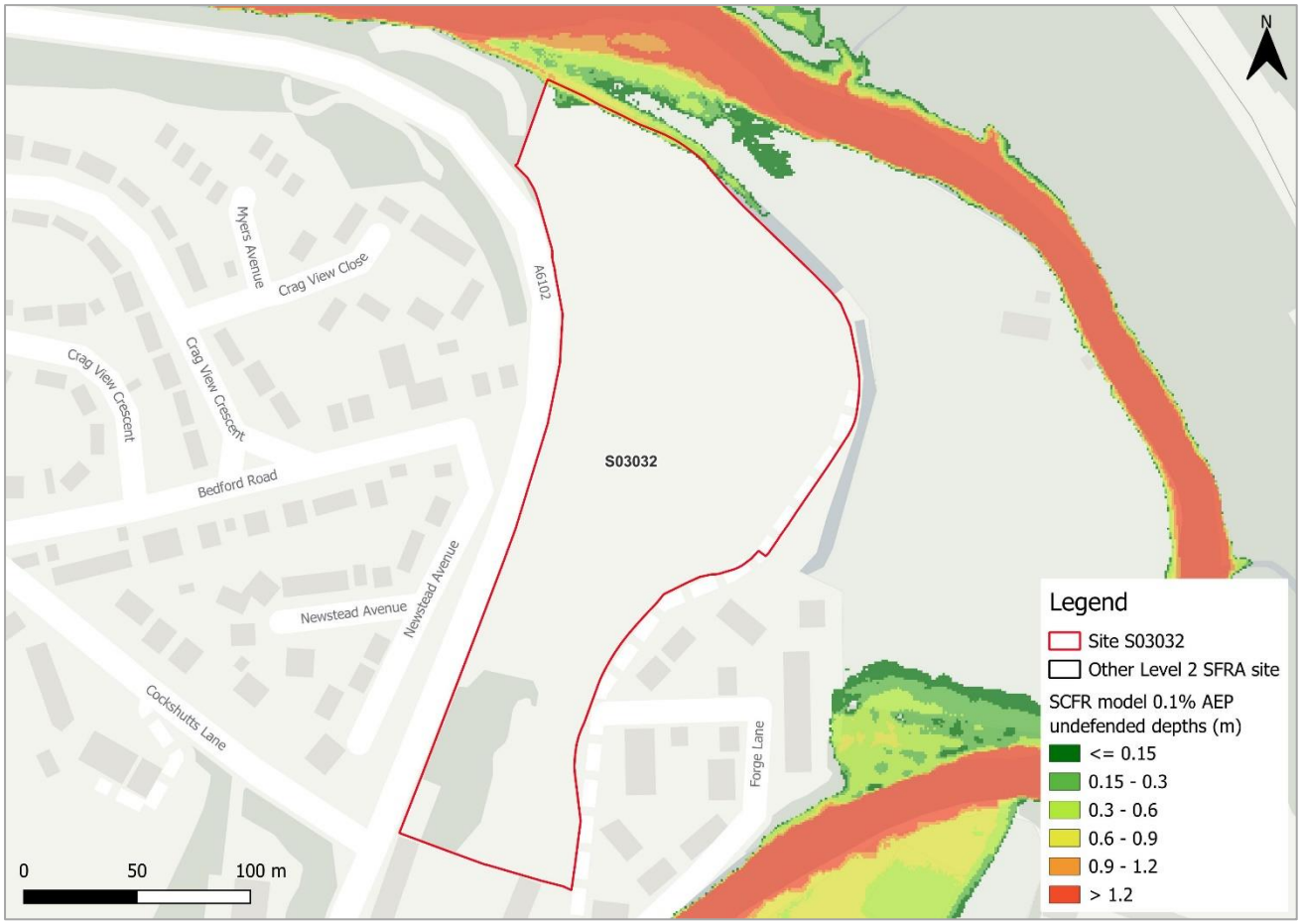

Figure 2-2: Flood depths for 0.1% AEP undefended flood event

2.2 Impacts from climate change

The impacts of climate change on flood risk from the River Don have been modelled without flood defence infrastructure in place. This allows for direct comparison with the existing risk of the Flood Map for Planning.

With consideration of the EA's SFRA guidance, the latest climate change central and higher central allowances have been modelled as shown in Table 2-2. The EA's SFRA guidance states that SFRAs should assess the central allowance for less, more, and highly vulnerable development, and also water compatible development. The higher central should be assessed for essential infrastructure.

Table 2-2: Modelled climate change allowances for peak river flows for the Don and Rother Management Catchment

Return period (AEP event)	Central allowance 2080s (% increase)	Higher central allowance 2080s (% increase)	Upper end allowance 2080s (% increase)
3.3% (functional floodplain)	28%	38%	60%
1%	28%	38%	60%

Figure 2-3 shows the modelled flood depths for the 1% AEP undefended event + 28% (central) climate change allowance for the River Don. Risk is modelled to be greater than the present day 1% AEP event, though less than the 0.1% AEP present day event, with flood extents impacting a small part of the northern site boundary. Maximum site depths are between 0.3 and 0.6 m. Safe access and escape routes remain achievable via the A6102 to the west or Forge Lane to the east of the site.

Figure 2-3: Flood depths for 1% AEP undefended flood event +28% (central climate change allowance)

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. This is reflected in the defended modelled flood extent and depths being very similar to the undefended event within the site for the 2012 SCFR model of the River Don (Figure 2-4).

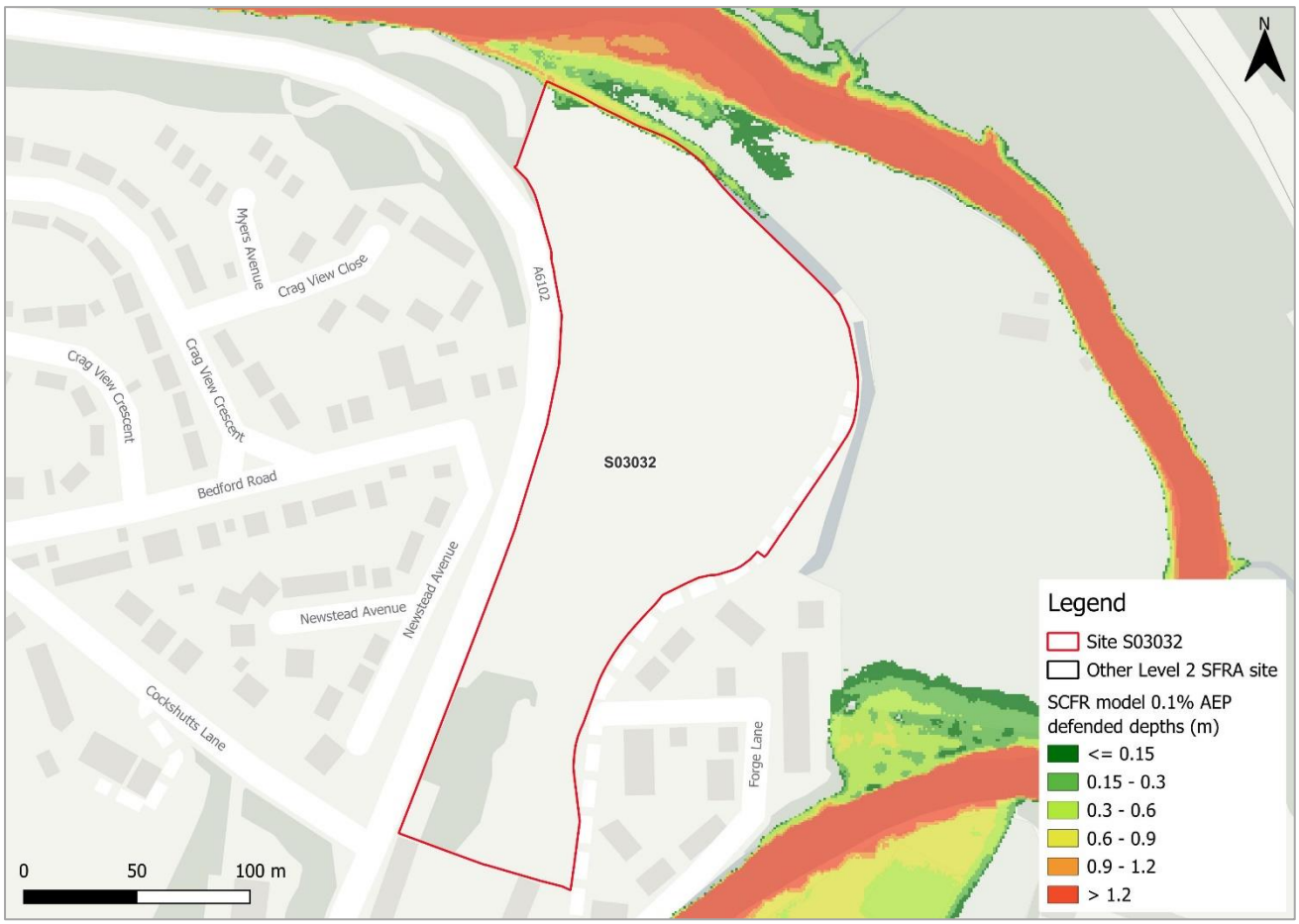

Figure 2-4: Flood depths for the present day 1% AEP defended flood event

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. Along the northern site boundary, mapping shows potential for riparian and floodplain woodland planting (Figure 2-5). 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. Within the south and east of the site, there is potential for run-off attenuation features so store surface water within the site, reducing flood risk to the surrounding area. Further investigation is required for any land shown to have potential for WwNP.

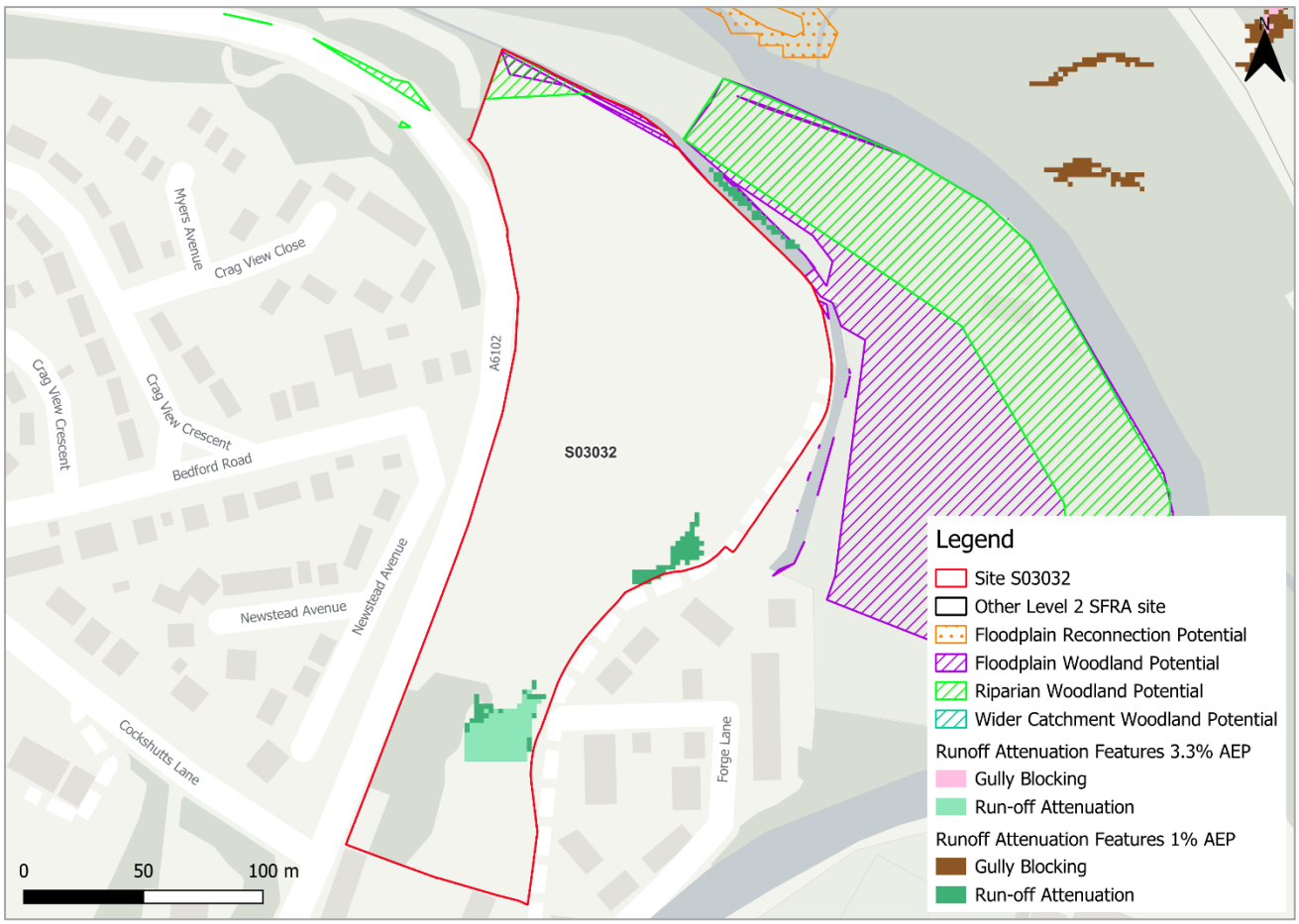

Figure 2-5: NFM potential mapping

2.4 Historic flood incidents

The EA's Historic Flood Map (HFM) has been considered and mapped in Figure 2-6 which shows a small amount of flooding along the northern site boundary. In the EA's Recorded Flood Outlines (RFO) dataset, this flooding is attributed to flooding from the River Don in 2007. The RFO dataset also shows records of surface water flooding along the southeastern site boundary and within the south of the site, also from 2007 (Figure 2-7).

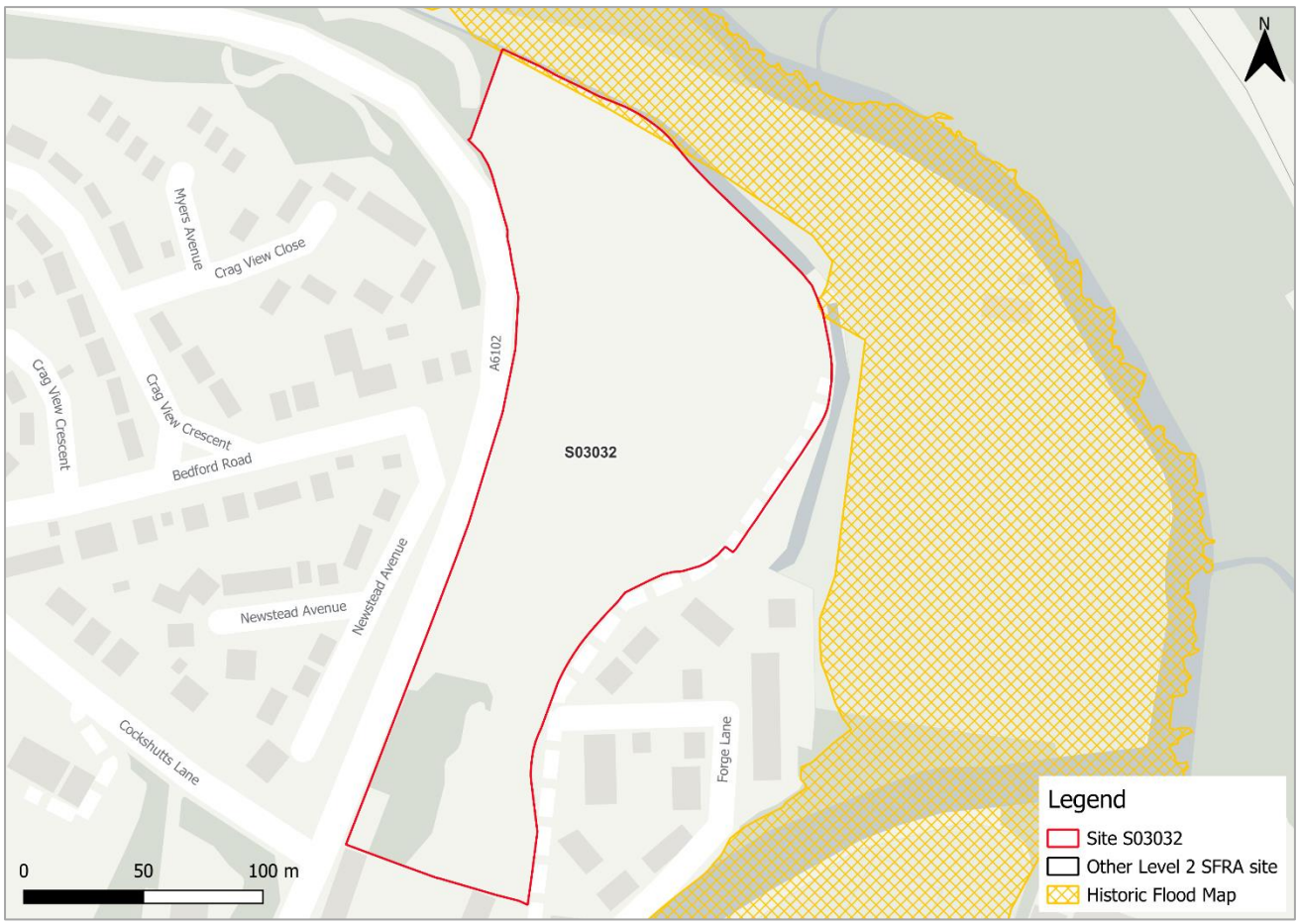

Figure 2-6: Recorded historic flood events onsite and around the site

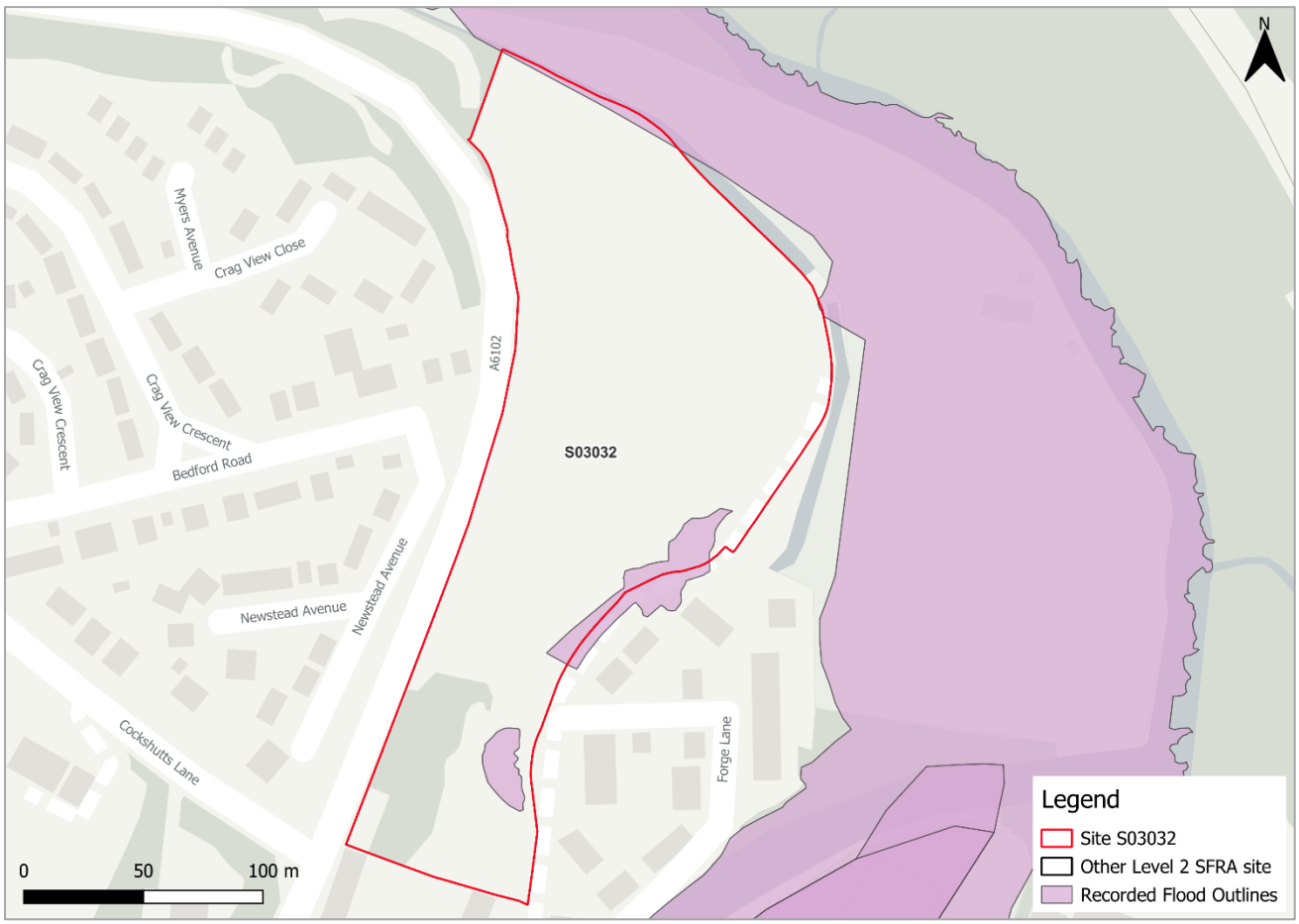

Figure 2-7: Recorded flood outlines onsite and around the site

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 northern site boundary is located within a FAA, namely 123WAF970 - Upper River Don Catchment.

Based on available information, safe access and escape routes should be achievable via the A6102 to the west or Forge Lane to the east of the site.

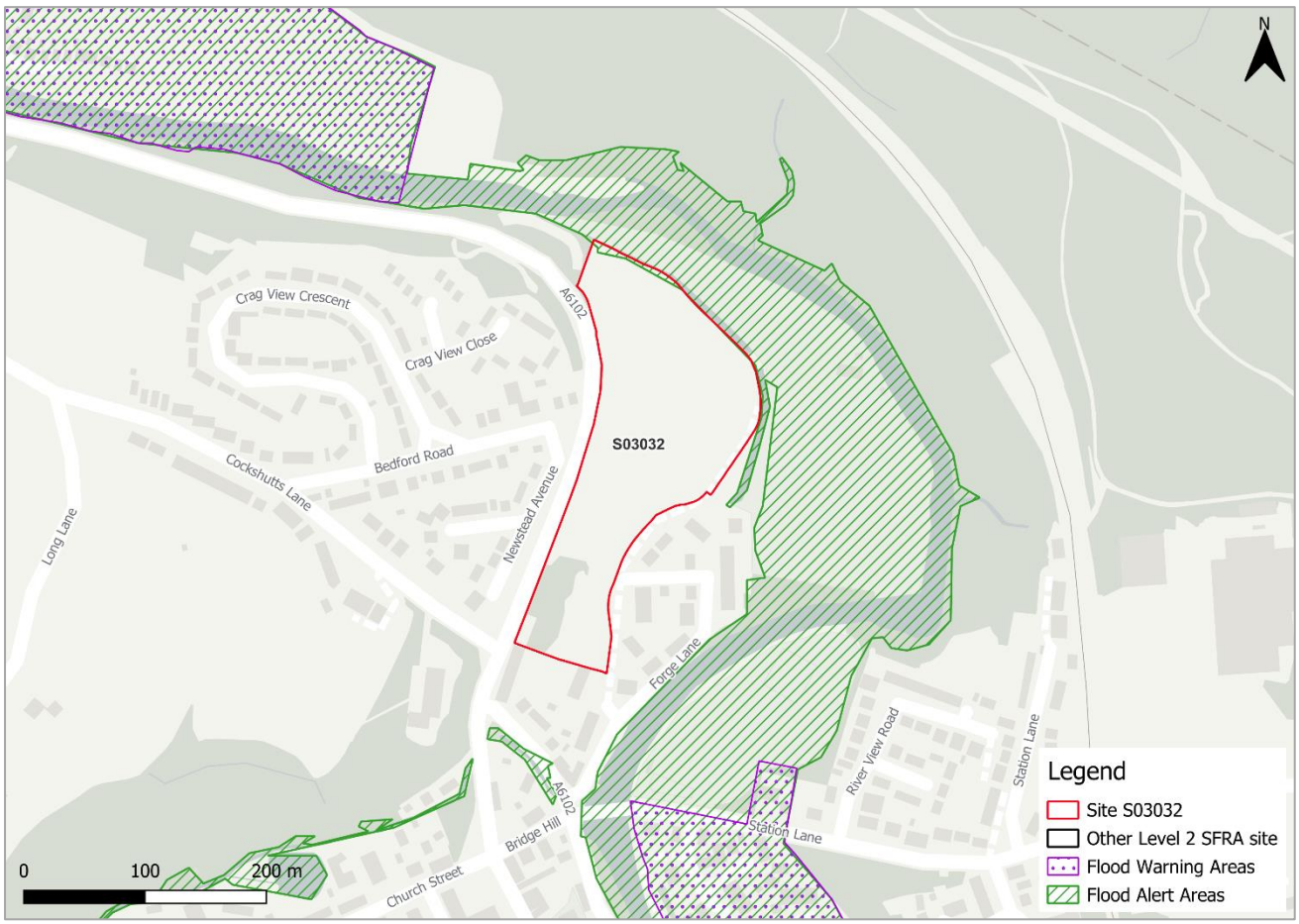

Figure 2-8: EA Flood Warning Areas and Flood Alert Areas

2.6 Observations, mitigation options and site suitability - fluvial

- The proposed development of the site would see a change in the risk classification from less vulnerable 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 modelled to be nominally within the functional floodplain along the northern boundary, based on the small tributary to the River Don. This area should be used as a blue green corridor which can provide multifunctional benefits providing ecological, social and amenity value.
- If the development of the site involves any activity within 8 metres of the Don, a flood risk activity permit may be required from the EA in addition to planning permission.
- The northern boundary and the area surrounding is modelled to be at risk from fluvial sources (according to the SCFR 2012 model) in the 0.1% AEP defended and undefended scenarios, to the same extent as Flood Zone 2.
- EA flood alerts should continue to be in place to ensure early evacuation of site users before an extreme flood event occurs.

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 5% of the site is at high surface water risk. A further 3% of the site is at medium risk and a further 5% is at low surface water risk, as shown in Table 3-1.

In the high risk event, ponding is confined to the southeastern corner of the site, including the area where there is an existing pond. In the medium risk event, ponding at the southeastern corner expands and a second area of ponding forms along the eastern site boundary, adjacent to the path which runs along the site boundary. In the low risk event, the two areas of ponding expand to form a flow path along the eastern site boundary. This flow path is also joined by a shallow flow path which travels along Langsett Road North and easterly into the site. Parts of the northern site boundary are impacted by a flow path along the tributary of the Don to the north of the site.

Greatest surface water depths in the medium risk event are between 0.6 and 0.9 m (Figure 3-1) with some areas of significant hazard at the southeastern corner of the site (Figure 3-2). Safe access and escape routes should be achievable via Langsett Road North to the west of the site. However, it should be noted that there is flooding to depths of up to between 0.3 and 0.6m on the road during the extreme event.

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)
87	5	3	5

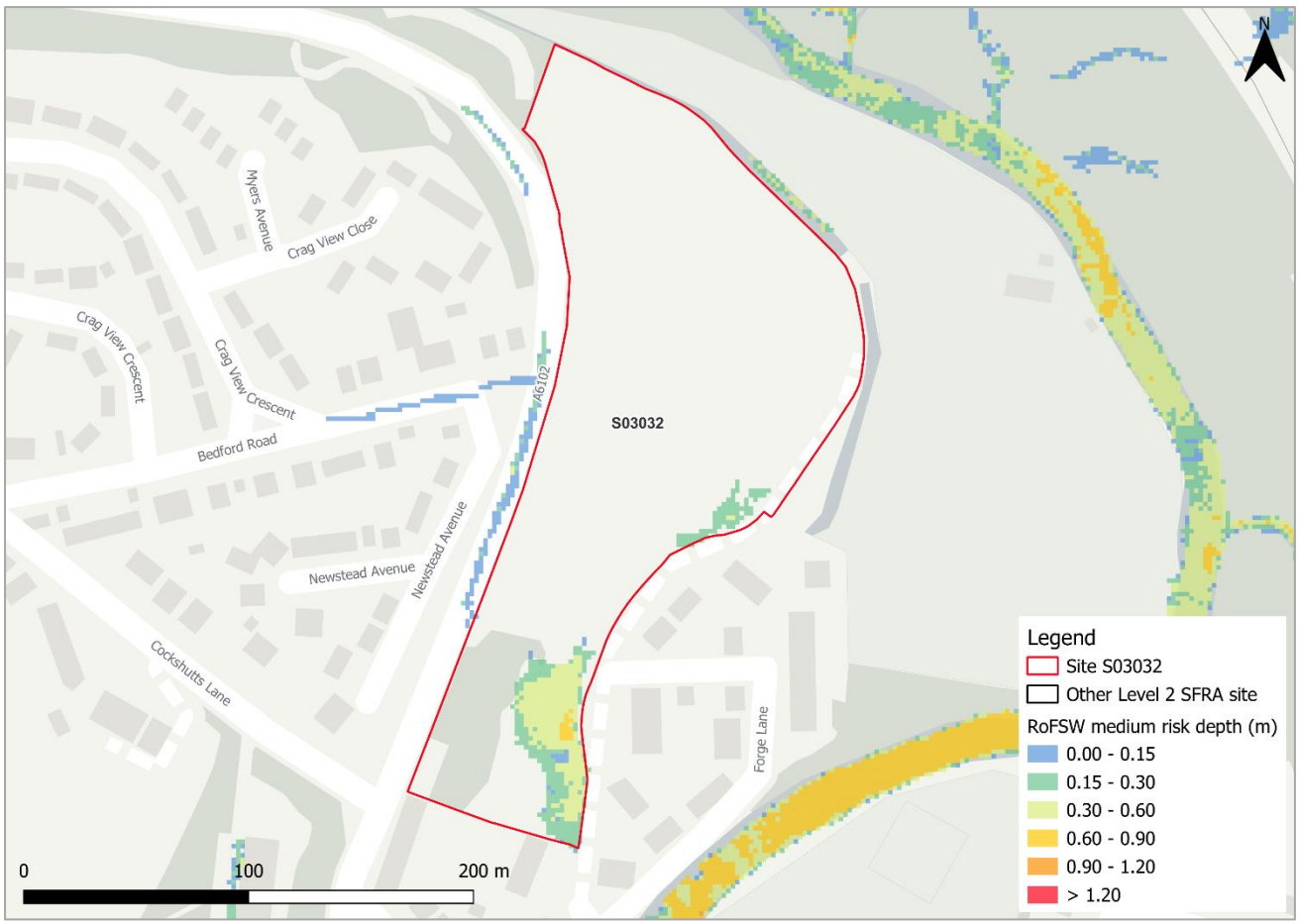

Figure 3-1: Medium risk event surface water flood depths (Risk of Flooding from Surface Water map)

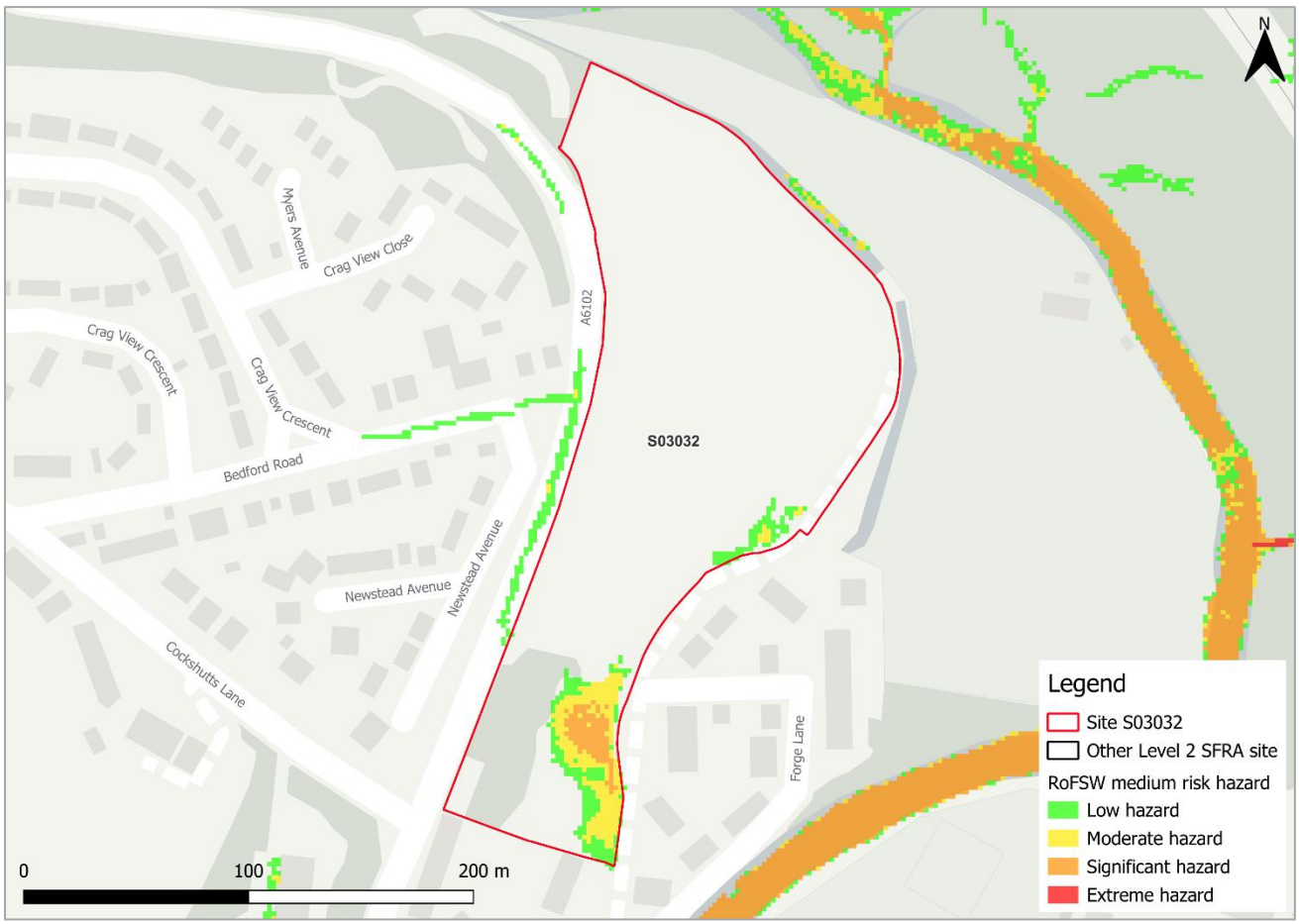

Figure 3-2: Medium risk event surface water flood hazard[1] (Risk of Flooding from Surface Water map)

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 greater than present day conditions, with the medium risk climate change event modelled to be similar to the present day low risk event. In addition to the flooding described above for the present day low risk event, a small area of ponding forms at the centre of the site, branching off from the flow path along Langsett Road North. Maximum flood depths remain between 0.6 and 0.9 m, with some areas of significant hazard (Figure 3-4). Safe access and escape routes should remain achievable via Langsett Road North, though there is flooding to this road during the climate change event.

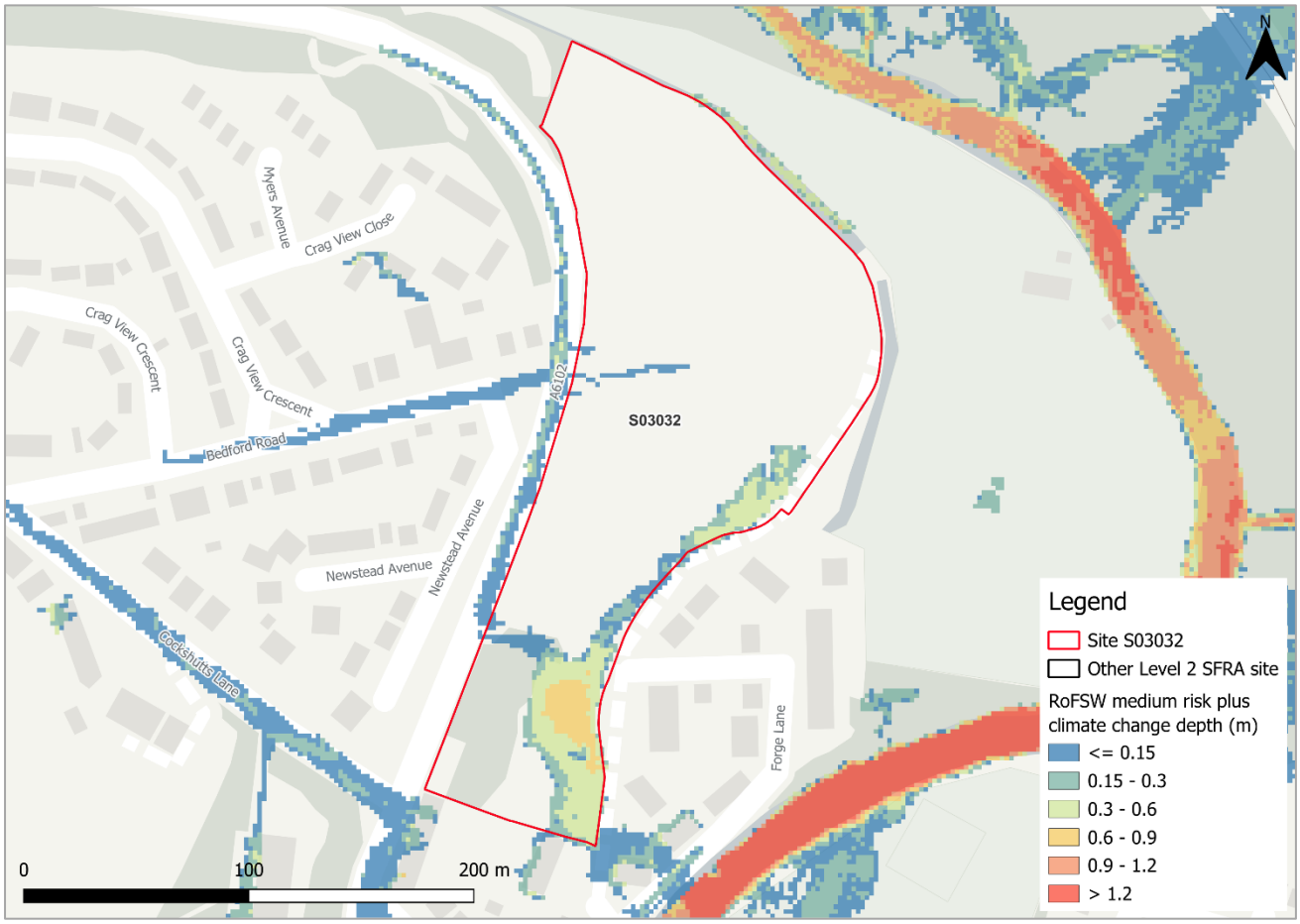

Figure 3-3: Medium risk event surface water flood depths plus 40% climate change (based on Risk of Flooding from Surface Water map)

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	2141	539	1602	35.6	0.11 Ha 3.4%
30yr Rainfall+35%	12	2312	539	1773	39.4	0.12 Ha 3.7%
100yr Rainfall+25%	12*	3473	1077	2396 (794 exceedance storage)	53.2	0.16 Ha 5.0%
100yr Rainfall+40%	12*	4169	1346	2823 (1050 exceedance storage)	62.7	0.19 Ha 5.9%
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) – 17.81 (assume 5l/s minimum discharge), Q30 – 31.16, Q100 – 37.04.

3.4 Observations, mitigation options and site suitability - surface water

- Current and future risk are confined to the southeastern corner, including for an existing pond, and along the southeast facing boundary of the site. The pond onsite should remain as a natural flood storage feature. It should be maintained and included within the landscaping design of the development.
- The topographic flow paths should also be and included in site design and left in place to flow naturally when required. Any regrading of land must include for like for like volumes to ensure risk is contained safely onsite for the lifetime of development.
- For the 1% AEP event plus 40% climate change, approximately 5.9% 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.
- A 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 consultation with the LLFA.

- 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, 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 majority of the site is located in an area where there is a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely. At the southeastern corner of the site, there is a risk of groundwater flooding to surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally at this southeastern corner. The use of infiltration SuDS may not be feasible at this site. Ground survey and percolation testing as part of the FRA should inform further on local groundwater conditions.

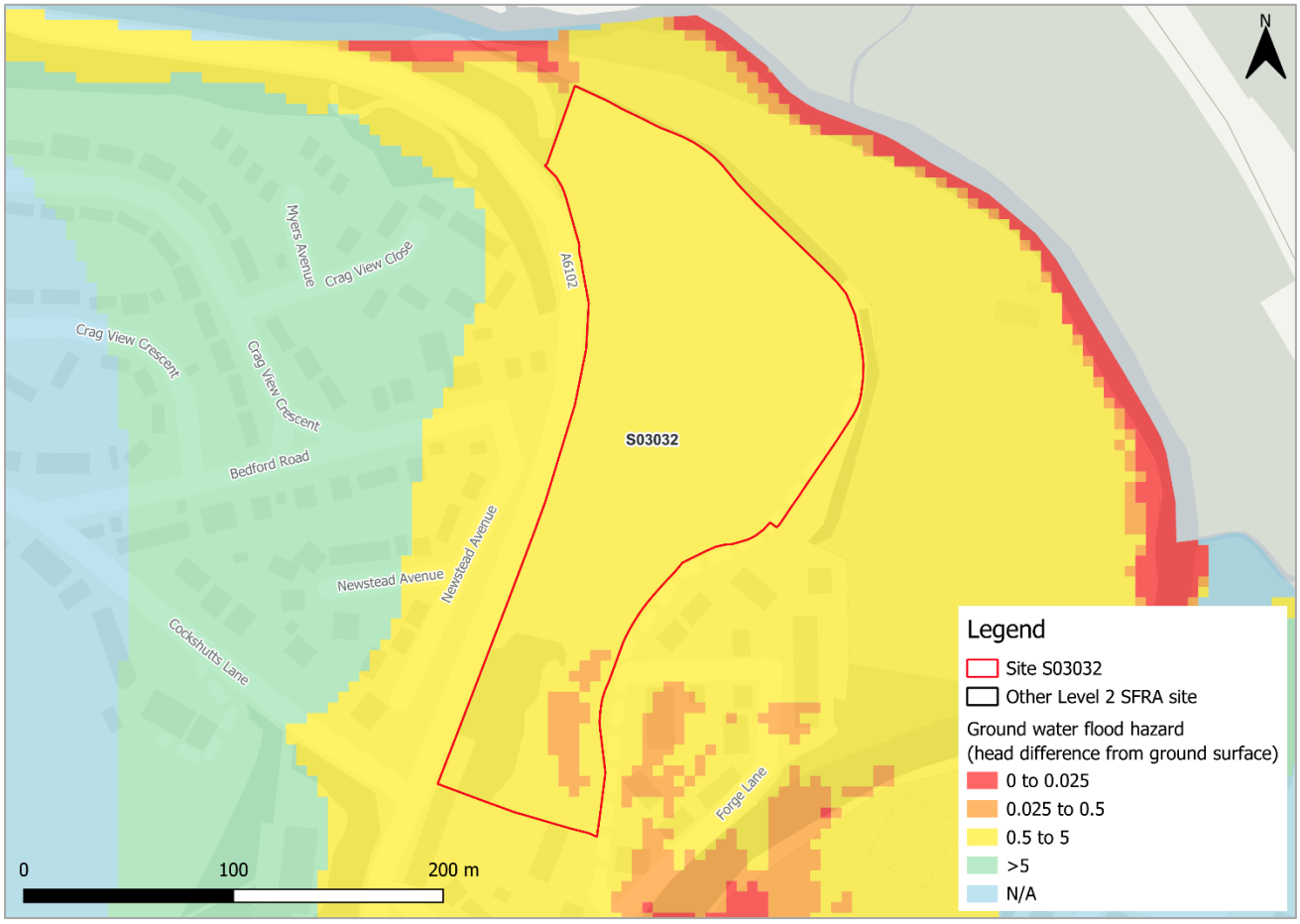

Figure 4-1: JBA 5m Groundwater Emergence Map

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. Figure 5-1 shows the RFM in a 'dry day' and 'wet day' scenario. 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 potentially at risk from 15 reservoirs. Of these 15 reservoirs, 10 are located within Barnsley and five are located within Sheffield. These reservoirs are all-but-one operated by Yorkshire Water. The one remaining reservoir is operated by The Wharncliffe Estates.

The EA's SFRA guidance states that where a proposed development site is at flood risk from a reservoir, then an assessment into whether the reservoir design or maintenance schedule needs improving should be carried out. Expert advice may be required from an all-reservoirs panel engineer. The Council should consult the relevant reservoir undertaker to ascertain whether the proposed development could affect the reservoir's risk designation, it's design category or how it is operated. The Council, as category 1 responders, can access more detailed information about reservoir risk and reservoir owners using the Resilience Direct system.

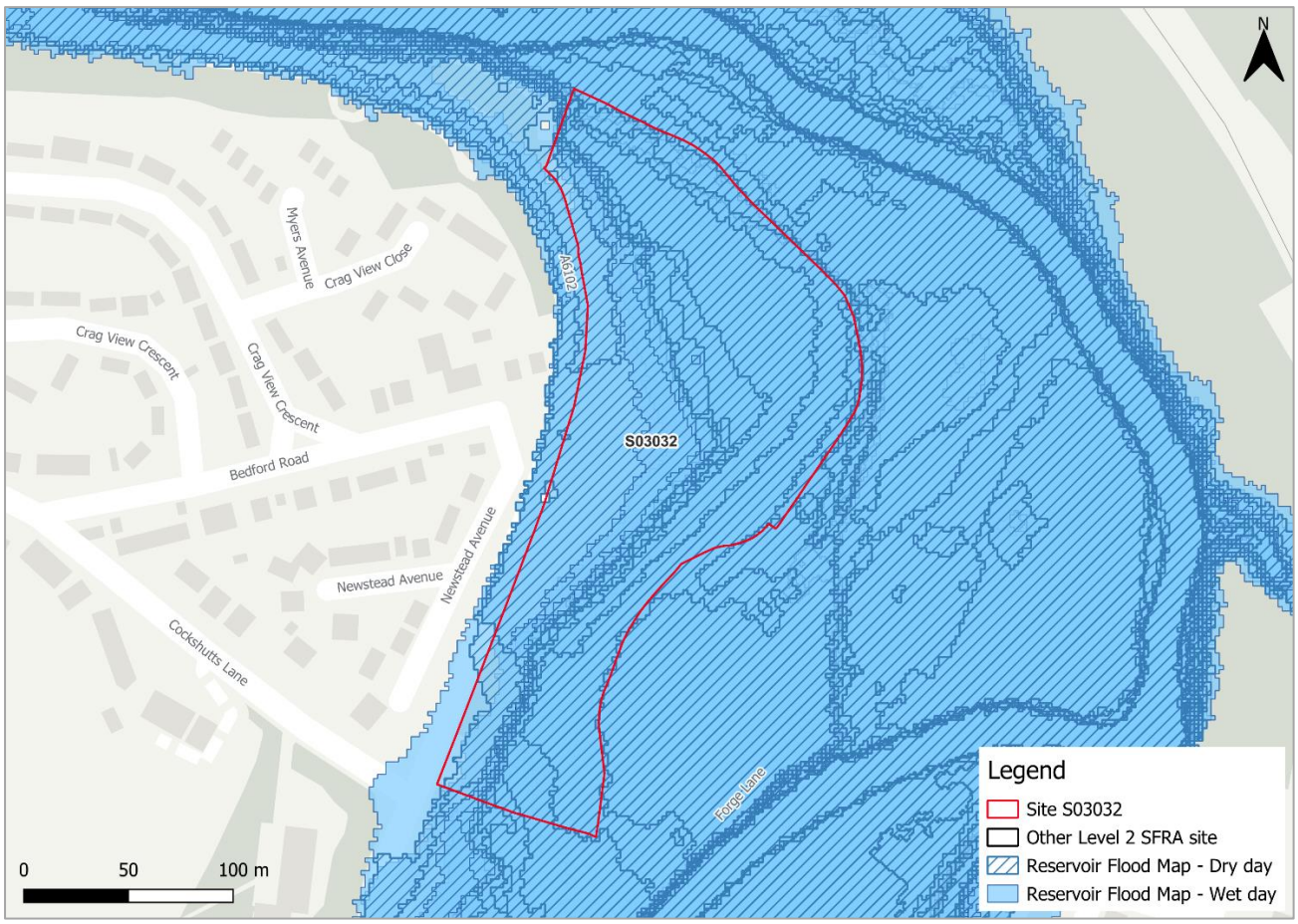

Figure 5-1: Flood risk from reservoirs

5.2 Observations, mitigation options and site suitability - residual risk

- The site is at potential residual risk from a breach of 15 reservoirs. However, only nine reservoirs impact the site in the 'dry day' flood extent, namely Ingbirchworth, Royd Moor, Scout Dyke and Winscar reservoirs, located within Barnsley; and Broomhead, Langsett, Midhope, More Hall and Underbank reservoirs, located within Sheffield. This indicates that the remaining six reservoirs are only modelled to impact the site based on the extreme 'wet day' flood extent, which represents a prediction of the credible worst-case scenario.
- Given the potential reservoir risk to the site, developers should consider[3]:
  - The potential loss of life and damage to buildings in the event of dam failure,
  - Whether emergency drawdown of the reservoir (reducing the water level) will add to flooding,
  - Consulting with relevant reservoir owners to assess if the design or maintenance of the reservoir would need improving, and whether development could affect the operation of the reservoir and impact on the reservoir category, and
  - Consulting with the local resilience forum for advice on emergency planning.

3 Reservoir flood maps: when and how to use them | Environment Agency | 2021

6 Overall site assessment

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

This site is required to pass part b) of the exception test[4], given it is proposed for more vulnerable uses and is located within Flood Zone 3. It must be proven that the development can be safe for its lifetime, which is considered to be 100 years for residential development. Based on the available information documented within this Level 2 SFRA, if development avoids the area of fluvial risk at the northern site boundary, the site should pass the exception test.

6.2 Recommendations, FRA requirements, and further work

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

- This site could be allocated if built development avoids the northern boundary of the site modelled to be at fluvial flood risk.
- The site is modelled to be at significant risk from surface water flooding in the future. A drainage strategy will be required to ensure surface water is retained onsite, accounting for climate change. This may reduce developable units. This would include retention of any topographic depressions, and the flow paths observed in the climate change event. This will require detailed surface water modelling based on layout plans and detailed design and full consultation with the LLFA on required runoff rates, likely to be greenfield or betterment.
- Consultation should be had with the reservoir owners that may be affected by or may have an effect on the development of this site.
- Groundwater conditions across the site must be investigated further through the site-specific FRA to ascertain groundwater levels and conditions.
- Any FRA must further consider the safe access and escape routes to the site.
- Any FRA should be carried out in line with the latest versions of the NPPF; FRCC-PPG; EA 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.

4 Para 178 National Planning Policy Framework 2024

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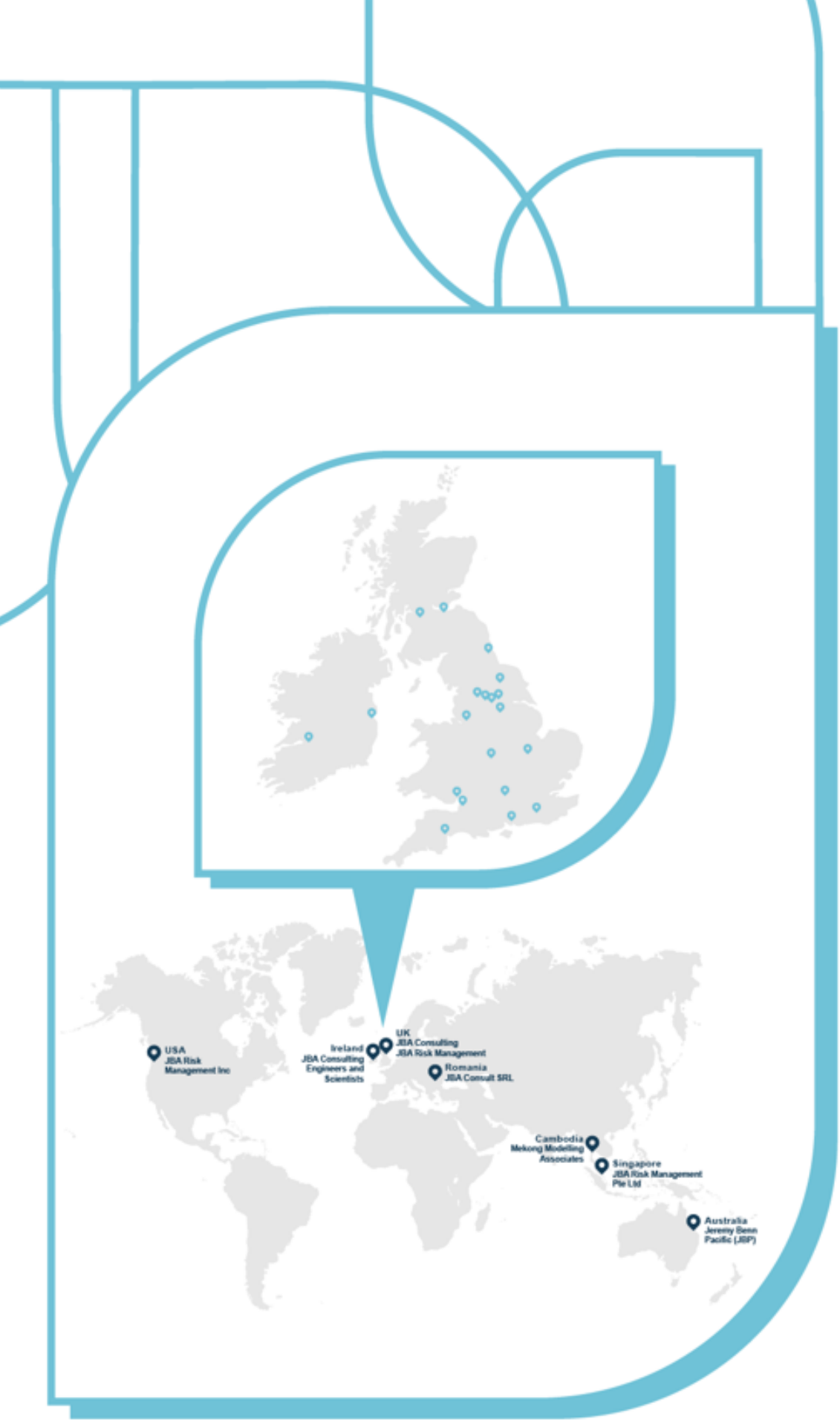

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