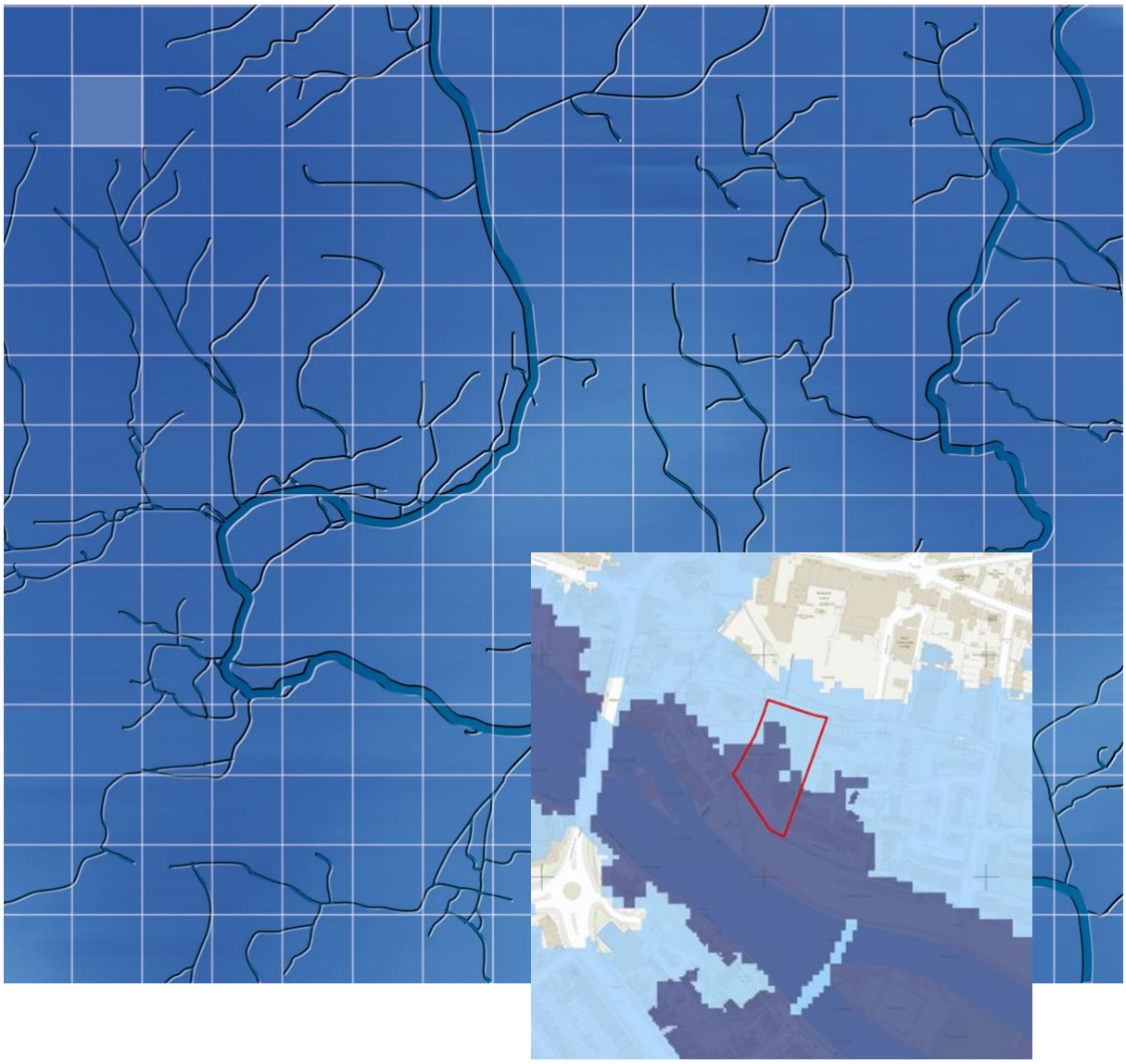
Reading Borough Council

May 2025

Reading Boat Club, Thames Promenade (CA1a)

Level 2 Strategic Flood Risk Assessment



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Reading Boat Club, Thames Promenade (CA1a) Level 2 Strategic Flood Risk Assessment

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1.0	02/05/2025	Draft	Daniel Hamilton (*Principal Consultant*)	Paul Blackman (*Director*)

For and on behalf of Wallingford HydroSolutions Ltd.

The WHS Quality & Environmental Management system is certified as meeting the requirements of ISO 9001:2015 and ISO 14001:2015 providing environmental consultancy (including monitoring and surveying), the development of hydrological software and associated training.

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Reading Boat Club (CA1a) Level 2 SFRA
Flood Risk Overview

Fluvial Flood Risk	**H**
Pluvial Flood Risk	**M**
Other Sources of Flood Risk	**M**
Confidence in Assessment	**H**

Flood Risk

Fluvial flood risk represents the greatest risk with a significant proportion of the site lying in Flood Zones 2 and 3 based on the EA's fluvial flood map.

In this location the fluvial flood map is based on detailed modelling in the form of the River Thames model (Pangbourne to Sonning) (2021). The outputs of this model were further assessed and show flood depths and velocities to be significant in some locations. In this respect fluvial flood risk is considered high.

The risk from other sources of flooding is considered to be moderate.

The overall confidence in the assessment is high. This is based on the availability of recent detailed modelling in the vicinity of the site.

Conclusions and Recommendations

The development proposed is categorised as *More Vulnerable Development,* which is permissible in Flood Zone 2, but needs to pass the Exception Test to justify development in Flood Zone 3a. More vulnerable development is not permissible in Flood Zone 3b.

In this regard, a new residential development at the site faces significant barriers, as 34% of the site lies in Flood Zone 3b so is not developable. To pass the Exception Test it must be demonstrated that the development will be *safe for its lifetime, without increasing flood risk elsewhere*. This will require a large amount of infrastructure to be raised above the design flood level. This will in turn compromise floodplain storage which will need to be offset by compensatory storage.

It is recommended that only the lower dwelling numbers proposed for the site is considered on flood risk grounds. A site-specific FRA would need to assess in more detail the development layout, requirements for compensatory storage and site access.

Contents

1 Introduction

1.1 Background

Wallingford HydroSolutions Ltd has been commissioned by Reading Borough Council (RBC) to undertake a Level 2 Strategic Flood Risk Assessment (SFRA) at Reading Boat Club (CA1a) in accordance with the National Planning Policy Framework (NPPF), Planning Practice Guidance (PPG) and associated guidance from the Environment Agency (EA).

Where there is a risk of flooding at the site, this risk has been quantified with the latest available datasets and any associated limitations with the assessment have been identified.

Where applicable, recommendations for improving our understanding of flood risk and/or mitigating the risk has also been included in this report.

1.2 Assessment of Flood Risk

For the site, a detailed assessment of the nature of flood hazard was undertaken. This included using the relevant fluvial modelling data to assess:

- The proportion of the site inundated for a range of return periods
- The speed of onset
- Flood depth
- Flood velocity
- Flood Hazard

The sites were assessed against a range of return periods, however the design event, the 100-year (plus central climate change) event, is the most important for planning purposes.

In addition to the analysis of modelling data, the location, standard and condition of existing flood defences was assessed. Other sources of flooding were also reviewed at each site. This included an assessment of surface water flooding and an assessment of groundwater flooding based on available hydrogeological information from BGS and Soilscapes. Potential access/egress routes were identified with respect to the risk posed from all sources of flooding.

Following a review of flood risk, flood defences and the identification of access/egress routes, an assessment was made on whether a future site-specific FRA would be able to show that the site can be allocated for development. The assessment takes into account the flood risk vulnerability of the development, the scale of development proposed along with any requirements for the Exception Test. In this context, any mitigative actions in the form of ground raising and compensatory storage are identified.

The site assessments also include guidance for the preparation of FRAs, including information about the use of SuDS.

1.3 Report Structure

This FRA follows the structure summarised below:

1 - Introduction (this section)

2 - Site Description

3 - Flood Risk

4 – Detailed Review of Primary Flood Risk

5 – Development Viability and FRA Recommendations

2 Site Description

2.1 General Location Plan

The Reading Boat Club (CR1a) site is 0.56ha in area and is located on the north bank of the River Thames. It is located in Caversham, approximately 1.3 km to the northwest of the centre of Reading. The surrounding land use is suburban, see Figure 1.

In the Replacement Local Development Plan (RLDP) it is proposed to be used for residential development in the form of 18-28 dwellings.

2.2 Topography

Based on 1m LiDAR data, the site is relatively flat, with levels gradually sloping downwards towards the River Thames to the south, see Figure 2. The ground levels within the site boundary range from 37.2 to 38.6m AOD. The average ground level is 37.9m AOD.

2.3 Nearby Watercourses

The River Thames is sited approximately 40m south of the site. The River Thames runs from west to east at this location. Christchurch Ditch is located immediately south of the site. It runs along the north bank of the Thames before joining the Thames 1.0 km to the east of the site. Figure 1 shows the location of these watercourses.

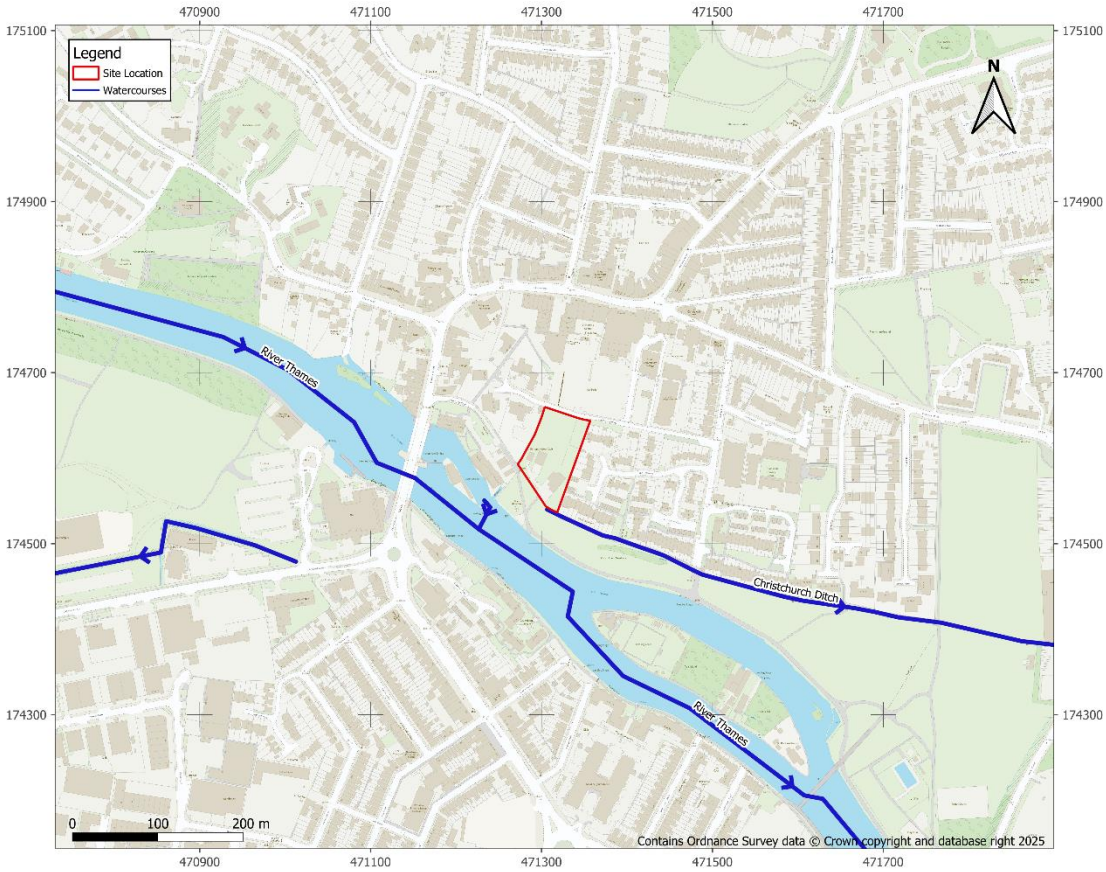

Figure 1 - Site Location

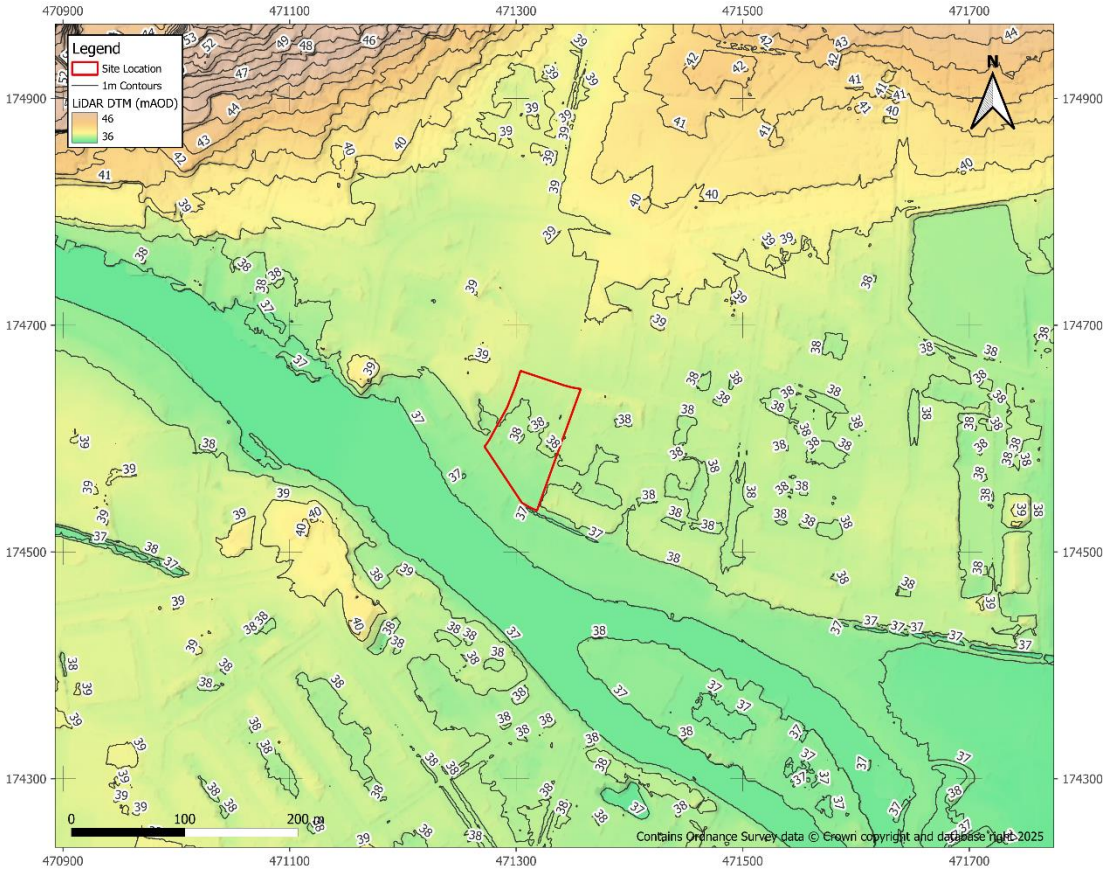

Figure 2 - Topography

3 Flood Risk

3.1 Historical Flooding

The EA has records of historic flooding at the site. In total, there are two events recorded in the EA database at this location. These events occurred in March 1947 and January 2003. Both were associated with flooding of the River Thames.

3.2 Fluvial Flood Risk

In the existing Flood Map for Planning (FMfP), the entire site is inundated by Flood Zone 2, with 62% of the site located in Flood Zone 3a. Viewing the model results for the 3.3% AEP event, 34% of the site is located in Flood Zone 3b. All flooding at this site is associated with the River Thames, see Figure 3.

The EA climate change fluvial outputs for Flood Zone 2 and 3 have also been assessed, the entire site is inundated by Flood Zone 2 and the proportion of the site located in Flood Zone 3a increases to 98%, see Figure 4.

Fluvial flood risk is considered to be high and is assessed in more detail in section 4.

3.3 Flood Defence Infrastructure

There is no formal flood defence infrastructure in the vicinity of the site. However, a small area in the northwest of the site is partially located within an area associated with a reduction in risk of flooding from rivers and sea due to defences. It is not clear what defences are leading to this reduction. The EA has been contacted for comment, but at time of writing is yet to confirm. The site is not located within a flood storage area.

3.4 Surface Water Flood Risk

The EA's surface water flood maps show a small area of land along the southern boundary of the site to be at surface water flood risk. In total, 3% of the site is inundated in the 3.3% AEP event, 4% is inundated in the 1.0% AEP event and 18% is inundated in the 0.1% AEP event, for the latter this includes a small area in the north of the site, see Figure 5. When accounting for climate change the proportions moderately increase to 4% in the 3.3% AEP event, 7% in the 1.0% AEP event and 30% in the 0.1% AEP, see Figure 6. Overall, the risk of surface water flooding is considered to be moderate.

3.5 Groundwater Flooding

The site is underlain by a bedrock of chalk in the form of the Seaford Chalk formation. It is expected to permit high amounts of infiltration. Superficial deposits of Alluvium and Till are also present at this site, these are also expected to be freely draining. The underlying soils are loamy and clayey floodplain soils with naturally high groundwater, these are expected to have impeded drainage.

Based on the data available the water table at the site could be mobile, translating to a moderate risk of groundwater flooding. More data is required at the planning stage to confirm this. However, given the site's location within a river, groundwater flooding is likely to be heavily correlated with fluvial flooding.

3.6 Reservoir Flood Risk

The FMfP shows that the entire site is at risk from reservoir flooding during the wet day scenario, however the site is not at risk during the dry day scenario, see Figure 7. Whilst the site is shown to be at risk, it should be noted that reservoir failure is a rare event with a very low probability of occurrence. Current reservoir regulations aim to make sure that all reservoirs are properly maintained and monitored to detect and repair any problem.

3.7 Flood Warning Service

The site is located within the River Thames from Scours Lane, Reading to Caversham Lakes EA Flood Warning Area.

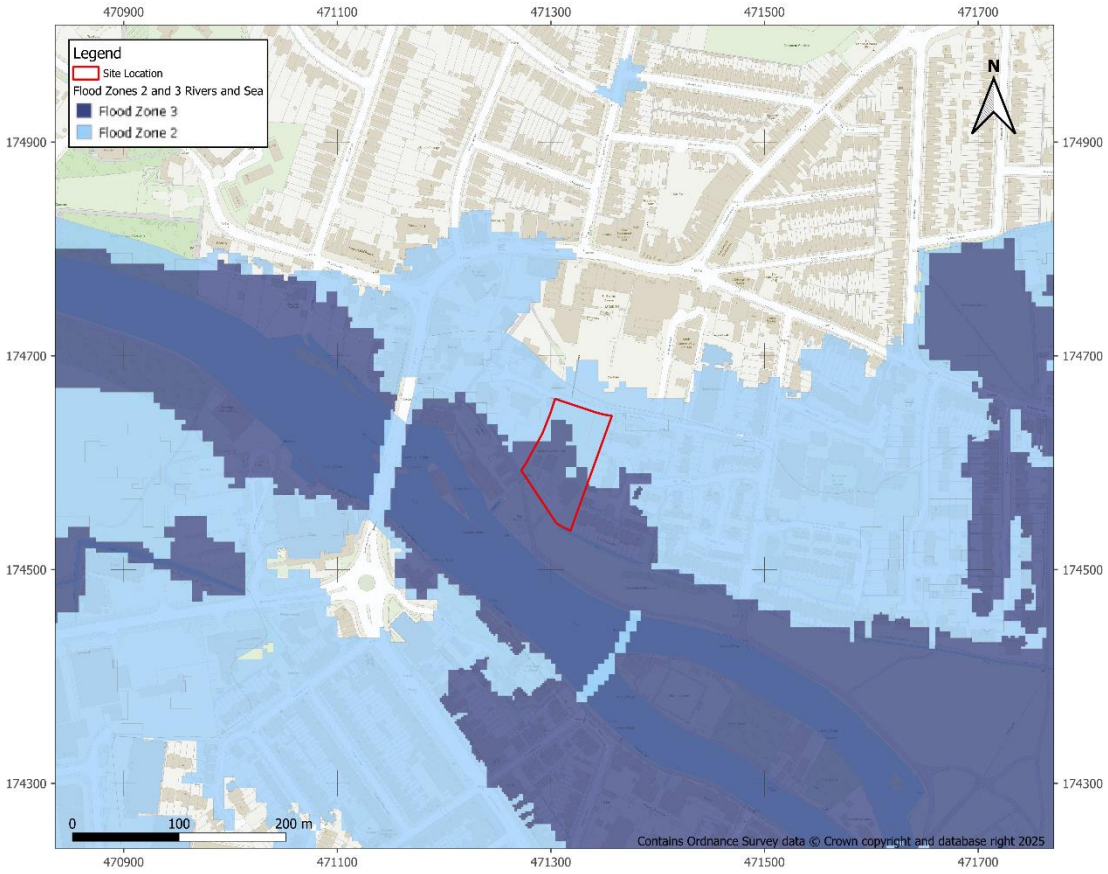

Figure 3 - Fluvial Flood Map

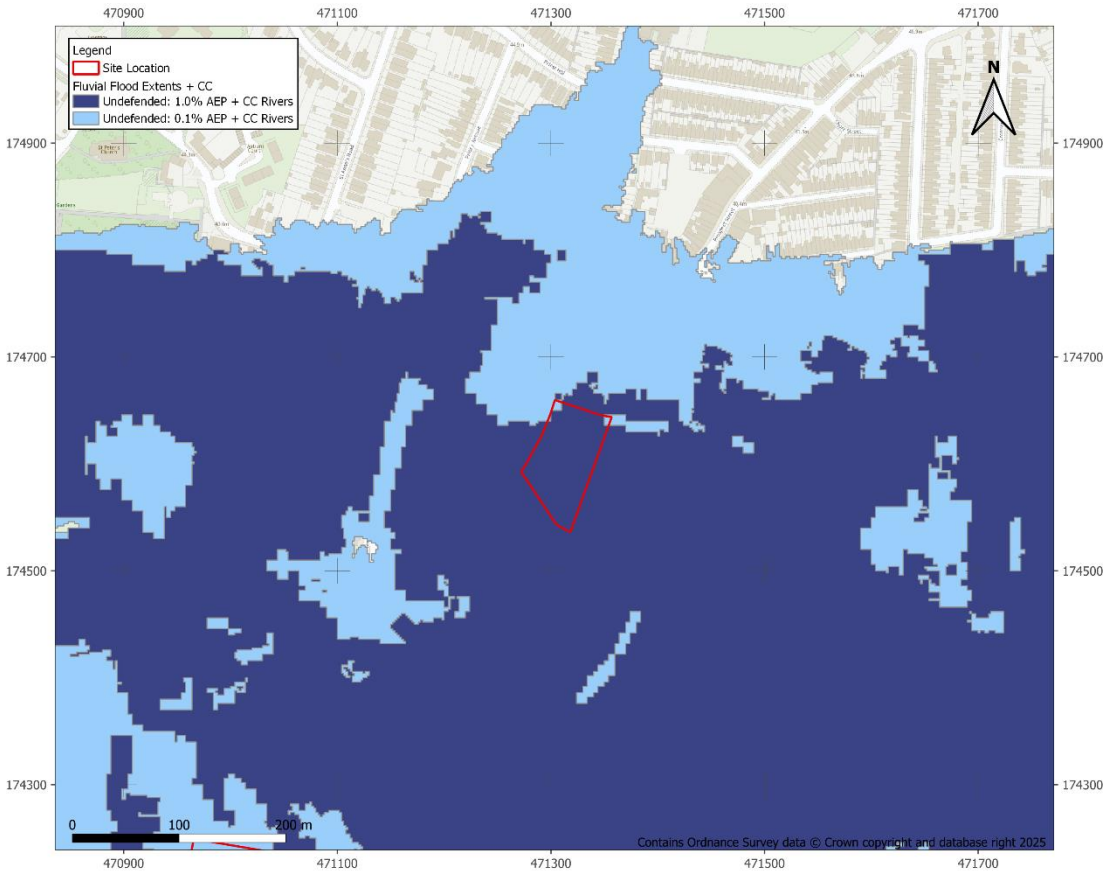

Figure 4 – Fluvial Climate Change Flood Map

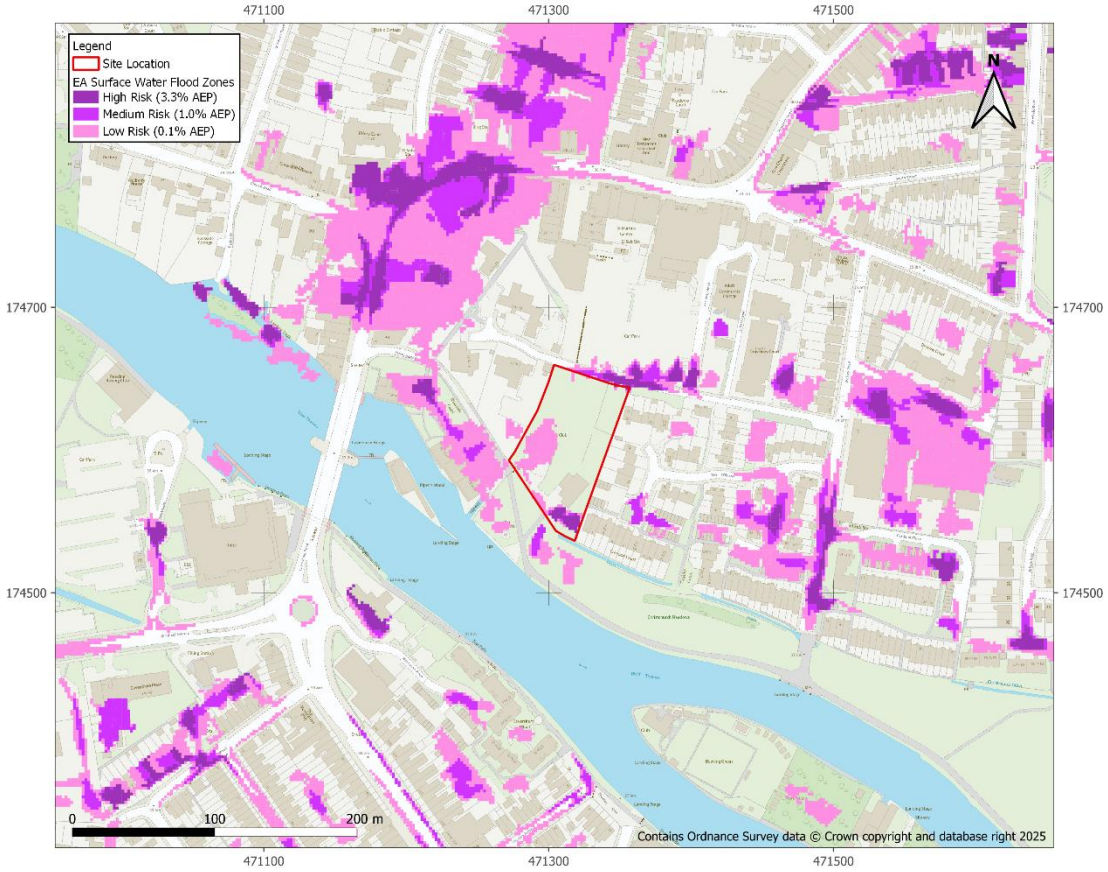

Figure 5 – Surface Water Flood Map

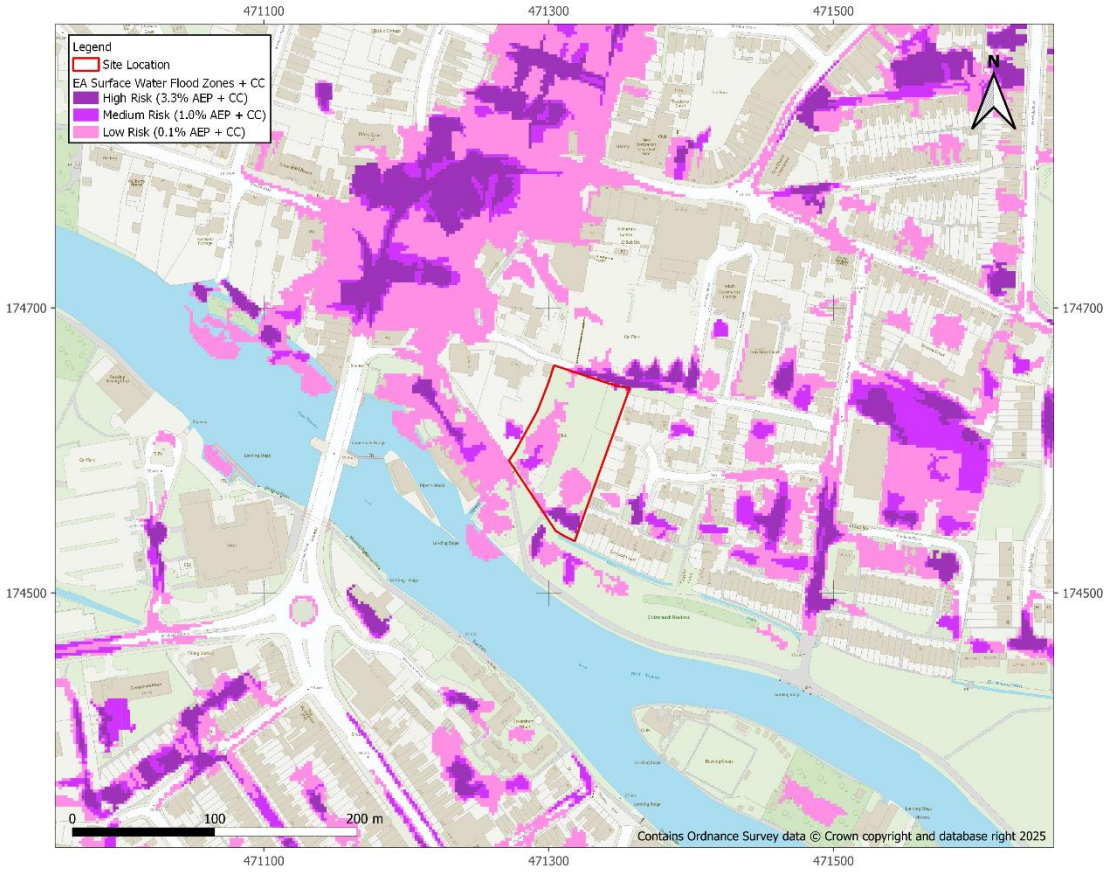

Figure 6 -Surface Water Climate Change Flood Map

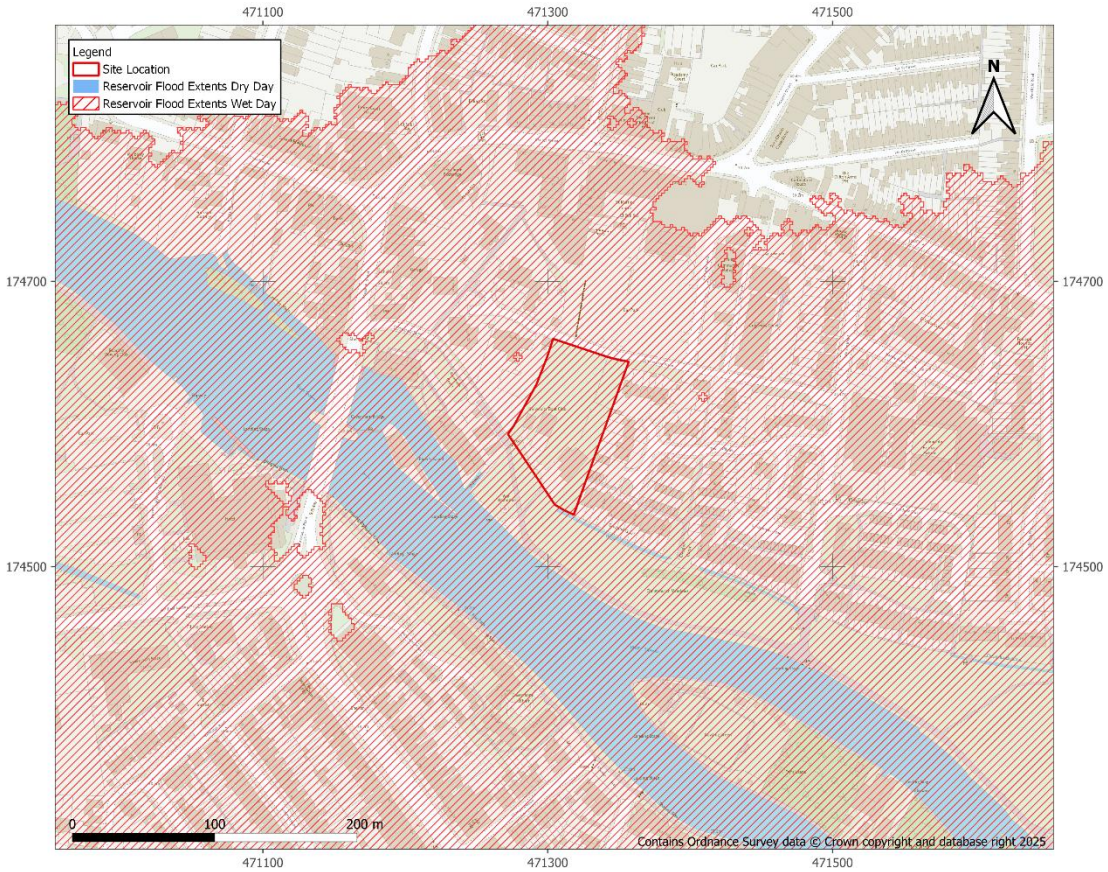

Figure 7 - Reservoir Failure Flood Map

4 Detailed Review of Primary Flood Risk

4.1 Primary Flood Risk

The primary flood risk mechanism at the site is fluvial in origin. The flood risk is quantitively assessed in more detail below.

4.2 Flood Risk Metrics

The River Thames model (Pangbourne to Sonning) (2021) was assessed to attain further detail on fluvial flooding.

For the 100-yr plus central climate change (31%) design event, the maximum flood level at the site is 38.4 m AOD, higher than the maximum ground level on the site. The hazard map for this event (see Figure 8) shows that the majority of the site is within areas of *danger for some* and *danger for most*, indicating higher flood depths and velocities. *Low* hazard is only present along the northern boundary of the site. There is a reasonable lag time between water first leaving the banks of the Thames and encroaching onto the site, with a speed of onset value of 13.0 hrs. Table 1 shows the flood risk metrics associated with the design event.

Table 1- Flood Risk Metrics

	Design Event 1.0% AEP (+31%)
Percentage Inundated (%)	98%
Average Flood Depth (m)	0.51m (Max- 1.36m)
Average Velocity (m/s)	0.06m/s (Max – 2.83m/s)
Speed of Onset (hrs)	13.0 hrs

4.3 Access and egress

Vehicular access to and from the site would be eastwards along the Abbotsmead Place. The start of the route lies within Flood Zone 2 (0.1% AEP) and is at risk of flooding in the design event also. For both events flood hazard is generally low, however in some locations the hazard rating indicates *danger for some*.

Approximately 200m into the route it becomes flood free. Onward travel would likely be northwards along Prospect Street or Hemdean Road, see Figure 9. Whilst much of the land north of the site lies in Flood Zone 1 including Prospect Street and Hemden Road, it is important to note that parts of the routes are at surface water flood risk. Whilst this risk is generally considered manageable, a site-specific FRA should consider in more detail the nature of the flood risk to determine how quickly it occurs and the degree of hazard.

To ensure the access route can be utilised before the site or route is inundated, early flood warning will be essential. It should be noted that the River Thames catchment, which the site falls within is dominated by chalk and has relatively slow river response times to storm events, being groundwater, rather than surface water dominated. This increases the time taken for inundation and for adequate warnings and preparation in an extreme flood event. This is partly reflected by the relatively slow speed of onset values for the site despite its position close to the banks of the river.

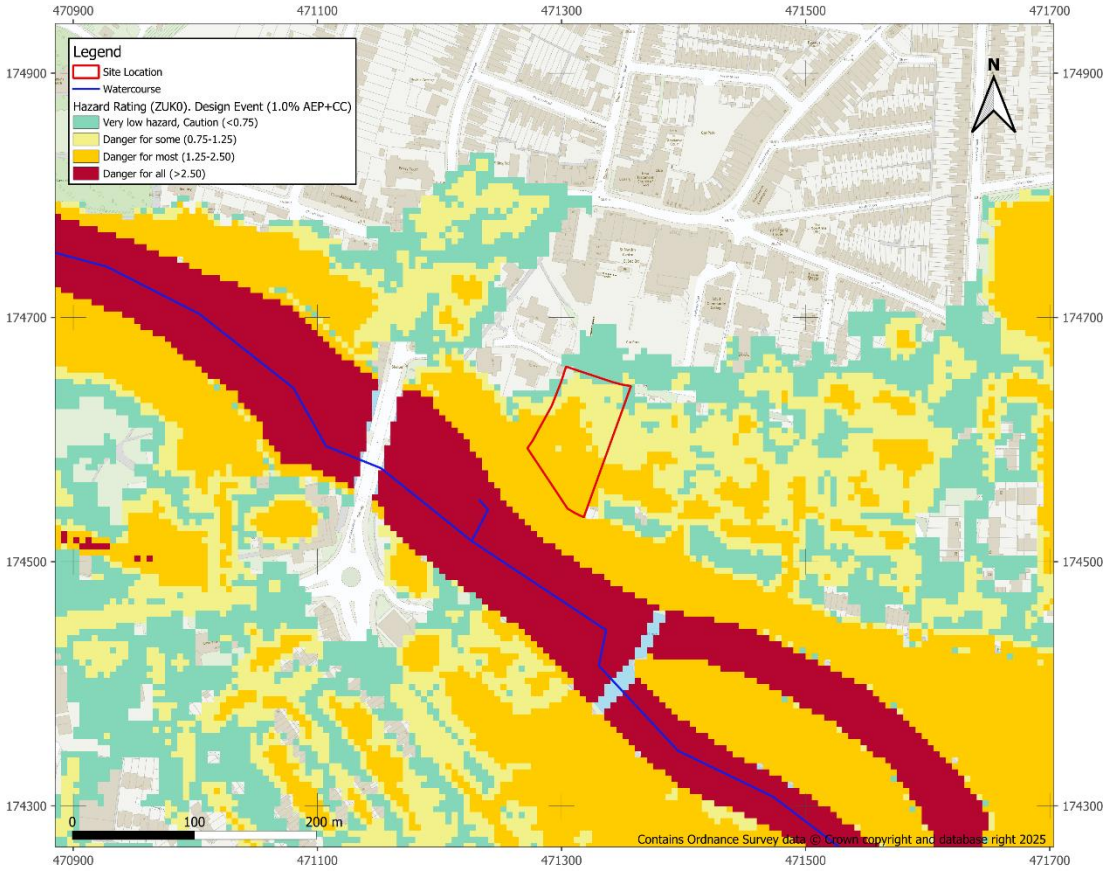

Figure 8 – Flood Hazard Map for the Design Event

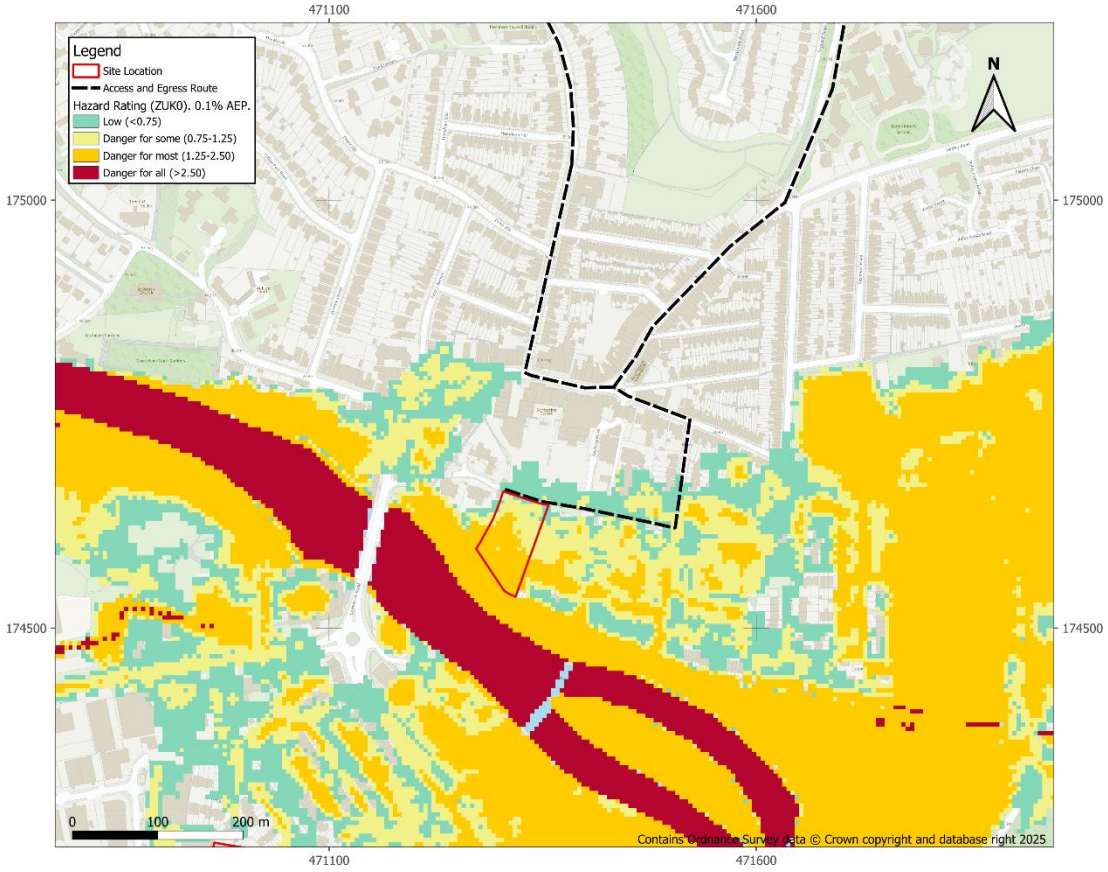

Figure 9 – Access/Egress Routes

5 Development Viability and FRA recommendations

5.1 Development Categorisation

The development proposed is categorised as *More Vulnerable Development,* which is permissible in Flood Zone 2, but needs to pass the Exception Test to justify development in Flood Zone 3a. More vulnerable development is not permissible in Flood Zone 3b.

In this regard, a new residential development at the site faces significant barriers, firstly 34% of the site lies in Flood Zone 3b so is not developable. Secondly to pass the Exception Test it must be demonstrated that the development will be *safe for its lifetime, without increasing flood risk elsewhere*. This will require a large amount of infrastructure to be raised above the design flood level of 38.4m AOD. This will in turn compromise floodplain storage which will need to be offset by compensatory storage.

5.2 Scale of Development

The total site area is 0.56ha; allocated for between 18-28 dwellings. As mentioned, 34% of the site (0.19ha) lies in Flood Zone 3b so is not developable which brings the amount of available land down to 0.37ha. Assuming 60 dwellings per hectare (medium density housing) 18-28 dwellings would translate to 0.30-0.46ha of residential land.

A significant amount of infrastructure will need to be located in Flood Zone 3a given its extent across the site. This infrastructure will need to be raised, which will in turn compromise floodplain storage requiring compensatory storage elsewhere on site. Given the size of the site, the provision of compensatory storage could be challenging and will further reduce the amount of developable land available.

It is recommended that only the lower dwelling amount is considered for development on flood risk grounds. A site-specific FRA would need to assess in more detail the requirements for compensatory storage.

5.3 Sequential Approach

It is important that a sequential approach is implemented at the site, prioritising more vulnerable residential development outside of Flood Zone 3a and in Flood Zone 2 wherever possible. To facilitate this, the majority of ancillary infrastructure such as car parks and green spaces could be located in higher flood risk areas; however no development should be located in Flood Zone 3b and it must be appropriately resilient to flooding without increasing risk elsewhere.

A sequential approach to access should also be considered, in ensuring that any residential areas are not only at the lowest flood risk but also with available safe access.

5.4 Other Site-Specific Considerations

There is limited surface water flood risk within the site, therefore it should not be a barrier to development. However, parts of the access route are shown to be at surface water risk. A site-specific FRA should consider in more detail the nature of the surface water flood risk to determine how quickly it occurs and the degree of hazard on site. If new infrastructure is proposed, the drainage strategy for the proposed development should be suitably designed to manage additional runoff arising from the development and ensure that surface water flood risk at the site and to third party land is not increased.

In assessing and demonstrating the viability of any drainage solution for the site, a site-specific FRA should follow the non-statutory technical standards for SuDS and any relevant Local Authority Local Plan policies. The geology at the site is freely draining. However, the water table is likely high and at the same level as the river, therefore the significant use of infiltration SuDS solutions may not be possible. It is recommended that a geotechnical

investigation is undertaken at this site to obtain further information relating to infiltration rates, this will confirm whether infiltration could be viable in some areas. Attenuated discharge to a watercourse or a sewer will also need to be considered as part of a site-specific FRA.

As mentioned, new infrastructure may compromise flood plain storage. Hydraulic modelling may need to be undertaken to assess 3rd party impacts and compensatory storage requirements. Storage and modelling requirements should be confirmed with the EA for a site-specific FRA. Furthermore, given the flood risk at the site provision of a Flood Evacuation Plan (FEP) should be considered.