

# Kennedy Avenue, Enfield

## Flood Risk Review

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# Kennedy Avenue, Enfield

## Flood Risk Review

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## Executive Summary

The site (off Kennedy Avenue, Enfield), which is currently occupied by garages and hardstanding, may be considered for potential future development.

Flood risk to the site from a range of potential sources has been considered in this Flood Risk Review. The entirety of the site is located in Flood Zone 1 and is therefore at a 'very low' risk of flooding from rivers and the sea. No other sources pose onerous risk to the site in the context of its potential development.

According to the National Planning Policy Framework (NPPF), a Flood Risk Assessment (FRA) is not necessary to support any future development of the site, as it is located in Flood Zone 1 on the Flood Map for Planning (Rivers and Sea), is less than 1 hectare (ha) in area, and this Flood Risk Review demonstrates that the site is not at significant risk of flooding from other local sources.

A Surface Water Drainage Strategy should nevertheless be prepared to support future redevelopment of the site to ensure that proposals meet national and local policy requirements and off-site flood risk is not increased as a result of redevelopment proposals

# 1 Introduction

## 1.1 Background

Arcadis Consulting (UK) Limited ('Arcadis') has been commissioned by Levitt Bernstein, on behalf of Enfield Council ('the Client'), to undertake technical surveys for land off Kennedy Avenue, Enfield, London, EN3 4EJ ('the site').

This Flood Risk Review is required to document the risk of flooding at the site and consider potential constraints to its future redevelopment, which may include residential uses.

## 1.2 Aim and Objectives

The aim of this Flood Risk Review is to assess and document the potential risk of flooding to the site from all sources (including rivers, the sea, surface water, groundwater and artificial sources) in the context of the site's future development.

Specific objectives of the Flood Risk Review are to:

- Review available sources of published flood risk data.
- Consider all relevant forms of flood risk (e.g. rivers, the sea, surface water, groundwater and artificial sources), and assign a risk rating (e.g. HIGH, MEDIUM, LOW) to each form of flooding.
- Confirm the site's Flood Zone designation and consider NPPF<sup>1</sup> acceptability in accommodating residential development, with reference to the Sequential and Exception Tests.

No site inspection, topographic survey or flood estimation/modelling has been undertaken by Arcadis to inform this desktop review.

## 1.3 Data Sources

The following data sources have informed the preparation of this Flood Risk Review:

- EA lidar topographic data (1m tiles TQ39NE) (Ref. 1)
- EA Long Term Flood Risk Maps, including the 'Risk of Flooding from Rivers and Sea Map', 'Risk of Flooding from Surface Water Map' and 'Risk of Flooding from Reservoirs Map' (Ref. 2)
- EA 'Flood Map for Planning' (Ref. 3)
- EA 'Recorded Flood Outlines dataset (Ref. 4)
- Enfield Strategic Flood Risk Assessment (SFRA) (Ref. 5)
- Enfield Local Flood Risk Management Strategy (LFRMS) (Ref. 6)
- British Geological Survey (BGS) Geology of Britain Viewer (Ref. 7)
- Defra Magic Maps (for EA Aquifer Designations) (Ref. 8)
- National Planning Policy Framework (Ref. 9)
- PPG5: Flood Risk and Coastal Change (Ref. 10)

## 1.4 Terminology

Flood risk is a product of both the likelihood and consequences of flooding. Throughout this report, flood events are defined according to their likelihood of occurrence. Floods are described according to an 'annual chance', meaning the chance of a particular flood occurring in any one year. This is directly linked to the

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<sup>1</sup> A summary of NPPF requirements with respect to flood risk is included in Appendix A.

probability of a flood. For example, a flood with an annual chance of 1 in 100 (a 1 in 100 chance of occurring in any one year on average), has an annual probability of 1%.

## **1.5 Limitations**

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## 2 Site Overview

### 2.1 Site Description

The proposed site is situated off Kennedy Avenue, at National Grid Reference (NGR) TQ 35244 95330, within the Ponders End area of Enfield, London. The site occupies an area of approximately 0.07 hectares (ha), as shown in *Figure 2-1: Site Location (Site outlined in red)*.

The site is situated at the western end of Kennedy Avenue and its western boundary backs onto a row of shops along the High Street. To the north and east there are residential properties and there is a small plot of undeveloped land along the southern boundary of the site.

The nearest watercourse to the site is identified on Google mapping as Boundary Ditch, which is located approximately 25m south of the site. Boundary Ditch appears to emerge above ground to the south of site after passing under the High Street, before flowing in a south-easterly direction to the Brimsdown Ditch.

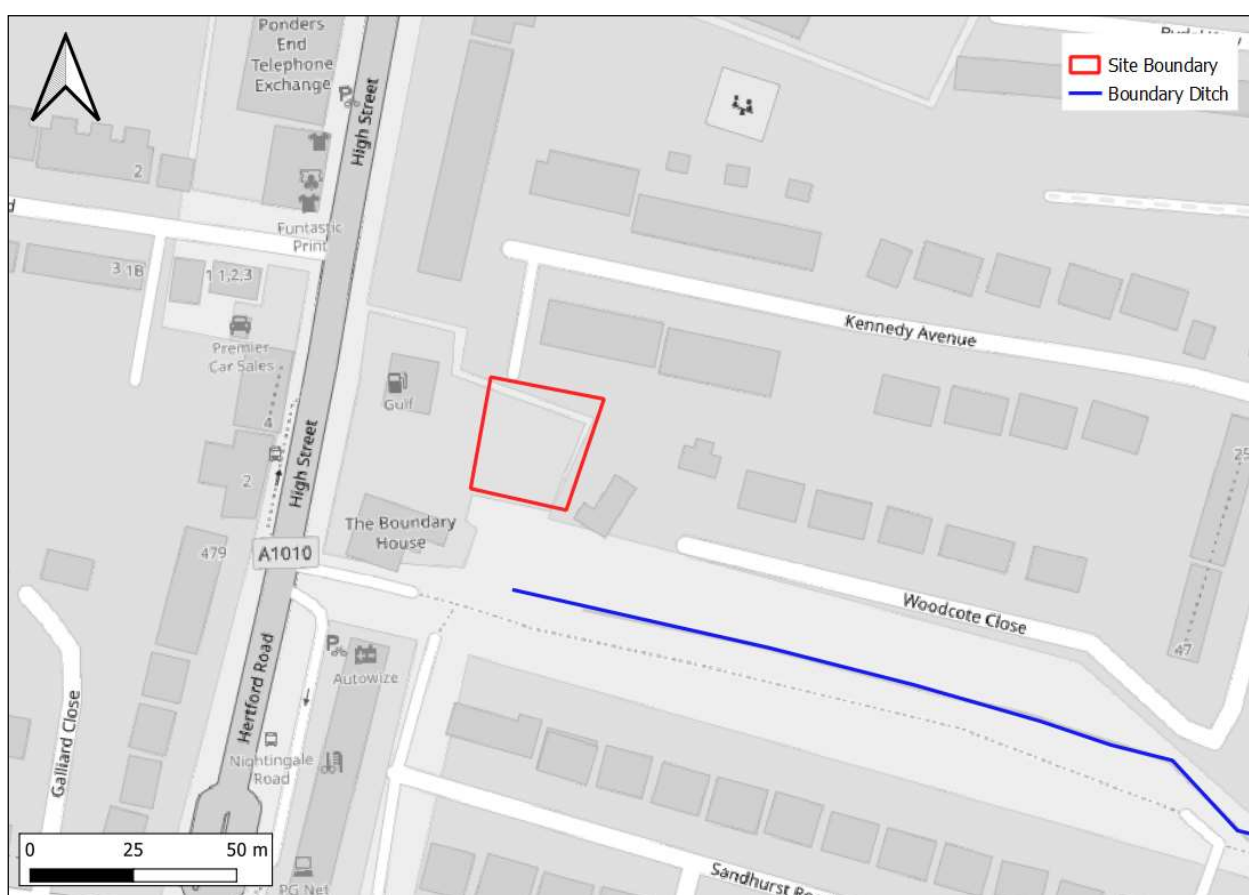


Figure 2-1: Site Location (Site outlined in red)

Contains Ordnance Survey data © Crown copyright and database right 2021

### 2.2 Site Topography

LiDAR data, shown in *Figure 2-2*, indicates that ground levels are consistent across the site, ranging between approximately 14.0m and 14.5m AOD. The highest ground levels are present along the eastern and western boundaries of the site. A review of the LiDAR indicates that the ground levels across the site are



approximately 1.5m higher than the Boundary Ditch to the south of the site. The left bank of Boundary Ditch appears to have a gentle slope, whereas the right bank appears to be slightly embanked.

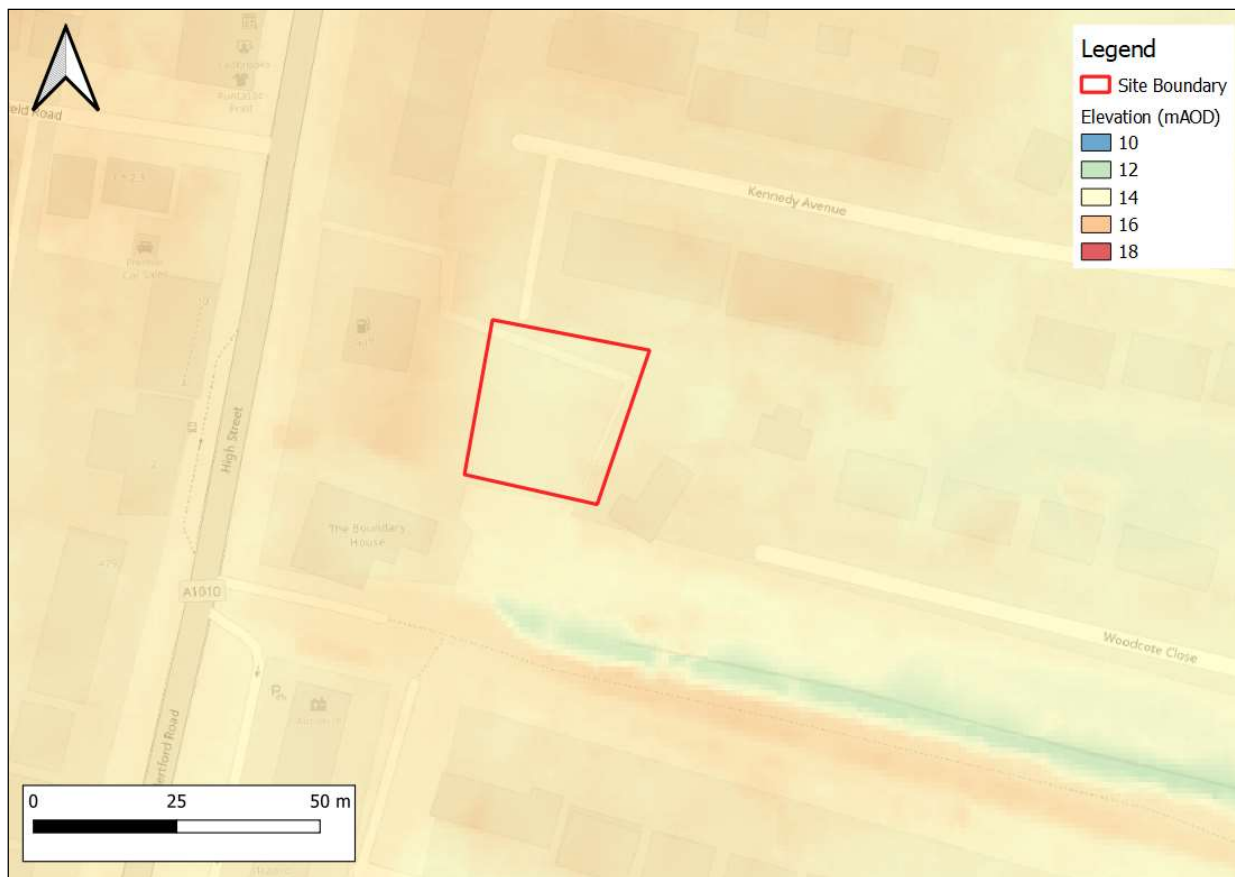


Figure 2-2: Site Topography (filter lidar data; site boundary outlined in red)  
 Contains Environment Agency information © Environment Agency and/or database right.

## 3 Sources of Flood Risk

### 3.1 Flooding from Rivers and the Sea

#### 3.1.1 Catchment Overview

The site is located in the catchment of the Brimsdown Ditch, which is a designated main river. The catchment of the Ditch is flat, heavily urbanised, and is drained almost entirely by the surface water sewer network, while the watercourse itself is largely culverted or channelised.

#### 3.1.2 Flood Mapping

The Risk of Flooding from Rivers and Sea Map is informed by the EA National Flood Risk Assessment (NaFRA), which takes account of flood defence survey information and modelled river levels, factoring in a risk of overtopping or failure of raised defences where they exist, to provide a probabilistic assessment of flooding on a relatively coarse 50m grid. The Flood Map for Planning (Rivers and Sea), which is intended to inform the planning process, does not account for the impact of flood defences, but is created using detailed flood modelling (where available). The map also shows areas benefitting from defences.

The Flood Map for Planning (Rivers and Sea) in Figure 3-1 shows the entirety of the site is located in Flood Zone 1, defined as land with an annual chance of flooding from these sources of less than 1 in 1000 (0.1%).

The area to the south of the site, alongside Boundary Ditch, is designated as Flood Zone 3. This is defined as land with a 1 in 100 (1%) or greater chance of flooding from rivers or a 1 in 200 (0.5%) or greater chance of flooding from the sea. The edge of Flood Zone 3 is situated approximately 10m from the south-eastern corner of the site. A review of the LiDAR (*Figure 2-2*) indicates that the ground levels across the site are approximately 1.5m higher than the Boundary Ditch, and therefore this watercourse is not considered to pose a significant risk to the site.

There is an area of Woodcote Close approximately 80m east of the site that is located in Flood Zone 2, defined as land having between a 0.1% and 1% chance of flooding from rivers or between a 0.1% and 0.5% chance of flooding from the sea.



Figure 3-1: EA Flood Zones Map

*Contains Environment Agency information © Environment Agency and/or database right.*

### 3.1.3 Historic Flooding

The EA holds details on the extent of historic flooding within England. The Historic Flood Map shows the maximum extent of recorded flood outlines from river, sea and groundwater springs that meet a set criteria. The mapping does not include historic flooding from surface water events.

The EA Historic Flood Map does not show any recorded flood events within the vicinity of the site. This mapping is consistent with the Enfield SFRA historical flood outlines map, which does not indicate that the site has been impacted by flooding in the past.

**Overall, the site is considered to have a 'low' risk of flooding from rivers and the sea, and these forms of flooding are not considered to pose a constraint in the context of its potential future development.**

## 3.2 Flooding from Surface Water

The Risk of Flooding from Surface Water (RoFSW) Map is informed by 'direct rainfall' modelling undertaken at a high (2m) resolution. It illustrates those areas at elevated risk of surface water flooding in low spots down-gradient of sloping ground or in the topographic valleys associated with current or former watercourses. An extract of the mapping is shown in *Figure 3-2*.

The map shows that the entirety of the site is considered to be at a 'very low' risk of flooding from surface water, equivalent to an annual chance of flooding of less than 0.1%.

Land to the south and southwest of the site is at a 'low' risk, indicating a chance of flooding between 0.1% and 1% in any given year. The channel of Boundary Ditch is shown to be at a 'medium' risk, indicating a chance of flooding between 1% and 3.3% in any given year. The High Street, located 50m to the west of the site, is at a 'low' to 'high' risk (greater than a 3.3% chance in any given year) of surface water flooding.

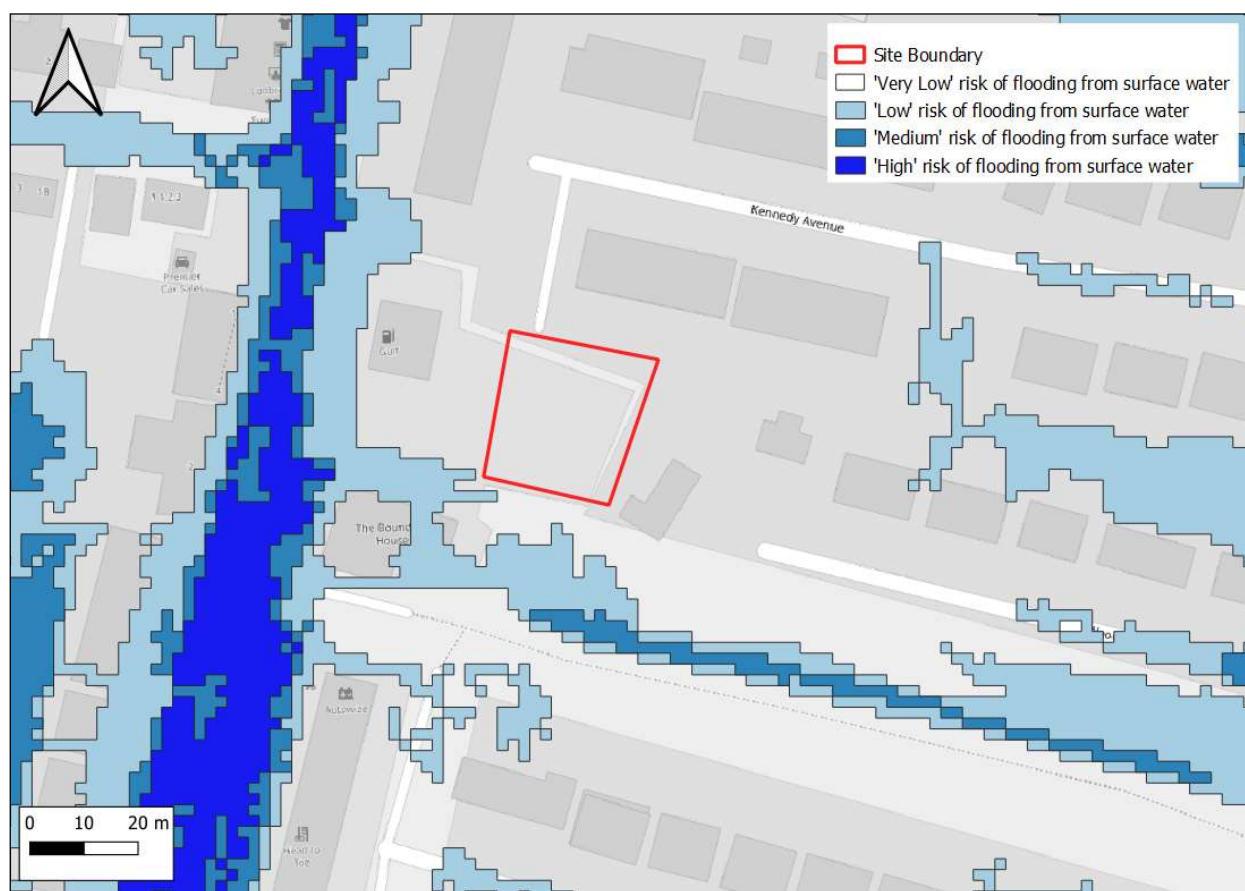


Figure 3-2: Risk of Flooding from Surface Water Map (site boundary shown in red)

*Contains Environment Agency information © Environment Agency and/or database right.*

Past surface water flood events are mapped within the Enfield SFRA. The SFRA maps show that two historic surface water flooding incidents have been recorded in the Ponders End area, however neither of these incidents impacted on the site.

**Overall, the site is considered to have a 'low' risk of surface water flooding, and this form of flooding is not considered to pose a constraint to the site in the context of its potential future development.**

### 3.3 Flooding from Groundwater

Groundwater flood risk is not as well-defined as other sources of flooding, and an assessment of risk often requires consideration of geological conditions. Groundwater flooding can occur from two general mechanisms (i) 'clearwater flooding', where the water table in unconfined aquifers rises above the ground surface, associated with permeable bedrock such as chalk and common in areas where 'winterbourne' streams are present, which may run dry for much of the year; and (ii) 'river-groundwater interaction', where river levels interact with permeable superficial deposits along river valleys, potentially flooding areas away from the river without necessarily overtopping the river banks.

A review of the BGS online mapping shows that the site is underlain by sedimentary bedrock of the London Clay formation, classified as Unproductive (non-aquifer). There are also superficial deposits of sand and

gravel underlying the site in the Kempton Park Gravel Member, which is classified as a Secondary A aquifer. Given the absence of a Principal aquifer, the risk of clearwater flooding is considered remote. However, flooding through river-groundwater interaction is possible at this location.

The SFRA 'Areas Susceptible to Groundwater Flooding' map indicates that the risk of groundwater flooding to the site is  $\geq 75\%$ , which is the highest risk category. However, given that groundwater flooding typically has a gradual onset with shallow flood depths, **the site is considered to be at a 'low' risk of flooding from groundwater**. This is supported by the SFRA which states that the risk of groundwater flooding in Enfield is low.

## 3.4 Flooding from Artificial Sources

### 3.4.1 Sewers

Flooding from sewers can result from lack of sewer capacity, blockages within the sewer network or failure of infrastructure such as pumps. Any area that benefits from sewerage infrastructure has a potential risk of flooding, but the likelihood and consequences are most likely increased by topographic constraints, such as low spots or flow paths that could influence the behaviour of floodwater originating from sewers.

The SRFA for Enfield indicates that the public sewerage network is managed by Thames Water and lists historic sewer flooding events by postcode from the last 20 years. The mapping indicates that no sewer flooding incidents have been recorded in the 'EN3 4' postal district. The SFRA states that sewer flooding does not represent a significant risk to properties in Enfield.

The ground levels across the site (see *Figure 2-2*) and the EA RoFSW flood extents (see *Figure 3-2*) do not show any obvious flow routes across the site which could convey water in the event of a sewer flooding incident.

**Overall, the site is considered to be at 'low' risk of flooding from sewers.**

### 3.4.2 Reservoirs, Canals and other Artificial Sources

The Environment Agency 'Risk of Flooding from Reservoirs' Map illustrates the potential flood extent if large, raised reservoirs were to fail and release the water that they hold. An extract of this map is included in *Figure 3-3*. This shows that the site is at risk of flooding from a reservoir breach during both a 'dry-day' scenario, where reservoir flooding takes place with river levels at normal levels, and when reservoir flooding takes place alongside wider river flooding (i.e. there is a fluvial contribution).

Whilst a risk to the site from this source of flooding has been identified, this is a residual risk. The likelihood of reservoir failure is very low due to the stringent governance that is in place regarding UK reservoir safety and maintenance, and therefore **this source of flooding is not considered to pose an onerous risk to the site in the context of its potential future development.**



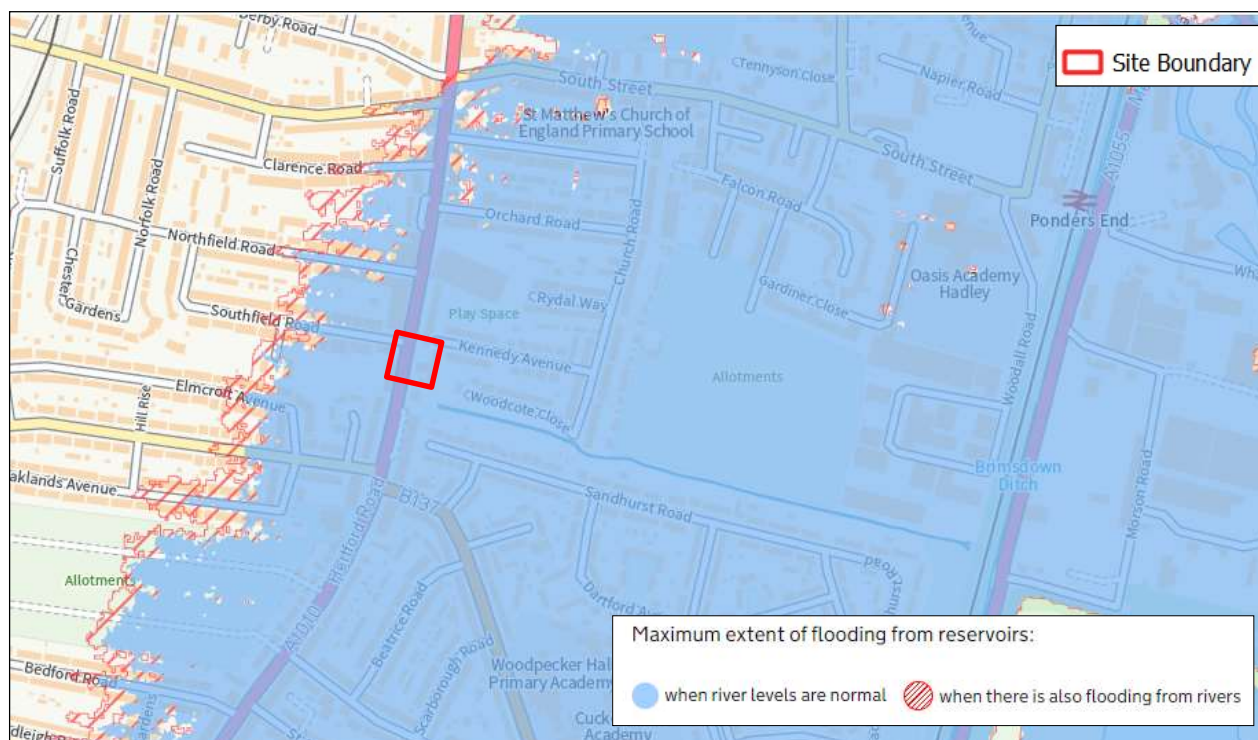


Figure 3-3: EA Risk of Flooding from Reservoirs Map

Contains Environment Agency information © Environment Agency and/or database right.

The nearest canal is the River Lee Navigation which is located approximately 1km to the east of the site, as such, it is not considered to pose as a flood risk to the site.

No other artificial waterbodies have been identified within the vicinity of the site.

**Overall, the site is considered to be at a ‘very low’ risk of flooding from canals and artificial waterbodies.**

## 3.5 Future Development

A Flood Risk Assessment (FRA) is not necessary to support the development of the site as it is located in Flood Zone 1, is less than 1ha in area and this Flood Risk Review has demonstrated that the site is low risk of flooding from other sources. The area to the south of the site alongside Boundary Ditch is designated as Flood Zone 3, however, a review of the LiDAR indicates that the ground levels across the site are approximately 1.5m higher than the watercourse.

According to the NPPF (see Appendix A), the site is suitable for all types of development and, being situated in the lowest risk flood zone, satisfies the Sequential Test. The Exception Test would not be triggered. Specific planning application validation requirements should however be confirmed with Enfield Council at the time a future planning application is prepared.

A Surface Water Drainage Strategy would be required. This strategy should identify available connections to and the capacity of the local surface water sewer network, informed by consultation with Thames Water where necessary. A strategy for managing runoff from the site should be developed to meet the London Plan (Ref. 12, Policy SI 13) requirement that developers should aim to achieve greenfield runoff rates, with a preference for green over grey features which follow the drainage hierarchy. The Drainage Strategy should be developed in consultation with Enfield Council and should detail methods to manage site drainage post-development, accounting for climate change.

## 4 Summary

This desktop Flood Risk Review has investigated the risk of flooding to the site based on a review of relevant data and information in the public domain. The following has been concluded:

- The entirety of the site is located within Flood Zone 1 and is therefore at a 'very low' risk of flooding from rivers and the sea.
- The area to the south of the site alongside Boundary Ditch is designated as Flood Zone 3, however, a review of the LiDAR indicates that the ground levels across the site are approximately 1.5m higher than the watercourse channel. Therefore, this watercourse is not considered to pose a significant risk to the site.
- The entirety of the site is at a 'very low' risk of flooding from surface water. Land to the south and southwest of the site is at a 'low' risk of surface water flooding.
- The SFRA 'Areas Susceptible to Groundwater Flooding' map indicates that the risk of groundwater flooding to the site is  $\geq 75\%$ , however, groundwater flooding typically has a gradual onset with shallow flood depths. The site is therefore considered to be at a 'low' risk of flooding from groundwater.
- The site is considered to be at a 'low' risk of flooding from sewers.
- Whilst there is a residual risk of reservoir flooding in the event of a breach, the likelihood of reservoir failure is very low due to the stringent governance that is in place regarding reservoir safety and maintenance.
- The findings of this Flood Risk Review suggest that an FRA is unlikely to be necessary to support the development of the site.
- It is recommended that a Surface Water Drainage Strategy is developed in consultation with Enfield Council and Thames Water and that it includes appropriate allowance for climate change.

Table 1 presents a summary of the risk of flooding by source. It should be noted that differing levels of information have been available to assess the risk of flooding for each source, and the ratings for flooding from rivers, the sea and surface water, for example are necessarily more detailed where they are informed by published flood maps and models.

*Table 1 – Summary of Flood Risk by Source*

Source of Flooding	Qualitative Flood Risk Rating
Rivers	Very Low
The Sea	Very Low
Surface Water	Low
Groundwater	Low
Artificial Sources (Infrastructure Failure)	Low (High residual risk)

## 5 References

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## APPENDIX A – Planning Policy and Flood Risk

### The National Planning Policy Framework

With regard to flood risk and surface water drainage, the National Planning Policy Framework (NPPF) (Ref. 15) and its accompanying flood risk and coastal change Planning Practice Guidance (PPG) (Ref. 16) set out the Government's planning policy for England and advises on '*how to take account of and address the risks associated with flooding and coastal change in the planning process*'. The principal aim of the NPPF is to achieve sustainable development by accounting for flooding at all stages of the planning process, avoiding inappropriate development in areas at risk of flooding and directing development away from areas where risks are highest. Where development is necessary in areas at risk of flooding, the NPPF aims to ensure it is safe, without increasing flood risk to third parties. Early adoption of, and adherence to, the principles set out in the NPPF with respect to flood risk, can ensure that detailed designs and plans for development take due account of flood risk and the need for appropriate mitigation, if required.

### The Sequential and Exception Tests

The PPG identifies four Flood Zone classifications, detailed in Table A1 below.

Table A1 – Flood Zones

Flood Zone	Annual Probability of Flooding
1 – Low Probability	Fluvial and Tidal <0.1% (AEP)
2 – Medium Probability	Fluvial 0.1-1.0% AEP Tidal 0.1-0.5% AEP
3a – High Probability	Fluvial > 1.0% AEP Tidal > 0.5% AEP
3b – The Functional Floodplain	Fluvial and Tidal >5.0% AEP *Starting point for consideration. Local planning authorities should identify Functional Floodplain, which should not be defined solely by rigid probability parameters.

Source: PPG, Flood Risk and Coastal Change

The NPPF specifies that the suitability of all new development in relation to flood risk should be assessed by applying the Sequential Test to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development proposed. The PPG provides guidance on the compatibility of each land use classification in relation to each of the Flood Zones, as summarised in Table A2.

Table A2 – Flood Risk Vulnerability Classification

Flood Zone	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3a	Exception Test required	✓	X	Exception Test required	✓
Zone 3b	Exception Test required	✓	X	X	X
Key:	✓ Development is appropriate		X Development should not be permitted		

Source: PPG, Flood Risk and Coastal Change

When the Exception Test is triggered, this requires the development proposals to demonstrate wider sustainability benefits to the community that outweigh flood risk, and that the development will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce overall flood risk.

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