Chiltern Dene, Enfield

Flood Risk Review

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Flood Risk Review

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Executive Summary

The site (off World's End Lane, Enfield), which is currently occupied by garages and hardstanding, may be considered for potential future redevelopment.

Flood risk to the site from a range of potential sources has been considered in this Flood Risk Review. The site has a 'very low' risk of flooding from rivers and the sea, equivalent to an annual chance less than 1 in 1,000 (0.1%). No other local sources of flooding are considered to pose an onerous risk to the site in the context of its potential redevelopment.

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 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 World's End Lane, Enfield, London, EN2 7RG, referred to as Chiltern Dene ('the site').

This Flood Risk Review is required to document the risk of flooding at the site and consider potential constraints on 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), with a risk rating assigned (e.g. HIGH, MEDIUM, LOW) to each form of flooding.
- Confirm the site's Flood Zone designation and consider NPPF[1] 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 tile TQ39nw) (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

[1] 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 site is located at National Grid Reference (NGR) TQ 30902 96241 and is situated between World End's Lane and Chiltern Dene as indicated in Figure 1. It covers an area of approximately 0.05 hectares (ha) and is currently occupied by garages and hardstanding.

The site is bounded to the east (and accessed from) World's End Lane and is surrounded by residential property on all other sides. Highlands School is located to the east of the site on the opposite side of World's End Lane.

Boxer's Lake is located approximately 280m west of the site and is connected to the Glenbrook which passes within 100m of the site at its closest point. Upstream of Boxer's Lake the Glenbrook is designated as an Ordinary Watercourse but is an EA designated Main River downstream of the lake to the point it discharges to the Salmon's Brook (also a Main River) 480m north-east of the site.



Figure 1 - Site Location (site outlined in red)

Background Mapping © OpenStreetMap contributors

2.2 Site Topography

LiDAR data, shown in extract in Figure 2, indicates that the site slopes downwards slightly from south to north with ground levels ranging from approximately 43.3m Above Ordnance Datum (mAOD) along the southern site boundary to approximately 42.6mAOD along the northern site boundary.

The prevailing topography of the surrounding area slopes downwards from south to north and north-east towards the Glenbrook and Enfield Golf Club.

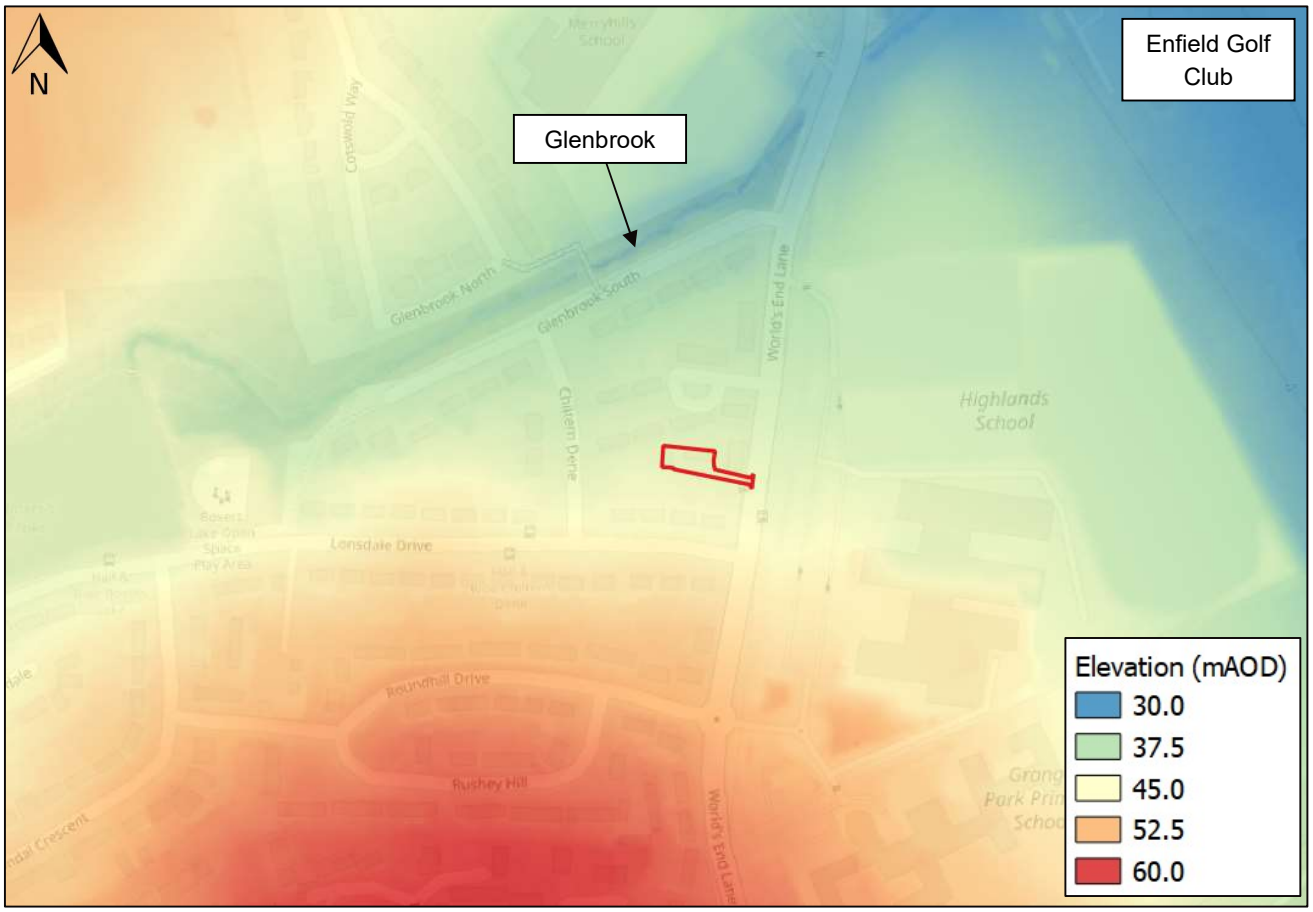


Figure 2 – Site Topography (filtered lidar data; site boundary outlined in red)

Contains Environment Agency information © Environment Agency and/or database right. Background Mapping © OpenStreetMap contributors

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 Glenbrook which is a tributary of the Salmon's Brook. To its confluence with the Salmon's Brook, the Glenbrook drains a catchment of approximately 1.3km^2. The Glenbrook flows through Boxer's Lake and in a north-easterly direction before discharging to the Salmon's Brook, which flows in a southerly direction, approximately 750m downstream of Boxer's Lake.

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 Risk of Flooding from Rivers and Sea Map estimates the risk of flooding to the site to be 'very low', equivalent to an annual chance of flooding less than 1 in 1,000 (0.1%).

The Flood Map for Planning (Rivers and Sea) shows 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 1,000 (0.1%).

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 criterion. The mapping does not include historic flooding from surface water events. The Historic Flood Map does not show any recorded flood events at the site, with the nearest recorded flood outline (associated with a Main River flood event in March 1947) being located over 280m north-east of the site.

Overall, the site is considered to have a 'very 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 redevelopment.

3.2 Flooding from Surface Water

The Risk of Flooding from Surface Water 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 map is shown in Figure 3.

The map indicates that the site is at 'very low' risk of flooding from surface water, equivalent to an annual chance of flooding of less than 1 in 1,000 (0.1%). Land immediately east of the site, along World's End Lane is shown to be at 'low' risk of surface water flooding, equivalent to an annual chance of flooding between 1 in 1,000 (0.1%) and 1 in 100 (1%). This area of flooding is indicative of a surface water flow path along World's End Lane which appears to flow past the site towards the Glenbrook.

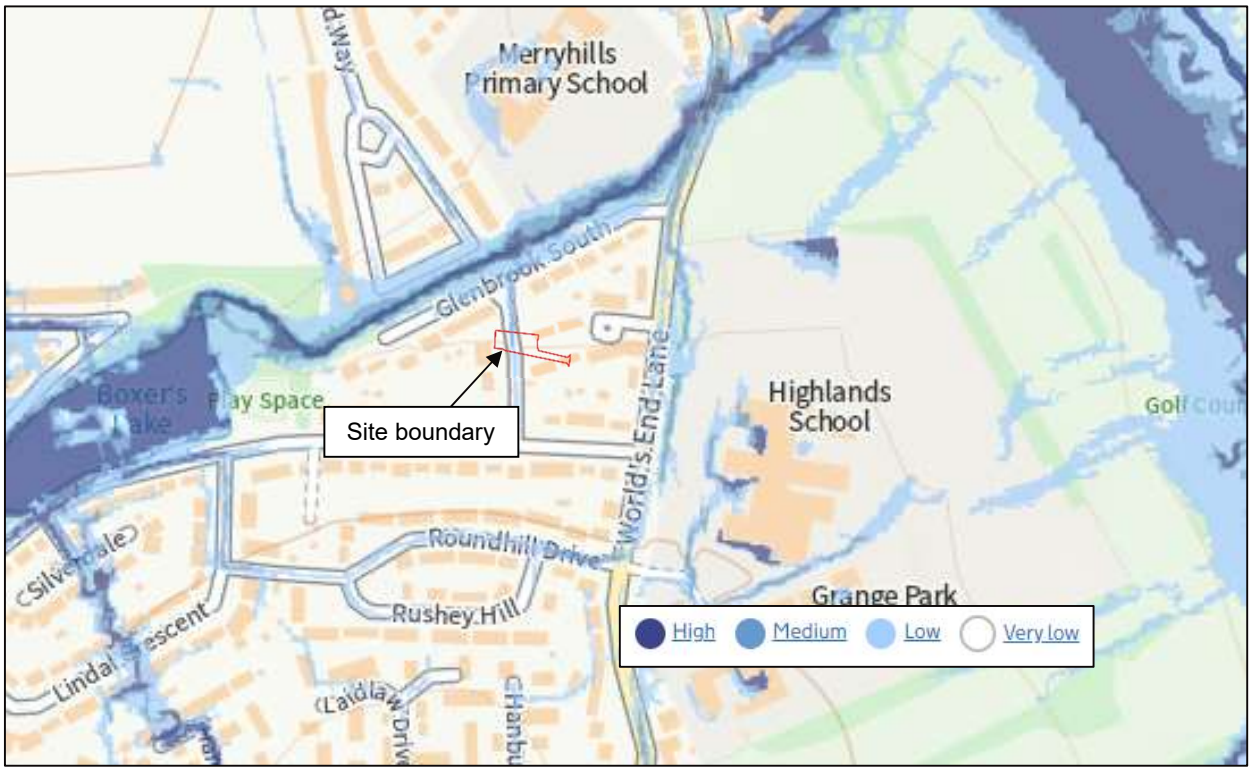


Figure 3 – Risk of Flooding from Surface Water Map
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Depths of floodwater adjacent to the site in the extreme 'low' likelihood surface water flood event are typically predicted to be shallow (less than 0.3m) and are commensurate with the wider flooding of roads and paved areas in the vicinity. This is not unexpected in a largely urban area and is unlikely to be indicative of a wider surface water flooding problem. The shallow depths of flooding modelled in the extreme event, would not pose an onerous constraint in terms of site access and egress.

Historic surface water flood events are mapped within the Enfield Level 1 SFRA. The mapping contains no records of flooding within the site boundary or its immediate surrounds from surface water sources.

Overall, the site is considered to have a 'very low' risk of surface water flooding, and this form of flooding is not considered to pose an onerous risk to the site in the context of its potential future redevelopment.

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.

BGS mapping shows the site is underlain by London Clay bedrock, classified as an 'Unproductive Aquifer' on account of its low permeability. There are no superficial deposits recorded at the site.

According to the Local Flood Risk Management Strategy for Enfield, groundwater flooding within the Enfield area is not considered to be a significant risk to people or property due to the prevailing geological conditions. Furthermore, the Enfield SFRA presents the 'Areas Susceptible to Groundwater Flooding' map which

indicates <25% of the 1km grid cell the site is situated in has the potential for groundwater to rise to the ground surface. Mapping of historical groundwater flood events in the Enfield SFRA contains no record of flooding at the site or in its surroundings from this source.

The site is considered to be at 'low' risk of groundwater flooding and this form of flooding is not considered to pose a constraint in the context of its potential future redevelopment.

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 Enfield SFRA shows incidents of flooding from sewers by postcode. Therefore, it is not possible to identify if any of the recorded incidents occurred at the site. The mapping shows that there have been 2 incidents of sewer flooding in the past 20 years in the 'EN2 7' postal district, suggesting that the general area does not have a high risk of sewer flooding.

In the absence of site-specific information on sewer flooding, the Risk of Flooding from Surface Water Map can aid understanding. Although the Surface Water Map suggests the site is located adjacent to an overland flow path, the site itself is not located in a topographical low spot and therefore flood waters from sewers would be unlikely to be directed towards the site. Furthermore, there are no overland flow paths through the site itself. Therefore, it is considered that this form of flooding does not pose a notably onerous risk over and above any similar site served by sewers.

3.4.2 Reservoirs

The Risk of Flooding from Reservoirs Map illustrates the potential flood extent were large, embanked reservoirs to fail and release the water that they hold, both when river levels are normal and when there is also flooding from rivers. The map shows that the site is not within these mapped flood extents.

Boxer's Lake, which is located approximately 280m west of the site, could pose a flood risk to the site in the event of a reservoir failure. However, in reality, the risk of reservoirs failing is relatively remote as a result of the stringent requirements placed on reservoir owners to inspect and maintain reservoirs under the Reservoirs Act 1975 and subsequent amendments.

3.4.3 Canals

There are no canals in the vicinity of the site. The New River is located over 1.3km east and down-gradient of the site and is therefore not considered to pose a flood risk to the site.

Overall, the site is considered to be at 'low' risk of flooding from artificial sources and this form of flooding is not considered to pose an onerous risk to the site in the context of its potential future redevelopment.

3.5 Future Redevelopment

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 at very low or low risk of flooding from other sources. 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 to consider available connections and the capacity of the local sewer network, informed by consultation with Thames Water where necessary. The strategy should be designed to meet the London Plan (Ref. 11, 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 (the Lead Local Flood Authority) and should detail methods to manage site drainage post-development, accounting for climate change.

Overall, flood risk is considered unlikely to substantively constrain redevelopment potential at the site.

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 site is located outside the floodplain of any nearby watercourse and is at 'very low' risk of flooding from rivers and the sea, equivalent to an annual chance of less than 1 in 1,000 (0.1%).
- No other sources are considered to pose an onerous risk of flooding to the site in the context of its potential redevelopment and the site is considered to be acceptable in principle for all types of redevelopment with respect to flood risk.
- The findings of this Flood Risk Review suggest that an FRA is not necessary to support the development of the site.
- It is recommended that a 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	Very Low
Groundwater	Low
Artificial Sources (Infrastructure Failure)	Low

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	✓	✗	Exception Test required	✓
Zone 3b	Exception Test required	✓	✗	✗	✗
Key:	✓ Development is appropriate		✗ 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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