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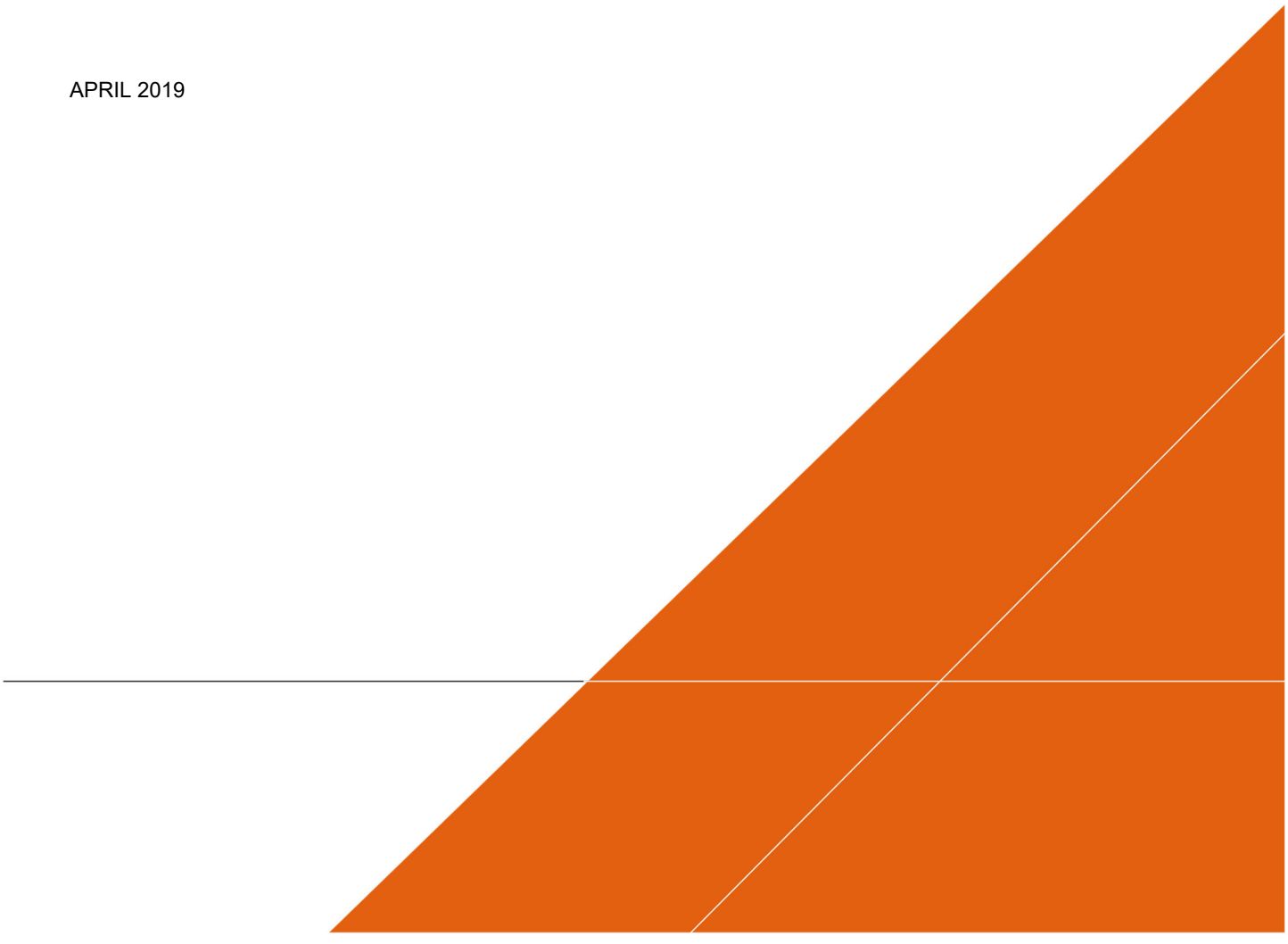
LONDON BOROUGH OF HOUNSLOW SMALL SITES SMALL BUILDERS PROGRAMME

GARAGE BLOCK OPPOSITE 14 & 16 BRENTSIDE, BRENTFORD, TW8 8BS

Flood Risk Review

10030793-ARC-XX-XX-RP-CW-0105-01-Flood Risk Review

APRIL 2019



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Executive Summary

The site (opposite 14 and 16 Brentside), which is currently occupied by garages and associated hardstanding, is part of London Borough of Hounslow's Small Sites Small Builders Programme, and hence may be considered for potential future redevelopment with residential uses.

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 Drainage Strategy should nevertheless be prepared to support future redevelopment of the site to ensure that proposals meet national and local 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 London Borough of Hounslow Council (LBH) ('the Client') to undertake a desktop Flood Risk Review for an area of hardstanding and garage blocks opposite 14 and 16 Brentside, Brentford, London, TW8 8BS ('the site').

The site is being considered for divestment under the Client's Small Sites Small Builders Programme, which aims to enable positive regeneration. This Flood Risk Review is required to document the risk of flooding 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, sewers and artificial sources) in the context of the Site's potential for future development.

Specific objectives of the Flood Risk Review are to:

- Review available sources of published flood risk data, supplemented by targeted data collection/consultation with the Environment Agency (EA) and the applicable Lead Local Flood Authority (LLFA).
- 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 (2m lidar tile) (Ref. 1)
- EA Long Term Flood Risk Maps (Ref. 2), including the 'Risk of Flooding from Rivers and Sea Map', 'Risk of Flooding from Surface Water Map' and 'Risk of Flooding from Reservoirs Map'
- EA 'Flood Map for Planning' (Ref. 3)
- EA 'Recorded Flood Outlines' dataset (Ref. 4)
- LBH Strategic Flood Risk Assessment (SFRA) (Ref. 5)
- LBH Preliminary Flood Risk Assessment (PFRA) (Ref. 6) and Addendum (Ref. 7)
- LBH Local Flood Risk Management Strategy (LFRMS) (Ref. 8)
- LBH Surface Water Management Plan (SWMP) (Ref. 9)
- West London SFRA (Ref. 10)
- British Geological Survey (BGS) Geology of Britain Viewer (Ref. 11)
- Department for Environment, Food and Rural Affairs (DEFRA) Magic Mapping (for EA Aquifer Designations) (Ref. 12)

1.4 Terminology

Flood risk is a product of both the likelihood and consequence 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

[1] A summary of NPPF requirements with respect to flood risk is included in Appendix A.

linked to the 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 approximate National Grid Reference (NGR) TQ173776 in a suburban area, within LBH. It occupies an area of approximately 0.16 hectares (ha) and is irregular on plan, as illustrated in Figure 1.

The site is bounded to the north-west by residential properties along Willow Close and to the south-east by residential properties along Somerset Road. The site is bounded to the west by landscaped border and grassed area on Brentside Road and by Church Road to the west. The Hounslow Loop railway line runs on a south-west to north-east axis approximately 140m north-west of the site. The River Brent flows in a south-easterly direction west of the site, passing within approximately 55m of the site to the south-west.

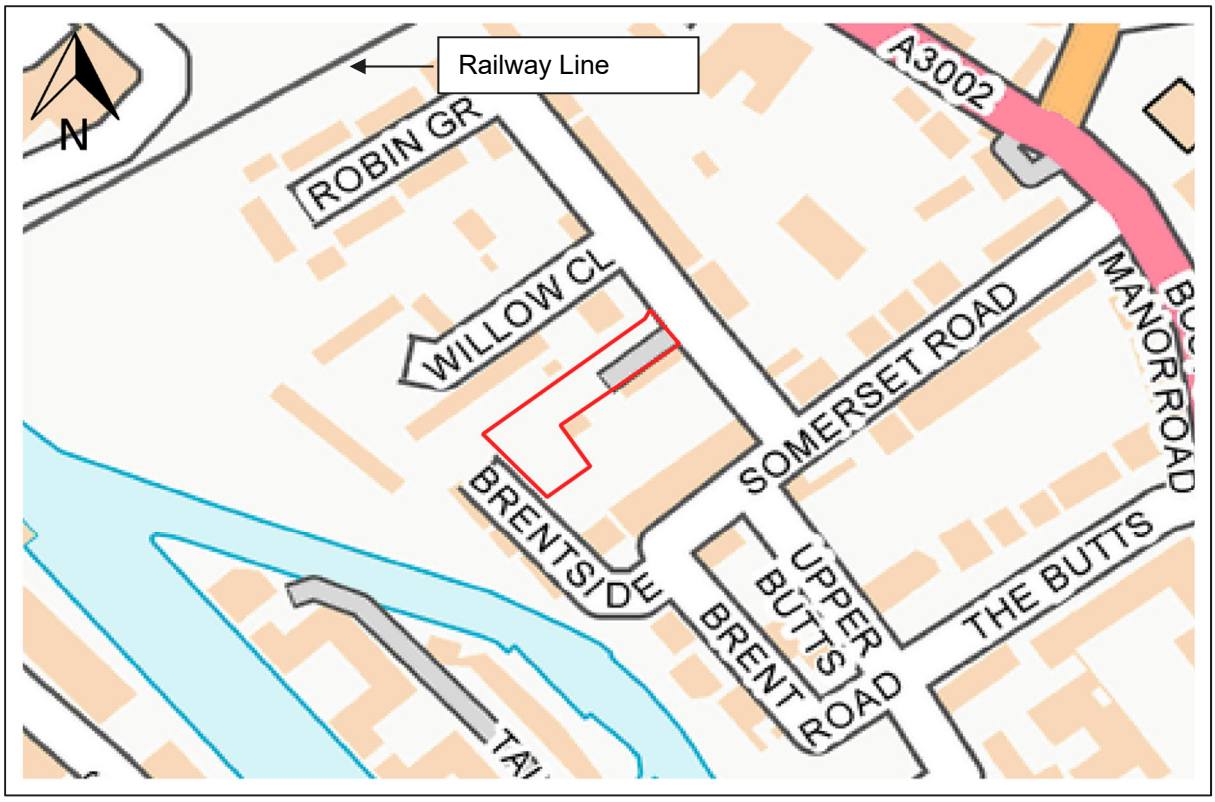


Figure 1 - Site Location (Site boundary outlined in red)

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2.2 Site Topography

As illustrated in Figure 2, LiDAR data indicates that the site slopes downwards from the north east to the south west towards the River Brent, with ground levels varying from 11.2 to 9.4m Above Ordnance Datum (AOD).

Off-site, the prevailing topography similarly slopes downwards to the south-west towards the River Brent, with ground levels adjacent to the River Brent approximately 3m lower than the site.

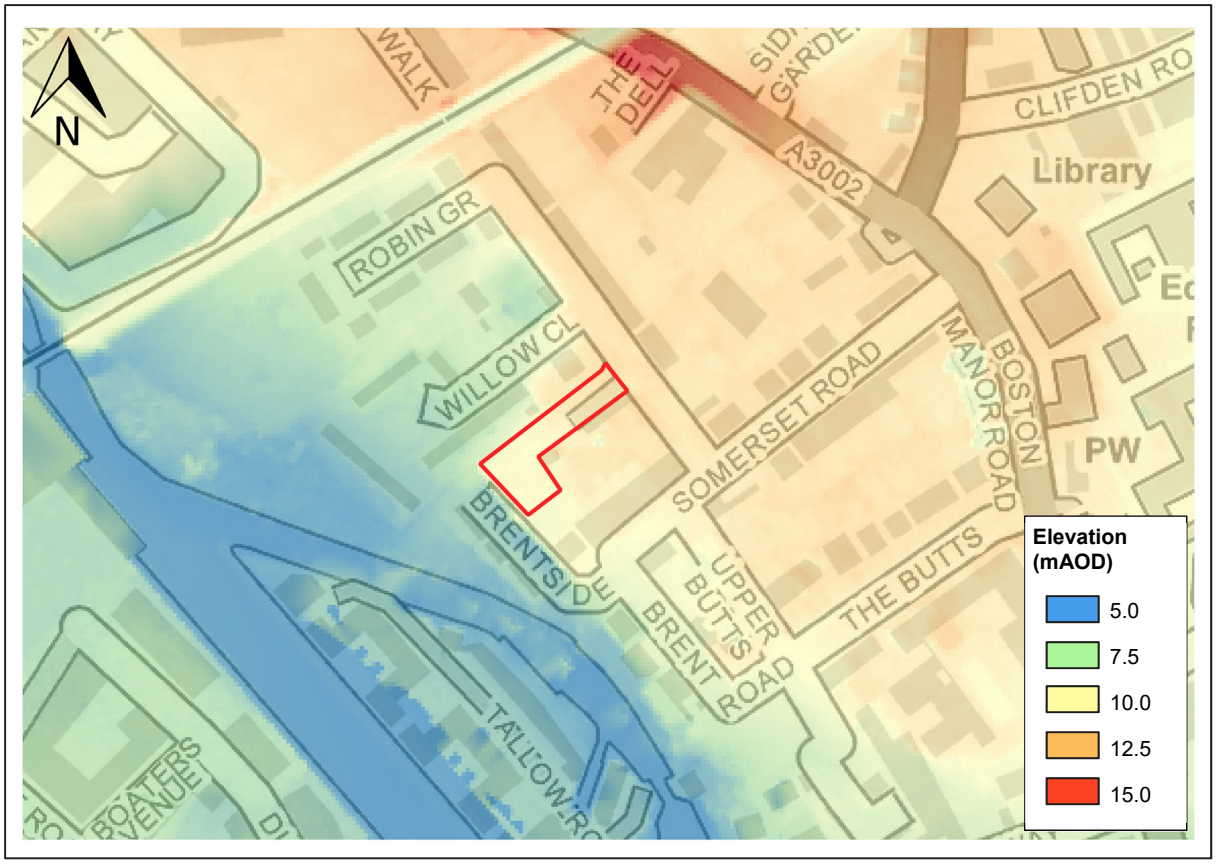


Figure 2 – Site Topography (filtered LiDAR data; site boundary outlined in red)
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3. Sources of Flood Risk

3.1 Flooding from Rivers and the Sea

Catchment Overview

The site is located in the catchment of the River Brent, which drains a total area of approximately 151km^2.

The River Brent joins the Grand Union Canal (GUC) upstream of Hamwell, approximately 3.0km north-west of the site. Downstream of this point the River Brent flows along the canalised route of the GUC, where water levels are maintained by locks and weirs. The GUC passes within approximately 55m of the site to the south-west and flows in a south-easterly direction before discharging into the River Thames at Brentford, via the Thames Lock and Brentford Dock, approximately 800m east of the site.

The River Thames flows in a generally north-easterly direction past Brentford, passing within approximately 750m of the site to the south-east.

Historical Flooding

Historical fluvial flood events are listed in the LFRMS and mapped in the PFRA. According to the LFRMS, small areas of Hounslow were exposed to fluvial flooding in the event of overflows from the rivers Brent and Crane (flooding of the latter has occurred in 1965 and 1999). Mapping in the PFRA shows that there are no records of fluvial flooding at the site and this is corroborated by the EA's Recorded Flood Outline dataset.

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 of 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. Extracts of these maps are shown in Figure 3 and Figure 4 respectively.

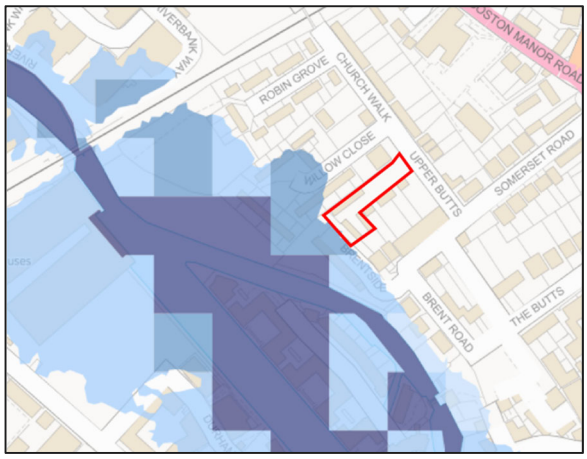


Figure 3 – Risk of Flooding from Rivers and Sea Map
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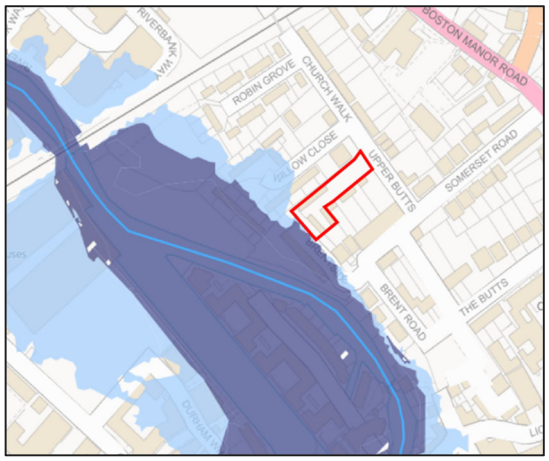


Figure 4 – Flood Map for Planning (Rivers and Sea)
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The Risk of Flooding from Rivers and Sea Map shows that the site is outside the extent of flooding associated with rivers and the sea and has a 'very low' risk of flooding, equivalent to an annual chance demonstrably less than 1 in 1,000 (0.1%). Accordingly, the Flood Map for Planning (Rivers and Sea) shows that the site is located in Flood Zone 1, equivalent to an annual chance of flooding

less than 1 in 1,000 (0.1%). However, the extents flooding shown on both maps are in close proximity to the south-eastern boundary of the site.

Detailed Flood Modelling

A request for up-to-date flood extents and levels from the latest detailed model of the River Brent was submitted to the EA, but a response is currently pending. In lieu of a response from the EA, a search has been undertaken of alternative data sources within the public domain.

Outputs from the EA's latest model of the River Brent (dating from 2018) informed preparation of a Flood Risk Assessment (FRA) prepared in support of redevelopment proposals at a site on the opposite banks of the River Brent for the redevelopment land known as 'Brentford Lock West Phase 3' in 2018 (Ref. 13). These indicate that flooding associated with the flood extents along the River Brent is fluvial originating from the River Brent rather than tidal from the River Thames (although water levels in the Thames may have an effect on peak levels in the Brent during a fluvial flood). The EA modelling supports the Flood Map for Planning (Rivers and Sea) by confirming that the site is located outside all flood extents modelled, including a flood with an annual chance of 1 in 1,000 (0.1%). It is therefore considered that the risk of fluvial flooding to the site from the River Brent is 'very low'.

Furthermore, the data indicates that fluvial flood levels for the River Brent nearest to the site are lower than ground levels on site for a flood with an annual chance of 1 in 100 (1%) with the 'upper end' climate change allowance of 70%[2], such that the above conclusion is not particularly sensitive to future climate change.

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

3.2 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 5 below.

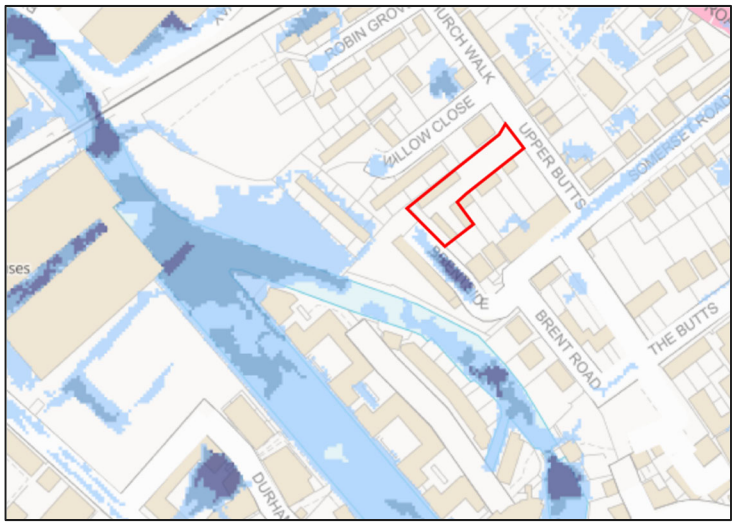


Figure 5 – Risk of Flooding from Surface Water Map
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[2] At 7.62mAOD, this climate change flood level exceeds an equivalent present day 1 in 1,000 (0.1%) flood level of 7.58mAOD. Both levels are demonstrably lower than lowest ground levels on site (9.4mAOD).

The map indicates that the Site is at 'very low' risk of surface water flooding, with an annual chance of less than 1 in 1,000 (0.1%). This is assumed to result from the sloping prevailing topography which tends to allow floodwater to flow in a south-westerly direction towards the River Brent.

Flooding is shown to affect Brentside Road immediately to the south of the site, in 'medium' and 'high' likelihood surface water flood events, with an annual chance of 1 in 100 (1%) and 1 in 30 (3.3%) respectively, albeit in all events flooding is limited to this isolated local low spot, and is relatively shallow such that flooding here is not considered to pose an onerous risk to the site.

The site is not located within a Critical Drainage Area (CDA), areas recognised as vulnerable to surface water flooding in the SWMP.

According to the records of historical surface water flooding in the PFRA, there have been no recorded incidents of surface water flooding at the site.

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.

According to BGS mapping, the site is underlain by superficial deposits of the Kempton Park Gravel Member above London Clay bedrock. The superficial deposits are classified as a 'Secondary A Aquifer' by the EA, while the London Clay bedrock is classified as 'Unproductive' on account of its low permeability.

According to the PFRA, the site and surrounds are not located in a zone of Increased Potential for Elevated Groundwater (IPEG). Furthermore, the SFRA states that Hounslow is at low risk of groundwater flooding and the mapping presented in the PFRA indicates that there have been no incidents of groundwater flooding at the site.

The unproductive nature of the London Clay bedrock suggests that the likelihood of clearwater flooding is remote. Groundwater is likely to be present at shallow depths within the permeable river terrace gravels overlying the London Clay bedrock at the site and this is likely to be responsible for the area's IPEG designation in the PFRA. However, water levels in these gravels are anticipated to be in continuity with water levels in the River Brent and, given the site's elevated position relative to extreme levels in the River Brent, the likelihood of river-groundwater interaction causing groundwater to rise to the surface is considered similarly low.

The site is considered to be at 'low' risk of groundwater 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.

3.4 Flooding from Artificial Sources

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.

Mapping in the PFRA 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 between 1 to 5 recorded incidents of sewer flooding in the 'TW8 8' postal district.

In the absence of site-specific information on sewer flooding, the Risk of Flooding from Surface Water Map can aid understanding. As the site is not in any flow paths or low spots, which would direct sewer water towards the site and the prevailing topography slopes away to the south-west, it is considered that sewer flooding in the vicinity does not pose an onerous risk to the site.

Reservoirs

The Risk of Flooding from Reservoirs Map illustrates the potential flood extent were large raised reservoirs to fail and release the water that they hold. The map shows that the north west corner of the site may be partially located within this flood extent, most likely associated with failure of the Brent Reservoir upstream along the River Brent. The Risk of Flooding from Reservoirs Map represents a worst-case scenario based on relatively coarse mapping, which may not reflect, at the edge of the site, the difference in ground levels between the site, the surrounds and the wider River Brent floodplain. Furthermore, 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.

Canals

The River Brent flows within the GUC approximately 50m to the east of the site. The GUC is not, however, raised above surrounding ground levels and there is no risk of a breach in the canal banks resulting in flooding to the local area. This is particularly true for the site and surrounds which are located outside the River Brent floodplain, as evidenced by available modelling in the public domain.

The SFRA notes that there have been recorded incidences of flooding onto the canal towpath. However, water levels within the GUC are maintained by locks and weirs such that the risk of more widespread flooding is limited.

Overall, it is considered that the risk of flooding from artificial sources is 'low' 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, less than 1ha in area and this Flood Risk Review has demonstrated that the site is not at risk of flooding from other sources. Specific planning application validation requirements should however be confirmed with LBH at the time a future planning application is prepared.

A 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. A Drainage Strategy should be designed to meet the London Plan (Ref. 14, Policy 5.15) requirement that developers should aim to achieve greenfield runoff rates and use Sustainable Drainage Systems (SuDS) unless there are practical reasons for not doing so. LBH provide guidance for the application of SuDS in their SFRA and the Drainage Strategy should be developed in consultation with LBH, detailing methods to manage site drainage post-development. Climate change allowances, detailed in the SFRA, also need to be incorporated into the Drainage Strategy. The suitability of these allowances should be confirmed with LBH during consultation.

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 the River Brent 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 of flooding 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 designed in consultation with LBH 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

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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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