

TFL_PSF_9131 SITE INVESTIGATIONS: SMALL SITES INITIATIVE LAND AT PALMERSTON CRESCENT AND BOWES ROAD, ENFIELD

Flood Risk Review

FEBRUARY 2020



Land at Palmerston Crescent and Bowes Road, Enfield

Flood Risk Review

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Executive Summary

The Site, which is located at Palmerston Crescent and Bowes Road, is part of Transport for London (TfL) Small Sites Initiative and hence may be considered for potential future redevelopment.

Flood risk to the site from all potential sources has been considered in this Flood Risk Review. The site is located in Flood Zone 1 on the Environment Agency (EA) Flood Map for Planning (Rivers and the Sea) and therefore 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), there is no requirement to produce a Flood Risk Assessment (FRA) to support future redevelopment of the site given the size (<1 hectare) and location of the site within Flood Zone 1. The Planning Practice Guidance (PPG) indicates that the site would be suitable for all types of development, including residential uses

A Drainage Strategy should also 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 Transport for London (TfL) ('the Client') to undertake technical surveys for a land parcel located at Palmerston Crescent and Bowes Road, Enfield, London, N13 4UQ ('the site').

TfL is aiming to divest a number of small sites to enable regeneration. The aim of this flood risk review is to assess the flood risk status of the site and confirm the suitability for various forms of development on the site, including residential.

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, supplemented by targeted data collection/consultation with the Environment Agency (EA) and the applicable Lead Local Flood Authority (LLFA)¹.
- 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 National Planning Policy Framework (NPPF)² 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 (TQ3091, TQ3092, TQ3191 and TQ3192) (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 (Rivers and Sea)' (Ref. 3)
- EA 'Recorded Flood Outlines' dataset (Ref. 4)
- London Borough of Enfield (LBE) Strategic Flood Risk Assessment (SFRA) (Ref 5)
- LBE Preliminary Flood Risk Assessment (PFRA) (Ref 6)
- LBE Surface Water Management Plan (SWMP) (Ref. 7)
- LBE Local Flood Risk Management Strategy (LFRMS) (Ref. 8)
- British Geological Survey (BGS) Geology of Britain Viewer (Ref. 9)
- Defra Magic Maps (for EA Aquifer Designations) (Ref. 10)
- The London Plan (Ref. 11)

¹ A request has been sent to the LLFA for flood information that they may hold for the site and a response is currently pending. It is recommended that the findings of this review are revisited once a response has been received.

² A summary of NPPF requirements with respect to flood risk is included in Appendix A.

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 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 TQ 30799 92132 within the urban setting of Enfield. It occupies an area of approximately 0.56 hectares (ha) and is roughly rectangular on plan, as illustrated in Figure 1.

The site is bounded to the south by the A406 North Circular Road / Bowes Road, which is a dual carriageway. The site is bounded to the west by Palmerston Crescent, to the east by Broadway Mews and to the north by the back gardens of the residential buildings on Elmdale Road.

New River aqueduct is located approximately 80m west of the site and flows in a southerly direction. Pymmes Brook is located approximately 100m north of the site.

The site is accessed off Palmerston Crescent and Broadway Mews. The land coverage currently comprises of grassed land.

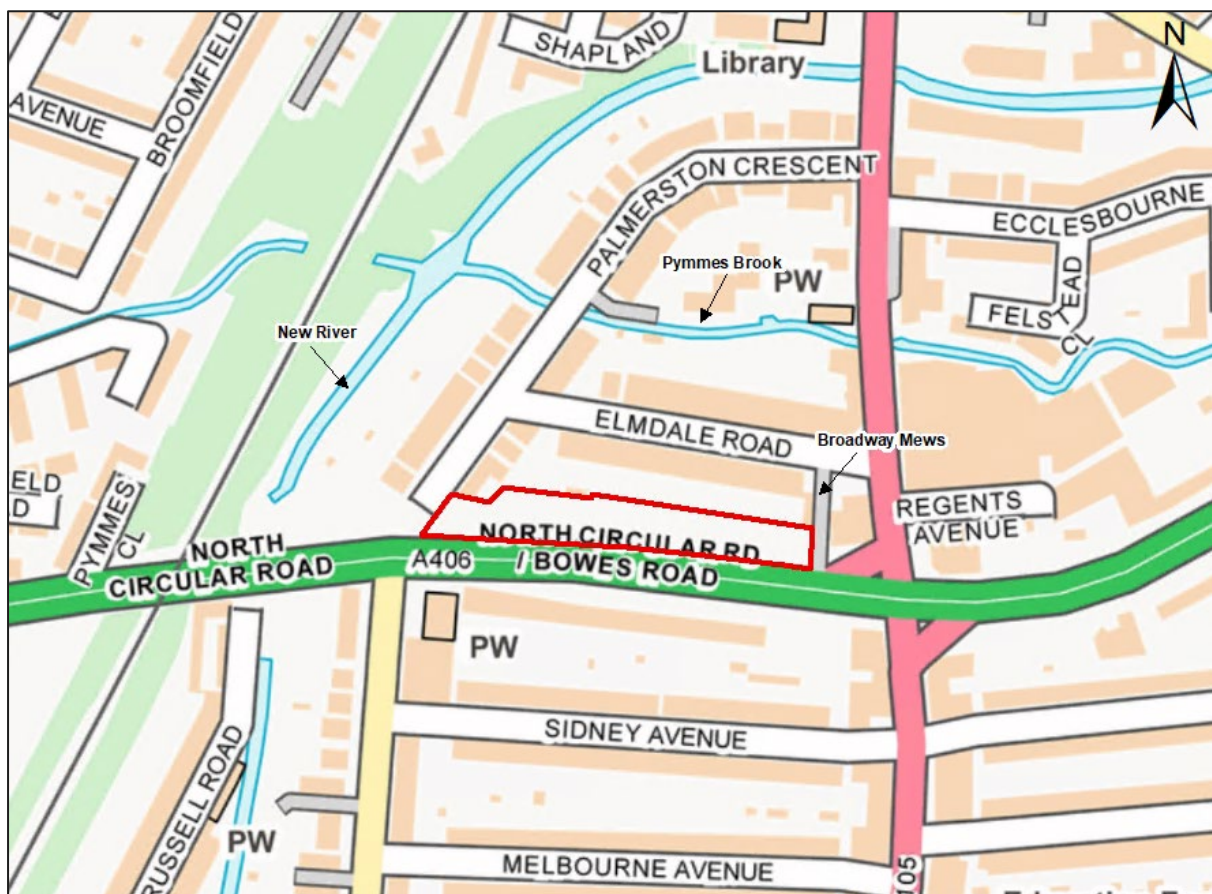


Figure 1 – Site Location (site boundary outlined in red)

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2.2 Site Topography

LiDAR data, shown in extract in Figure 2, indicate that the site slopes down to the north, away from the A406 North Circular Road / Bowes Road and towards Pymmes Brook, from a level of 30.2m Above Ordnance Datum (AOD) in the southwest corner to a level of 26.9mAOD along the northern and eastern boundaries of the site.

Off site, the prevailing topography tends to slope downwards to the north towards Pymmes Brook, which is over 2m lower than the site. The railway embankment which runs to the west of the site is at least 6m above the site ground levels (circa. 36.5mAOD). New River, which runs parallel to the railway embankment to the west of the site, is also embanked, with crest levels (circa. 30.9mAOD) a minimum of 0.7m above the site.

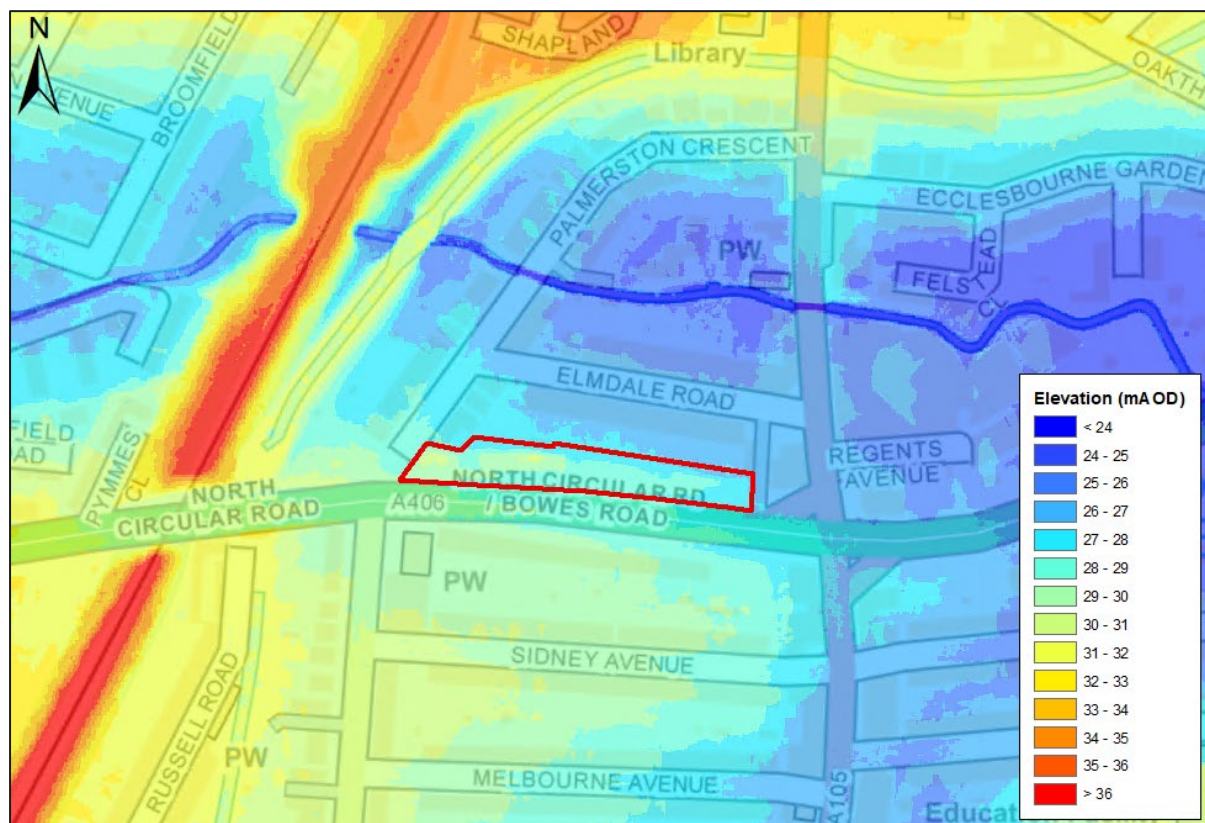


Figure 2 – Site Topography (filtered LiDAR data; site boundary outlined in red)

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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 Lee, which is one of the largest tributaries of the River Thames and drains a total area of approximately 1,415km² to its confluence with the River Thames. Pymmes Brook, a tributary of the River Lee is located approximately 100m north of the site and flows in an easterly direction.

New River, a water supply aqueduct, is located approximately 80m west of the site. The waterway is fed from the River Lee in Hertfordshire and runs for 32km, flowing southwards past the site to the West Reservoir in Stoke Newington.

Flood Mapping

The EA 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 EA 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.

The EA 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 EA Flood Map for Planning (Rivers and Sea) shows the site is located in Flood Zone 1, equivalent to an annual chance of flooding which is less than 1 in 1000 (0.1%). Broadway Mews, to immediately to the northeast of the site, is located in Flood Zone 2, equivalent to an annual chance of fluvial flooding between a 1 in 100 (1%) and 1 in 1,000 (0.1%).

NPPF requires that the potential impact of climate change on flood risk is considered and the EA have produced guidance on what increased in peak river flow allowances should be adopted in a Flood Risk Assessment (FRA)³. The site is located within the Thames River Basin where a 70% increase in flows is the upper end (worst-case) climate change allowance that should be considered for 'more vulnerable' development types, such as residential. No information on the impact of climate change on fluvial flood risk is provided in any of the reports used to inform this Flood Risk Review and detailed information from the EA was not available within the timescale of the study. Given that the site is located on the edge of Flood Zone 2, climate change could potentially result in an increased flood risk to the site. A review of LiDAR levels indicates that site levels are typically a minimum of 0.3m above the 1 in 1,000 (0.1%) flood, therefore, it is considered unlikely that climate change would pose significant development constraints⁴.

³ Flood risk assessments: climate change allowances,
<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

⁴ Whilst an FRA is not technically required to support development at the site, it may be prudent to obtain detailed flood information for the Pymmes Brook from the EA in order to confirm the potential impact of climate change on fluvial flood risk.

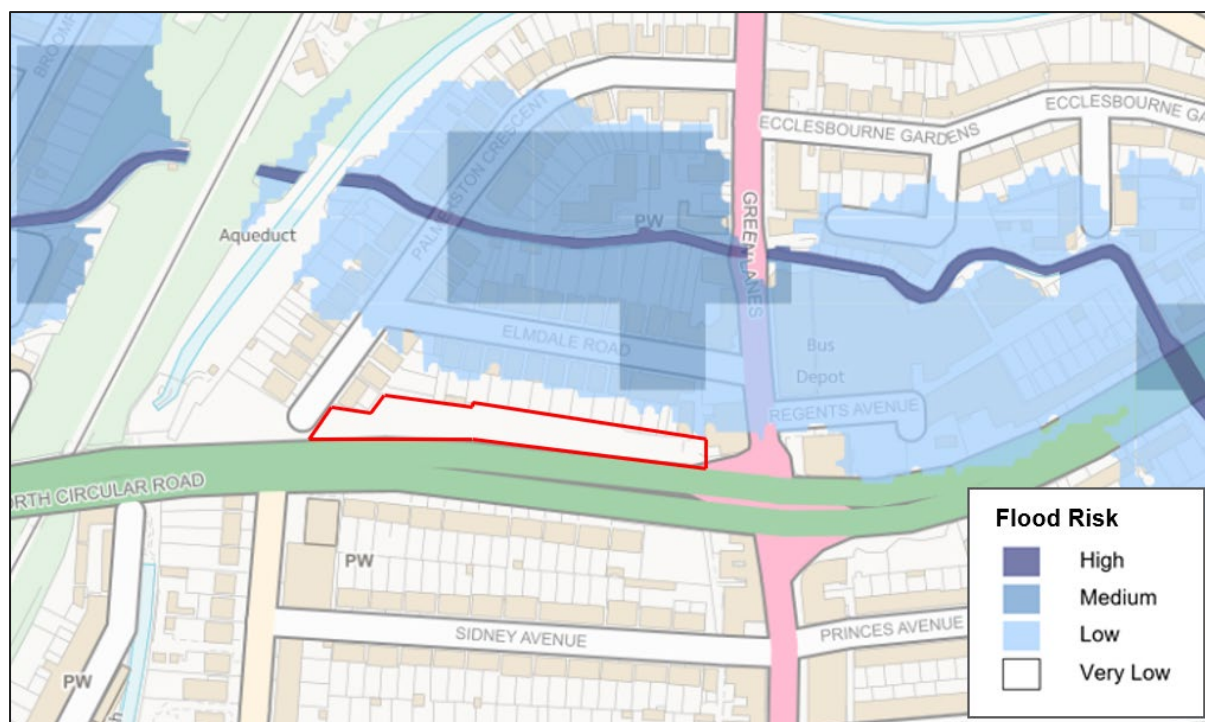


Figure 3 – Risk of Flooding from Rivers and Sea Map (site boundary outlined in red)

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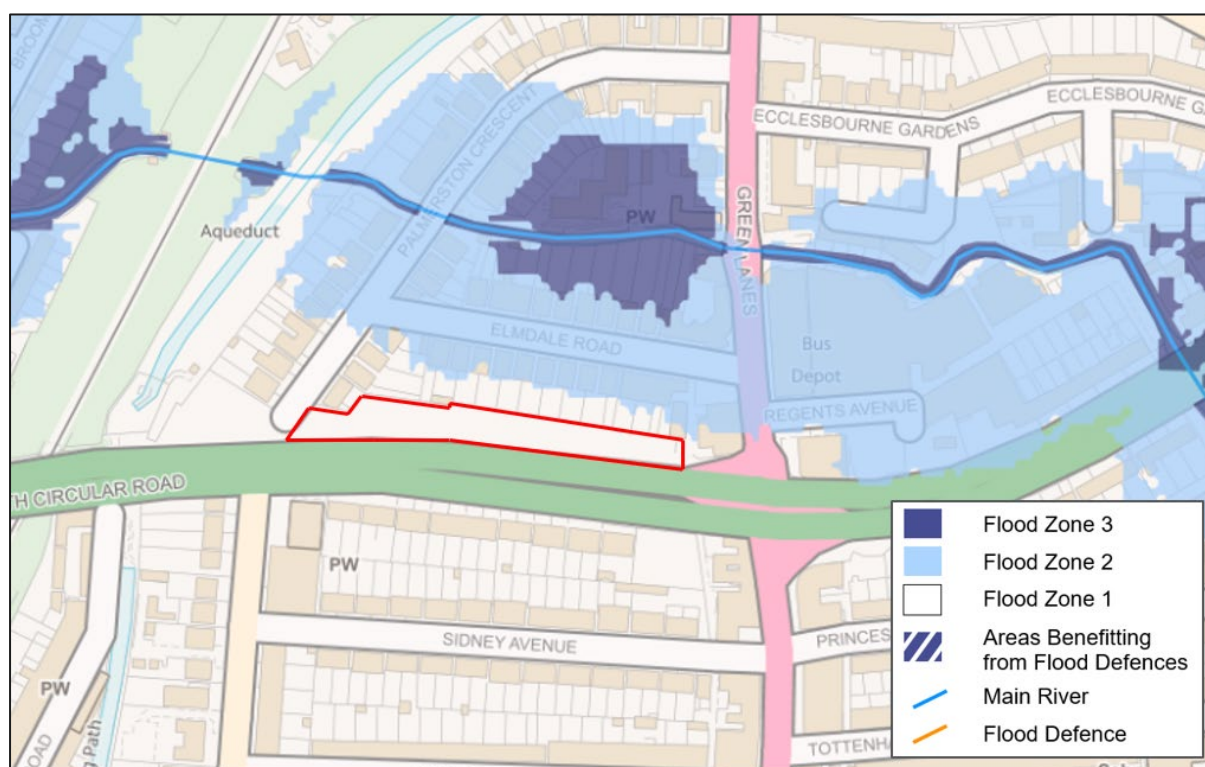


Figure 4 – Flood Map for Planning (Rivers and Sea) (site boundary outlined in red)

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Historical Flooding

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 Defences

There are no formal flood defences in the vicinity of the site.

The site is considered to currently have a '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.

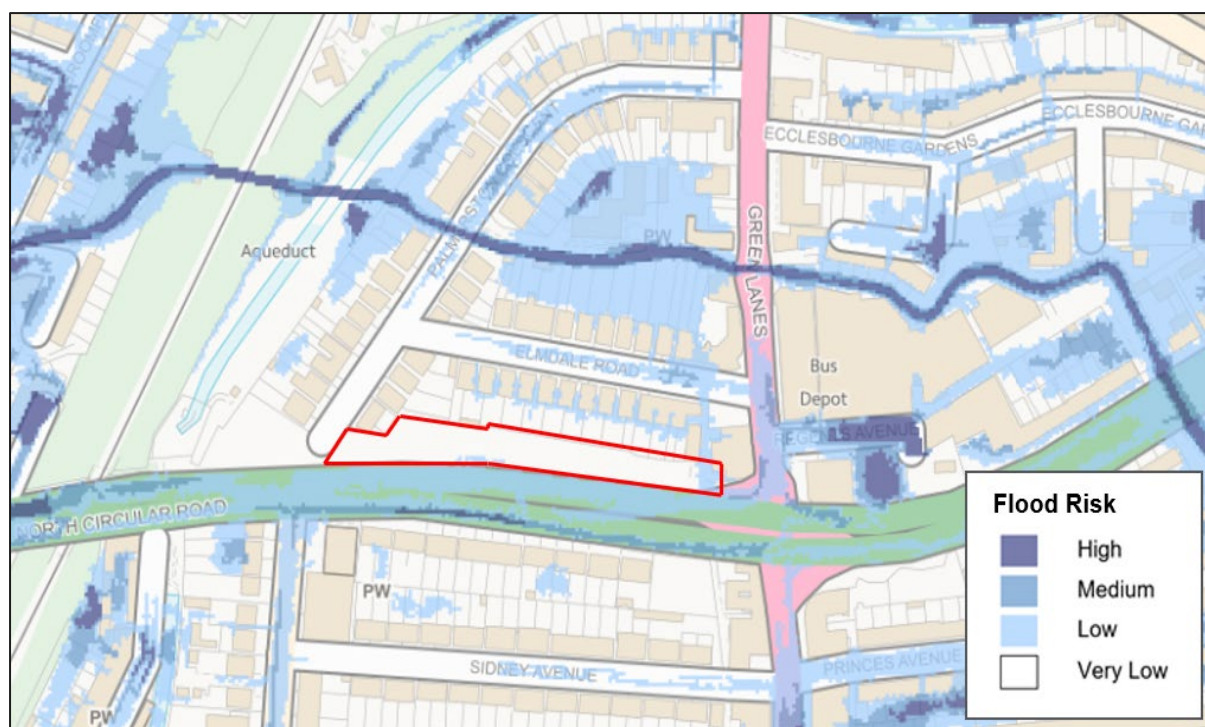


Figure 5 – Risk of Flooding from Surface Water Map (site boundary outlined in red)

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The map indicates that majority of the site is at 'very low' risk of surface water flooding, with an annual chance of less than 1 in 1,000 (0.1%). There are two small areas of the site at 'low' risk of surface water flooding, with an annual chance of 1 in 1,000 (0.1%). The first is to the north of A406 North Circular Road / Bowes Road and the second is along Broadway Mews, with shallow (< 300mm) flood depths predicted in these areas in this extreme event.

Mapping in the PFRA shows recorded incidents of surface water flooding across the borough. The nearest surface water historic flood incident occurred 150m south west of the site on Russell Road. Mapping in the SWMP shows the Critical Drainage Areas (CDA) in Enfield which are areas recognised as vulnerable to surface water flooding. The site is not located within a CDA.

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 located in a zone of Increased Potential for Elevated Groundwater (IPEG). Mapping in the PRFA shows recorded incidents of groundwater flooding across the borough. According to mapping, there have been no recorded incidents of groundwater flooding at the site. The nearest historic surface water historic flood incident occurred approximately 130m northeast of the site on the A105.

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 gravels overlying the London Clay bedrock at the site. Given the elevated nature of the site above the Pymmes Brook, the likelihood of risk of river-groundwater interaction causing groundwater to rise to the surface at the site is remote.

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 11 to 20 recorded incidents of sewer flooding in the N13 4 postal district.

In the absence of site-specific information on sewer flooding, the EA 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, it can be argued that sewer flooding in the vicinity does not pose a notably onerous risk over and above any similar site benefiting from sewers.

Reservoirs

The EA 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 site is not within this flood extent.

Canals

New River, located approximately 80m west of the site, is a water supply aqueduct which is owned and managed by Thames Water. Limited information was available, however, flows and water levels along the waterway are assumed to be controlled, for example, by sluice gates, weirs, etc. limiting the likelihood of flood conditions occurring.

Examination of the LiDAR data show New River is embanked above the levels of the site (Figure 2). Failure of the canal embankment to the west of the site would present a significant flood risk. Given the importance of this water supply structure, it is assumed there would be a regular inspection and maintenance regime of the control structures and embankments which would result in a very low likelihood of a breach occurring. Therefore, the site is considered to be at low risk of flooding from this source.

There is no mention of flood risk from this source in either the PFRA or the SFRA.

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) would not ordinarily be required to support the development of the site as it is located in Flood Zone 1, less than 1ha in area, is not located in a CDA and this Flood Risk Review has demonstrated that the site is at low risk from all sources. Specific planning application validation requirements should, however, be confirmed with LBE at the time a future planning application is prepared.

Surface water drainage and runoff from the site, including available connections with and capacity of the local sewer network should be further investigated with Thames Water. Further investigations should include the calculation of current rainfall-runoff rates and volumes, greenfield runoff rates for the site and confirmation of the available capacity of the local and wider sewer networks. This should be undertaken as part of developing a Drainage Strategy designed to meet the London Plan (Ref. 11, 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. LBE provide guidance for the application of SuDS in their SWMP. Climate change allowances also need to be incorporated into the Drainage Strategy, and the SWMP details the allowances that must be considered. The suitability of these allowances should be confirmed with LBE 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 and obtained from the EA. The following has been concluded:

- The site is located within Flood Zone 1 and has a very low flood risk, with an annual chance of fluvial/tidal flooding that is 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.
- An FRA is unlikely to be required to support redevelopment proposals on account of its location in Flood Zone 1 and as it is less than 1 hectare in size, however, it is recommended that a Drainage Strategy is developed in consultation with LBE 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	Low

5 References

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11. Greater London Authority, 2016. The current London Plan. Accessed January 2020 via: <https://www.london.gov.uk/what-we-do/planning/london-plan/current-london-plan>
12. Department for Communities and Local Government, 2018. National Planning Policy Framework
13. Department for Communities and Local Government, 2014. Planning Practice Guide: Flood Risk and Coastal Change.

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. 12) and its accompanying flood risk and coastal change Planning Practice Guidance (PPG) (Ref. 13) 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.

Flood Risk Review

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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