CHATHOM

17 NORTH END, LONDON

ARTEFACT STUDIO

FLOOD RISK ASSESSMENT
September 2023
2023-0025-R01(2)

DOCUMENT CONTROL

Project Name	**17 North End, London**
Report Title	Flood Risk Assessment
Reference	2023-0025-R01(2)
Client	Artefact Studio

Revision	Status	Date	Author	Reviewer
0	First Issue	04/08/2023	TM	CA
1	CCTV information added	08/09/2023	TM	CA
2	Client comments addressed	19/09/2023	TM	CA

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1 INTRODUCTION

1.1 Scope

Chathom Limited was commissioned by Artefact Studio to undertake a flood risk assessment (FRA) for the proposed development at 17 North End, London NW3 7HR.

This report has been produced in support of a planning application and should be read in conjunction with the other planning documents.

1.2 Sources of Information

This report has been prepared based on the following set of information:

- Topographical Survey by EDI Surveys Ltd drawing 17940/T/01-01 Rev A dated May 2019
- Existing Site Layout by Artefact, drawing references NOR-001 to 032, dated December 2021
- Existing Building Layout by Artefact, drawing references NOR-110 to 304, dated December 2021
- Geotechnical Ground Investigation by Land Science, report reference LS5787, dated September 2021
- CCTV and drainage survey by Integrum Site Services, report reference 1483, dated August 2023
- Utilities records – Thames Water record reference ALS/ALS Standard/2022_4737453, dated October 2022
- Utilities records – Thames Water Sewer Flooding History Enquiry reference SFH/SFH Standard/2023_4861748 dated 24 July 2023
- Environment Agency (EA) online flood maps at https://flood-map-for-planning.service.gov.uk/
- British Geological Survey online mapping available at https://www.bgs.ac.uk/map-viewers/bgs-geology-viewer/
- Magic website mapping available at https://magic.defra.gov.uk/magicmap.aspx
- Lead Local Flood Authority (LLFA) information – London Borough of Camden Strategic Flood Risk Assessment July 2014, available at https://www.camden.gov.uk/documents/20142/15822724/LB+Camden+Strategic+Flood+Risk+Assessment+2014.pdf/25379616-c452-b39b-9839-9f0c374cfa83
- Camden Planning Guidance, Water and flooding, March 2019 available at https://www.camden.gov.uk/documents/20142/4823269/Water+and+Flooding+CPG+-+March+2019.pdf/c7633c7d-2b93-cb52-ee01-717fa0416e84
- Greater London Authority - City of London Local Plan, available at https://www.london.gov.uk/sites/default/files/the_london_plan_2021.pdf
- Guidance on Flood risk and coastal change – UK Government, available from https://www.gov.uk/guidance/flood-risk-and-coastal-change#Table-3-Flood-risk-vulnerability
- National Planning Policy Framework: Annex 3, Flood risk vulnerability classification – UK Government, published March 2012, updated July 2021, available at https://www.gov.uk/guidance/national-planning-policy-framework/annex-3-flood-risk-vulnerability-classification

- Guidance on Flood risk and coastal change, Table 2: Flood risk vulnerability and flood zone 'incompatibility', published 6 March 2014, updated 25 August 2022 – UK Government, available from https://www.gov.uk/guidance/flood-risk-and-coastal-change#para77

1.3 Limitations

This report has been prepared in accordance with the NPPF and Local Planning Policy. The proposed flood management (including ground floor level recommendations) and surface water management strategies are based on the relevant British Standards (BS8533), the standing advice provided by the EA or based on common practice. The findings of this report are based on the information available at the time of the production.

The Construction (Design and Management) Regulations 2015 (CDM Regulations) will apply to any future development of this site which involves "construction" work, as defined by the CDM Regulations. As such it is the responsibility of the proposed developer (ultimate client) to fulfil its duties under the CDM Regulations.

2 SITE SETTING

2.1 Site Description

The site covers approximately 0.04 ha in area and is located within the London Borough of Camden. The site layout comprises an irregular shaped parcel of terraced land with a shallow stone retaining wall separating the two levels. The upper terrace contains a timber outbuilding with paving slabs around the perimeter with steps leading down to the lower terrace which contains a lawn and vegetable beds. The site is bounded by Wildwood Cottage to the north, North End to the east and private dwellings to the south and west. The approximate grid reference for the site is 526120E, 187035N.

Figure 2.1 – Site location plan

2.2 Proposed Development

The proposed development comprises a split-level dwelling including front courtyard and rear garden, with part of the dwelling being cut into the existing slope. The proposal involves excavation into the existing slope to form the back wall of the lower ground split level. The excavation shall be to a maximum depth of 2.3 m below the upper terrace level.

2.3 Topography

The site has an irregular shape with the major axis running approximately northeast to southwest. The land within contains split levels with the upper terrace to the northeast and lower terrace to the southwest. The site levels range from ~ 110.5 to 111.9 m AOD on the upper terrace and ~ 108.5 to 109 m AOD within the lower terrace area. The site is within a wider hillside setting, rising up to Hampstead Heath to the southeast.

2.4 Hydrology

Ordnance Survey (OS) mapping and the EA's web-based mapping indicate that Mutton Brook is located approximately 1.6 km to the north and west of the site. A number of minor water bodies are located

within a radius of 0.5 km from the site, with the closest approximately 300 m from the site to the north and west.

2.5 Geology

Based on the information available from BGS online mapping:

- Bedrock geology description - Bagshot formation - sand. Sedimentary bedrock formed between 56 and 47.8 million years ago during the Palaeogene period.
- Superficial deposits – none recorded.

The nearest borehole records with similar geological profiles to the site available from this website are summarised below.

- TQ28NE256, approximately 50 m northwest of the site, dated June 1987 - indicated uppermost 1.45 m made ground, with soft brown peat between 1.45 to 4.5 m, with soft organic gravelly clay between 4.5 to 4.95 m, with soft grey silty clay with gravel between 4.95 to 5.5 m and firm grey silty clay below to a drilled depth of 10.0 m. The cover level for the borehole was recorded to be 108.61 m AOD. The borehole remained reportedly dry during drilling.
- TQ28NE258, approximately 70 m southeast of the site, dated June 1987 – indicated uppermost 1.0 m made ground, with soft light brown fine sandy clay between 1.0 to 2.8 m, with firm orange and brown very clayey sandy silt between 2.8 to 5.0 m, with firm grey silty clay between 5.0 to 13.5 m and grey brown clayey sand below to a drilled depth of 15 m. The cover level for the borehole was recorded to be 112.87 m AOD. The overnight standing water level within the borehole was recorded to be 3.6 m below cover level.
- TQ28NE257, approximately 90 m southwest of the site, dated June 1987 – indicated uppermost 1.0 m made ground, with firm to stiff brown mottled silty gravelly clay between 1.0 to 2.0 m, with brown and grey very silty sand between 2.0 to 3.0 m, with orange silty sand between 3.0 to 4.0 m, with orange brown clayey sand between 4.0 to 6.0 m, with orange silty sand between 6.0 to 7.0 m and firm grey silty clay below to a drilled depth of 15.5 m. The cover level for the borehole was recorded to be 112.54 m AOD. The overnight standing water level within the borehole was recorded to be 5.7 m below cover level.

Soilscape information available from Magic Maps service indicate this area as:

- Freely draining slightly acid loamy soils.

An onsite geotechnical investigation was undertaken by Land Science, report reference LS 5787, dated 9th September 2021. An excerpt from the Land Science report providing a summary of the encountered conditions is shown in Figure 2.2.

Base Depth m		Strata	Description
DS101	DS102		
0.50	1.20+	Topsoil	Dark brown slightly gravelly sandy SILT with abundant rootlets and brick fragments.
1.60	-	Head Deposits - granular	Gravelly clayey fine SAND. Gravels are fine to medium sub-angular to sub-rounded flints.
2.80	-	Head Deposits - cohesive	Firm light orange-brown gravelly sandy CLAY. Sands are fine. Gravels are fine to medium sub-angular to sub-rounded flint.
3.20	-	Head Deposits - granular	Gravelly SAND. Gravels are fine to coarse sub-angular to sub-rounded flints.
6.00+	-	Bagshot Formation	Light orange brown, becoming a dark green-grey silty, locally clayey, fine SAND.

Figure 2.2 – Extract from Land Science report

The Land Science report made the following clarifying comments:

The expected ground conditions were anticipated to comprise Bagshot Formation to depth. However, the investigation encountered a stratum interpreted as superficial materials which were Head Deposits above the Bagshot Formation. A thin capping of Topsoil was also encountered at the surface.

Groundwater was struck during the excavation of DS101 at a depth 3.50 m bgl. During the monitoring visit the water was initially standing at a depth of 3.10 m bgl; this was purged out to a depth of 4.40 m bgl, and returned to a depth of 3.15 m bgl after one hour.

2.6 Hydrogeology

The following hydrogeological information was obtained from the online Magic Maps service.

- Aquafer destination (Bedrock) – Secondary A
- Aquifer Designation Map (Superficial Drift) – no features found
- Groundwater Vulnerability – High

The onsite geotechnical investigation undertaken by Land Science recorded rest water level to be at 3.10 m bgl at location DS101, as shown on Figure 2.3. The topographical level of the location is approximately 110.36 m AOD. Therefore, the groundwater level is assumed to be at approximately 107.26 m AOD.

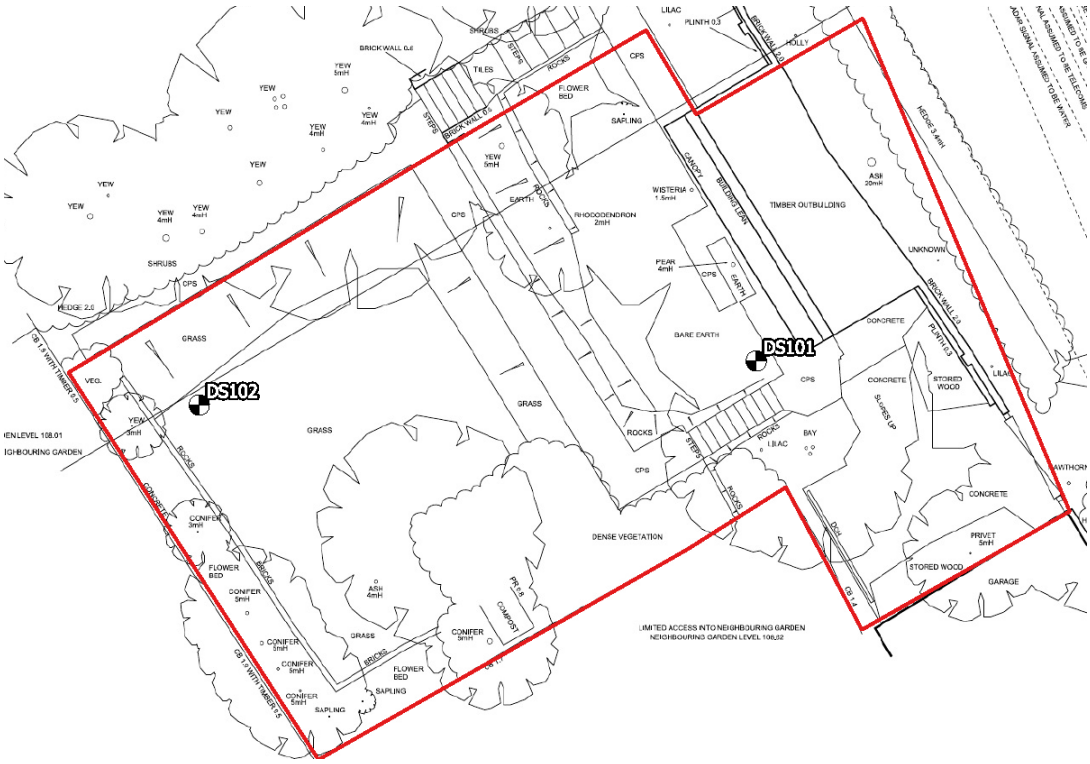

Figure 2.3 – Location of onsite testing (extracted from the Land Science report)

2.7 Existing Drainage

A schematic excerpt from Thames Water record reference ALS/ALS Standard/2022_4737453 is shown in Figure 2.4.

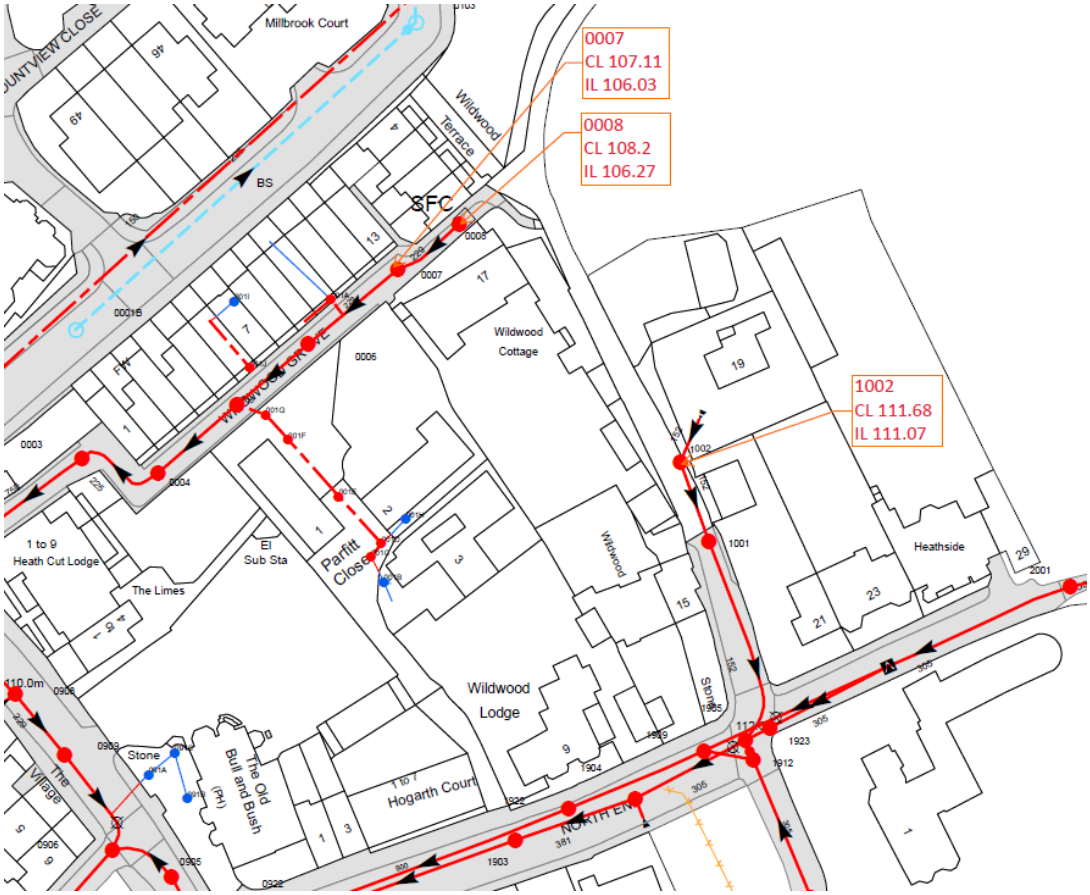

Figure 2.4 – Thames Water asset record reference ALS/ALS Standard/2022_4737453, dated October 2022

The Thames Water asset record shows that to the east and south of the site there is a combined sewer running approximately north to south along Wildwood Terrace, which joins the combined sewer running approximately east to west along North End. To the north of the site, there is a combined sewer running approximately northeast to southwest along Wildwood Grove.

Table 2.1 – Existing Thames Water manholes

Thames Water MH Ref	Location	Cover Level (m AOD)	Invert Level (m AOD)
1002 CS	Wildwood Terrace	111.68	111.07
0007 CS	Wildwood Grove	107.11	106.03
0008 CS	Wildwood Grove	108.2	106.27

A CCTV and drainage survey was carried-out by Integrum Site Services, report reference 1483, dated August 2023. The survey reported '*a private drainage system, with services collected from the rear of the existing property, into an inspection chamber IC1'*. A schematic sketch of the drainage system provided within the report is reproduced in Figure 2.5.

The report identifies '*IC1 to be 550 mm deep and takes the rear foul and surface water goods in both modern 100 mm Ø plastic and vitrified clay pipework, before flowing under the building to a manhole (MH1) assumed to be concealed within the bathroom. The line from IC1 to MH1 is 100 mm Ø vitrified clay and flows into an interceptor manhole (MH2) located at the front of the property. MH2 is 2200 mm deep and has an anti-flood valve fitted. There is a slipper in MH2 which is believed to be from further*

private manholes at the front of the property. A walkover within Wildwood Grove revealed a manhole (MHA) which appears to serve the main sewer; dye was introduced to MH2 and this could clearly be seen in MHA, thus confirming connection from the property.

The condition of the drainage system was summarised '*to be in a condition commensurate with its age and usage; with some minor and operational issues noted*'. The contents of the full report are provided in Appendix A.

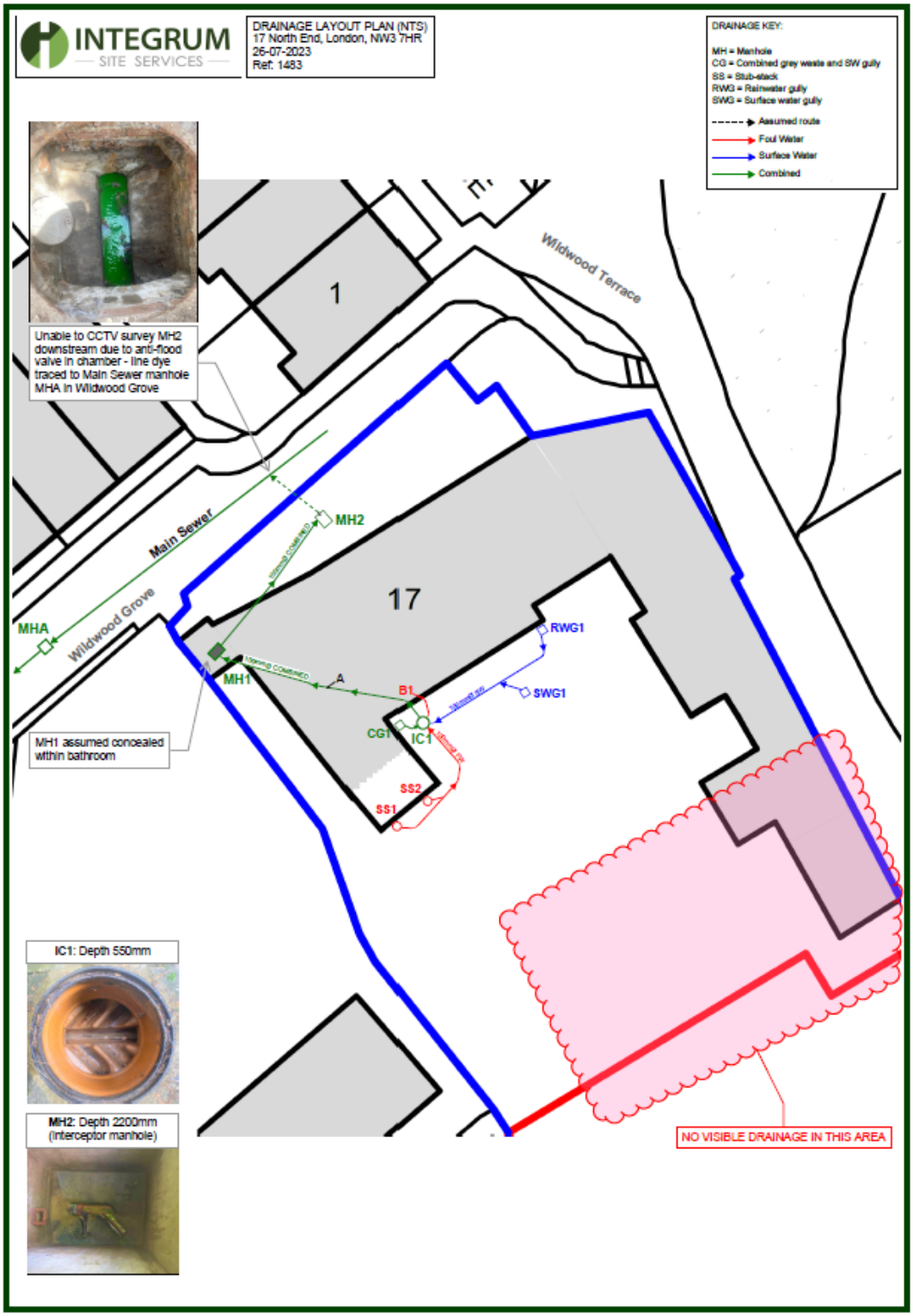

Figure 2.5 Schematic sketch of drainage layout

3 FLOOD RISK

3.1 Criteria

The flood risk elements that need to be considered for any site are defined in BS 8533- 'Assessing and managing flood risk in development Code of practice' (October 2011) as the "Forms of Flooding" which are listed as:

- Flooding from rivers (fluvial flood risk)
- Flooding from the sea (tidal flood risk)
- Flooding from the land/surface water (pluvial flood risk)
- Flooding from groundwater
- Flooding from sewers (sewer and drain exceedance, pumping station failure etc)
- Flooding from reservoirs, canals and other artificial structures

The following section reviews each of these in respect of the subject site.

3.2 Fluvial Flood Risk

The latest EA published flood zone map (Figure 3.1) shows that the site lies within Flood Zone 1, i.e. land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding.

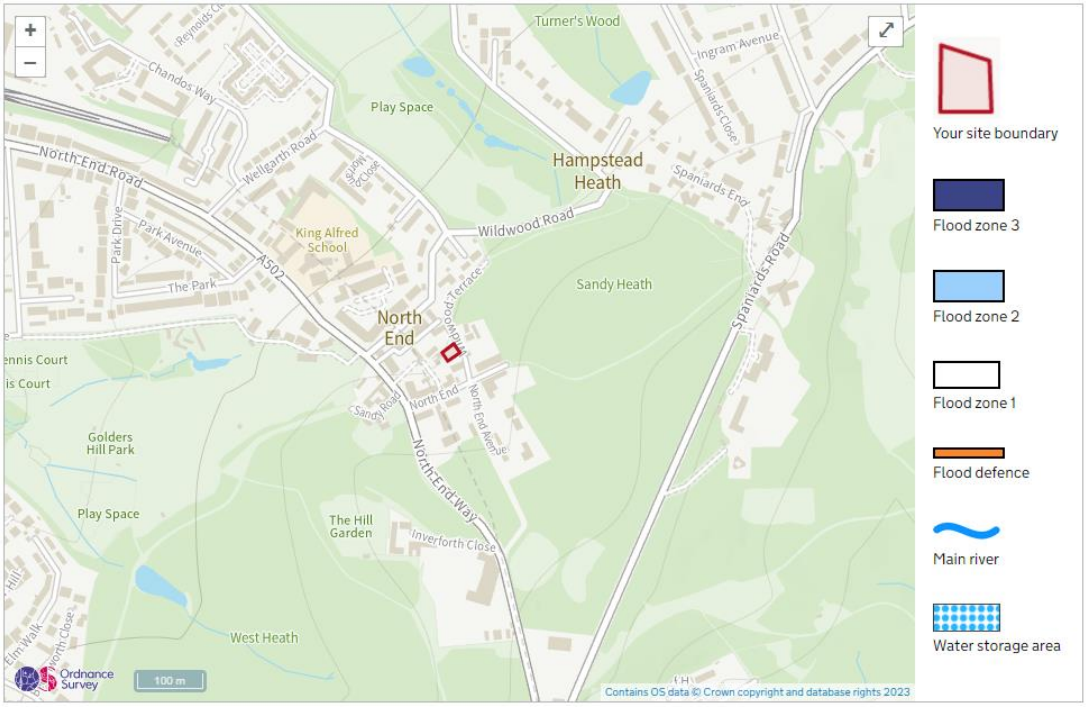

Figure 3.1 – EA fluvial flood risk map

As the site is within Flood Zone 1, there is a low risk of fluvial flooding to the site. Based on the above, the risk of flooding from rivers is considered very low.

3.3 Tidal Flood Risk

The site is located inland and approximately 9 km north of the River Thames. Therefore, there is very low risk of flooding from this source.

3.4 Pluvial Flood Risk

Surface water flooding occurs when the rainwater does not drain away through the normal drainage system or infiltrate the ground, but instead lies on or flows over the ground.

Surface water flood risk to the site has been assessed using EA mapping. The maps were produced using 'direct rainfall' modelling. Although they consider local drainage capacity, non-surface water influences such as rivers, seas or groundwater are not considered. The map is based on LIDAR topographic data which is not suitable for site specific assessment and therefore, where available, topographic survey data should be used to provide a more accurate understanding of potential flow paths.

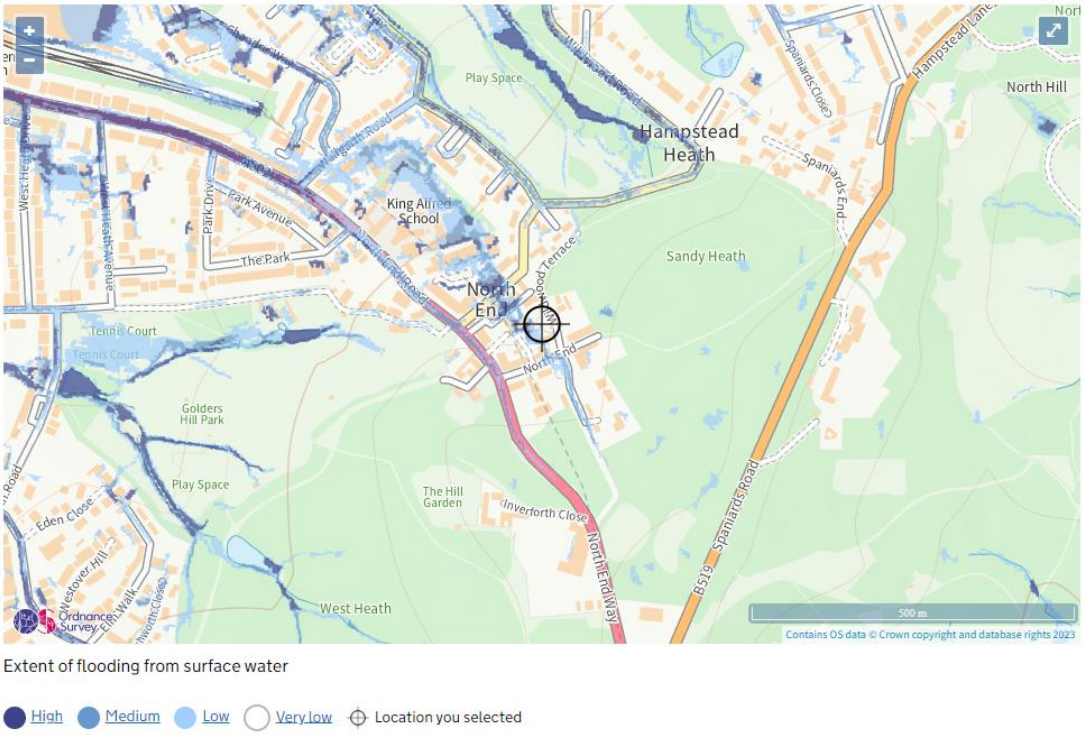

Figure 3.2 – EA mapping for surface water

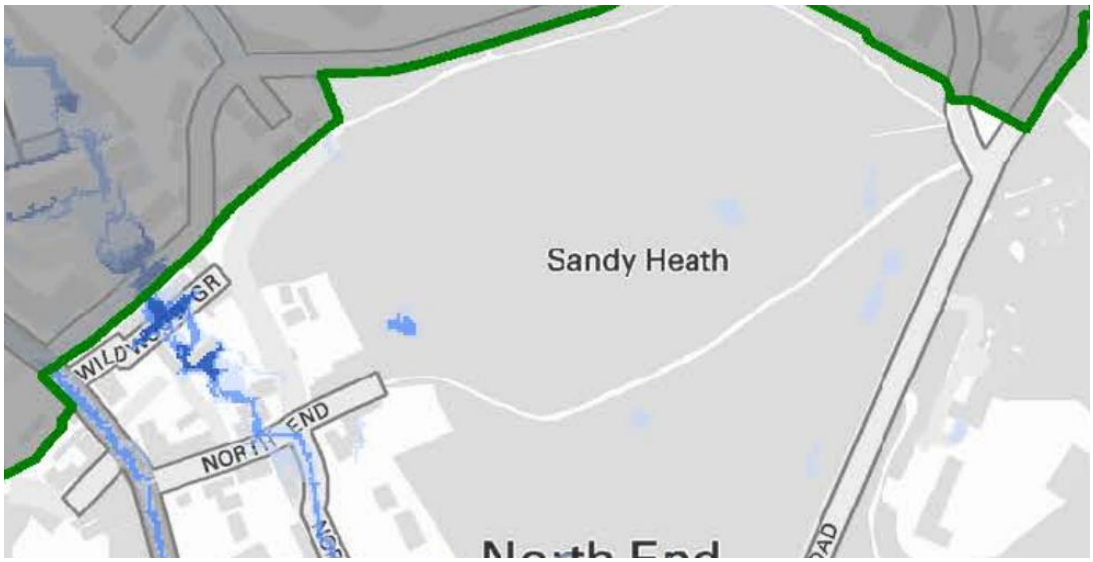

Figure 3.3 – Extract of the Figure 3iii from SFRA showing updated flood map for surface water flooding (uFMfSW) from SFRA (page 87)

EA surface water flood mapping indicates low levels of surface water flooding potentially encroaching along the southwestern edge of the site from an overland flow of surface water originating from North End Avenue to the south southeast. The information provided within the SFRA for surface water flooding for this area also indicates a similar flow path, as shown in Figure 3.3.

Based on the schematic flow paths, it appears that the surface water partially encroaching onto the site may be due to ponding where the flow passes an existing property to the west of the site. However, the extent of ponding does not extend to the area proposed for development. Furthermore, the flow path is to the west of the site boundary and would not be affected by the development. The historical flooding incident in the vicinity of site is associated with Parfitt Close and did not affect the proposed site. Hence, the risk of surface water flooding to the development is considered low.

3.5 Groundwater Flood Risk

Appraisal of BGS borehole logs from the closest available records with similar geology to the site informed that rest groundwater levels ranged from between 3.6 to 5.7 m bgl at borehole references TQ28NE258 and TQ28NE257 respectively. Figure 4e of the SFRA did not identify the site as being affected by historical groundwater flooding incidents or having elevated susceptibility to high groundwater. The onsite geotechnical investigation undertaken by Land Science recorded initial standing groundwater level to be at 3.10 m bgl and rest groundwater level 3.15 m bgl.

The proposed development includes an excavation into the existing terraced slope on site to form the back wall of the lower ground split level, to a maximum depth of 2.3 m below the upper terrace level. For the lower ground floor, the interpreted groundwater level from the onsite geotechnical investigation is approximately 1.3 m bgl. Therefore, the risk of groundwater affecting the lower ground split level is considered to be medium to high. Furthermore, it should be noted that the groundwater levels cited were based on a single measurement and therefore would not be representative of seasonal changes.

3.6 Sewer/Drainage Flood Risk

Sewer flooding is often caused by excess surface water entering the drainage system when there is insufficient sewer capacity to cope with this excess water, but also due to ‘one off’ events such as blockages.

Thames Water is the statutory undertaker for the local public sewer network. There are limited drainage networks running in the vicinity of the site and there are no adopted sewers identified within the site boundary. The SFRA Figure 5a did not identify the area as being affected by sewer flooding. The records provided by Thames Water also stated that there are no recorded incidences of sewer flooding in relation to this site. Therefore, the risk of sewer flooding to the site is considered to be low.

3.7 Reservoirs/Canal Flood Risk

The EA has produced a Reservoir Flood Map (Figure 3.4) that shows that the site is not at risk from reservoir flooding.

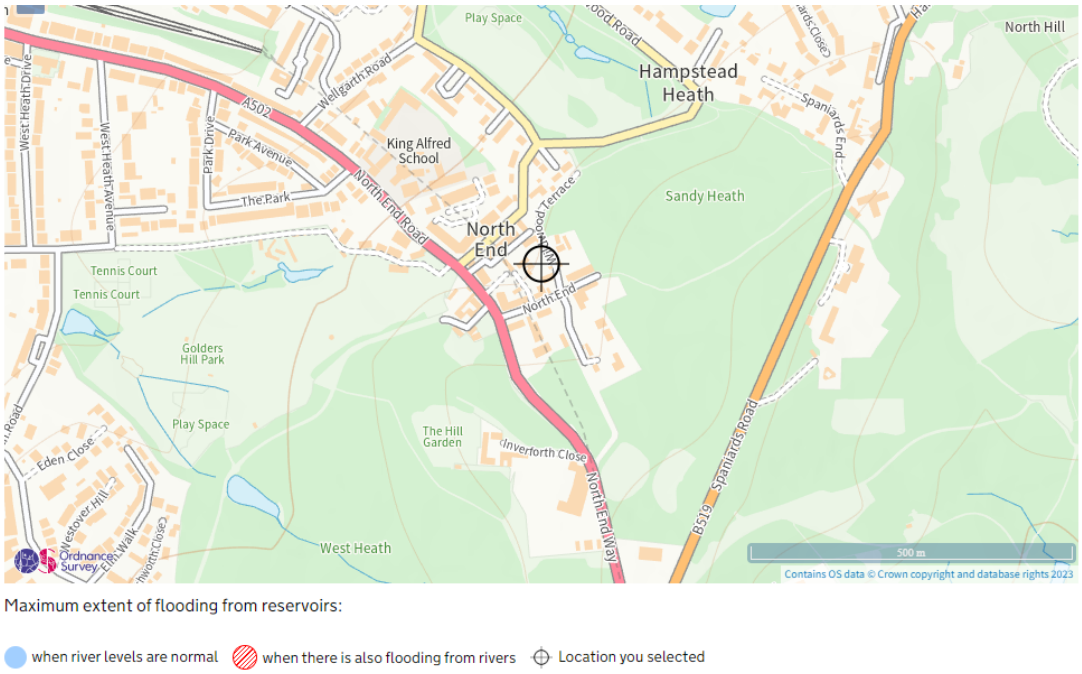

Figure 3.4 – EA reservoir flood risk map

It should also be emphasised that the risk of flooding from reservoir breach is very small since the EA is the enforcement authority for the Reservoirs Act (1975) and all large raised reservoirs are inspected and supervised by reservoir panel engineers.

On this basis, the risk from reservoir flooding to the site is considered to be negligible.

3.8 Summary of Flood Risk

The following table provides a summary of flood risk for the site.

Table 3.1 – Summary of sources of flood risk

Source of Flooding	Risk Level	Source of Data	Comments, Mitigation Requirements
Fluvial	Low	EA mapping	Flood zone 1
Tidal	Low	EA mapping	Inland location
Surface water (Pluvial)	Low	EA mapping	EA surface water flood mapping indicates low levels of surface water flooding potentially encroaching along the southwestern edge of the site from an overland flow of surface water originating from North End Avenue to the south southeast.
Groundwater	Medium /High	Onsite Geotechnical Investigation	The onsite geotechnical investigation recorded rest groundwater level to be at 3.10 m bgl for the higher region of the site towards the eastern boundary. As the proposed development includes a 2.3 m excavation to incorporate a lower ground split level, the risk of ground water flooding is considered to be medium/high. Anti floatation measures may be required for the belowground drainage arrangements. The risk associated with the groundwater level may be further assessed with additional site investigation works for the lower ground floor area.

Source of Flooding	Risk Level	Source of Data	Comments, Mitigation Requirements
Sewers	Low	Thames Water records	No recorded incidences of sewer flooding affecting the site. Therefore, the risk of sewer flooding to the site is considered to be low.
Reservoirs, Canals	Low	EA mapping	Site not affected

Key	Description
	Low/Negligible Risk – No noticeable impact to site and not considered to be a constraint to development.
	Medium Risk – Issue requires consideration but not a significant constraint to development
	High Risk – Major constraint to development requiring active consideration in mitigation proposals

4 FLOOD RISK MITIGATION

Appropriate flood mitigation measures are to be considered when developing the design for the site.

4.1 Climate Change Allowances

Appropriate climate change allowances should be applied when developing the surface water drainage design. In line with the latest government guidance, the surface water drainage design must be able to cater for a rainfall event up to and including the 1 in 100 year event + 40 % allowance for climate change at this location.

4.2 Overland Flow

EA mapping does not identify any overland flows through the site. However, the EA and SFRA maps indicate low levels of surface water flooding potentially encroaching along the southwestern edge of the site from an overland flow of surface water originating from North End Avenue to the south southeast. The surface water encroaching onto the site appears to be due to ponding where the overland flow passes an existing property to the west of the site. Care should be taken when developing the landscaping proposals to avoid alteration to levels in this area that could affect the migration of ponded surface water onto the site. Mitigation measures may be implemented as a part of the landscaping strategy to prevent surface water entering any further than the current extent into the garden area.

SuDS measures are to be provided on site to control and store the surface water as a part of the surface water design for the development, as required. Surface flows may be generated on site due to drainage capacity exceedance, which can be conveyed into the SuDS features via surface flows along the hard standing and roof areas.

Surface Water Drainage Strategy report (Ref:2023-0025-R02) provides further details on the proposed arrangements for accommodating the surface water flow paths and SuDS strategy.

4.3 Finished Floor Levels

As this site is unlikely to be affected by fluvial flooding there is no need to incorporate any freeboard levels into the finished floor levels of the design. Low lying areas that could lead to ponding of surface flows will be avoided by careful design of finished levels. If practicable, it would be beneficial to raise ground floor levels at least 150 mm above surrounding land to protect against ingress of ponded surface water or groundwater. However, consideration should be given to the access requirements and tie in levels when assessing proposed finished floor levels. The Structural Engineer may recommend further measures such as tanking lower-level walls to mitigate against the risk of groundwater.

4.4 Flood Compensation

The site is shown to be outside the 1 in 100-year climate change floodplain, so floodplain compensatory measures are not deemed necessary.

4.5 Safe Access/Egress

Flood Zone 1 refers to land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1 %) i.e. lowest risk level. As the site lies outside of the 1 in 1,000-year flood extent, safe access and egress will be available up to this extreme storm event.

5 PLANNING CONTEXT

5.1 Land Use Vulnerability

Table 3 of the Planning Practice Guidance (PPG) indicates the compatibility of various land uses in each flood zone, dependent on their vulnerability to flooding. Figure 5.1 below is reproduced from Table 3 of PPG.

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

Key: ✓ Development is appropriate.
× Development should not be permitted.

Figure 5.1 – Table 3 of PPG detailing Flood Risk Vulnerability Classification

Annex 3 of the PPG classifies 'Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels' as more vulnerable. This classification of development is appropriate for areas within Flood Zone 1 and therefore appropriate for the subject site.

5.2 Sequential Test

The Sequential Test aims to direct new development to areas with the lowest probability of flooding. The site has been identified as located within Flood Zone 1.

The risk associated with groundwater can be mitigated with appropriate measures incorporated to the structural and civil engineering design for the scheme, such as tanking the lower ground floor structure and providing anti floatation measures for the drainage network. It is therefore considered to pass the Sequential Test.

5.3 Exception Test

In accordance with Table 3 of PPG, there is no requirement to apply the Exception Test for a 'more vulnerable' development within Flood Zone 1.

6 CONCLUSION

This FRA has been undertaken for the proposed development at 17 North End, London NW3 7HR. The site covers approximately 0.05 ha in area and currently contains a shallow stone retaining wall separating two levels. The upper terrace contains a timber outbuilding with hard landscaping and the lower terrace contains a lawn and vegetable beds.

This FRA complies with the NPPF and Planning Practice Guidance and demonstrates that flood risk from all sources has been considered in relation to the proposed development. It is also consistent with the Local Planning Authority requirements with regards to flood risk.

The proposed development site lies in an area designated by the EA as Flood Zone 1, and is outlined to have a chance of fluvial flooding of less than 1 in 1,000 (<0.1 %) in any year. A summary of the flood risk and any associated mitigation measures are summarised in Table 6.1.

Table 6.1 – Flood risk summary

Source of Flooding	Risk Level	Mitigation
Fluvial (Fluvial)	Low	N/A
Tidal	Low	N/A
Surface water (Pluvial)	Low	Maintain the existing boundary ground levels where the site is affected by low levels of surface water flooding, to avoid affecting the existing flow path to the west of the site. Landscaping can be utilised to further mitigate against ponded surface water egress beyond the current extent.
Groundwater	Medium-High	If possible, raise ground levels by 150 mm compared to the surrounding ground to mitigate against ponded surface water or groundwater. Follow Structural Engineer's recommendations for the groundwater mitigation measures for the lower level. Provide anti floatation measures for the belowground drainage network as required. Additional site investigation works may be required in the lower ground floor area to further assess the groundwater levels and associated risk.
Sewers	Low	N/A
Reservoirs, Canals	Negligible	N/A

The surface water drainage design for the site is to be developed in line with the LLFA requirements and applying appropriate mitigation factors. The LLFA requires a system that caters for a 1 in 100-year rainfall event + 40 % allowance for climate change. This is to be addressed as a part of the surface water drainage strategy for the scheme.

Overall, taking into consideration the content of this report, the development of the site should not be precluded on flood risk grounds.