

WE ARE SYMMETRYS

FLOOD RISK ASSESSMENT AND SUDS REPORT

139 CRANLEY GARDENS
LONDON
N10 3AH

21066-SYM-XX-XX-RP-C-0001



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REVISION HISTORY

Revision	Description	Date	By	Checked
A	Issue for Planning Submission	03/05/23	YP	RF
B	Updated for Planning Submission	09/08/23	YP	RF



1.0 Executive Summary

- 1.1 The site is located in 139 Cranley Gardens, Haringey, London, N10 3AH.
- 1.2 The proposed development consists of basement extension to implement a new gym, swimming pool, sauna room, plant room and bathroom.
- 1.3 The site is classified as 'More Vulnerable', in accordance with the National Planning Policy Framework.
- 1.4 The site is located in Flood Zone 1 and is in an existing residential area. The development should fulfil the requirements of the Sequential Test.
- 1.5 An Exception Test is not required as the 'More Vulnerable' development lies within Flood Zone 1.
- 1.6 The site lies within a Critical Drainage Area as identified by The LB of Haringey SWMP (Surface Water Management Plan)
- 1.7 The overall flood risk to the site is assessed as 'Medium', associated with surface water and sewer failure flooding mechanisms.
- 1.8 The proposed drainage strategy for the development would provide adequate water management for the site.
- 1.9 An assessment of the feasibility of the sustainable urban drainages (SuDS) has been conducted in accordance with the London Plan's drainage hierarchy.
- 1.10 The introduction of permeable paving will reduce discharge rates by minimum 56%.
- 1.11 The inclusion of flood resistant, resilience and mitigation techniques stated in this Flood Risk Assessment reduce the impact of flooding to 'low' from all sources.
- 1.12 To be read in conjunction with BIA Report 21066-SYM-XX-XX-RP-S-0001.

2.0 Introduction

- 2.1 This site-specific Flood Risk Assessment (FRA) has been prepared for the proposed works, which consists of a basement extension to implement a new gym, swimming pool, sauna room, plant room and bathroom.
- 2.2 The proposed development is within a Critical Drainage Area (CDA) hence the purpose of this FRA is to provide information regarding the potential flood risk hazards affecting the site and demonstrate that the development is safe for its intended use.
- 2.3 This FRA has been prepared with reference to the National Planning Policy Framework (NPPF, 2021) and the National Planning Practice Guidance (NPPG, 2022), Haringey Council Strategic Flood Risk Assessment (SFRA) and Surface Water Management Plan (SWMP)

3.0 Scope of Flood Risk Assessment

3.1 National Planning Policy Framework (NPPF)

- 3.1.1 The National Planning Policy Framework (NPPF) was published in March 2012 and sets out the government's planning policies for England and how they are expected to be applied. Chapter 14 'Meeting the challenge of climate change, flooding and coastal change' deals with planning for a low carbon future, taking full account of flood risk and coastal change.
- 3.1.2 Paragraph 161-163 of the NPPF states that all plans should apply a sequential, risk-based approach to the location of the development and manage any residual risk by considering a sequential test, and if necessary, an exception test. The sequential test aims to steer new development to areas with the lowest risk of flooding from any source. If this is not possible, the exception test may have to be applied.
- 3.1.3 Paragraph 167 of the NPPF states that when determining any planning application, the Local Authority should ensure flood risk is not increased elsewhere and, where appropriate, be supported by a site-specific flood risk assessment. In areas at risk of flooding, development should only be allowed if it can be demonstrated that (and in light of the sequential and exception tests, as applicable):

(a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location.

(b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment.

(c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate.

(d) any residual risk can be safely managed; and

(e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

- 3.1.4 Footnote 55 in the NPPF states that a site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.
- 3.1.5 The national planning practice guidance to the NPPF was launched as a web-based resource in March 2014 The category dealing with flooding is contained in Flood Risk and Coastal Change, updated in August 2022.
- 3.1.6 Paragraph 30 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-030-20140306) advises that a site-specific flood risk assessment is carried out to assess the flood risk to and from a development site. The assessment should demonstrate how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its users.
- 3.1.7 Paragraph 2 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-002-20140306) advises that "flood risk" is a combination of the probability and the potential consequences of flooding from all sources - including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers, and drainage systems, and from reservoirs, canals and lakes and other artificial sources.
- 3.1.8 Paragraph 020 (Reference ID: 7-020-20220825) of the Flood Risk and Coastal Change Planning Practice Guidance gives a checklist for site-specific flood risk assessments and provides the basis of the scope of this FRA.

3.2 Department for Environment, Food & Rural Affairs (DEFRA) and Environment Agency (EA) Guidance

- 3.2.1 Paragraph 32 of the NPPF states that applicants for planning permission (or prior approval in the case of certain permitted development rights) will find the Environment Agency's advice on assessing flood risk for planning applications helpful when preparing a site-specific flood risk assessment for, and before designing, a development that raises lower risk concerns.
- 3.2.2 Guidance from the Department for Environment, Food & Rural Affairs (DEFRA) and Environment Agency (EA), published on the Government's GOV.UK website, includes guidance on how to carry out a flood risk assessment entitled: 'Flood risk assessment in flood zones 2 and 3', 'Flood risk assessment in flood zone 1 and critical drainage areas', and 'Preparing a flood risk assessment: standing advice'. The guidance provides information on the range of factors that need to be considered when assessing flood risk.
- 3.2.3 For Flood Zone 1, the Environment Agency is to be consulted if the development is:
 - (a) within 20m of a main river on the Environment Agency flood map.
 - (b) in an area with critical drainage problems, other than minor development, as classed in the legislation.gov.uk website.
- 3.2.4 Based on the guidance detailed above, the EA has not been consulted for the purposes of this Flood Risk Assessment.



3.3 Level 1 Strategic Flood Risk Assessment (SFRA)

3.3.1 Paragraph 160 of the NPPF states:

“Strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards.”

3.3.2 A SFRA was prepared by JBA Consulting on behalf of the London Boroughs of Haringey, dated February 2015. The SFRA provides an overview of flood risk from all sources including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers, and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

3.3.3 The SFRA states the following requirements for development proposals:

- show development is not at risk of flooding or is compatible with the residual risk.
- not increase flood risk elsewhere, taking into account the impacts of climate change.
- not increase surface water peak flow rates or runoff volumes above green field levels including an allowance for climate change, as this would result in an increased flood risk to the receiving catchments.
- not increase the risk of groundwater flooding elsewhere or change the hydrogeological regime of the area.
- the location of basement development should be carefully considered within the LB of Haringey and attention should be paid to all sources of flood risk early within the planning process for new development (including the impact of potential future subterranean works that fall under permitted development).
- wherever possible use the opportunities offered by new development to reduce flood risk within the site and elsewhere.
- ensure that where new development is necessary in areas of flood risk (in exceptional circumstances); it is made safe from flooding for the lifetime of the development, taking into account the impacts of climate change. This includes consideration of the potential effect of residual risks.

3.3.4 The following requirements should be included in the FRA.

- There shall be no self-contained basement developments located in areas of fluvial pluvial or groundwater flood risk. Any self-contained developments located in an area shown on the National Reservoir Inundation Maps should include within their FRA, an emergency evacuation plan and should be designed to withstand the forces that might be encountered during breach event of reservoir or flood defences.
- Any development including, basement extensions, shall include within their FRA evidence that flood risk from fluvial, pluvial and groundwater sources are not increased to the development site itself and to third parties.
- Surface water discharge from proposed development sites should mimic that of a present-day green field site, up to and including a 1:100 AEP critical storm event including an allowance for climate change. Green field runoff rates should be maintained irrespective of whether the site falls within an area designated as being affected by flood risk from any source.
- It is critical that the onsite drainage models should demonstrate that there is no increased flood risk to third parties. Use SuDS measures wherever practical and achieve 50% attenuation of undeveloped site's surface water runoff at peak times. Exemplar SuDS schemes, should consult.

4.0 Proposed Site and Location

4.1 The site is located in Cranley Gardens, Haringey. The postcode is N10 3AG and an approximate Ordnance Survey grid reference is 529257, 189072.

4.2 The current site is occupied by a 2 -storey house, an outbuilding for gym use at the rear, a football pitch and grass and paved areas. The total site area is circa 595 sqm, location is shown on Figure 1, below.



Figure 1. Site Location

5.0 Existing Development

5.1 Existing Drainage

5.1.1 An asset map has been obtained from Thames Water. it shows two 300 dia and 1143X763 foul and surface water sewers and a 305 dia surface water sewer running along Cranley Gardens. The smaller foul network is circa 2.5m deep and connects into the bigger sewer, which depth his unknown. The surface water sewer is circa 4m deep. Extract is shown in Figure 2 below, and maps are included in Appendix A.



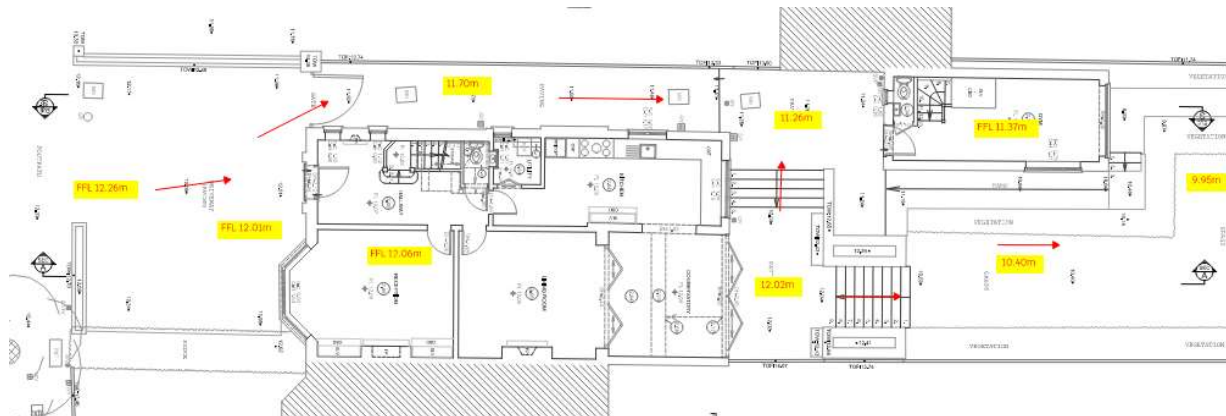
Figure 2. Thames Water Asset Map



- 5.1.2 A CCTV Drainage Survey was carried out by Cleverworks on 31st August. A combined connection to the foul sewer was identified. Connections from neighbouring properties into the private drainage were also exposed.
- 5.1.3 Connections from the neighbours into the private drainage and are assumed to be lateral drains and therefore to be maintained by Thames Water. A buildover agreement application is required at next stage.
- 5.1.4 The connection into the sewer is considered a public sewer and is also subject to A buildover agreement application to Thames Water.
- 5.1.5 CCTV Report can be found in appendix F.

5.2 Existing Levels

- 5.2.1 A topographical survey was completed in March 2021 by Metro Plans. Drawing can be found in Appendix B
- 5.2.2 Internal floor level is circa 12.06m. External levels are slightly higher along the footpath, 12.18-12.26m and they ramp down towards the rear of the building, where levels are circa 11.24m. There are steps down to the garden area, circa at 10.50m, sloping down toward the football pitch, where the lowest level is 9.85m.



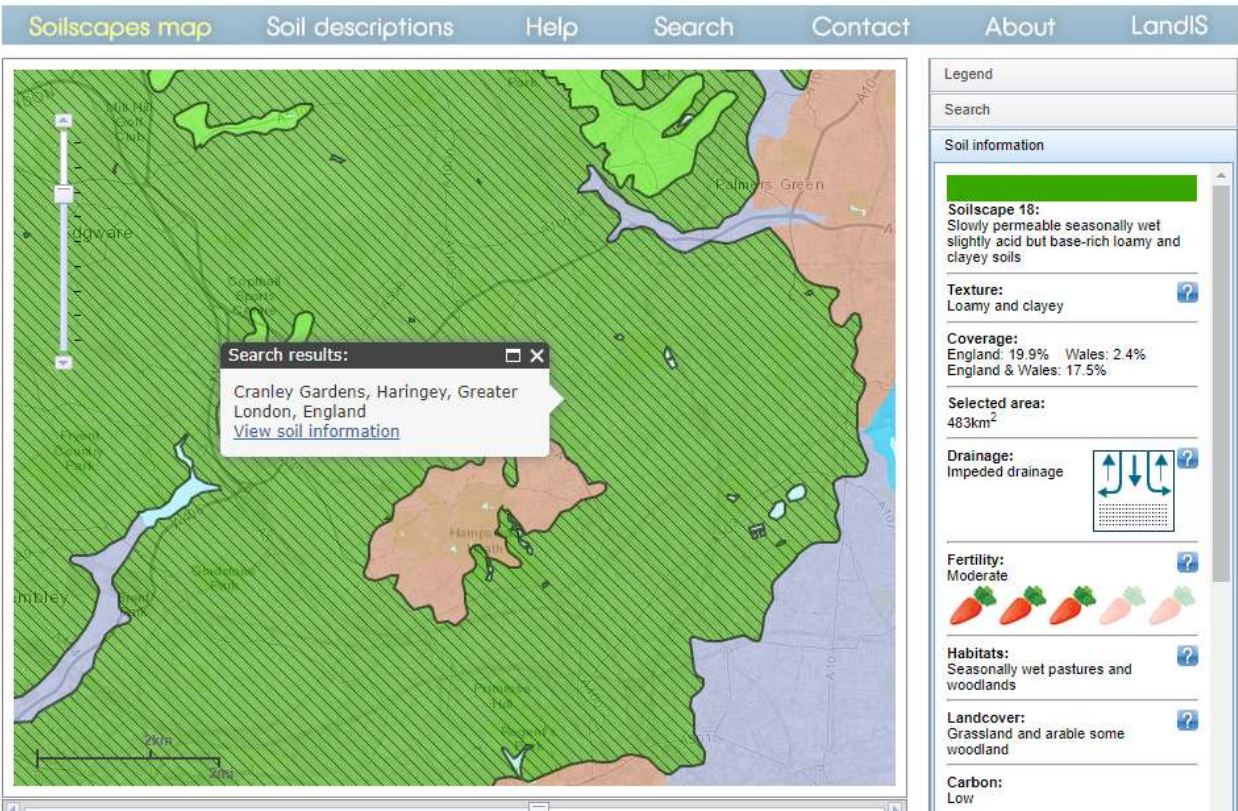


Figure 5. Soilscape Map

- 5.3.5 Source Protection Zones (SPZs) are used to provide additional protection to safeguard drinking water quality through constraining the proximity of an activity that may impact upon a drinking water abstraction. From the Environment Agency's Source Protection Zones dataset on the MAGIC website, the site is not located within a SPZ1. This zone is defined by a travel time of 50-days or less from any point within the zone at, or below, the water table. Additionally, the zone has as a minimum a 50-metre radius. It is based principally on biological decay criteria and is designed to protect against the transmission of toxic chemicals and water-borne disease.
- 5.3.6 Aquifer designation maps dataset identifies different types of aquifers – underground layers of water-bearing permeable rock or drift deposits from which groundwater can be extracted. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems. The site is at an unproductive area.
- 5.3.7 The Groundwater Vulnerability Maps show the vulnerability of groundwater to a pollutant discharged at ground level based on the hydrological, geological, hydrogeological and soil properties within a single square kilometre. The site is not in area of vulnerability.

6.0 Proposed Development

- 6.1 The proposal consists of a basement extension to implement a new gym, swimming pool, sauna room, plant room and bathroom.

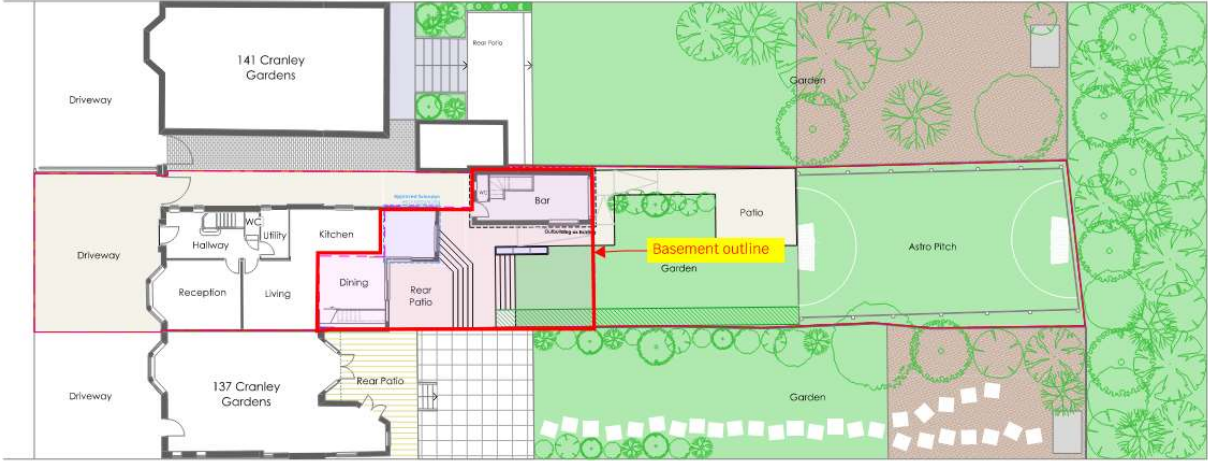


Figure 6. Site plan

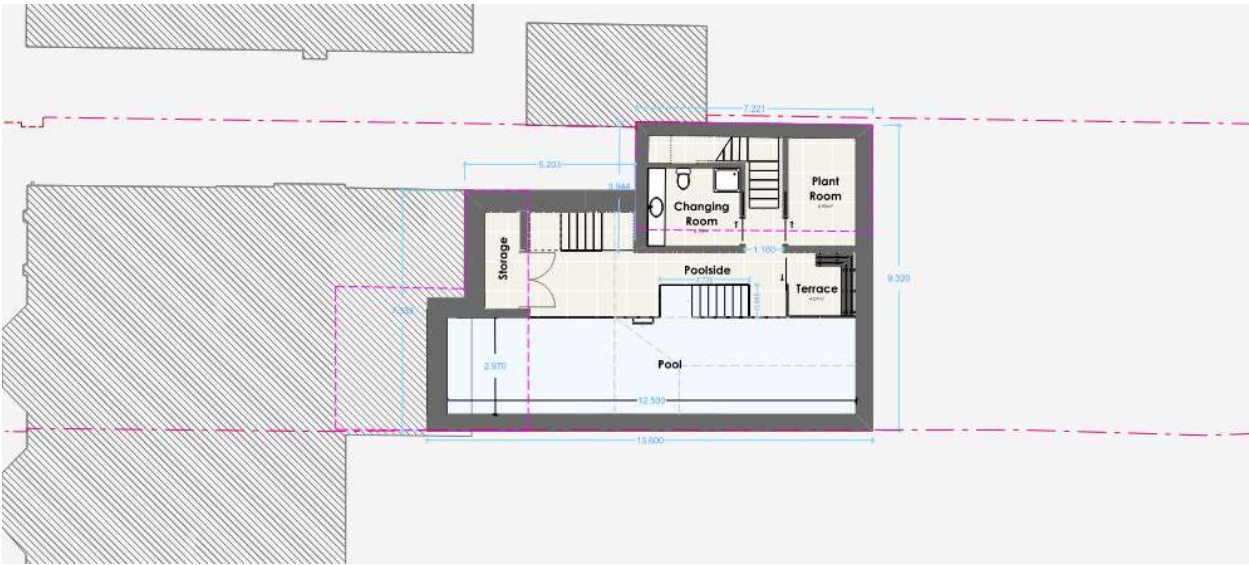


Figure 7. Basement Plan

- 6.2 The footprint of the basement works has a total area of circa 120sqm.
- 6.3 Architectural layouts can be found in BIA Appendix A – Stage 2 Drawings

7.0 Flood Risk Vulnerability and Flood Zone 'Compatibility'

- 7.1 Paragraph 077 (Reference ID: 7-077-20220825) of the Flood Risk and Coastal Change Planning Practice Guidance contains in Annex 3: Flood risk vulnerability classification. With reference to Table 2, the proposed development falls into the 'More vulnerable'. A copy of the More Vulnerable classification from the Table is reproduced below:

NPPG Annex 3: Flood Risk Vulnerability Classification – More Vulnerable

Hospitals
Residential institutions such as residential care homes, children’s homes, social services homes, prisons, and hostels
Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs, and hotels
Non-residential uses for health services, nurseries, and educational establishments
Landfill* and sites used for waste management facilities for hazardous waste
Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan

Figure 8. NPPG Annex 3

7.2 With reference to Paragraph 079 (Reference ID: 7-079-20220825) Table 2: Flood risk vulnerability and flood zone ‘compatibility’, ‘More Vulnerable’ developments in Flood Zone 1 is appropriate. A screenshot of Table 3 is given below:

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
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.

Figure 9. NPPG Table 2

7.3 The Sequential Test and Exception Test

7.4 For developments in areas identified as being at risk of any source of flooding now or in the future a sequential is required, Paragraph: 033 (Reference ID: 7-033-20220825) states that if the exception test is not required and the development is made safe through its lifetime, without increasing flood risk elsewhere, the development is appropriate.

7.5 SFRA Basement Development Guidance

7.5.1 Table 6-2 included in the SFRA and shown in Figure 6 describes the basement property type and recommends whether a type is suitable depending on its location in the Environment Agency Flood Zones, the LB of Haringey SWMP surface water maps and the iPEG maps.

Property Type	Type of Development	Fluvial				LB of Haringey SWMP Surface Water Maps				Reservoir	Groundwater
		FZ3a	FZ3b	FZ2	FZ1	30yr > 0.1m	30yr > 0.3m	200yr > 0.1m	200yr > 0.3m	NRIM	Permeable Superficial Deposits
Type 1	Self Contained Basement Dwelling	✗	✗	✗	✓	✗	✗	✗	✗	✓ (i) (ii)	✗
	Permitted Development Basement is less than 3 metres depth and does not extend beyond the footprint of the original building	✓ (i)	✗	✓ (i)	✓ (i)	✓ (i)	✓ (i)	✓ (i)	✓ (i)	✓ (i) (ii)	✓ (i)
Type 2	Householder Application Larger than the dimensions of permitted development: greater than 3 metres in depth and extends beyond 3-4 metres outside of the footprint of the original building.	✗	✗	✓	✓	✓	✓	✓	✓	✓ (ii)	✓
Type 3	New Building [Usually a new house] One level basement below footprint of the new house and less than 4 metres beyond the rear main wall of the building.	✗	✗	✓	✓	✓	✓	✓	✓	✓ (ii)	✓
Type 4	New Building with basement excavation Boundary to boundary excavation and/or more than one level and projecting beyond the building footprint of the original building.	✗	✗	✓	✓	✓	✓	✓	✓	✓ (ii)	✓
✗	Development should not be permitted										
✓	The LB of Haringey should, as a minimum maintain a register in conjunction with Building Control of subterranean development that falls under permitted development rights, existing and proposed, to monitor the potential cumulative impact of subterranean development on the drainage regime. Prior to commencement of construction on basement development, assessments shall be submitted and approved by the London Borough of Haringey to demonstrate: - There are suitable assessments to demonstrate there is no risk from surface water, groundwater and/or fluvial flooding. - Basement extensions in flood risk areas do not contain sleeping accommodation. - There is an internal access to upper levels from the basement extension.										
ii	It is recommended that regulation of basement development be applied through the building control process.										
iii	If the proposal lies within a RfM outline a reservoir breach analysis should be included in a FRA. RfM outlines can be found at http://www.environment-agency.gov.uk/homeandbusiness/floods/default.aspx										
	The LB of Haringey should, as a minimum maintain a register in conjunction with Building Control of subterranean development that falls under permitted development rights, existing and proposed, to monitor the potential cumulative impact of subterranean development on the drainage regime.										
✓	A FRA appropriate to the size and scale of the basement extension will be required to support the planning application.										
✓	A FRA appropriate to the size and scale of the basement extension will be required to support the application, the FRA should be able to demonstrate that there will be no increase in surface water run off as a minimum, with an aim to reduce the overall surface water run off from the proposed development.										
✓	There should be no sleeping accommodation in the basement extension and internal access can be provided to upper levels. A FRA must be submitted for approval. In addition, it should be shown that there is egress from the development to an area outside of National Reservoir Foundation mapped flood outline.										
✓	The FRA will need to demonstrate that the basement extension does not impact upon the existing hydro-geological regime and that flood risk from groundwater is not increases to the development or to third parties.										

Figure 10. Basement and Flood risk

7.6 Figure 6 that in FZ1 basement development is appropriate subject to findings of the FRA. In case of risk from flooding from reservoirs no sleeping accommodation is allowed, but this risk is not relevant to the site.

8.0 Climate Change

8.1 The NPPF requires development to take account of the impacts of climate change. The allowances to be made for climate change effects when assessing flood risk are related to the lifetime of the development.

8.2 Guidance from the Environment Agency titled ‘Flood risk assessments: climate change allowances’ was published in February 2016. Climate change allowances are predictions of anticipated change for peak river flow, peak rainfall intensity, sea level rise, offshore wind speed and extreme wave height. There may be circumstances where local evidence supports using other data or allowances. Climate change allowances are set out below.

8.3 Peak River Flow Allowances

8.3.1 Peak river flow allowances show the anticipated changes to peak flow based on the site’s management catchment. The site lies in the London Management Catchment (Department for Environment Food and Rural Affairs, 2022). However, the site is in Flood Zone 1, as shown in Figure 7 below, and has a ‘low’ probability of flooding from rivers and the sea and therefore peak river flow allowance are not relevant.



Figure 11: EA Flood Zone Map

8.4 Peak Rainfall Intensity Allowances

- 8.4.1 Drainage systems need to be designed to make sure there is no increase in the rate of runoff discharged from the site for the upper end allowance. As a minimum, there should be no significant flood hazard to people from on-site flooding for the central allowance. According to the Environment Agency guidance on climate changes allowances, for developments with a lifetime of beyond 2100, FRAs should consider the upper end allowance for both the 1.0% and 3.3% annual exceedance probability events for the 2070s epochs (2061-2125).

Range	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper End	10%	20%	40%
Central	5%	10%	20%

Figure 12. Peak rainfall intensity allowance in small catchments (less than 5km2) or urban drainage catchments (based on a 1961 to 1990 baseline) shows the total potential change anticipated for the 2080s (2070 to 2115) is 20% for the central category and 40% for the upper end category.

9.0 Site Specific Flood Risk

9.1 Flooding from Rivers and Sea

- 9.1.1 Fluvial flooding is caused by rivers, watercourses or ditches overflowing. It can also be caused by excessive snow melt or exacerbated by high tides and storm surges for rivers with tidal influences.
- 9.1.2 The Environment Agency's Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences, and show the extent of the natural floodplain and the additional extent of an extreme flood. In Flood Zone 1 ("Low Probability"), there is a less than 1 in 1000 chance of river and sea flooding occurring each year.

- 9.1.3 The Environment Agency's Flood Map for Planning, reproduced in Figure 9 and contained in Appendix #, indicates that the site is unaffected by any floodplain and falls entirely within Flood Zone 1 where flooding from rivers and the sea is very unlikely.



Figure 13: EA Flood Map for Planning

- 9.1.4 The probability of flooding from rivers and sea is assessed as 'Very Low'.

9.2 Flooding from Surface Water

- 9.2.1 Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead, resulting in overland flow or ponding. Overland run-off follows the gradient of the land, whereas ponding occurs when overland flows reach low lying areas. These flood events tend to have a short duration and depend on factors such as geology, topography, rainfall, saturation, extent of urbanisation and vegetation.

9.2.2 The Environment Agency's Risk of Flooding from Surface Water map for the proposed development, taken from the GOV.UK website, is shown in Figure 9, below. It shows the site being in an area of 'Medium' risk of flooding from surface water.

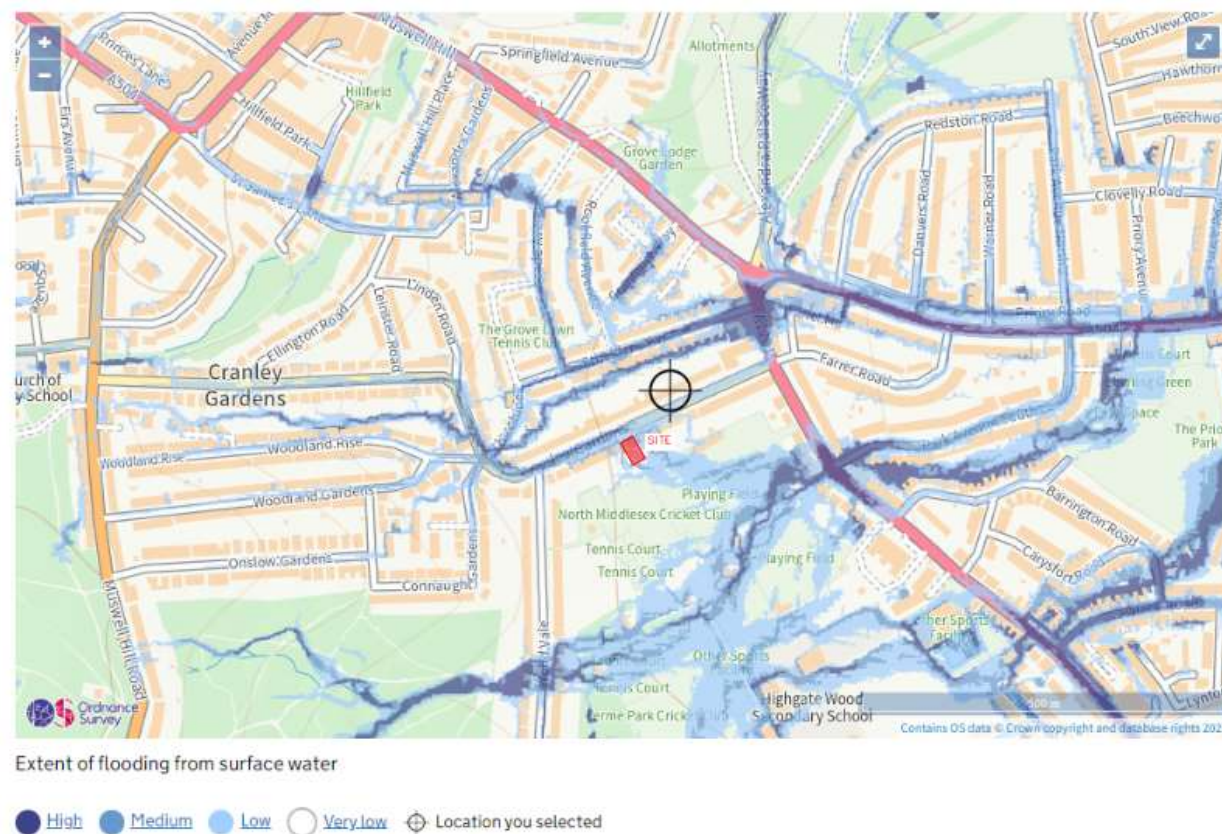


Figure 14: Surface Water Flooding – Extent

For this medium risk scenario, associated with storm events with a probability between 1 and 3.3% (1 in 100 and 1 in 30) the estimated flood depth is maximum 300mm.

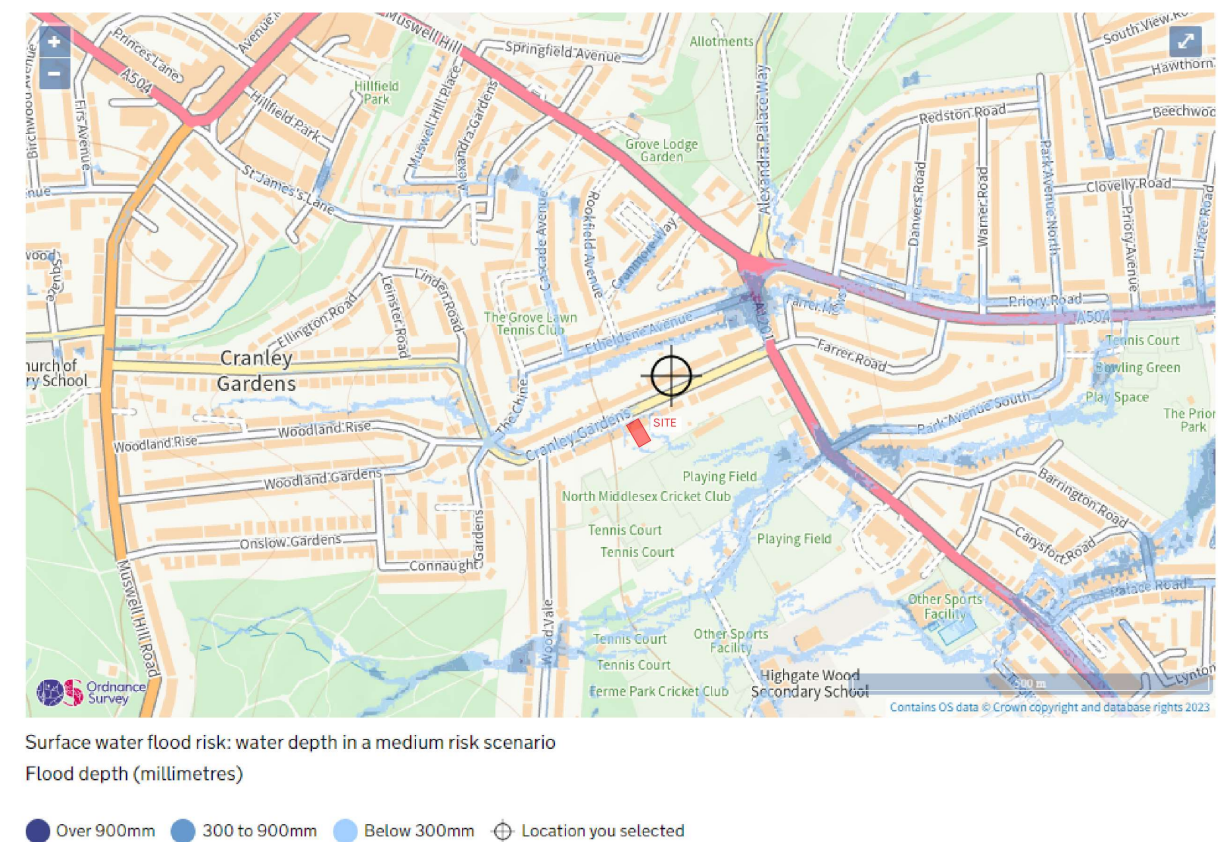


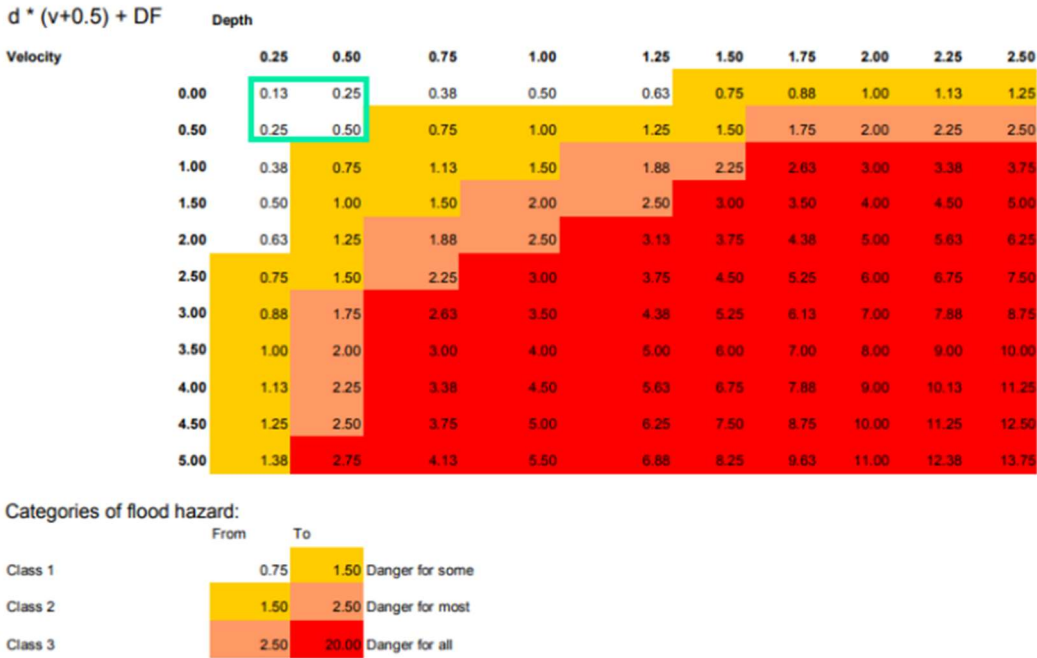
Figure 15: Medium risk flood depth

Water velocity maps values of $>0.25\text{m/s}$, with flows west to east following the local topography.



Figure 16. Medium risk flood velocities

9.2.3 The Department for Environment, Flood & Rural Affairs (Defra) and the Environment Agency (EA) published FD2321/TR2; a guidance document which provides a study on the combinations of flood depths and velocities that cause danger to people. The results are reproduced in Figure 17, below. It shows that at 300mm and velocities of 0.25 m/s, the category of flood hazard is less than Class 1 – *Danger for some*.



Note: The table gives values of flood hazard (= $d \cdot (v+0.5) + DF$)

Figure 17. FD2321/TR2 Figure 2.1 Combinations of flood depth and velocity that cause danger to people (Defra/EA, 2006)

- 9.2.4 The LB of Haringey SWMP completed an analysis of the number of properties at risk of flooding for the 1 in 100-year rainfall event and reviewed the potential number of properties with surface water flooding of a depth greater than 0.03m. A review of the numbers of properties affected coupled with local knowledge of the study area identified 9 Critical Drainage Areas.
- 9.2.5 As shown in Figure 18 below, the site is within CDA Group_055

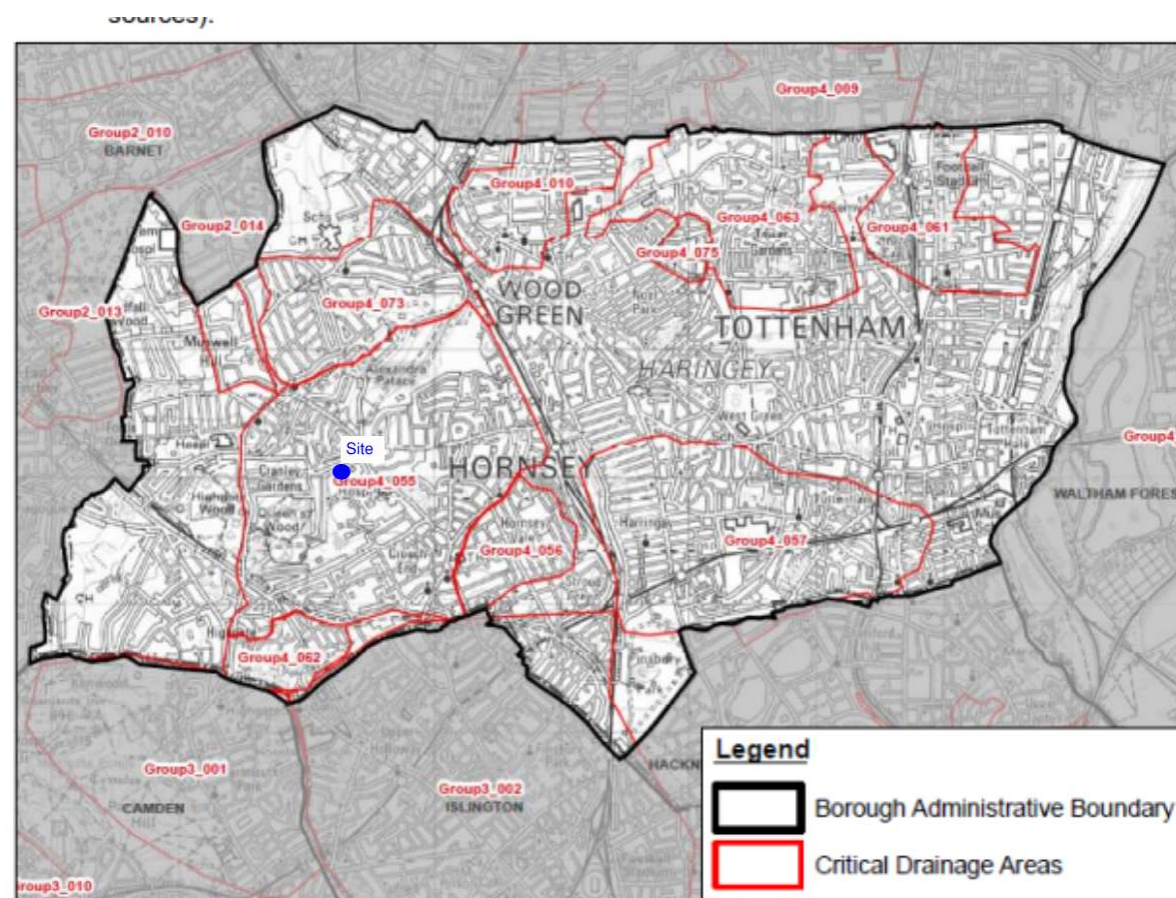


Figure i Critical Drainage Areas within the London Borough of Haringey

Figure 18. Critical Drainage Areas

9.2.6 A review of the low-risk flood scenario, for rainfall events with a probability of less than 1% (1 in 100) concludes that in flow depths are mostly up to 300mm in the property.

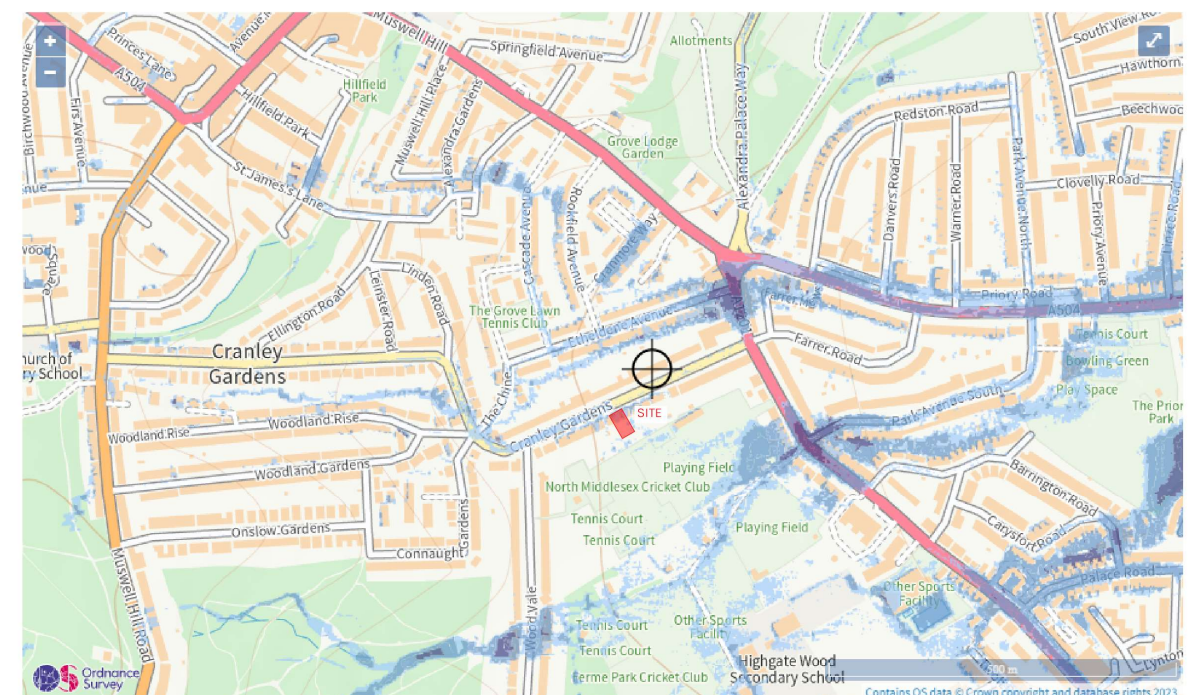
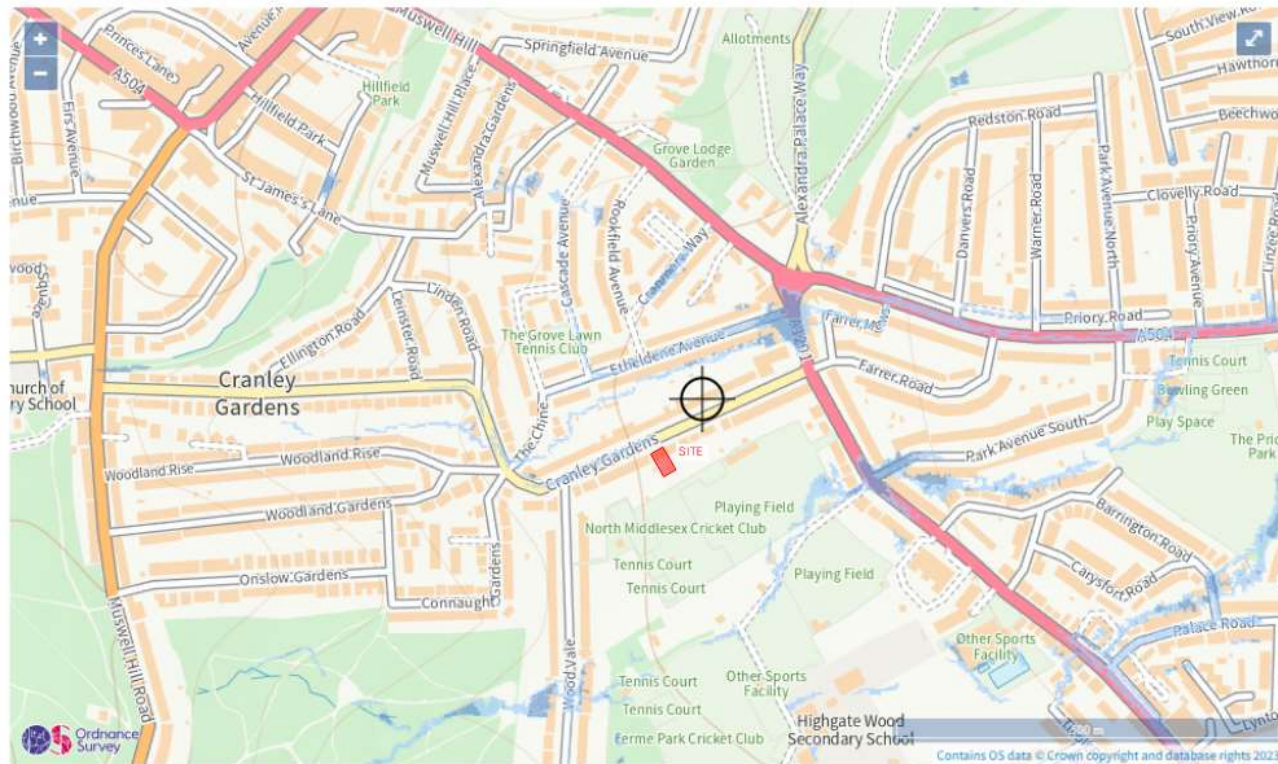


Figure 19. Low Risk Flood scenario

For the high-risk scenario, flood is contained to the road and has not impact on the property.



Surface water flood risk: water depth in a high risk scenario

Flood depth (millimetres)

● Over 900mm ● 300 to 900mm ● Below 300mm ⊕ Location you selected

Figure 20. High Risk flood scenario

9.2.7 The flood distribution is consistency among the EA Surface Water Maps and the SWMP.

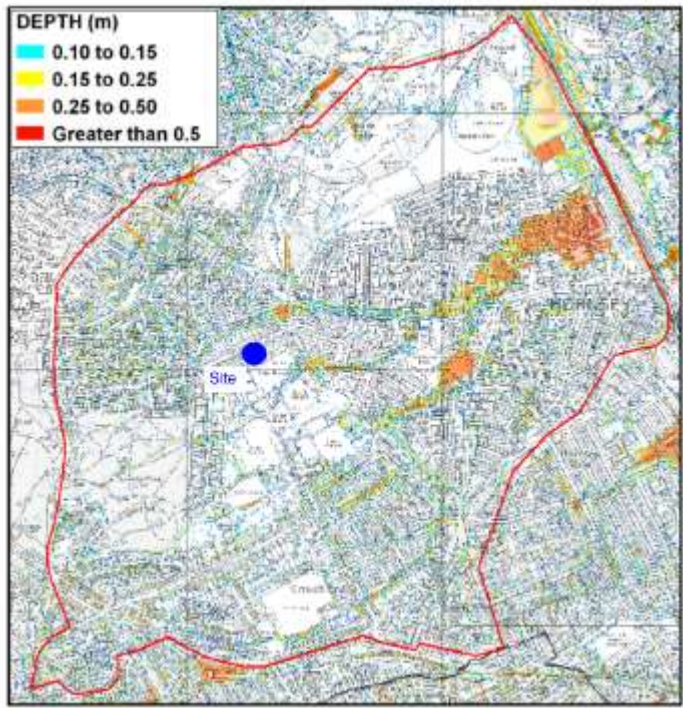


Figure 21. Surface Water flood depth form SWMP

9.2.8 As a result of further consideration of the mapping, the probability of flooding from surface water is considered to be 'Medium to Low'.

9.3 Flooding from Groundwater

9.3.1 Groundwater flooding occurs as a result of water rising from the underlying rocks or water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. In low-lying areas, the water table is usually at shallower depths, so during very wet periods, all the additional groundwater flowing towards these areas can cause the water table to rise to the surface causing groundwater flooding.

9.3.2 As shown in Haringey in Increased potential of elevated ground water map shown below, the site is not in an area at risk.

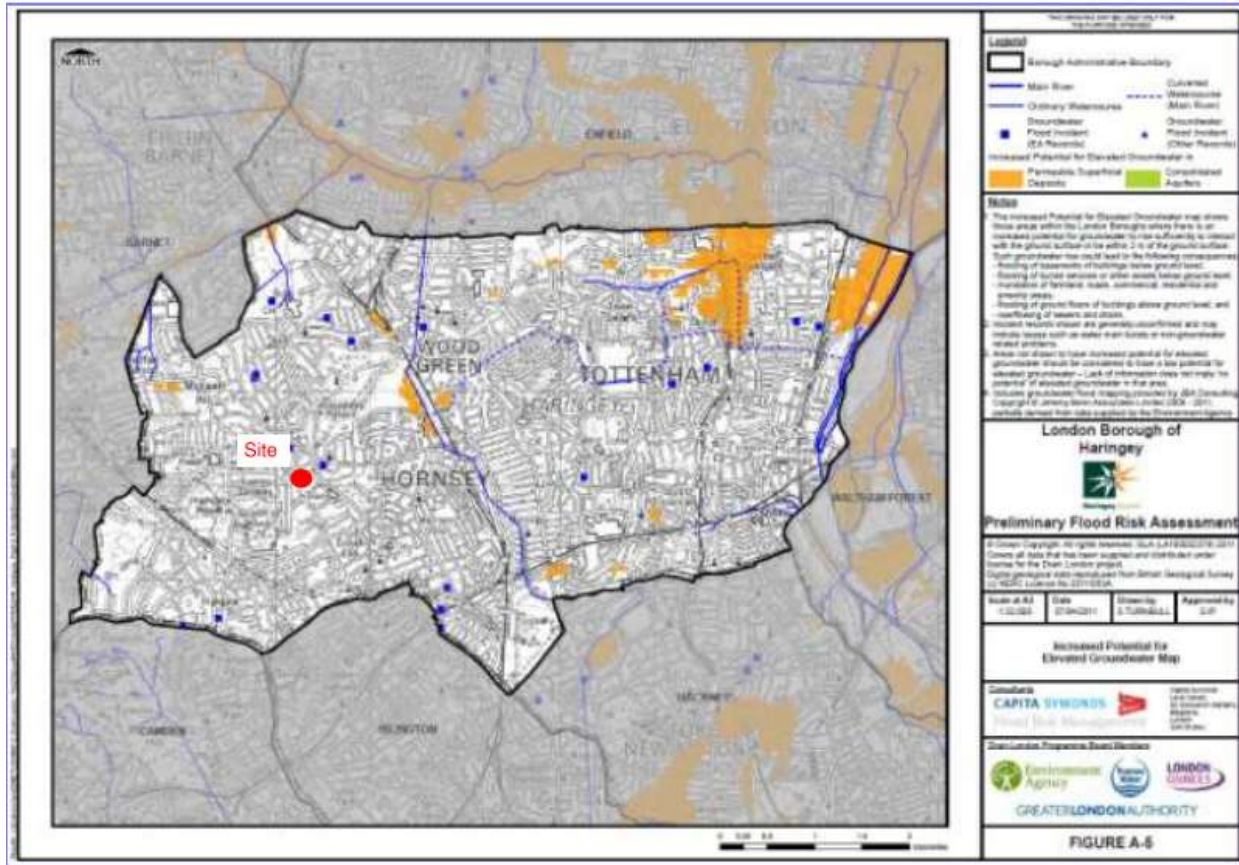


Figure 22. Risk of increase potential for elevated groundwater map

- 9.3.3 As stated in the Site Investigation report, no groundwater was recorded during the ground investigation works and that found during the return monitoring is associated with trapped surface water in the pipe.
- 9.3.4 The bedrock is a London Clay, classified as non-aquifer.
- 9.3.5 Based on the evidence above, the risk of groundwater flooding is assessed as 'Very Low'.

9.4 Flooding from Sewers and Drainage Systems

- 9.4.1 Flooding from sewers and drainage systems occurs when the sewer or drainage system is overwhelmed as a result of a blockage or excessive flow exceeding its capacity.
- 9.4.2 A Sewer Flooding History Enquiry of the Thames Water sewer flooding resulted in 'no incidents as a result of surcharging public sewers. The history enquiry is contained in Appendix #.
- 9.4.3 London Flood Review**
- 9.4.4 The London Flood Review was set up to examine the flash flooding that affected many parts of the capital in July 2021. The review has sought to better understand the extent and causes of these floods, to assess how the drainage systems performed, and to recommend how the increasing risks of future flooding events can be managed.
- 9.4.5 The review, commissioned by Thames Water, will play an integral part in ensuring the company future proofs its infrastructure to protect its customers, their communities and the environment as such severe weather events look set to become the norm across the UK.

9.4.6 A Root Cause Analysis (RCA) has been undertaken to determine within each London Borough the key flooding areas (known from here as 'Hotspots') from both the 12 and 25 July events and to assess the likely associated flooding mechanisms. Any difference of flooding mechanisms between the two events will be detailed specifically where identified. All flooding Hotspots have been captured based on identifying clusters of reported incidents with the boundaries of the Hotspots following (where practicable) the sewer model sub catchments. The model subcatchments identify which houses drain to each manhole and as such are a useful boundary for grouping together houses that are likely to be impacted.

9.4.7 Figure 23 below shows the RCA map for Haringey.

Figure 4.6: London Borough of Haringey - Root Cause Analysis

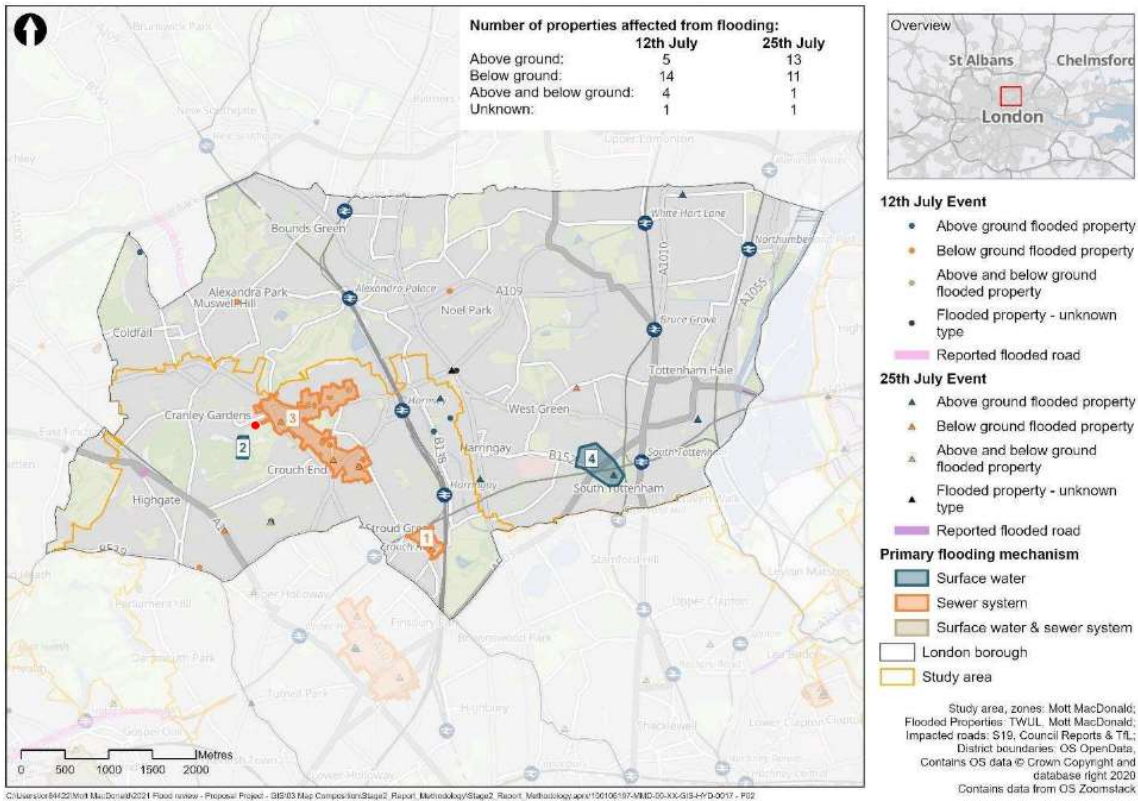


Figure 23. RCA Map

- 9.4.8 The site is next to hotspot 3, areas which experienced predominantly below ground flooding caused through direct sewer connections to basement and resulting in property flooding when the sewers surcharge.
- 9.4.9 On this basis, the risk of flooding from sewers and drainage systems is assessed as 'Medium'.

9.5 Flooding from Artificial Sources

- 9.5.1 Artificial sources of flood risk include waterbodies that have been amended by means of human intervention. Where infrastructure retains, transmits, or controls the flow of water, flooding may occur if there is a structural, hydraulic, geotechnical, or mechanical failure of the infrastructure.

9.5.2 The risk of inundation to the LB of Haringey as a result of reservoir breach or failure of a number of reservoirs within the area was assessed as part of the National Inundation Reservoir Maps (NRIM) 48 study. Extract can be found in Figure 14 below.

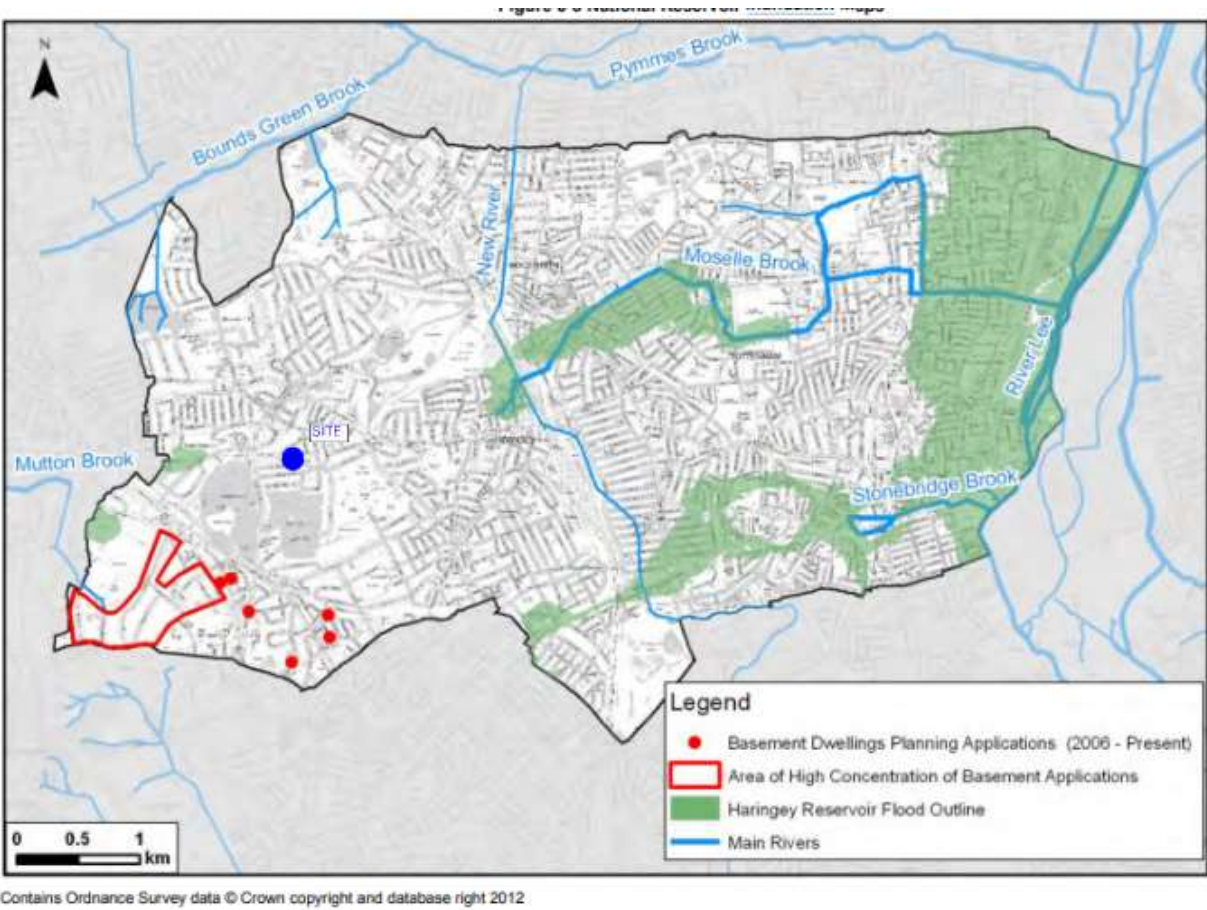


Figure 24. Reservoir Inundation Maps

9.5.3 Based on the information above, the risk of flooding from artificial sources is assessed as ‘Very Low’.

9.6 Summary of Flood Risk

9.6.1 A summary of the potential flood risks associated with existing conditions (pre-development) is shown in Table 3, below.

Flood Source	Potential Risk			
	Very Low	Low	Medium	High
Fluvial (rivers and sea)	√			
Surface Water			√	
Ground Water	√			
Sewers and Drainage Systems	√		√	

Artificial Sources	√			
Overall	√			

Figure 25. Pre-development Potential Flood Risk from All Sources of Flooding

9.6.2 The pre-development potential flood risk from all sources of flooding is considered to be ‘Low to Medium’.

10.0 Run-Off Assessment

10.1 The Environment Agency’s ‘Rainfall runoff management for developments – Report SC030219’ sets out interim national procedure principles so that.

“Stormwater runoff rates and volumes discharged from urban developments should approximate to the site greenfield response over a range of storm frequencies of occurrence (return periods) and managed runoff on site for extreme events.

This requires:

- the peak rate of stormwater run-off to be limited.
- the volume of run-off to be limited.
- the pollution load to receiving waters from stormwater runoff to be minimised.
- the assessment of overland flows and temporary flood storage across the site”

10.1.1 The SFRA’s also states that FRA should include a site drainage strategy including assessment of the local and cumulative impact of storing runoff with controlled release at greenfield rates to ensure no negative impact downstream.

10.1.2 The existing areas are summarised in the table below:

Area	Permeable, m2	Impermeable, m2
House		113
Outbuilding		25
Front driveway		60
External paving areas		120
Grass areas	120	
Small football pitch	160	
Total	280	310

Figure 26. Existing Areas Summary

10.1.1 The proposed areas are summarised in the table below:

Area	Permeable, m2	Impermeable, m2
House		113
Outbuilding		25
Front driveway	60	0
External paving areas	8	112
Grass areas	112	

Basement below grass	35	
Small football pitch	160	
Total	340	250

Figure 27. Proposed Areas Summary

10.1.2 The proposed development does not increase the total impermeable areas.

10.1.3 Existing brownfield rates were calculated following The Modified Rational Method as developed by The Wallingford Procedure, using the formula below:

$$Q = 2.78 C \times i \times A$$

Q – Design event peak rate of runoff (l/s); *A* – Total catchment area being drained (ha); *i* – peak rainfall intensity in mm/hr

C – Non-dimensional runoff coefficient which is dependent on the catchment characteristics

10.1.4 Intensities have been calculated in accordance with the Wallingford Procedure based on the following site-specific values:

M5-60: 20mm

10.2 R=0.421

10.3 Intensities for different return periods and storm durations are shown in the table below:

Rainfall intensity, mm			
Storm duration	1 in 1	1 in 30	1 in 100
15 min	35.1	76.4	101.2

Figure 28. Rainfall intensities

10.4 For the total impermeable site area of 0.0310Ha the following flowrates have been calculated:

Runoff rates, l/s			
Storm duration	1 in 1	1 in 30	1 in 100
15 min	2.97	6.47	8.70

Figure 29. Existing runoff rates

10.5 Greenfield rates have been obtained from HR Wallingford Greenfield runoff estimation tool.

Runoff rates, l/s			
Qbar	1 in 1	1 in 30	1 in 100
0.26	0.22	0.60	0.82

Figure 30. Greenfield rates

Haringey Development Management requires Sustainable Drainage Systems (SuDS) to be sensitively incorporated into new development by way of site layout and design, having regard to the following requirements:

All major development proposals will be required to reduce surface water flows to a greenfield run-off rate for a 1 in 100-year critical storm event.

- All minor development proposals should aim to achieve a greenfield run-off rate and, at a minimum, achieve a 50 per cent reduction on existing site run-off rates.

- All other development should seek to achieve a greenfield run-off rate and include at least one ‘at source’ SuDS measure resulting in an improvement in water quantity or quality discharging to a sewer; and
- For all development where a greenfield runoff rate cannot be achieved justification must be provided to demonstrate that the run-off rate has been reduced as much as possible.

10.5.1 Given site constraints, it is concluded a 50% reduction of runoff rates up to the 1 in 100+40% storm is acceptable. A volume of 8m3 is estimated to be required in order to achieve such reduction from all impermeable areas.

10.5.2 According to Table 26.2 *Pollution hazard indices for different land use classifications* of The SUDS Manual (CIRIA, 2015) the pollution hazard level is ‘Very low’ for residential roofs and ‘low’ for property driveways.

10.5.3 Overland flows are to be collected within the proposed drainage system. Flood storage will not be displaced as the site does not lie within a flood storage area.

10.6 Sustainable Urban Drainage Systems

10.6.1 The introduction of Sustainable Drainage Systems (SuDS) contributes to mitigate the risk of flood risk by reducing the impact of large rainfall events. By reducing runoff rates, SuDS help to decrease of risk of surface water and sewer flooding.

10.6.2 A SuDS Assessment has been carried out using the guidance set out in The London Plan published by Greater London Authority and The SuDS Manual published by CIRIA. SuDS techniques were assessed as possible surface water disposal methods and priority was given to SuDS which provide multi-functional benefits in line with the drainage hierarchy. Table 5, below, presents the drainage hierarchy taken from Policy SI 13 Sustainable drainage of The London Plan. The feasibility of incorporating different SuDS into the development proposals is outlined.

Method	Feasibility	Explanation
Rainwater harvesting (including a blue roofs)	✗	Site constraints and reduced size make unpracticable the installation of rainwater harvesting devices
Infiltration to ground techniques	✗	Ground conditions and site constraints are not compatible with infiltration due to the presence of London Clay
Rainwater attenuation in open water features and gradual release	✗	There is not space on site for the construction of open water features
Rainwater discharge direct to a watercourse	✗	There is no watercourse in the close enough vicinity to the site to make discharge to a watercourse a feasibility option.
Rainwater attenuation above ground (including blue roofs)	✗	Site constraints and reduced size make unpracticable the installation of bluroofs
Rainwater attenuation below ground	✓	Attenuation is provided within the permeable paving at the front garden.
Discharge surface water to a surface water drain or drain.	✗	There is a surface water sewer in the main road however the existing connection from the property is combined. The construction of a new connection in a major road is not considered feasible for the extent of the proposed works (basement extension). However, a reduction of the flowrates will be proposed.
Discharge rainwater to the combined sewer	✗	It is proposed to re-use existing surface water sewer connections into the public surface water sewer.
Inclusion of raingardens	✗	Space is only available at the rear of the site, where because of levels (ow point) is not possible to direct RWP intp raingardens and provide and outlet to the below ground drainage

Figure 31. SUDS Hierarchy

10.7 Resistance, Resilience and Mitigation Measures

The guidance document ‘Improving the Flood Performance of New Buildings: Flood Resilient Construction’ was produced as part of the Department for Communities and Local Government Buildings Regulations (Sanitation) Research Framework, and the joint Defra/Environment Agency Flood Risk Management Research and Development programme. It defines flood resistance as:

Constructing a building in such a way to prevent floodwater entering the building and damaging its fabric.

- 10.7.1
- Given the medium overall risk from all sources with a maximum water depth of 300mm it’s considered water resilience (water inclusion) measures are not required. Proposed measures are considered to provide further mitigation and ensure the flood resistance of the building.
- 10.7.2
- Slot channels at threshold will prevent runoff from entering the property.
- 10.7.3
- Attenuation in the form permeable paving will reduce runoff rates and limit the risk of surface and sewer flooding.
- 10.7.4
- Non-return valves to be installed at the connection to the foul sewer will prevent basement flooding due to sewer surcharge.
- 10.7.5
- Consideration should be made to the installation Flood resistance doors and gates for depth of up to 300mm.
- 10.7.6
- The site is not within an area of flood warnings or alerts.
- 10.7.7
- As a precaution, it is recommended that the owners obtain adequate flood insurance to manage risk and minimise potential economic losses.
- 10.7.8
- Subject to the implementation of the proposed measures, the summary of the flood risk associated with the proposed development is considered to be the following:

Flood Source	Potential Risk			
	Very Low	Low	Medium	High
Fluvial (rivers and sea)	√			
Surface Water		√		
Ground Water	√			
Sewers and Drainage Systems	√	√		
Artificial Sources	√			
Overall	√			

Figure 32. Proposed development flood risk

10.8 Drainage Strategy

- 10.8.1
- An outline drainage strategy has been developed. It is proposed runoff rates are reduced by 50% for all rainfall events up to the 1 in 100 +40% climate changes storm.
- 10.8.2
- Attenuation is provided by 8m3 attenuation tank and flow control chamber.
- 10.8.3
- Proposed runoff rates and reductions are shown in table below.

Runoff rates, l/s			
Storm event	Existing	Proposed	Reduction
1 in 1	2.97	2.4	19%
1 in 30	6.47	2.8	56%
1 in 100	8.70	2.8	67%
1 in 100 + 40%	n/a	3.0	n/a

Figure 33. Proposed runoff rates

- 10.8.4
- * a reduction of 50% for the 1 in 1 is not applicable. Volumetric run-off coefficient applied for the Rational Method (0.75) used for the existing rates will typically result in runoff values than in Microdrainage, where a coefficient of 0.9 has been used.
- 10.8.5
- Existing and proposed foul rates have been calculated using guidelines for developments given in BS EN 12056-2:2000 – “Gravity Drainage Systems Inside Buildings – Part 2: Sanitary Pipework, layout and calculation”
- 10.8.6
- Existing rates have been estimated at 3.73 l/s and proposed at 5.52 l/s.
- 10.8.7
- A pre-capacity enquiry was submitted at Thames Water. At the time this report was completed a final had not been received. The proposal includes an overall reduction of the combined flows into the foul sewer and therefore it is assumed this will not have a negative impact on sewer capacity.
- 10.8.8
- Outline drainage strategy can be found in Appendix C.
- 10.8.9
- Microdrainage calculations can be found in Appendix D
- 10.8.10
- SuDS Proforma can be found in Appendix E.

10.9 Operation and Maintenance

- 10.9.1
- The drainage strategy has been designed such that the foul and surface water pipes conform with Building Regulations Part H. This ensures operation of the drainage system is fit for purpose.
- 10.9.2
- Gullies and channels will be specified with silt buckets to prevent the ingress of silts into the drainage network and impairing the performance of the system.
- 10.9.3
- A maintenance regime to ensure efficient functioning of the drainage system is recommended.
- 10.9.4
- All waste arising from the maintenance of the drains and sewers shall be handled, stored, and disposed of correctly to avoid pollution. Waste may be designated as hazardous / special waste and, as such, the End User shall ensure that they comply with the Hazardous Waste (England and Wales) Regulations 2005.

11.0 Conclusions

- 11.1
- In accordance with the National Planning Policy Framework, the site would be categorised as lying within Flood Zone 1 – an area assessed as having 1 in 1000 or less annual probability of river or sea flooding (<0.1%).
- 11.2
- In accordance with the NPPF, the proposed development is classified as ‘more vulnerable’ land use.
- 11.3
- Land use in the proposed development is acceptable under the terms of Sequential Test and there is no requirement for an Exception Test to be carried out.
- 11.4
- The site is at ‘Very Low’ risk for fluvial flooding.
- 11.5
- The site has been assessed as being at ‘Medium’ risk from surface water flooding.



- 11.6 The site has been assessed as being at 'Very Low' risk from groundwater sources.
- 11.7 The site has been assessed as being at 'Medium' risk from surcharging sewers.
- 11.8 The site has been assessed as being at 'Very Low' risk from artificial sources.
- 11.9 The overall pre=development flood risk to the site is assessed as 'Medium'
- 11.10 The surface water risk is associated with overland flows from impermeable areas from the road following the slope of the ground. Considering the basement works are proposed in an existing impermeable area, it is assumed there is not increased on the surface water flows.
- 11.11 The provision of the SuDS, including permeable paving, and the inclusion of the proposed flood resistance measures will reduce the surface water flood risk.
- 11.12 The proposed overall reduction of runoff rates by 56% for all events up the 1 in 100 +40% storm will also mitigate the risk of flooding downstream,
- 11.13 The comments stated above are based on information received from other consultees. The flood risk classification of this site has been based on the above observations, and the recommendations stated.