

FloodSmart Plus



Flood Risk Assessment

Site Address

221 Hale Lane
Edgware
HA8 9QF

Date

2024-04-10

Report Status

FINAL

Grid Reference

520083, 192415

Site Area

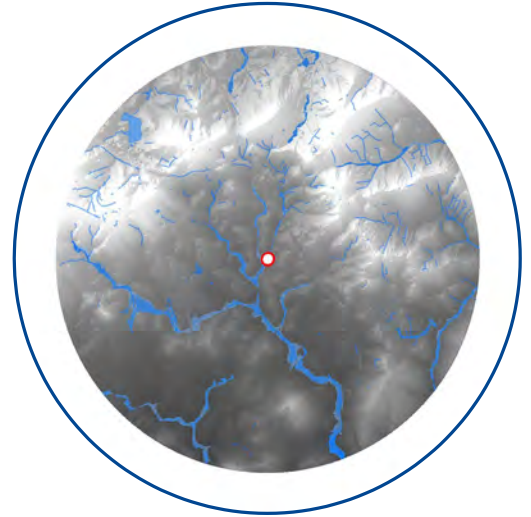
0.038 ha

Report Prepared for

IMAGE Architecture Limited

Report Reference

81713R1



RISK – Very Low to Medium

The Site is located in Flood Zone 2 and 3, according to the EA's RoFRS mapping indicates the Site has a Low risk of flooding from rivers and the sea. Surface water (pluvial) flood risks are Very Low to Medium. Groundwater flood risks are Negligible and flooding risks from artificial sources (i.e. canals, reservoirs and sewers) are Low. Mitigation measures are recommended in this report to reduce the risks to an acceptable level over the lifetime of the development.

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1. Executive summary



A review has been undertaken of national environmental data sets to assess the flood risk to the Site from all sources of flooding in accordance with the National Planning Policy Framework (NPPF) (2023) and National Planning Practice Guidance (NPPG) (Published in 2014 and updated in August 2022). A site-specific flood risk assessment, to assess the flood risk to and from the development Site, is provided within this concise interpretative report written by an experienced GeoSmart consultant. Baseline flood risk and residual risks that remain after the flood risk management and mitigation measures are implemented are summarised in the table below.

Site analysis

Source of Flood Risk	Baseline*	Final **
River (fluvial) flooding	Low	Very Low
Sea (coastal/tidal) flooding	Very Low	N/A
Surface water (pluvial) flooding	Very Low to Medium	Very Low to Low
Groundwater flooding	Low	Negligible
Other flood risk factors present (reservoirs)	Yes	Yes
Is any other further work recommended?	Yes	Yes (see below)

*BASELINE risks have been calculated for the whole Site, using national risk maps, including the benefit of EA flood defences.**FINAL RISK RATING Includes a detailed analyses of flooding risks over the lifetime of the proposed development, including allowances for climate change AND assumes recommended mitigation measures are implemented. N/A indicates where mitigation is not required.

Summary of existing and proposed development

The Site is currently used within a residential capacity as a three storey detached, three-bedroom dwelling including associated access, car parking and landscaped areas. The client has confirmed the finished floor level (FFL) of the ground floor is 0.515 m above ground level at the front of the property. The estimated FFL is 56.51 mAOD. The basement has a lower, but unconfirmed FFL.

Development proposals comprise the demolition/removal of the existing garage and basement and construction of a two storey side and loft extension. The development will create 1 additional bedroom, with the retention of the existing access, car parking and landscaped areas. With the FFLs being lowered by 0.2 m to ~56.31 mAOD.

Summary of flood risks

The flood risks from all sources have been assessed as part of this report and are as follows:

- According to EA records, historical flooding is understood to have previously occurred at/in the vicinity of the Site in 1992.

River (fluvial) and Sea (Estuarine/Coastal) flooding

- According to the Environment Agency's (EA) Flood Map for Planning Purposes, the Site is located partially within a fluvial Flood Zones 2 (Medium Probability) and 3 (High Probability).
- The Site benefits from the presence of flood defences, 5 m away in unknown condition, designed to provide a 1 in 75 year event standard of protection. Despite this information, these flood defences appear to offer a lower standard of protection, as the fluvial flood modelling undertaken by JBA (discussed below) indicates that these flood defences are breached in a 1 in 5 year event.
- According to the EA's Risk of Flooding from Rivers and Sea (RoFRS) map, which considers the type, condition and crest height of flood defences, the Site has a Low risk of flooding from the nearby watercourse, the Dean's Brook.
- The Site could potentially be at risk from flooding due to blockage or failure of a bridge located on the water course within 50 m of the Site.
- Buildings and important features on the Site are within the mapped flood extents, however, the FFLs would prevent internal flooding.

During a 1 in 100 year plus 17% climate change allowance event the flood level at the Site would be 55.38 mAOD. During this event, the area proposed for development would not experience internal flooding due to the proposed FFLs being 56.31 mAOD.

Emergency evacuation routes are available to the north west. In the event of a flood, safe refuge can be taken on the 1st floor levels and above.

Surface water (pluvial) flooding

According to the EA's Risk of Flooding from Surface Water (pluvial) flood mapping, the Site has a risk of pluvial flooding ranging from Very Low to Medium.

- Flooding modelling indicates that the area proposed for development would be affected by flooding in the 1 in 100 year present day scenario, it also indicates that the area proposed for development would be affected by flooding in the 1 in 100 year plus climate change event however, the proposed FFLs (56.31 mAOD) would prevent internal flooding.

As there is a reduction in the built footprint at the Site and the area proposed for development is affected by the design flood level, there won't be an increase in the displacement of flood water. This is discussed further in Section 5 of this report.

Groundwater flooding

- Groundwater Flood Risk screening data indicates there is a Negligible potential risk of groundwater flooding at the surface in the vicinity of the Site during a 1 in 100 year event.

Artificial sources of flooding

- The risk of flooding from artificial (man-made) sources such as reservoirs, sewers and canals has been assessed:
 - The EA's Risk of Flooding from Reservoir map confirms the Site is at risk of reservoir flooding. The potential for a breach of a reservoir to occur and flooding affecting the Site is low.
 - Ordnance Survey (OS) data confirms there are no canals near to the Site.
 - The Strategic Flood Risk Assessment (SFRA) (Metis Consultants, 2018) has identified 81-100 incidences or modelled incidences of flooding as a result of surcharging sewers within the HA8 9 postcode. However, it is recognised that this four digit postcode covers a large area and instances of flooding are not specific to the Site.
 - Records held by Thames Water indicate that there have been no incidences of flooding related to the surcharging of public sewers at the Site

A risk has been identified from reservoirs, although the level of risk could not be determined. The risk of flooding from artificial sources is considered to be Low.

- The risk to the development has been assessed over its expected 100 year lifetime, including appropriate allowances for the impacts of climate change which could increase the flood risk to the Site. Risks identified include or increases in river flooding and increased potential for surface water flooding and appropriate mitigation measures are proposed.

In accordance with paragraphs 167, 174 and footnote 60 of the NPPF (2023), as the development proposals are comprised of a minor extension within Flood Zone 2 and 3 and the Site has not been allocated within the Councils Local Plan, the Sequential Test is not required.

Recommendations

Recommendations for flood mitigation are provided below, based upon the proposed development and the flood risk identified at the Site.

- As the design flood level at the Site is 56.00 mAOD, finished floor levels must remain 0.3m (300mm) above that level. The proposed FFLs of the ground floor are 56.31 mAOD and thus are safe from flooding.

- The ongoing management and maintenance of existing and any proposed drainage networks, under the riparian ownership of the developer, should be undertaken in perpetuity with the development.
- A Sustainable Drainage Strategy (SuDS) should be developed for the Site, for effective management of surface water runoff over the lifetime of the proposed development.

GeoSmart recommend the mitigation measures discussed within this report are considered as part of the proposed development where possible and evidence of this is provided to the Local Planning Authority as part of the planning application.

2. Introduction



Background and purpose

A site-specific flood risk assessment has been undertaken, to assess the flood risk to and from the development Site. This assessment has been undertaken by firstly compiling information concerning the Site and the surrounding area. The information gathered was then used to construct a 'conceptual site model', including an understanding of the appropriateness of the development as defined in the NPPF (2023) and the source(s) of any flood risk present, guided by the NPPG (Published in 2014 and updated in August 2022). Finally, a preliminary assessment of the steps that can be taken to manage flood risk to the development was undertaken.

This report has been prepared with reference to the NPPF (2023) and NPPG (2022).

"The National Planning Policy Framework set out the Government's planning policies for England and how these are expected to be applied" (NPPF, 2023).

The NPPF (2023) and NPPG (2022) promote a sequential, risk based approach to the location of development. This also applies to locating a development within a Site which has a variable risk of flooding.

"The approach is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. This means avoiding, so far as possible, development in current and future medium and high flood risk areas considering all sources of flooding including areas at risk of surface water flooding" (Paragraph: 023. NPPG, 2022).

The purpose of this report is to provide clear and pragmatic advice regarding the nature and potential significance of flood hazards which may be present at the Site.

Report scope

In accordance with the requirements set out within NPPG 2022 (Paragraph: 021 Reference ID: 7-021-20220825), a thorough review of publicly and commercially available flood risk data and EA supplied data indicating potential sources of flood risk to the Site from rivers and coastal sources, surface run-off (pluvial), groundwater and reservoirs, including historical flood information and modelled flood extent. Appropriate measures are recommended to manage and mitigate the flood risk to the property.

Information obtained from the EA and a review of the West London Strategic Flood Risk Assessment (SFRA) (Metis Consultants, 2018) and the London Borough of Barnet Local Plan (Core Strategy) (Barnet London Borough, 2012) are used to ascertain local flooding issues and, where appropriate, identify information to support a Sequential and/or Exception test required as part of the NPPF (2023).

The existing and future flood risk to and from the Site from all flood sources is assessed in line with current best practice using the best available data. The risk to the development has been assessed over its expected lifetime, including appropriate allowances for the impacts of climate change. Residual risks that remain after the flood risk management and mitigation

measures are implemented, are considered with an explanation of how these risks can be managed to keep the users of the development safe over its lifetime.

An indication of whether the Site will potentially increase flood risk elsewhere is provided, including where the proposed development increases the building footprint at the Site. A drainage strategy to control runoff can be commissioned separately if identified as a requirement within this report.

Report limitations

It is noted that the findings presented in this report are based on a desk study of information supplied by third parties. Whilst we assume that all information is representative of past and present conditions, we can offer no guarantee as to its validity and a proportionate programme of site investigations would be required to fully verify these findings.

The basemap used is the OS Street View 1:10,000 scale, however the Site boundary has been drawn using BlueSky aerial imagery to ensure the correct extent and proportion of the Site is analysed.

This report excludes consideration of potential hazards arising from any activities at the Site other than normal use and occupancy for the intended land uses. Hazards associated with any other activities have not been assessed and must be subject to a specific risk assessment by the parties responsible for those activities.

Datasets

The following table shows the sources of information that have been consulted as part of this report:

Table 1. Datasets consulted to obtain confirmation of sources of flooding and risk

Source of flooding	Datasets consulted				
	Commercial Flood Maps	Local Policy & Guidance Documents*	Environment Agency (Appendix B)	Thames Water (Appendix C)	OS Data
Historical	X	X	X		
River (fluvial) / Sea (tidal/coastal)	X	X	X		

Source of flooding	Datasets consulted				
	Commercial Flood Maps	Local Policy & Guidance Documents*	Environment Agency (Appendix B)	Thames Water (Appendix C)	OS Data
Surface water (pluvial)	X	X	X		
Groundwater	X	X			
Sewer		X		X	
Culvert/bridges		X			X
Reservoir		X	X		

*Local guidance and policy, referenced in Section 6, has been consulted to determine local flood conditions and requirements for flood mitigation measures.

Local policy and guidance

For this report, several documents have been consulted for local policy and guidance and relevant information is outlined below:

London Borough of Barnet Local Plan (Barnet London Borough, 2012):

Policies

Surface water flooding in Barnet presents a low to moderate risk, and sewer flooding is low risk. Groundwater flooding was also found to be relatively low risk due to the impermeable geology (primarily London Clay) and depth of the groundwater table.

Reducing or slowing the amount of rainfall (run off) entering the drainage network is important to help reduce flood risk both in Barnet and further downstream. The borough has 14kms of streams and brooks. The North London Strategic Flood Risk Assessment identified fluvial flooding from Dollis Brook, Silk Stream, Pym's Brook and their associated tributaries as the primary source of flood risk in the borough.

West London Strategic Flood Risk Assessment (Metis Consultants, 2018):

- Ensuring that land within development sites are safeguarded for potential flood mitigation use through the active consideration of predicted flood mapping from all sources at the master planning stage.

- Developers must submit completed Flood Risk Assessments and Drainage Strategy (with supporting Checklists) to demonstrate compliance with requirements detailed in Sections 2 and 4 for all Major development proposals.
- Where development is proposed for sites within Flood Zones 3a (surface water), evidence must be submitted to demonstrate that:
 - There will be no increase of flood risk to properties outside of the development boundary.

Guidance

Strategic Flood Risk Assessments are carried out by local authorities, in consultation with the Environment Agency, to assess the flood risk to the area from all sources both now and in the future due to climate change. They are used to inform planning decisions to ensure inappropriate development is avoided (NPPF, 2023).



Site information

The Site is located in Edgware in a setting of commercial and residential land use at National Grid Reference TQ 20083 92415.

Figure 1. Aerial imagery of the Site (Bluesky, 2024)

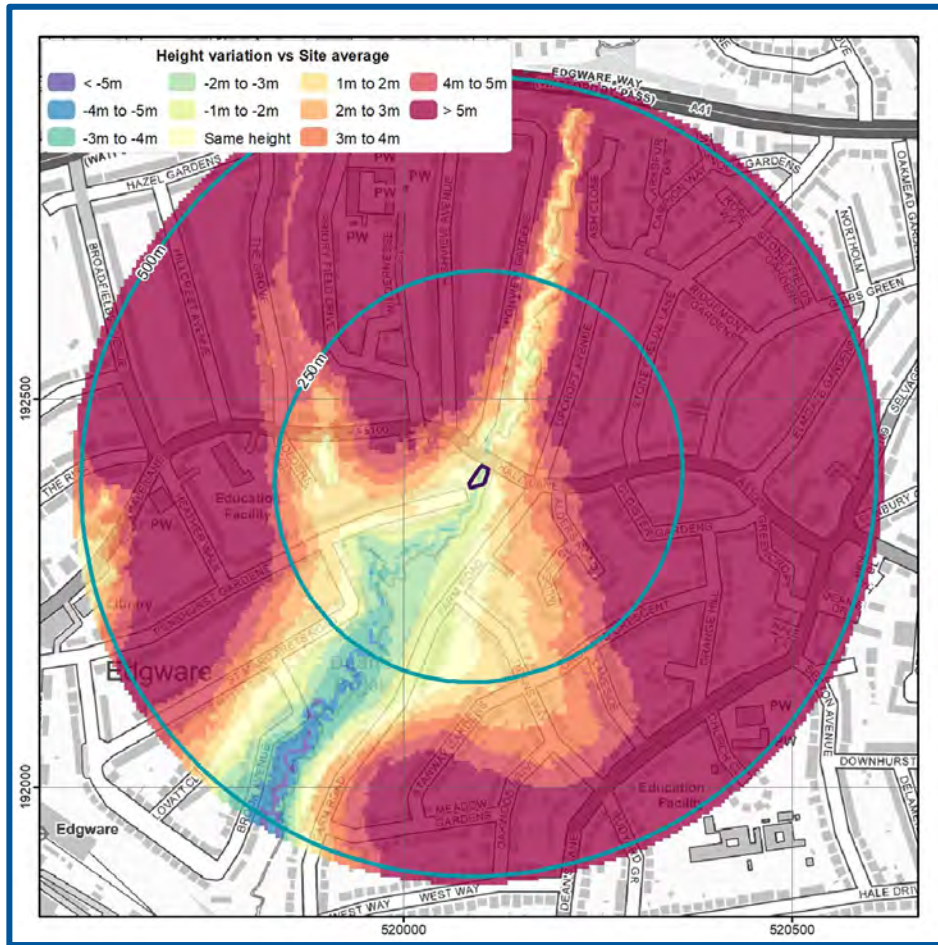


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Figure 2 overleaf indicates ground levels within 500m of the Site fall in a south westerly direction.

The general ground levels on the Site are between 55.07 and 56.40 mAOD with the Site falling gradually in a southerly direction. This is based on EA elevation data obtained for the Site to a 1 m resolution with a vertical accuracy of ± 0.15 m (Appendix D).

Figure 2. Site Location and Relative Elevations (GeoSmart, 2024)



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Development

The Site is currently used within a residential capacity as a three storey detached, three-bedroom dwelling including associated access, car parking and landscaped areas. The client has confirmed the finished floor level (FFL) of the ground floor is 0.515 m above ground level at the front of the property. The estimated FFL is 56.51 mAOD. The basement has a lower, but unconfirmed FFL.

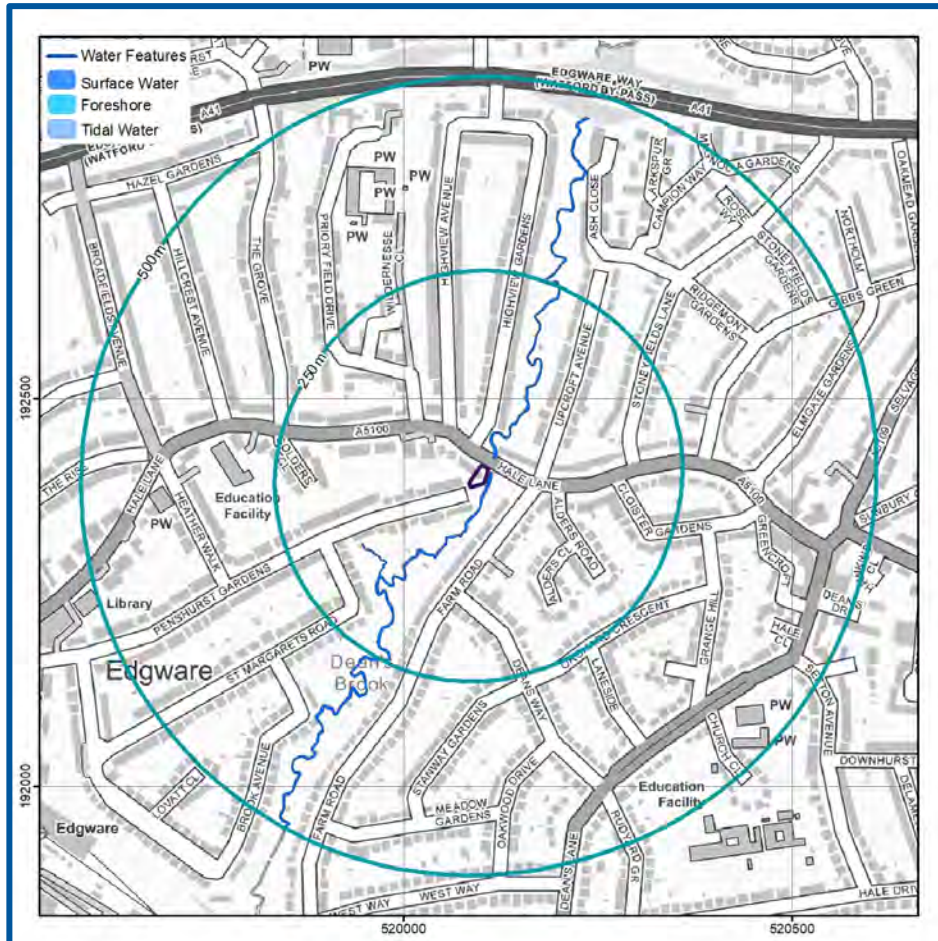
Development proposals comprise the demolition/removal of the existing garage and basement and construction of a two storey side and loft extension. The development will create 1 additional bedroom, with the retention of the existing access, car parking and landscaped areas. With the FFLs being lowered by 0.2 m to ~56.31 mAOD. Site plans are included within Appendix A.

The effect of the overall development may result in an increase in number of occupants and/or users of the Site but will not result in the change of use, nature or times of occupation. According to Annex 3 of the NPPG (2022), the vulnerability classification of the existing development is More Vulnerable and proposed development is More Vulnerable. The estimated lifespan of the development is 100 years.

Hydrological features

According to Ordnance Survey (OS) mapping included in the following figure, a single surface water feature is located within 500 m of the Site.

Figure 3. Surface water features (EA, 2024)



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Dean's Brook is located approximately 5m to the east of the Site boundary.

Proximity to relevant infrastructure

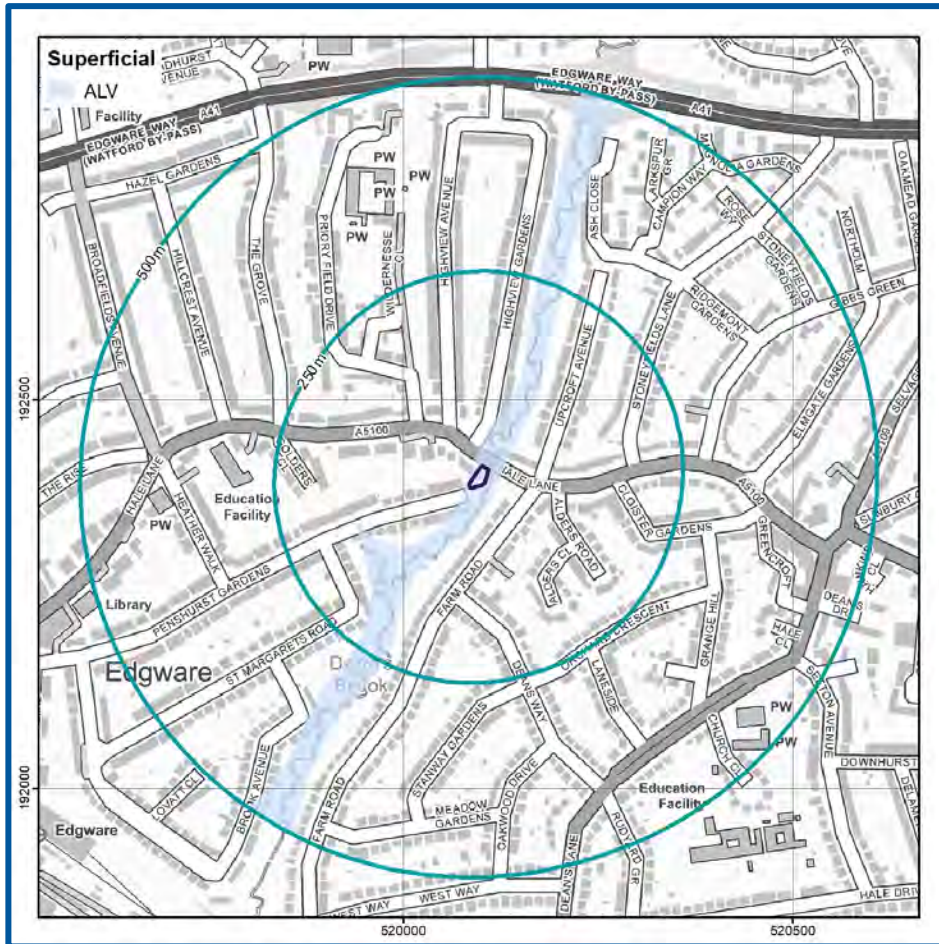
A culvert on Dean's Brook has been identified approximately 150m to the southwest of the Site boundary.

Hale Lane bridges Dean's Brook approximately 10m to the northeast of the Site boundary.

Hydrogeological features

British Geological Survey (BGS) mapping indicates the underlying superficial geology (Figure 4) consists of Alluvium (ALV) (BGS, 2024) and is classified as a Secondary (A) Aquifer (EA, 2024).

Figure 4. Superficial Geology (BGS, 2024)



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BGS mapping indicates the underlying bedrock geology (Figure 5, overleaf) consists of the London Clay Formation (LC) (BGS, 2024) and is classified as Unproductive Strata (EA, 2024).

Figure 5. Bedrock Geology (BGS, 2024)



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Geological conditions

A review of the BGS borehole database (BGS, 2024) indicates there are no relevant boreholes within the vicinity of the Site from which the mapped geology can be confirmed.

Groundwater

There were no relevant boreholes from which the groundwater level could be confirmed.

4. Flood risk to the development



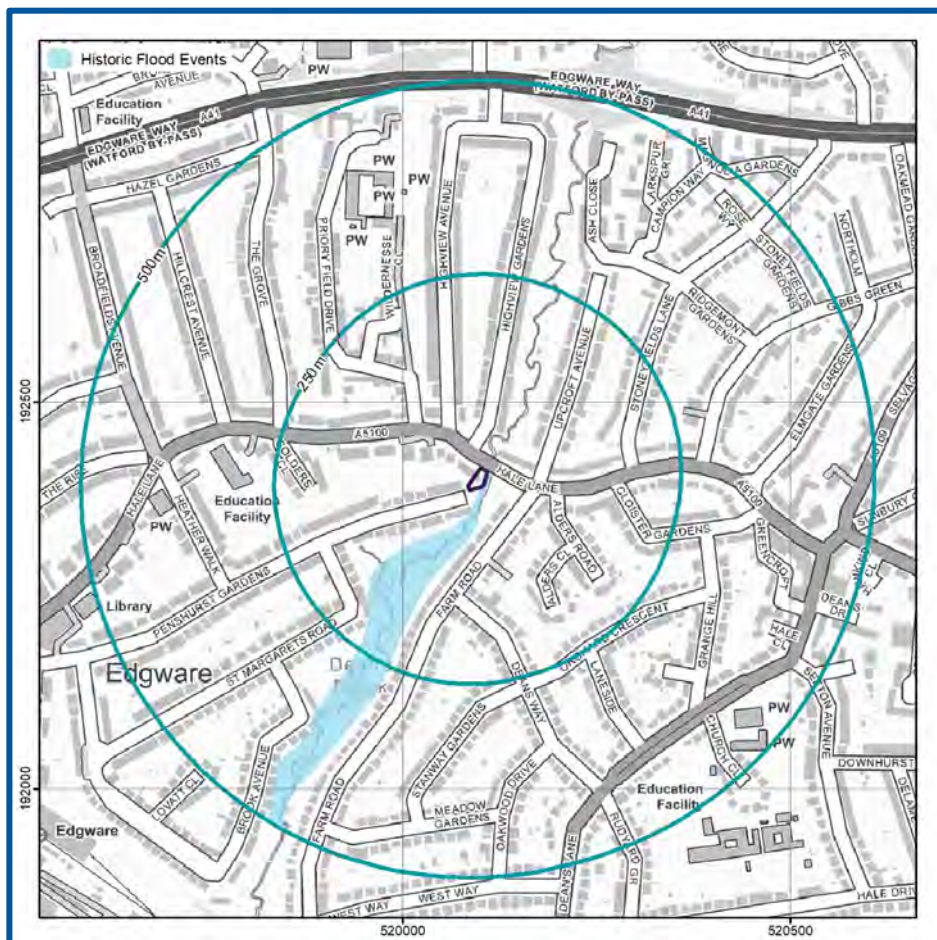
Historical flood events

According to the EA's Historical Flood Map (Figure 6) and the online mapping of the SFRA (Metis, 2018), there has been a flood event which has affected the Site.

- Flooding occurred in 1992 due to channel exceedance of Dean's Brook, as there were no raised flood defences. According to the EA modelling, this flood event did affect the area proposed for development and the existing garage. However, the client has confirmed that they are not aware of any flood events affecting the property.

The purpose of historical flood data is to provide information on where and why flooding may have occurred in the past. The absence of any recorded events does not mean flooding has never occurred on-Site or that flooding will never occur at the Site.

Figure 6. EA Historic Flood Map (EA, 2024)



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Rivers (fluvial) / Sea (coastal) / Estuarine (tidal) flooding

The predominant risk at the Site is from flooding from rivers, termed as fluvial flooding. The Site is located in an inland location and the risk of flooding from coastal and tidal processes are therefore considered to be Negligible.

River (fluvial) flooding occurs during times of heavy rainfall or snow melt when watercourses' capacity can be exceeded, over topping the banks and flood defences.

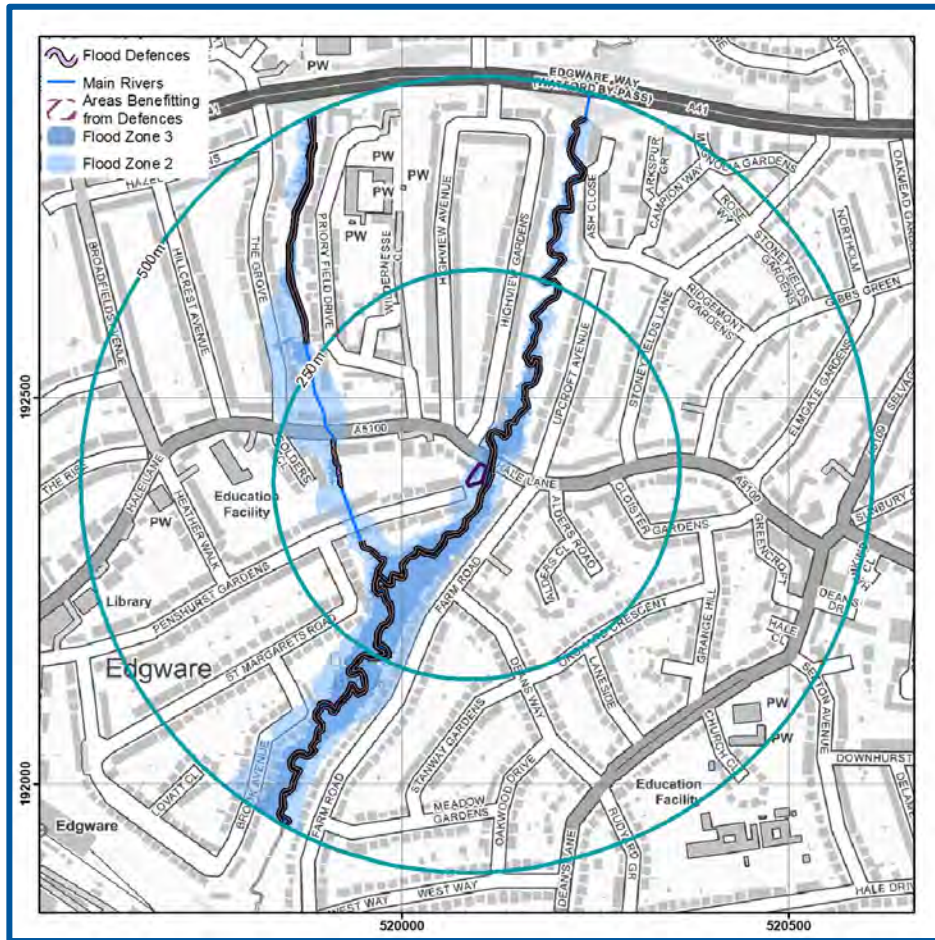
According to the EA's Flood Map for Planning Purposes (Figure 7, overleaf), the Site is located on the boundary of a fluvial Flood Zone 2, 3a and Flood Zone 3b and is therefore classified as having a Medium to High probability of fluvial flooding from Dean's Brook.

Approximately 40% of the Site is located in Flood Zone 2. This area within Flood Zone 2 is mostly made up of the landscaped area in the south of the Site boundary. The EA defines Flood Zone 2 as *"Land considered to have a Medium probability of flooding, with between a 1 in 100 and 1 in 1000 annual probability of fluvial flooding or between a 1 in 200 and 1 in 1000 annual probability of coastal flooding in any one year."* The remaining 60% of the Site is located in Flood Zone 3.

Approximately 5% of this is classed as flood zone 3b, this area impacts a small portion of the existing garage on the easternmost edge of the Site boundary. Flood zone 3b is defined as *"Land within EA modelled fluvial and tidal flood risk extents predicted for up to and including 1 in 20 year return period events allowing for the impact of flood defences"* in the West London SFRA (Metis Consultants, 2018). The proposed development will actually be moved out of this area and into flood zone 3a.

The remaining 55% of the Site is in flood zone 3a. This area includes the house and garage as well as access and car parking space. Flood zone 3a is defined as *"Land within EA modelled fluvial flood risk extents predicted for up to and including 1 in 100 year return period events and Land within EA modelled surface water flood risk extents predicted for up to and including 1 in 100 year return period events"*. This area impacts the existing house, garage and front landscaped area. It will also impact the majority of the area proposed for development.

Figure 7. EA Flood Map for Planning Purposes (EA, 2024)



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Flood defences

Guidance

Sites that are located close to flood defences are likely to be zones where rapid inundation will occur in the event of the flood defences being overtopped or breached. A Site located close to flood defences (within 250 m) may require a more detailed FRA subject to local topography.

Existing flood defences

- The Site is in an area which benefits from flood defences, but is not within the EA's ABD.

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¹ The EA maps Areas which Benefit from the presence of Defences (ABD) in a 1 in 100 (1%) chance of flooding each year from rivers; or 1 in 200 (0.5 %) chance of flooding each year from the sea. If the defences were not there, these areas would flood in a 1 in 100 (1%) / 1 in 200 (0.5 %) or larger flooding incident. The EA do not show all areas that benefit from

- There are flood defences within 5 m of the Site.

Information from the EA relating to the flood defences is outlined below.

- The nearest and most applicable formal flood defences are natural high ground which are privately owned and have a minimum crest level of 54.08 mAOD.
- According to the EA (2024) the flood defences in this area are designed to defend up to a 1 in 75 year flood event. Despite this information, these flood defences appear to offer a lower standard of protection, as the fluvial flood modelling undertaken by JBA (discussed below) indicates that these flood defences are breached in a 1 in 5 year event.
- The current condition of these defences are unknown and they were last inspected in October 2021.

Model data

As the Site is located within the EA’s fluvial floodplain, modelled flood elevation data was obtained from the EA and has been used to assess flood risk and to provide recommendations for mitigation for the proposed development.

Defended modelled data from the Silk Stream, North West London Modelling Study (JBA Consulting, 2019) the in-channel flood level provided. The Node point (ref: DEAN42) was selected as it is located within close proximity and is located at a cross section to the Site. The data is provided in the table below and is included within Appendix B.

Table 2. EA present day defended modelled flood data compared to ground level in area proposed for development.

Ground levels on Site (mAOD)	Defended Modelled Flood Levels (mAOD)*		
	1 in 20 year	1 in 100 year	1 in 1000 year
55.07 to 56.40	54.84	55.16	56.15
External Flood depths (m)	No flooding	Up to 0.09	Up to 0.95

all flood defences, some defences are designed to protect against a smaller flood with a higher chance of occurring in any year, for example a flood defence which protects against a 1 in 30 chance of flooding in any year. Such a defence may be overtopped in a flood with a 1 in 100 (1%) / 1 in 200 (0.5%) chance of occurring in any year, but the defence may still reduce the affected area or delay (rather than prevent) a flood, giving people more time to act and therefore reduce the consequences of flooding.

Internal FFLs of 56.31 mAOD	No internal flooding	No internal flooding	No internal flooding
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* Modelling shows that flooding will impact the Site from the 1 in 10 year scenario. However, as development proposals comprise the removal of the existing garage, this area will no longer be developed.

Figure 8 overleaf confirms the flood extent associated with overtopping of the flood defences in the present day flooding scenarios. The FFL of the proposed development prevents it from flooding in any of the modelled flood scenarios. However, the stair access point from the garden to the building will be affected by flooding of up to 0.95 m in the 1 in 1000 year present day flooding scenario.

Figure 8. Modelled present day flooding scenarios (JBA Consulting, 2019)



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Climate change factors

The EA's *Flood risk assessments: climate change allowances* guidance (Published 19 February 2016 and updated May, 2022) has been used to inform a suitable increase in peak river flows for the proposed development. The updated guidance confirms 'More Vulnerable' developments are required to undertake a Basic assessment approach.

As the Site is located within the London Management Catchment and the proposed development is classed as More Vulnerable, where the proposed lifespan is approximately 100 years, the Central (17%) allowance has been used to determine a suitable climate change factor to apply to river data.

Modelled in-channel flow data has not been provided and so a stage graph has been produced (Appendix B) using the EA's modelled flood level data. The climate change allowances have been derived as a proportion of the 100 year peak flow to the 1 in 1000 year event, using the Flood Studies Report (FSR) (1975) growth curves.

In the Thames region, the 1 in 1000 year event flow is approximately 60% greater than the 1 in 100 year flow, therefore the following flood levels apply.

Table 3. Flood levels plus climate change allowances

Ground levels on Site(mAOD)	Modelled Flood Levels (mAOD)	
	1 in 100 year plus 25% provided allowance for climate change flood level (mAOD)	1 in 100 year plus 17% 2080 central allowance for climate change flood level (mAOD)
55.07 to 56.40	55.49	55.38
External flood depths (m)	Up to 0.42	Up to 0.31
Internal FFLs of 56.31 mAOD	No internal flooding	No internal flooding

Figure 9 overleaf shows the flood extent for the modelled 1 in 100 year plus 25% climate allowance. This is an over exaggeration of the actual flood extent as the climate allowance is greater than the required percentage.

Figure 9. Modelled present day flooding scenarios (JBA Consulting, 2019)



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Flood risk including the benefit of defences

The type and condition of existing flood defences influence the 'actual' risk of fluvial flooding to the Site, albeit the long-term residual risk of flooding (ignoring the defences) should be considered when proposing new development.

According to the EA's Risk of Flooding from Rivers and Sea (RoFRS) map (Figure 10, overleaf), which considers the type, condition and crest height of flood defences, the Site has a Low risk of flooding from the nearby watercourse, Dean's Brook.

Figure 10. Risk of Flooding from Rivers and Sea map (EA, 2024)



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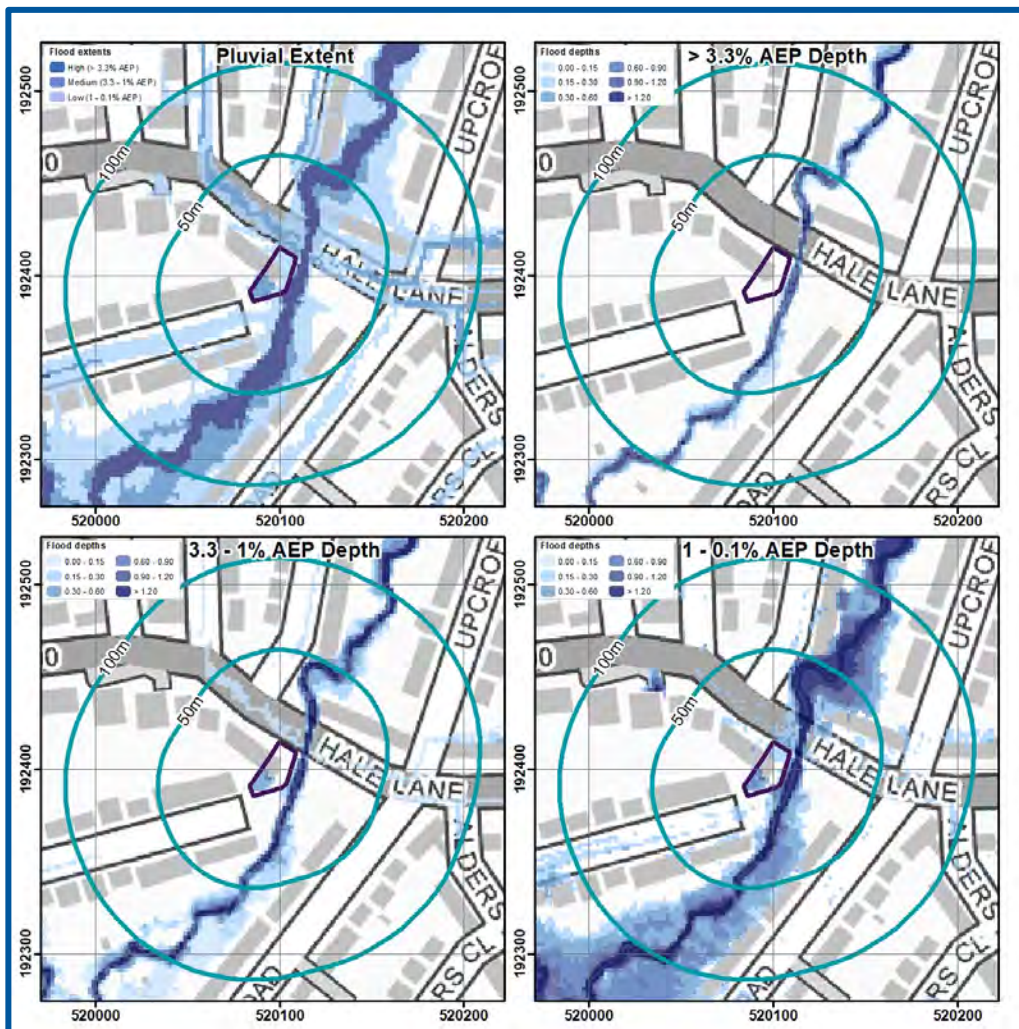
Surface water (pluvial) flooding

Surface water flooding occurs when intense rainfall exceeds the infiltration capacity of the ground and overwhelms the drainage systems. It can occur in most locations even at higher elevations and at significant distances from river and coastal floodplains.

According to the EA's Risk of Flooding from Surface Water (pluvial) flood mapping (Figure 11), the Site is at a variable risk of pluvial flooding ranging from Very Low to Medium.

The West London SFRA (Metis Consultants, 2018) defines flood zone 3a as "Land within EA modelled surface water flood risk extents predicted for up to and including 1 in 100 year return period events". This impact southern garden area of the Site but not the area proposed for development.

Figure 11. EA surface water flood extent and depth map (EA, 2024)



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According to EA's surface water flood risk map the Site is at:

- Very Low risk - chance of flooding of less than 1 in 1000 (0.1%).
- Low risk - chance of flooding of between a 1 in 1000 & 1 in 100 (0.1% and 1%).
- Medium risk - chance of flooding of between a 1 in 100 and 1 in 30 (1% and 3.3%).

The SFRA does not indicate reported incidents of historical surface water flooding within 100 m of the Site and confirms the Site is not located within a Critical Drainage Area (CDA)² (Metis Consultants, 2018).

Figure 11 on the previous page, confirms the extent and depth of flooding in multiple modelled flood scenarios. Flooding depths of up to 0.90m would impact the southernmost part of the area proposed for development (the entrance to the basement) in the 3.3 - 1% AEP (Medium) risk and the 1 - 0.1% AEP (Low) risk events. This flooding occurs at the lowest point of elevation on the Site (51.10 mAOD) and thus creates a 'design' flood level of 56.00 mAOD. This comes from adding the 0.90m modelled flood level to the LiDAR elevation at which this flood depth occurs. However, in the development proposals, the basement is to be removed, thus lowering the flood risk to the development.

Flood depths of up to 0.30m are modelled at the northernmost part of the area proposed for development. However, existing floor levels will be 0.31m (310mm) above the ground level and thus the modelled flooding would not affect the area proposed for development. Potentially, access and egress points would be impacted by flooding in the Medium and Low risk scenarios.

According to EA's surface water flood risk map the following advisory guidance applies to the Site:

Flood Depth

- 0.15 to 0.3 m - Flooding would: typically exceed kerb height, likely exceed the level of a damp-proof course, cause property flooding in some areas
- 0.3 to 0.9 m - Flooding is likely to exceed average property threshold levels and cause internal flooding. Resilience measures are typically effective up to a water depth of 0.6 m above floor level.

² A Critical Drainage Area (CDA) is an area that has critical drainage problems and which has been notified to the local planning authority as such by the Environment Agency in line with the National Planning Policy Framework (NPPF, 2023). CDA's are specific to Flood Zone 1, defined as areas where runoff can and may have historically contributed to flooding downstream, although they are not necessarily areas where flooding problems may occur. Where a Site is located in Flood Zone 1 and within a CDA, a Flood Risk Assessment (FRA) is required and the Council may also request Sustainable Drainage Scheme (SuDS) features to be included within the proposed development.

- >0.9 m Very likely to exceed the maximum flood depth where property-level flood resilience measures are still effective.

Climate change factors

Paragraph 002 of the National Planning Practice Guidance (August, 2022) requires consideration of the 1% AP (1 in 100 year) event, including an appropriate allowance for climate change.

As the Site is located within the London Management Catchment and the proposed development is classed as More Vulnerable, where the proposed lifespan is approximately 100 years, the Upper End (40%) allowance is required to determine a suitable climate change factor to apply to rainfall data.

The 0.1% AP (1 in 1000 year) surface water flooding event has been used as a proxy in this instance for the 1% AP (1 in 100 year) plus climate change event. In this event, flood depths of up to 0.9m are modelled in the area proposed for development. However, as the FFL of the proposed development is going to be 56.31 mAOD, the risk to the development is lower.

Surface water flooding flow routes

Analysis of OS mapping, ground elevation data and the EA's pluvial flow route mapping in the 1 in 1000 year (Low probability) event confirms the Site is located on a potential overland flow route.

The 1 in 1000 year (low probability) event indicates the extent of flooding in a worst-case future 100 year with climate change scenario, where a flood flow route does develop within the Site.

During a 1 in 1000 year event the majority of flow velocities are greater than 0.25 m/s. The flows could potentially affect the buildings and/or access routes to the Site.

A review of the Site plans, topography and the EA's Risk of Flooding from Surface Water Direction mapping indicates any overland flows on the Site would not be obstructed by the proposed development and occur across non-essential areas of the Site.

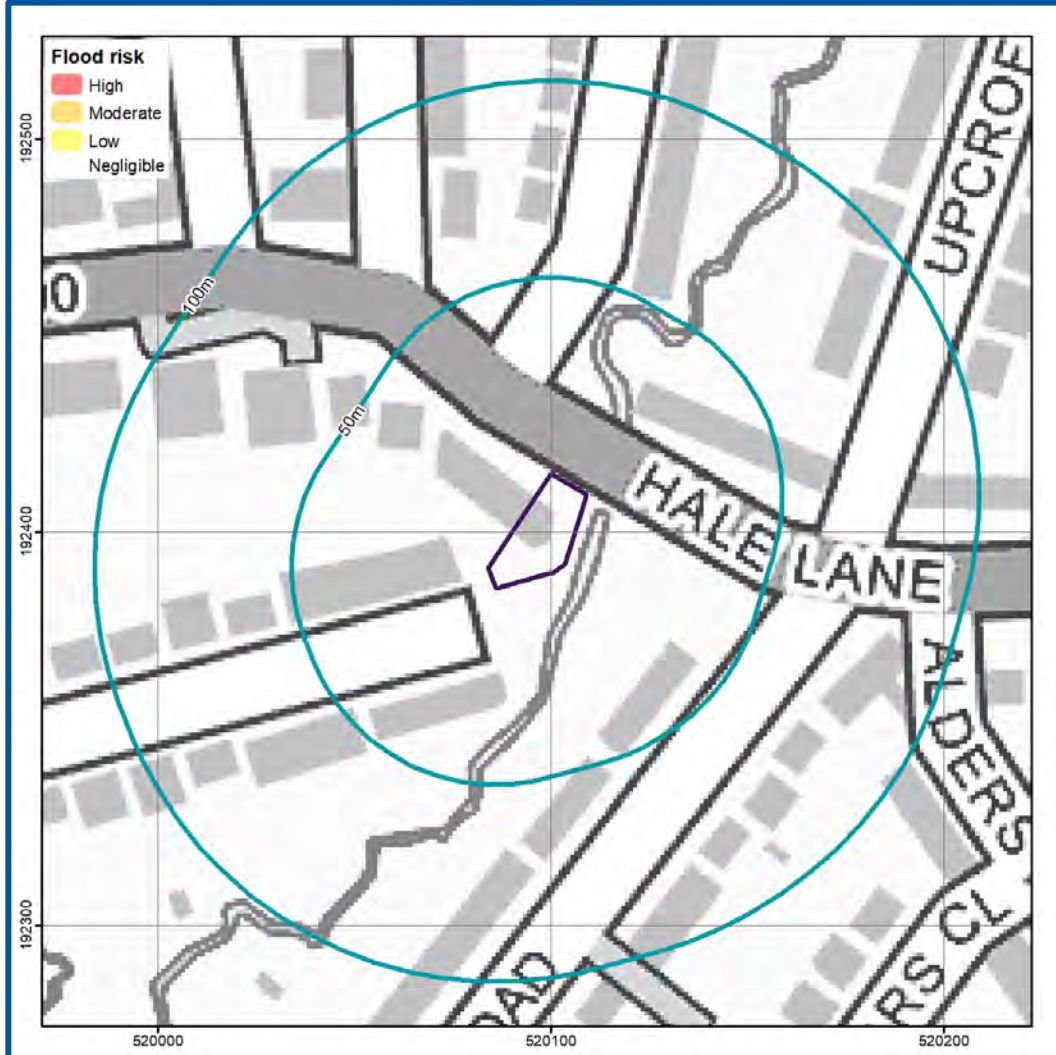
Local drainage features and boundary walls/fences, not accounted for in the EA model, have been identified which may intercept and mitigate the surface water flooding. There is a drain on the road at the front of the Site that could potentially mitigate the flow route.

Groundwater flooding

Groundwater flooding occurs when sub-surface water emerges from the ground at the surface or into Made Ground and structures. This may be as a result of persistent rainfall that recharges aquifers until they are full; or may be as a result of high river levels, or tides, driving water through near-surface deposits. Flooding may last a long time compared to surface water flooding, from weeks to months. Hence the amount of damage that is caused to property may be substantially higher.

Groundwater Flood Risk screening data (Figure 12) indicates there is a Negligible risk of groundwater flooding at surface in the vicinity from permeable superficial deposits during a 1 in 100 year event.

Figure 12. GeoSmart GW5 Groundwater Flood Risk Map (GeoSmart, 2024)



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Mapped classes within the screening map combine likelihood, possible severity and the uncertainty associated with predicting the subsurface system. The map is a national scale screening tool to prompt site-specific assessment where the impact of groundwater flooding would have significant adverse consequences. Mapping limitations and a number of local factors may reduce groundwater flood risk to land and property even where it lies within mapped groundwater flood risk zones, which do not mean that groundwater floods will occur across the whole of the risk area.

A site-specific assessment has been undertaken to refine the groundwater risk screening information on the basis of site-specific datasets (see Section 3) including BGS borehole data, and the EA's fluvial and tidal floodplain data (where available) to develop a conceptual groundwater model. The risk rating is refined further using the vulnerability of receptors

including occupants and the existing and proposed Site layout, including the presence of basements and buried infrastructure. The presence of any nearby or on-Site surface water features such as drainage ditches, which could intercept groundwater have also been considered.

It is understood there is an existing basement, however, the development proposals include the removal of it. The risks are higher for basements, buried infrastructure and soakaway systems which may be affected by high groundwater levels.

According to a review of the hydrogeology (Section 3), the Site is underlain by permeable superficial deposits above low permeability bedrock. A shallow groundwater table could potentially exist above the contact between the superficial and bedrock layers, resulting in a 'perched' groundwater table. Groundwater levels may rise in the superficial aquifer in a seasonal response to prolonged rainfall recharge which may cause an unusually high peak in groundwater levels during some years.

Groundwater levels may also rise in the superficial aquifer in response to high river events due to the potential hydraulic continuity with the nearby Dean's Brook.

It is noted groundwater flooding may occur in response to prolonged high water levels, bypassing flood defences even if overtopping does not occur.

Despite the presence of an aquifer the Site would only be at risk of groundwater flooding if the water table reaches the base of the Site development or the ground surface when groundwater seepage could lead to overland flow and ponding.

According to a review of the hydrogeology (Section 3), there are no nearby boreholes from which the underlying groundwater depth can be inferred.

Online mapping of the SFRA does not indicate reported incidents of historical ground water flooding within 50 m of the Site (Metis Consultants, 2018).

Spring lines have not been identified in close proximity to the Site.

The local topography and drainage is such that the development threshold is likely to be higher than the area where groundwater emerges in adjacent low points.

The hydrogeological characteristics suggest there is the potential for there to be a shallow groundwater table beneath the Site.

The baseline groundwater flood risk rating is Negligible, but on the basis of the site-specific assessment the groundwater flood risk to the Site is considered to be Low. This has been raised due to the close proximity of the nearby watercourse and the permeable superficial deposit.

Guidance

Low Risk - There will be a remote possibility that incidence of groundwater flooding could lead to damage to property or harm to other sensitive receptors at, or near, this location.

Climate change predictions suggest an increase in the frequency and intensity of extremes in groundwater levels. Rainfall recharge patterns will vary regionally resulting in changes to average groundwater levels. A rise in peak river levels will lead to a response of increased

groundwater levels in adjacent aquifers subject to the predicted climate change increases in peak river level for the local catchment. Sea level rises of between 0.4m and 1m are predicted by 2100, leading to a rise in average groundwater levels in the adjacent coastal aquifer systems, and potential increases in water levels in the associated drainage systems. The 'backing up' of groundwater levels from both coast and tidal estuary locations may extend a significant distance inland and affect infrastructure previously constructed above average groundwater levels.

The impact of climate change on groundwater levels beneath the Site is linked to the predicted rise in peak river levels and the variation in rainfall recharge which is uncertain.

Flooding from artificial sources

Artificial sources of flood risk include waterbodies or watercourses that have been amended by means of human intervention rather than natural processes. Examples include reservoirs (and associated water supply infrastructure), docks, sewers and canals. The flooding mechanism associated with flood risk from artificial sources is primarily related to breach or failure of structures (reservoir, lake, sewer, canal, flood storage areas, etc.)

Sewer flooding

The online Sewer, Groundwater & Artificial Flood Risk mapping of the SFRA has identified 81-100 incidences or modelled incidences of flooding as a result of surcharging sewers within the HA8 9 postcode. However, it is recognised that this four digit postcode covers a large area and instances of flooding are not specific to the Site (Metis Consultants, 2018).

Records held by Thames Water indicate that there have been no incidences of flooding related to the surcharging of public sewers at the Site (Thames Water, 2024; Appendix C).

Guidance

Properties classified as “at risk” are those that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system either once or twice in the ten year reference period. Records held by the sewage utility company provide information relating to reported incidents, the absence of any records does not mean that the Site is not at risk of flooding.

Canal failure

According to Ordnance Survey (OS) mapping, there are no canals within 500 m of the Site.

Water supply infrastructure

Water supply infrastructure is comprised of a piped network to distribute water to private houses or industrial, commercial or institution establishments and other usage points. In urban areas, this represents a particular risk of flooding due to the large amount of water supply infrastructure, its condition and the density of buildings. The risks of flooding to properties from burst water mains cannot be readily assessed.

If more information regarding the condition and history of the water supply infrastructure within the vicinity of the Site is required, then it is advisable to contact the local water supplier (Thames Water).

Culverts and bridges

The blockage of watercourses or structures by debris (that is, any material moved by a flowing stream including vegetation, sediment and man-made materials or refuse) reduces flow capacity and raises water levels, potentially increasing the risk of flooding. High water levels can cause saturation, seepage and percolation leading to failure of earth embankments or other structures. Debris accumulations can change flow patterns, leading to scour, sedimentation or structural failure.

Bridges have been identified within 50m upstream of the Site. These structures may pose a flood risk to the Site should they become blocked or damaged.

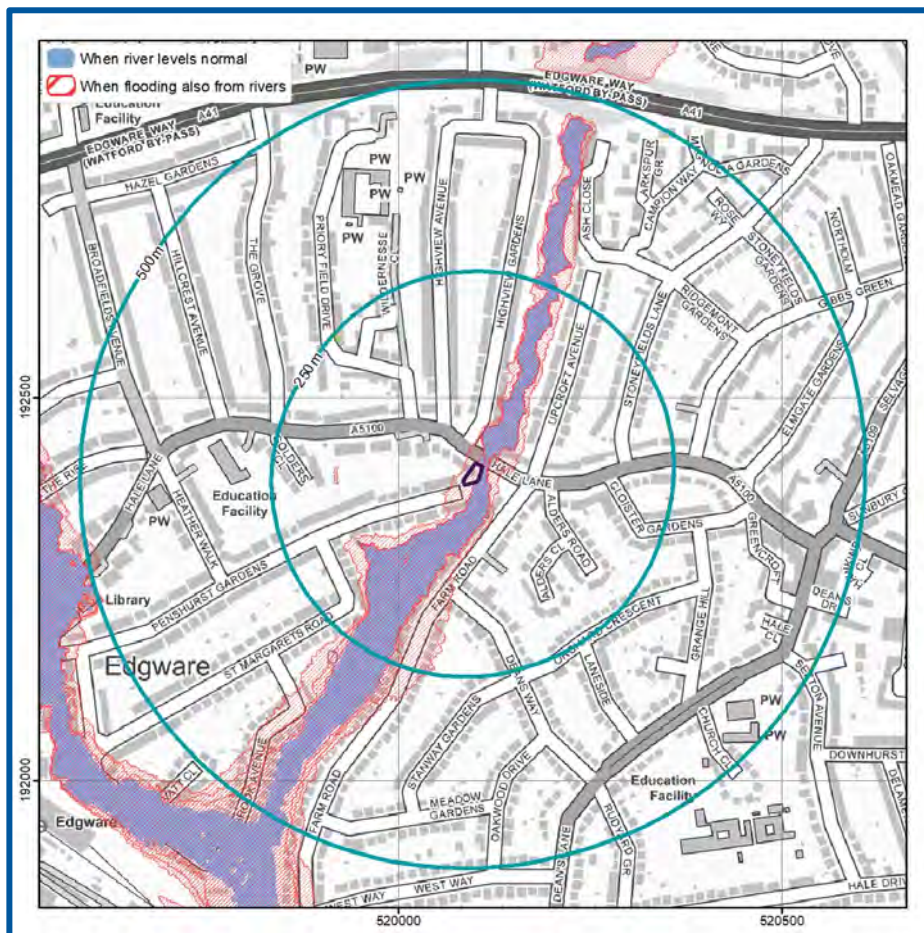
Culverts have been identified within 150 m of the Site. However, these structures are a significant distance from the Site and are unlikely to represent a flood risk to the Site in the event of a blockage.

Reservoir flooding

According to the EA's Risk of Flooding from Reservoir mapping the Site is at risk of flooding from reservoirs (Figure 13) (EA, 2024).

The Site is considered to be at risk of flooding from the Stoney Wood Reservoir.

Figure 13. EA Risk of Reservoir Flooding (EA, 2024)



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Guidance

The risk of reservoir flooding is related to the failure of a large reservoir (holding over 25,000 m³ of water) and is based on the worst-case scenario. Reservoir flooding is extremely unlikely to occur (EA, 2024).

5. Flood risk from the development



Floodplain storage

Where flood storage from any source of flooding is to be lost as a result of development, on-Site level-for-level compensatory storage, accounting for the predicted impacts of climate change over the lifetime of the development, should be provided. Where it is not possible to provide compensatory storage on-Site, it may be acceptable to provide it off-Site if it is hydraulically and hydrologically linked.

The loss of floodplain storage is less likely to be a concern in areas benefitting from appropriate flood risk management infrastructure or where the source of flood risk is solely tidal.

The development is located within a fluvial Flood Zone 2/3 but does not involve an increase in building footprint. The existing built footprint of the Site is approximately 182m², the new proposals create a built footprint of approximately 165m². Therefore, there would be no displacement of flood water and compensatory flood storage is not required.

Drainage and run-off

Based on the topography and surface water flood risk in the vicinity, interference or interaction with overland flow paths and inflows from off-Site is considered possible. It is recommended that steps are taken to manage these potential inflows within the Site drainage system.

The potential surface water run-off generated from the Site during a 1 in 100 year return period should be calculated, using FEH 2022 rainfall data from the online Flood Estimation Handbook (FEH), developed by NERC (2009) and CEH (2016).

The NPPF (2023) recommends the effects of climate change are incorporated into FRA's. As per the most recent update to the NPPG (May 2022) the applicable climate change factor for the 1 in 30 ($\geq 3.3\%$ AEP) and 1 in 100 (< 3.3 to 1% AEP) year event to apply to surface water flooding is dependent upon the management catchment.

As the proposed development is residential, the lifespan of the development and requirements for climate change should allow up to the 1% AEP upper end allowance. As the Site is located within the London Management Catchment the following peak rainfall allowances are to be applied.

Table 4. Climate change rainfall allowances

London Management Catchment	3.3% Annual exceedance rainfall event		1% Annual exceedance rainfall event	
	2050s	2070s	2050s	2070s

Upper end	35%	35%	40%	40%
Central	20%	20%	20%	25%

Sustainable Drainage System (SuDS)

It is recommended that attenuation of run-off is undertaken on-Site to compensate for proposed increases in impermeable surface areas. Attenuation may comprise the provision of storage within a Sustainable Drainage System (SuDS). SuDS can deliver benefits from improving the management of water quantity, water quality, biodiversity and amenity. The client has proposed a green roof (Appendix A). This as well as other potential SuDS features are presented in the table below, subject to further investigation:

Table 5. SuDS features which may be feasible for the Site

Option	Description
Rainwater harvesting	Rainwater harvesting can collect run-off from the roofs for use in non-potable situations, using water butts for example.
Green roof	Having part/all of the roof as a green roof covered in vegetation can intercept and store a proportion of the rainfall to result in an overall reduction in the amount of surface water run-off generated from a building structure. They comprise a substrate (growth medium) layer which can be seeded with specially selected plants suitable for the local climatic conditions. Beneath the growth medium is a geotextile filter layer which filters out the substrate from entering the aggregate/geo-composite drainage layer below. At the very bottom of the green roofing, a waterproof membrane protects the roof structure below.
Permeable paving	Permeable pavements can be used for driveways, footpaths and parking areas to increase the amount of permeable land cover. Suitable aggregate materials (angular gravels with suitable grading as per CIRIA, 2007) will improve water quality due to their filtration capacity. Plastic geocellular systems beneath these surfaces can increase the void space and therefore storage but do not allow filtration unless they are combined with aggregate material and/or permeable geotextiles.
Soakaways	An excavation filled with gravel within the Site. Surface water run-off is piped to the soakaway.

6. Suitability of the proposed development



The information below outlines the suitability of proposed development in relation to national and local planning policy.

National policy and guidance

The aims of the national planning policies are achieved through application of the Sequential Test and in some cases the Exception Test.

Guidance

Sequential test: The aim of this test is to steer new development towards areas with the lowest risk of flooding (NPPF, 2023). Reasonably available sites located in Flood Zone 1 should be considered before those in Flood Zone 2 and only when there are no reasonably available sites in Flood Zones 1 and 2 should development in Flood Zone 3 be considered.

Exception test: In some cases, this may need to be applied once the Sequential Test has been considered. For the exception test to be passed it must be demonstrated that the development would provide wider sustainability benefits to the community that outweigh flood risk and a site-specific FRA must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Suitability of the proposed development, and whether the Sequential and Exception Tests are required, is based on the Flood Zone the Site is located within and the flood risk vulnerability classification of the existing and proposed development. Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

This report has been produced to assess all development types, prior to any development. The vulnerability classification and Flood Zones are compared within the table overleaf (Table 2 of the NPPG (2022)).

As the Site is located within Flood Zone 3a and the proposed development is defined as More Vulnerable; the proposals are acceptable, but may be subject to the Sequential and Exceptions Test.

Where the Sequential Test is required it must be demonstrated that there are no alternative reasonably available Sites at lower risk of flooding within an area agreed with the council e.g. London Borough of Barnet Council NPPF (2023).

Table 6. Flood risk vulnerability and flood zone ‘incompatibility (taken from NPPG, 2022)

Flood risk vulnerability classification		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood Zone	Zone 1 – low probability	✓	✓	✓	✓	✓
	Zone 2 – medium probability	✓	✓	Exception test required	✓	✓
	Zone 3a – high probability	Exception test required	✓	X	Exception test required	✓
	Zone 3b – functional flood plain	Exception test required	✓	X	X	X

EA Flood Risk Standing Advice for vulnerable developments located in Flood Zones 2 or 3 (February, 2022)

The proposed development is considered to be a minor extension, this is defined as a household or non-domestic extension with a floor space of no more than 250 m².

In line with the 'Minor extensions standing advice'

- A plan is required showing the finished floor levels and the estimated flood levels.
- Floor levels are either no lower than existing floor levels or 0.3 m above the estimated flood level. If your floor levels aren't going to be 0.3 m above existing flood levels, you need to check with your local planning authority if you also need to take flood resistance and resilience measures.

For all relevant vulnerable developments (i.e. more vulnerable, less vulnerable and water compatible), advice on the points should be followed:

- Surface water management;
- Access and evacuation; and
- Floor levels.

Surface water management

Plans for the management of surface water need to meet the requirements set out in either the local authority's:

- Surface water management plan where available; OR
- Strategic flood risk assessment.

They also need to meet the requirements of the approved building regulations Part H: drainage and water disposal. Read section H3 rainwater drainage.

Planning permission is required to use a material that can't absorb water (e.g. impermeable concrete) in a front garden larger than 5m².

Access and evacuation

Details of emergency escape plans should be provided for any parts of a building that are below the estimated flood level:

Plans should show:

- Single storey buildings or ground floors that don't have access to higher floors can access a space above the estimated flood level, e.g. higher ground nearby;
- Basement rooms have clear internal access to an upper level, e.g. a staircase;
- Occupants can leave the building if there's a flood and there's enough time for them to leave after flood warnings.

Floor levels

The following should be provided:

- average ground level of your site
- ground level of the access road(s) next to your building
- finished floor level of the lowest room in your building

Finished floor levels should be a minimum of whichever is higher of 300mm above the:

- average ground level of the site
- adjacent road level to the building
- estimated river or sea flood level

You should also use construction materials that have low permeability up to at least the same height as finished floor levels.

If you cannot raise floor levels to meet the minimum requirement, you will need to:

- raise them as much as possible
- consider moving vulnerable uses to upper floors
- include extra flood resistance and resilience measures

When considering the height of floor levels, you should also consider any additional requirements set out in the SFRA. Flood water can put pressure on buildings causing structural issues. If your design aims to keep out a depth of more than 600mm of water, you should get advice from a structural engineer. They will need to check the design is safe.

Extra flood resistance and resilience measures

Follow the guidance in this section for developments in flood risk areas where you cannot raise the finished floor levels to the required height. You should design buildings to exclude flood water where possible and to speed recovery in case water gets in.

Make sure your flood resilience plans for the development follow the guidance in the CIRIA Property Flood Resilience Code of Practice. Please note that the code of practice uses the term 'recovery measures'. In this guide we use 'resilience measures'.

Flooding can affect the structural stability of buildings. If your building design would exclude more than 600mm of flood water, you should get advice from a structural engineer. They will need to check the design is safe. Only use resistance measures that will not cause structural stability issues during flooding. If it is not possible to safely exclude the estimated flood level, exclude it to the structural limit then allow additional water to flow through the property.

The design should be appropriately flood resistant and resilient by:

- using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
- making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level

- using flood resilient materials (for example lime plaster) to at least 600mm above the estimated flood level
- by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level
- making it easy for water to drain away after flooding such as installing a sump and a pump
- making sure there is access to all spaces to enable drying and cleaning
- ensuring that soil pipes are protected from back-flow such as by using non-return valves

Temporary or demountable flood barriers are not appropriate for new buildings. Only consider them for existing buildings when:

- there is clear evidence that it would be inappropriate to raise floor levels and include passive resistance measures
- an appropriate flood warning or other appropriate trigger is available

If proposals involve the development of buildings constructed before 1919, refer to Flooding and Historic Buildings guidance produced by Historic England.

7. Resilience and mitigation



Based on the flood risk identified at the Site, the national and local policies and guidance and proposed development, the mitigation measures outlined within this section of the report are likely to help protect the development from flooding.

Sea (coastal/tidal) flood mitigation measures

As the Site is not identified as being at risk of flooding from the sea, mitigation measures are not required.

Rivers (fluvial) and Surface Water (pluvial) flood mitigation measures

The Site is located within an area which is affected by flooding from rivers, the following table confirms the flood depths associated with the area proposed for development.

Table 7. Flood levels compared to ground levels in the area proposed for development.

Ground levels on Site (mAOD)	Modelled Flood Levels (mAOD)		
	1 in 100 year (fluvial)	1 in 100 year plus 17% allowance for climate change (fluvial)	1 in 100 year plus 40% climate allowance for climate change (pluvial)
55.07 to 56.40	55.16	55.38	56.00
External flood depths (m)	No Flooding	Up to 0.06	Up to 0.90m
Internal FFLs of 56.31 mAOD	No Internal Flooding	No Internal Flooding	No Internal Flooding

As the proposed Finished Floor Levels (FFLs) are above modelled flood levels, no further mitigation measures are required.

If these mitigation measures are implemented this could reduce the flood risk to the development from Very Low to Medium to Very Low to Low.

Groundwater flood mitigation measures

A Low risk of groundwater flooding has been identified at the Site. As the proposed FFLs are 0.30m (300mm) above adjacent ground levels this mitigates the groundwater flood risk at the Site. Alternative mitigation measures include:

- Waterproof tanking of the ground floor;
- Interceptor drains;
- Automatic sump to extract flood water; and
- Non-return flap valves on the proposed foul and surface water sewer lines.

If these mitigation measures are implemented this could reduce the flood risk to the development from Low to Negligible.

Reservoir flood mitigation measures

According to EA data, the Site is at risk of flooding from the Stoney Wood reservoir. There would be a relatively high rate and onset of flooding associated with a reservoir breach, it is therefore unlikely that safe access could be achieved unless a long warning period was provided. Therefore, occupants should get to the highest level of the building as possible and contact the emergency services.

Other flood risk mitigation measures

As the Site is not identified as at risk from other sources, mitigation measures are not required.

Residual flood risk mitigation measures

The risk to the Site has been assessed from all sources of flooding and appropriate mitigation and management measures proposed to keep the users of the development safe over its lifetime. There is however a residual risk of flooding associated with the potential for failure of mitigation measures if regular maintenance and upkeep isn't undertaken. If mitigation measures are not implemented or maintained, the risk to the development will remain as the baseline risk.

Further flood mitigation information

More information on flood resistance, resilience and water entry can be found here: http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf

www.knowyourfloodrisk.co.uk

Emergency evacuation - safe access / egress and safe refuge

Emergency evacuation to land outside of the floodplain should be provided if feasible. Where this is not possible, 'more vulnerable' developments and, where possible, development in general (including basements), should have internal stair access to an area of safe refuge within the building to a level higher than the maximum likely water level. An area of safe refuge should be sufficient in size for all potential users and be reasonably accessible to the emergency services.

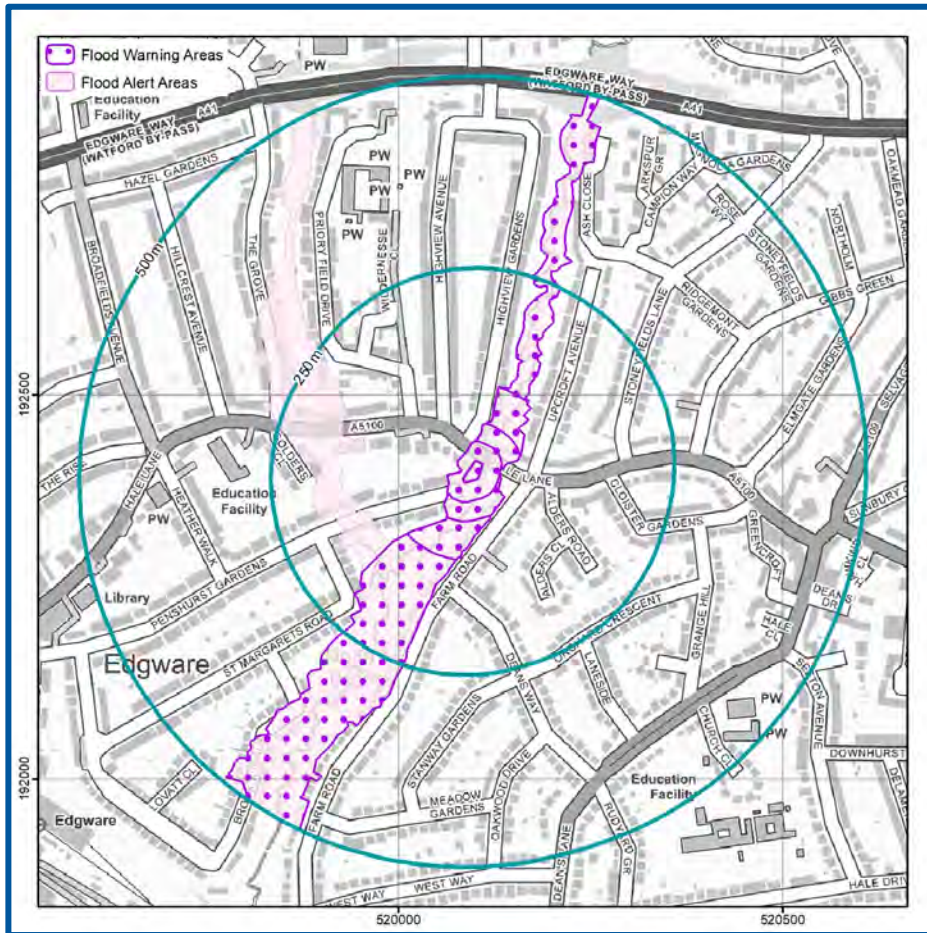
Emergency evacuation from the development and the Site should only be undertaken in strict accordance with any evacuation plans produced for the Site, with an understanding of the flood risks at the Site including available mitigation, the vulnerability of occupants and preferred evacuation routes.

Flood warnings

The EA operates a flood warning service in all areas at risk of flooding; this is available on their website: <https://www.gov.uk/check-flood-risk>. The Site is located within an EA Flood Alerts and Warning coverage area (ref: 062WAF38BRentBks & 062FWF38BrentBk) so is able to receive alerts and warnings (Figure 14). All warnings are also available through the EA's 24 hour Floodline Service 0345 988 1188.

The EA aims to issue Flood Warnings 2 hours in advance of a flood event. Flood Warnings can provide adequate time to enable protection of property and evacuation from a Site, reducing risk to life and property.

Figure 14. EA Flood Warning Coverage for the local area (EA, 2024).



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Emergency evacuation

Where possible, a safe access and egress route with a 'very low' hazard rating from areas within the floodplain to an area wholly outside the 1 in 100 year flood event including an allowance for climate change should be demonstrated.

Based on the EA's Flood Zone Map the closest dry evacuation area within Flood Zone 1 is along Hale Lane (c.25 m north west – direct measurement). It is advised that evacuation from the premises would be the preferred option in a flood event if safe to do so. It is recommended that residents prepare to evacuate as soon as an EA Flood Warning is issued in order to completely avoid flood waters.

On-Site refuge

Evacuation should be the primary action in preference, however safe refuge could be sought at first floor level in a worst-case scenario as the residential areas of the development are situated on the first and second floor.

Other relevant information

A Flood Warning and Evacuation Plan (FWEP) is recommended, and occupants should be signed up to receive EAs Flood Alerts and/or Warnings.

Registration to the Environment Agency's flood warning scheme can be done by following this link: <https://www.gov.uk/sign-up-for-flood-warnings>.

It is recommended that main communication lines required for contacting the emergency services, electricity sockets/meters, water supply and first aid stations and supplies are not compromised by flood waters. Where possible these should all be raised above the extreme flood level.

8. Conclusions and recommendations



Table 8. Risk ratings following Site analysis

Source of Flood Risk	Baseline ¹	After analysis ²	After Mitigation ³
River (fluvial) flooding	Low		Very Low to Low
Sea (coastal/tidal) flooding	Very Low		N/A
Surface water (pluvial) flooding	Very Low to Medium		Very Low to Low
Groundwater flooding	Negligible	Low	Negligible
Other flood risk factors present (reservoirs)	Yes		Yes
Is any other further work recommended?	Yes		Yes (see below)

1 BASELINE risks assigned for the whole Site, using national risk maps, including the benefit of EA flood defences.

2 AFTER ANALYSIS modification of risk assessment based on detailed site specific analysis including some or all of the following: flood model data, high resolution mapping, building location, access routes, topographic and CCTV surveys. Reasons for the change in classification are provided in the text.

3 AFTER MITIGATION risks include risks to proposed development / asset and occupants if mitigation measures recommended in this report are implemented, including the impacts of climate change.

*N/A indicates where mitigation is not required.

The table below provides a summary of where the responses to key questions are discussed in this report. Providing the recommended mitigation measures are put in place it is likely that flood risk to this Site will be reduced to an acceptable level.

More vulnerable developments in a Flood Zone 2 and 3 are acceptable according to the NPPF and providing the recommended mitigation measures are put in place (see previous sections) it is likely that flood risk to this Site will be reduced to an acceptable level.

Table 9. Summary of responses to key questions in the report

Key sources of flood risks identified	Fluvial (rivers), pluvial (surface water) & reservoirs (see Section 4).
Are standard mitigation measures likely to provide protection from flooding to/from the Site?	Yes (see Section 7).
Is any further work recommended?	Yes (See exec summary and section 7)

9. Further information



The following table includes a list of additional products by GeoSmart:

Additional GeoSmart Products			
✓	Additional assessment: SuDSmart Report		<p>The SuDSmart Report range assesses which drainage options are available for a Site. They build on technical detail starting from simple infiltration screening and work up to more complex SuDS Assessments detailing alternative options and designs.</p> <p>Please contact info@geosmartinfo.co.uk for further information.</p>
✓	Additional assessment: EnviroSmart Report		<p>Provides a robust desk-based assessment of potential contaminated land issues, taking into account the regulatory perspective.</p> <p>Our EnviroSmart reports are designed to be the most cost effective solution for planning conditions. Each report is individually prepared by a highly experienced consultant conversant with Local Authority requirements.</p> <p>Ideal for pre-planning or for addressing planning conditions for small developments. Can also be used for land transactions.</p> <p>Please contact info@geosmartinfo.co.uk for further information.</p>



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Glossary

General terms

BGS	British Geological Survey
EA	Environment Agency
GeoSmart groundwater flood risk model	GeoSmart's national groundwater flood risk model takes advantage of all the available data and provides a preliminary indication of groundwater flood risk on a 50m grid covering England and Wales. The model indicates the risk of the water table coming within 1 m of the ground surface for an indicative 1 in 100 year return period scenario.
Dry-Island	An area considered at low risk of flooding (e.g. In a Flood Zone 1) that is entirely surrounded by areas at higher risk of flooding (e.g. Flood Zone 2 and 3)
Flood resilience	Flood resilience or wet-proofing accepts that water will enter the building, but through careful design will minimise damage and allow the re-occupancy of the building quickly. Mitigation measures that reduce the damage to a property caused by flooding can include water entry strategies, raising electrical sockets off the floor, hard flooring.
Flood resistance	Flood resistance, or dry-proofing, stops water entering a building. Mitigation measures that prevent or reduce the likelihood of water entering a property can include raising flood levels or installation of sandbags.
Flood Zone 1	This zone has less than a 0.1% annual probability of river flooding
Flood Zone 2	This zone has between 0.1 and 1% annual probability of river flooding and between 0.1% and 0.5 % annual probability sea flooding
Flood Zone 3	This zone has more than a 1% annual probability of river flooding and 0.5% annual probability of sea flooding
Functional Flood Plain	An area of land where water has to flow or be stored in times of flood.
Hydrologic model	A computer model that simulates surface run-off or fluvial flow. The typical accuracy of hydrologic models such as this is $\pm 0.25\text{m}$ for estimating flood levels at particular locations.
OS	Ordnance Survey
Residual Flood Risk	The flood risk remaining after taking mitigating actions.
SFRA	Strategic Flood Risk Assessment. This is a brief flood risk assessment provided by the local council

SuDS	A Sustainable drainage system (SuDS) is designed to replicate, as closely as possible, the natural drainage from the Site (before development) to ensure that the flood risk downstream of the Site does not increase as a result of the land being developed. SuDS also significantly improve the quality of water leaving the Site and can also improve the amenity and biodiversity that a Site has to offer. There are a range of SuDS options available to provide effective surface water management that intercept and store excess run-off. Sites over 1 Ha will usually require a sustainable drainage assessment if planning permission is required. The current proposal is that from April 2014 for more than a single dwelling the drainage system will require approval from the SuDS Approval Board (SABs).
------	--

Aquifer Types

Principal aquifer	These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
-------------------	---

Secondary A aquifer	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.
---------------------	---

Secondary B aquifer	Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.
---------------------	--

Secondary undifferentiated	Has been assigned in cases where it has not been possible to attribute either category A or B to a rock type due to the variable characteristics of the rock type.
----------------------------	--

Unproductive Strata	These are rock layers or drift deposits with low permeability that has negligible significance for water supply or river base flow.
---------------------	---

NPPF (2023) terms

Exception test	Applied once the sequential test has been passed. For the exception test to be passed it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk and a site-specific FRA must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.
----------------	---

Sequential test	Aims to steer new development to areas with the lowest probability of flooding.
-----------------	---

Essential infrastructure	Essential infrastructure includes essential transport infrastructure, essential utility infrastructure and wind turbines.
--------------------------	---

Water compatible	Water compatible land uses include flood control infrastructure, water-based recreation and lifeguard/coastal stations.
Less vulnerable	Less vulnerable land uses include police/ambulance/fire stations which are not required to be operational during flooding and buildings used for shops/financial/professional/other services.
More vulnerable	More vulnerable land uses include hospitals, residential institutions, buildings used for dwelling houses/student halls/drinking establishments/hotels and sites used for holiday or short-let caravans and camping.
Highly vulnerable	Highly vulnerable land uses include police/ambulance/fire stations which are required to be operational during flooding, basement dwellings and caravans/mobile homes/park homes intended for permanent residential use.

Data Sources

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Bedrock & Superficial Geology	Contains British Geological Survey materials © NERC 2024 Ordnance Survey data © Crown copyright and database right 2024
Flood Risk (Flood Zone/RoFRS/Historic Flooding/Pluvial/Surface Water Features/Reservoir/ Flood Alert & Warning)	Environment Agency copyright and database rights 2024 Ordnance Survey data © Crown copyright and database right 2024
Flood Risk (Groundwater)	GeoSmart, BGS & OS GW5 (v2.4) Map (GeoSmart, 2024) Contains British Geological Survey materials © NERC 2024 Ordnance Survey data © Crown copyright and database right 2024
Location Plan	Contains Ordnance Survey data © Crown copyright and database right 2024
Topographic Data	OS LiDAR/EA Contains Ordnance Survey data © Crown copyright and database right 2024 Environment Agency copyright and database rights 2024

11. Appendices








Site plans

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KEY

-  NEW WALLS
-  NEW OPENING
-  LINE DENOTES REMOVAL OF EXISTING STRUCTURE



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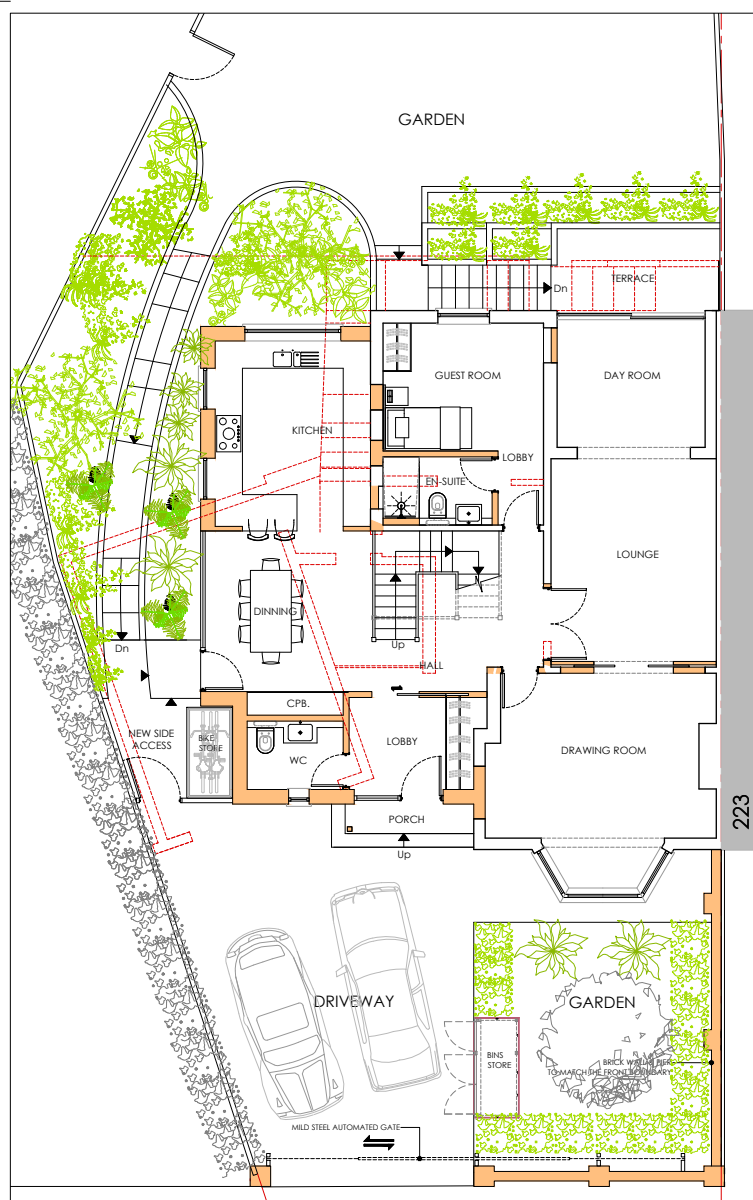
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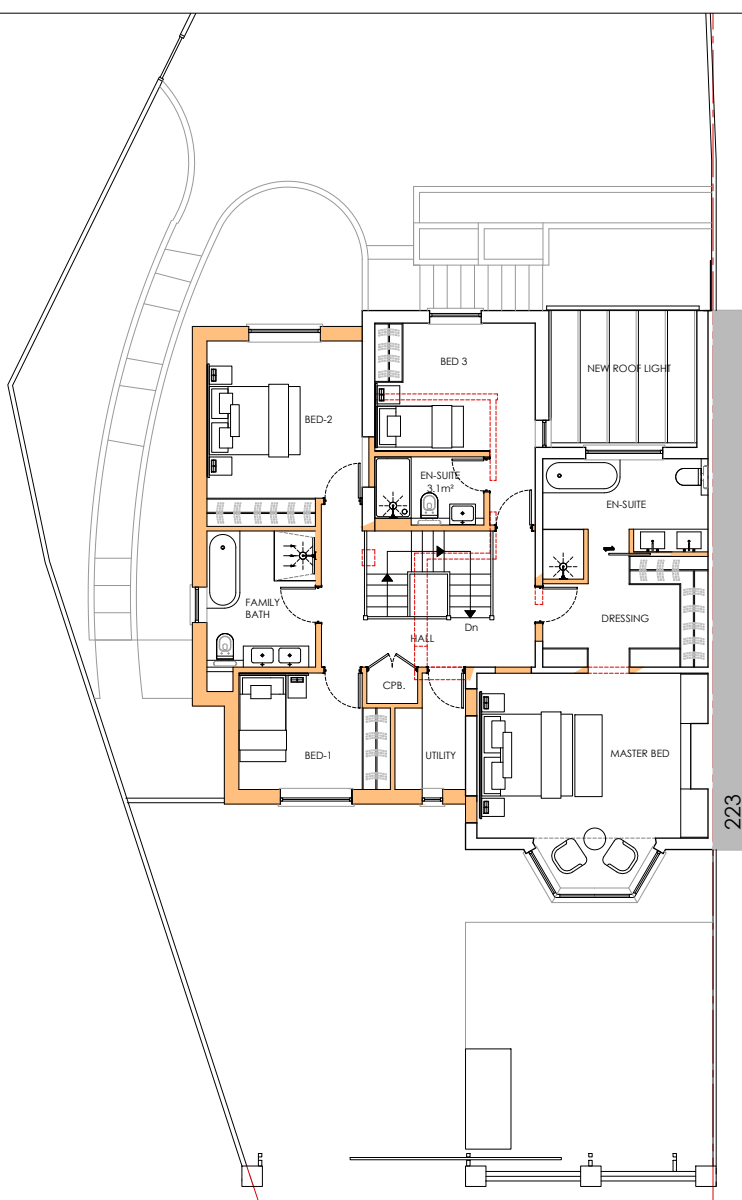
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PROPOSED GROUND & FIRST FLOOR PLAN

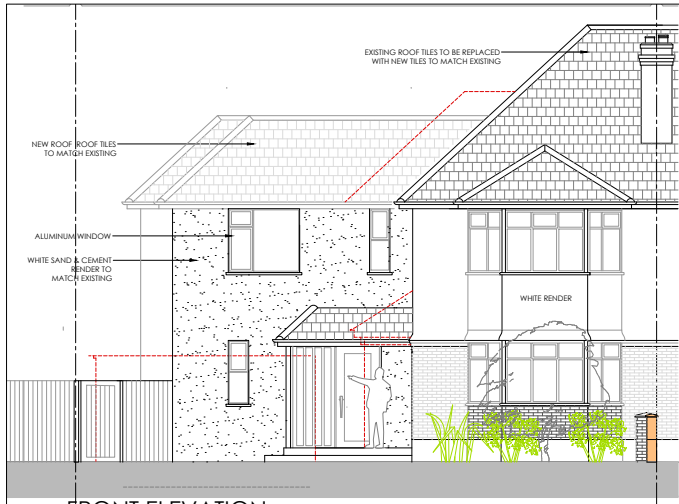
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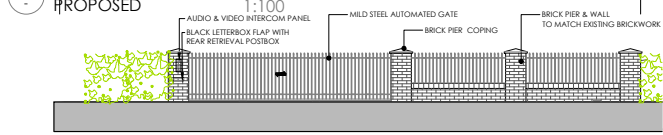
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PROPOSED 1:100



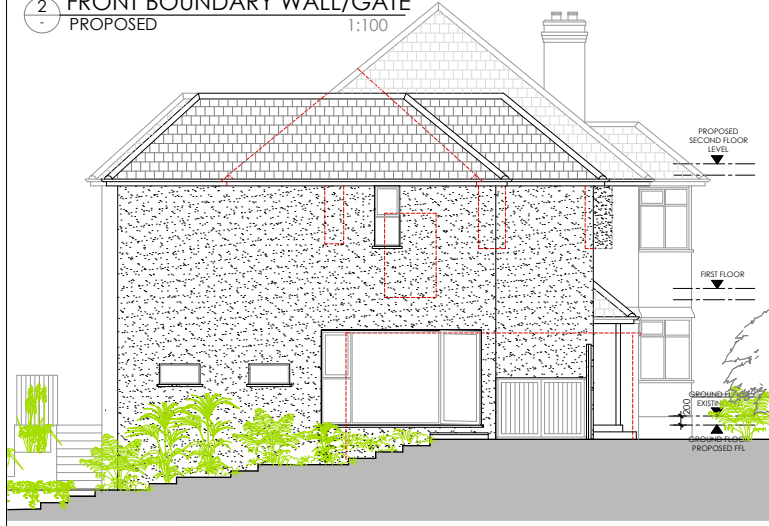
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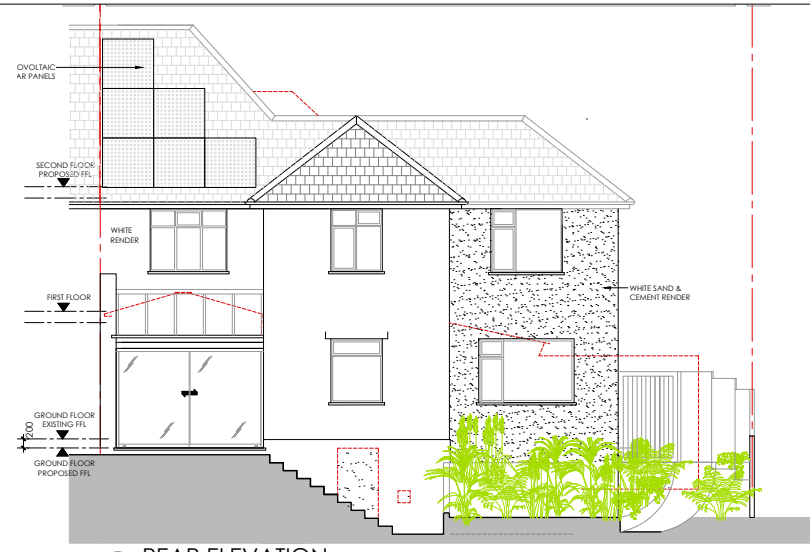
1 FRONT ELEVATION
PROPOSED



2 FRONT BOUNDARY WALL/GATE
PROPOSED



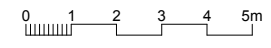
4 SOUTH EAST ELEVATION
PROPOSED



3 REAR ELEVATION
PROPOSED



5 NORTH WEST ELEVATION
PROPOSED



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CLIENT		
MR SAED S FAGHIH		

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IMAGE

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PLANNING	A3	
PROJECT CODE	DOC. CODE	DRAWING NO.
2316	EL	212

SITE PHOTOS

Site Address: 221 Hale Lane, Edgware HA8 9QFJH



architecture . interiors . planning

January 2024



FRONT FACADE

GROUND FLOOR



FRONT FACADE

GROUND FLOOR



SIDE FACADE

GROUND FLOOR

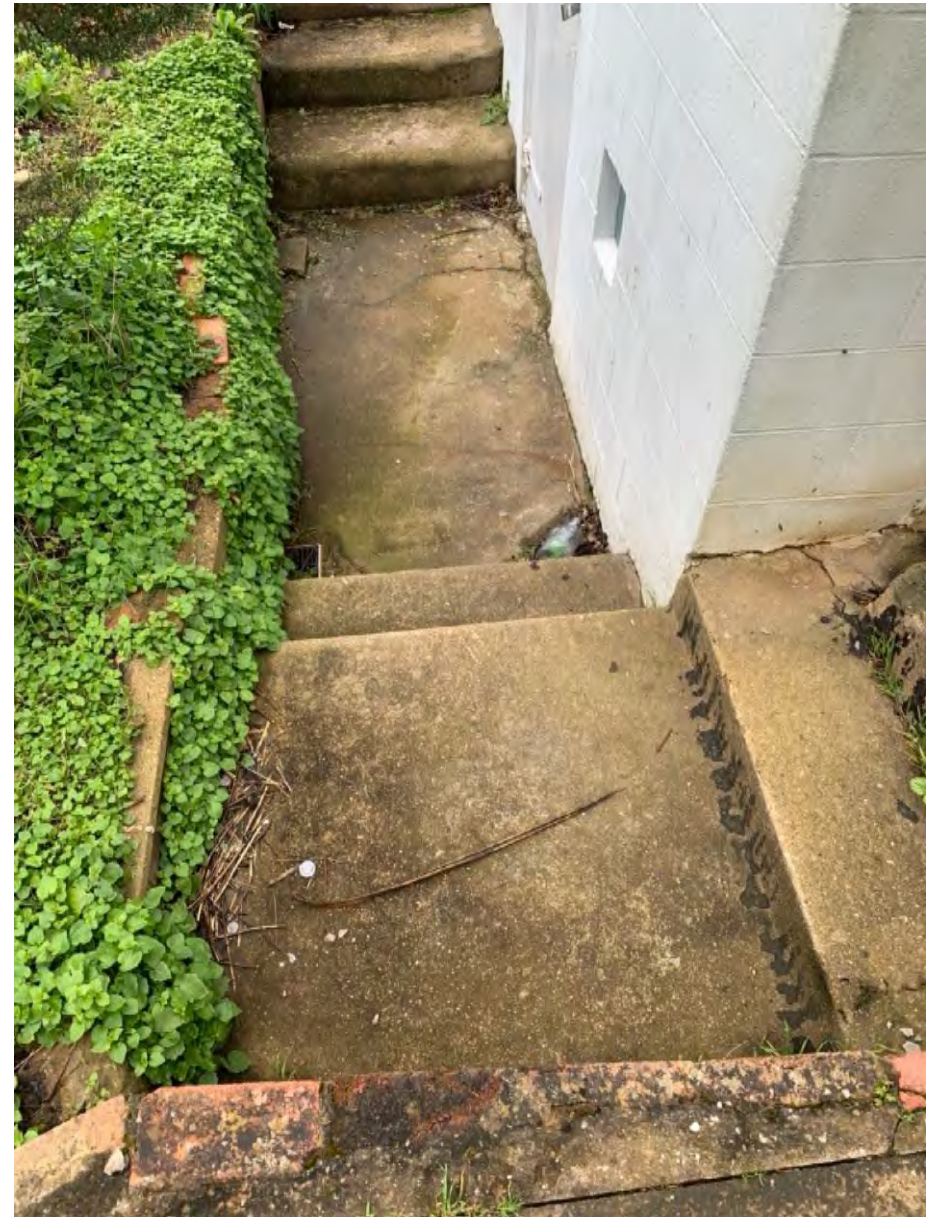


REAR FACADE- GARGAE





REAR FACADE



REAR FACADE



REAR GARDEN



REAR GARDEN



REAR GARDEN



Environment Agency data

Silk Stream, North West London Modelling study

Final Report




January 2019

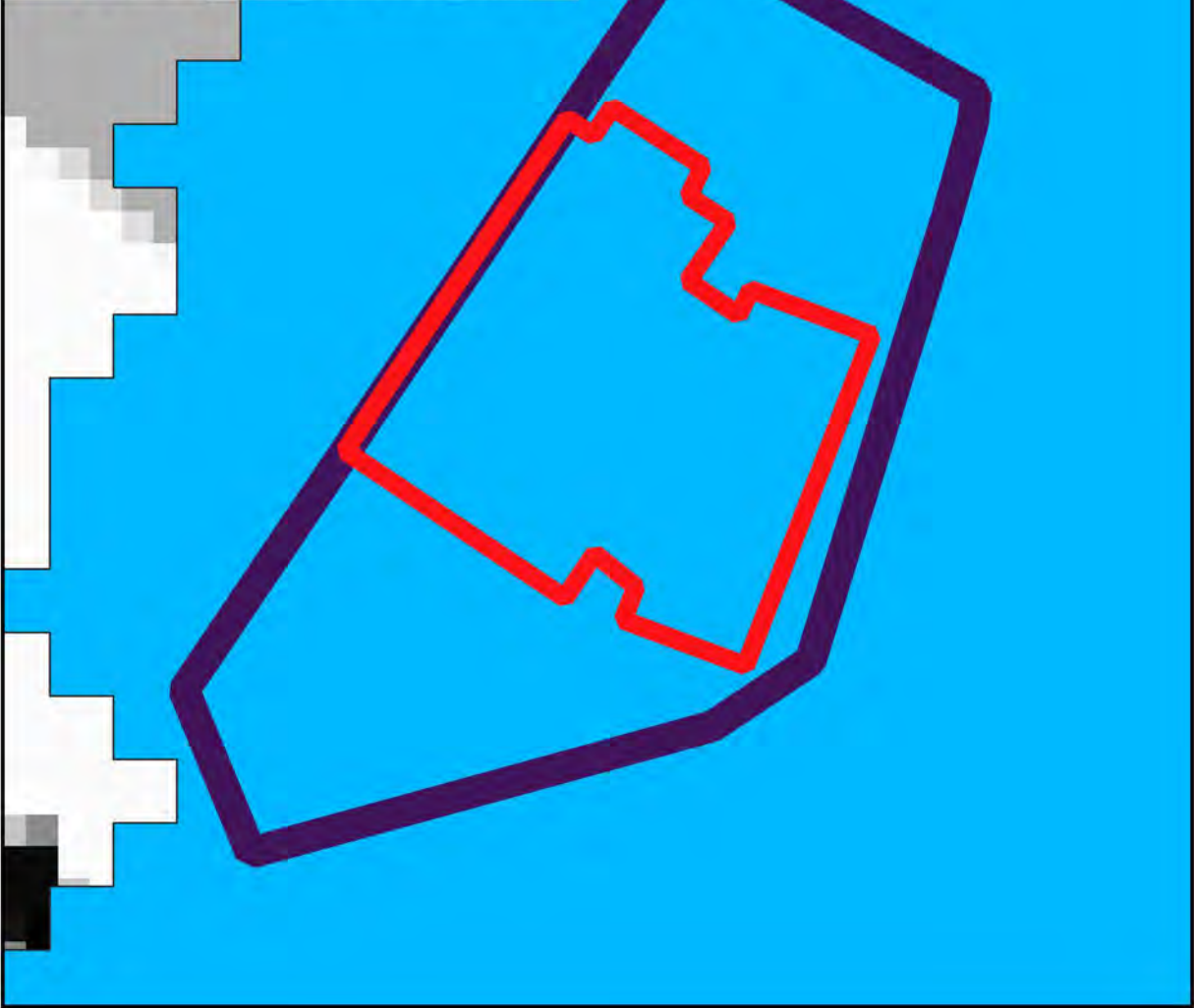
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Alchemy
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WELWYN GARDEN CITY
Hertfordshire
AL1 1HE





-  Area proposed for development
-  Client Site
-  1 in 100 year + 25% CC allowance





Thames Water sewer flooding history

Sewer Flooding

History Enquiry



Property Searches

GeoSmart Information Ltd

Bellstone

Search address supplied 221
Hale Lane
Edgware
HA8 9QF

Your reference 81713

Our reference SFH/SFH Standard/2024_4961312

Received date **14 March 2024**

Search date **14 March 2024**



Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW



searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk



0800 009 4540

Sewer Flooding

History Enquiry



Property Searches

Search address supplied: 221,Hale Lane,Edgware,HA8 9QF

This search is recommended to check for any sewer flooding in a specific address or area

TWUL, trading as Property Searches, are responsible in respect of the following:-

- (i) any negligent or incorrect entry in the records searched;
- (ii) any negligent or incorrect interpretation of the records searched;
- (iii) and any negligent or incorrect recording of that interpretation in the search report
- (iv) compensation payments



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Property Searches, PO Box 3189, Slough SL1 4WW



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www.thameswater-propertysearches.co.uk



0800 009 4540

History of Sewer Flooding

Is the requested address or area at risk of flooding due to overloaded public sewers?

The flooding records held by Thames Water indicate that there have been no incidents of flooding in the requested area as a result of surcharging public sewers.

For your guidance:

- A sewer is “overloaded” when the flow from a storm is unable to pass through it due to a permanent problem (e.g. flat gradient, small diameter). Flooding as a result of temporary problems such as blockages, siltation, collapses and equipment or operational failures are excluded.
- “Internal flooding” from public sewers is defined as flooding, which enters a building or passes below a suspended floor. For reporting purposes, buildings are restricted to those normally occupied and used for residential, public, commercial, business or industrial purposes.
- “At Risk” properties are those that the water company is required to include in the Regulatory Register that is presented annually to the Director General of Water Services. These are defined as properties that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system more frequently than the relevant reference period (either once or twice in ten years) as determined by the Company’s reporting procedure.
- Flooding as a result of storm events proven to be exceptional and beyond the reference period of one in ten years are not included on the At Risk Register.
- Properties may be at risk of flooding but not included on the Register where flooding incidents have not been reported to the Company.
- Public Sewers are defined as those for which the Company holds statutory responsibility under the Water Industry Act 1991.
- It should be noted that flooding can occur from private sewers and drains which are not the responsibility of the Company. This report excludes flooding from private sewers and drains and the Company makes no comment upon this matter.
- For further information please contact Thames Water on Tel: 0800 316 9800 or website www.thameswater.co.uk



Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW



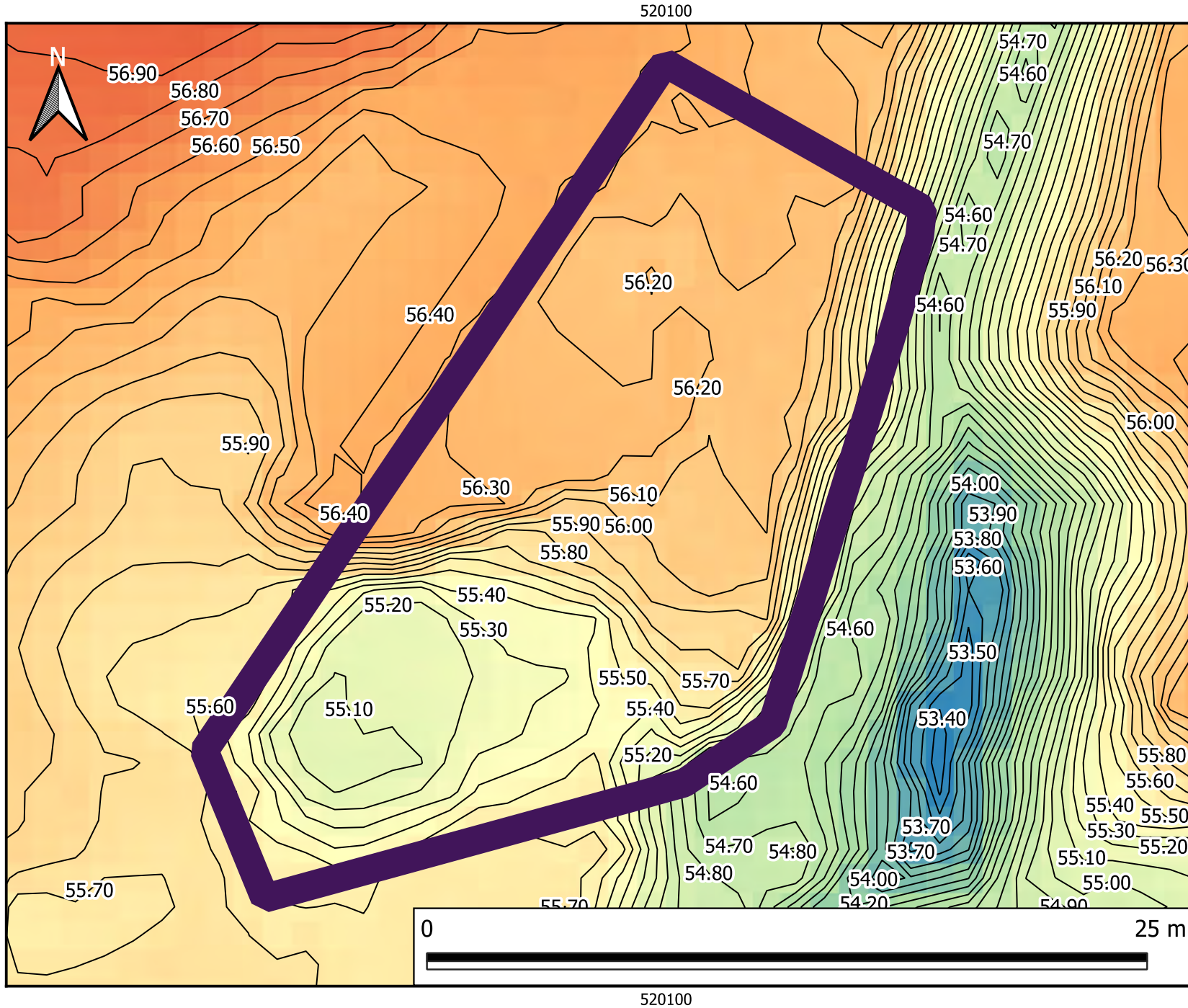
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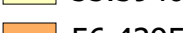

Environment Agency LiDAR ground elevation data



Elevation on Site
(LiDAR Data)

-  Client Site
-  0.1m Contours

Elevation (mAOD)

-  53.3230
-  54.3585
-  55.3940
-  56.4295
-  57.4650

Disclaimer

This report has been prepared by GeoSmart in its professional capacity as soil, groundwater, flood risk and drainage specialists, with reasonable skill, care and diligence within the agreed scope and terms of contract and taking account of the manpower and resources devoted to it by agreement with its client and is provided by GeoSmart solely for the internal use of its client.

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Tel: 01743 298 100

Email: info@geosmartinfo.co.uk

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If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award up to £5,000 to you if the Ombudsman finds that you have suffered actual financial loss and/or aggravation, distress or inconvenience as a result of your search provider failing to keep to the Code.

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The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk. Please ask your search provider if you would like a copy of the search code

Complaints procedure

GeoSmart Information Limited is registered with the Property Codes Compliance Board as a subscriber to the Search Code. A key commitment under the Code is that firms will handle any complaints both speedily and fairly. If you want to make a complaint, we will:

- Acknowledge it within 5 working days of receipt.
- Normally deal with it fully and provide a final response, in writing, within 20 working days of receipt.
- Keep you informed by letter, telephone or e-mail, as you prefer, if we need more time.
- Provide a final response, in writing, at the latest within 40 working days of receipt.
- Liaise, at your request, with anyone acting formally on your behalf.

If you are not satisfied with our final response, or if we exceed the response timescales, you may refer the complaint to The Property Ombudsman scheme (TPOs): Tel: 01722 333306, E-mail: admin@tpos.co.uk.

We will co-operate fully with the Ombudsman during an investigation and comply with his final decision. Complaints should be sent to:

Martin Lucass

Commercial Director

GeoSmart Information Limited

Suite 9-11, 1st Floor,

Old Bank Buildings,

Bellstone, Shrewsbury, SY1 1HU

Tel: 01743 298 100

martinlucass@geosmartinfo.co.uk

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<http://geosmartinfo.co.uk/data-limitations/>