GeoSmart Information

FloodSmart Plus

Flood Risk Assessment

Site Address

107 Castlenau
Barnes
SW13 9EL

Grid Reference

522529, 177368

Report Prepared for

Dayalan Nayager

Date

2024-08-13

Report Status

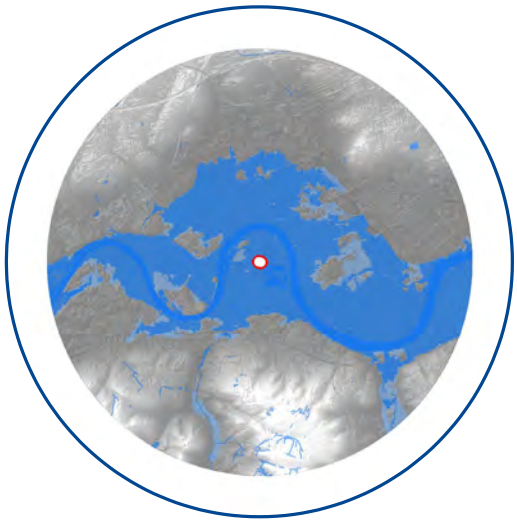
FINAL

Site Area

0.076 ha

Report Reference

83110R1



RISK – Very Low to Low

The Site is located in Flood Zone 3, which equates to a High risk of flooding from rivers and the sea. However, due to the presence of flood defences the risks posed by the tidal River Thames are judged to be Very Low. Surface water (pluvial) flood risks are Low. Groundwater flood risks are Low and flooding risks from artificial sources (i.e. canals, reservoirs and sewers) are Very Low. Mitigation measures are recommended in this report to maintain the risks at 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[1]	After analysis[2]	After Mitigation[3]
River (fluvial) flooding	Very Low		N/A
Sea (coastal/tidal) flooding	Very Low		Very Low
Surface water (pluvial) flooding	Low		Very Low
Groundwater flooding	Low		Very Low
Other flood risk factors present	Yes	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.

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.

Summary of existing and proposed development

The Site is located in Barnes, London, within a setting of residential land use at National Grid Reference TQ 22529 77368. The current residential dwelling on the Site is a five bedroom, four-storey dwelling with a basement.

The proposed development comprises a minor ground floor extension to the rear (west face) of the existing residential dwelling.

Summary of flood risks

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

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

- According to the Environment Agency's (EA) Flood Map for Planning Purposes, the Site is located within a tidal Flood Zone 3 (High probability).
- The Site benefits from the presence of flood defences, located c. 675 m away; the defences are in an unknown condition and are designed to provide a 1 in 1000-year event standard of protection.
- 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 Very Low risk of flooding from the nearby watercourse, the River Thames.
- Modelled flood data obtained from the EA has been analysed in line with the most up to date guidance on climate change (EA, 2022), to confirm a maximum "design" flood level at the Site.

  No overtopping of the existing and proposed future flood defences is anticipated during an extreme flood event. As such, assuming the defences are appropriately maintained, these should offer adequate flood protection to the Site.

  During a 1 in 200 year 2105 scenario tidal flood event, if a breach occurred in the tidal flood defences, the flood level at the Site could be up to 5.23 mAOD (equivalent to a flood depth of c. 0.82 m). It is acknowledged that a flood defence breach is considered to be very unlikely.

  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 Low. Areas of Low flood risk have been identified in the area proposed for development.
- Flooding depths of up to 0.90 m may impact the area proposed for development during the 1 - 0.1% AEP (Low) risk event.
- Flooding depths of up to 0.30 m may impact the access routes to and from the Site in the 1 - 0.1% AEP (Low) risk event.
- The SFRA does not indicate any 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) (Metis, 2021).

Note: a SuDS strategy for the Site has been prepared separately (ref: 83110.01) to ensure surface water runoff from the Site is managed over the lifetime of the proposed development.

Groundwater flooding

- Groundwater Flood Risk screening data indicates that there is a Low 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. However, the potential for a breach of a reservoir to occur and flooding affecting the Site is considered to be Very Low.
    - Ordnance Survey (OS) data confirms there are no canals near to the Site.
    - The Strategic Flood Risk Assessment (SFRA) (Metis, 2021) confirms no recorded instances of sewer flooding at or within the vicinity of the Site.
    - Records held by Thames Water also indicate that there have been no incidences of flooding related to the surcharging of public sewers at the Site

  The risk of flooding from artificial sources is considered to be Very Low.

Recommendations

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

- The Site is located within an area which is potentially affected by flooding from tidal sources (albeit only during a breach of the current and proposed flood defences). It is noted that flood model data indicate that the River Thames flood defences will provide adequate protection from flooding during extreme events during both current and future flooding scenarios (including an allowance for climate change).
- In the context of the prevailing flood risks, it is recommended that finished floor levels for the proposed building extension should be set no lower than the existing building floor levels. It is noted that the proposed plans involve a 0.15 m upstand to mitigate against future floor risks.
- In addition, appropriate water exclusion and resilience measures may also be considered within the extension construction (see Section 7). Note: where sleeping accommodation is proposed at ground level, this should be moved to a higher level of the building.
- The surrounding ground levels should be designed to slope away from the extension, where possible.
- The regular maintenance of any drains and culverts surrounding/on the Site under the riparian ownership of the Site owner should be undertaken to reduce the flood risk.

- The surface water drainage (SuDS) strategy (ref: 83110.01) should be fully implemented and suitably maintained.

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 London Borough of Richmond upon Thames Strategic Flood Risk Assessment (SFRA) (Metis, 2021) is 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 has been commissioned separately (ref: 83110.01).

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)	Utility provider (Appendix C)	OS Data
Historical	X	X	X		
River (fluvial) / Sea (tidal/coastal)	X	X	X		
Surface water (pluvial)	X	X	X		

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

*Local guidance and policy, referenced below, 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 Richmond upon Thames Surface Water Management Plan (Metis, 2021):

Policies

- We will continue to maintain flood defences at their current level accepting that the likelihood and/or consequences of a flood will increase because of climate change.
- Policy LP 21 of the Local Plan is about Flood Risk and Sustainable Drainage. It states that:
  "All developments should avoid, or minimise, contributing to all sources of flooding, including fluvial, tidal, surface water, groundwater and flooding from sewers, taking account of climate change and without increasing flood risk elsewhere. Unacceptable developments and land uses will be refused in line with national policy and guidance [and] the Council's Strategic Flood Risk Assessment (SFRA)".

London Borough of Richmond upon Thames Strategic Flood Risk Assessment (Metis, 2021):

- A site-specific FRA is required for all development proposals. Site-specific FRAs in Flood Zone 3a must also demonstrate that there will be no net loss of floodplain storage.
- Developments categorised as 'Essential Infrastructure' and 'More Vulnerable' can only be considered following application of the Exception Test.
- The bedrock geology for the entirety of the London Borough of Richmond upon Thames is London Clay, a geology type comprised of clay and silt, and one with very low permeability. This geological unit generally has a low hydraulic conductivity, which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if aquifer outcrops are located uphill of areas only underlain with London Clay.

  The superficial geology for the London Borough of Richmond upon Thames is predominantly a range of different river terrace deposits, including the Kempton Park Gravel Member, Taplow Gravel Member, Boyn Hill Gravel Member, and Black Park Gravel Member. Each of these geological units are comprised of sand and gravel, geology with a higher hydraulic conductivity than those comprised of clay and silt. The other dominant superficial geology type is the Langley Silt Member, a geological unit comprised of clay and silt. Water moves less easily through this geology as it has a low hydraulic conductivity. Area-specific information on groundwater flood risk and geology is shown in Groundwater, Sewer and Artificial Flood Risk Web Map.

  Subterranean conditions in certain areas throughout the London Borough of Richmond upon Thames are also at risk of groundwater influenced flooding via throughflow. Groundwater travels downhill through the aquifers/permeable superficial deposits from the top of the catchment area. In locations where there are no aquifers/permeable superficial deposits for water to flow through, water continues to flow through the interface of the made ground subsurface level and the clay geology stratum. This is referred to as throughflow. For further information on throughflow and the borough-wide groundwater influenced investigations, see *Section 7.3*.
- Wastewater sewerage in the London Borough of Richmond upon Thames is serviced by TWUL. The borough is predominantly served by separate surface water and foul sewer systems. Modern sewer systems are designed to be separate systems, typically accommodating up to 1 in 30 year rainfall events in surface water sewers. However, sewer system segments across London vary in capacity due to age. Older segments have a smaller capacity and may not be designed to accommodate rainfall events as significant as 1 in 30 year events. TWUL have responsibilities for all 'public sewers' (the drainage network which serves more than one property, including associated manholes) under the *Water Industry Act 1991*. Typically gullies or drains and the interconnecting pipework which drain into sewers are the responsibility of the private landowner or, for those draining the highway, the Highways Authority. Due to the

interconnection between these different assets, any associated flooding may be caused by a combination of factors, therefore all relevant parties should be involved in subsequent investigations and, where necessary, work to resolve the root cause.

Consideration needs to be given to the existing sewer network as part of all new development proposals. Local Plan Policy LP 23 requires that applicants for major developments provide evidence in the form of written confirmation as part of the planning application that capacity exists in the public sewerage and water supply network to serve their development. As new developments are added into the catchment area additional capacity stress is applied to sewers, increasing the chance of them becoming overloaded. Sewer flood risk is something that can therefore increase throughout the borough. The Groundwater, Sewer and Artificial Flood Risk Web Map contains information regarding recorded sewer flood incidents.

The predicted impacts of climate change on sewer flood risk are closely linked to potential changing rainfall patterns and intensity, as well as changes in surface water flood risk. Based on the EA's UK climate change projections for peak rainfall intensity, the UK can expect an increase in rainfall intensity during rainfall events. This would increase the flow and volume of water attempting entry into the drainage system, increasing the chances of service overload. Service overload can result in surface water surcharging, resulting in localised flooding above ground. It can also result in an increase in untreated wastewater overflows entering the environment through combined sewer overflows into rivers, causing widespread damage.

Residual Risk of Flooding

5.9.1 Tidal breach

- The TTD offers significant protection against flooding from tidal sources; however, risk still remains. Overtopping or failure of the Thames Barrier and other flood defence assets could occur. Defences can also be overtopped due to wind and wave actions. In addition, structural failure of TTD assets can lead to these features being breached. The Fluvial and Tidal Flood Risk Web Map shows the potential extent of inundation, including maximum likely water level, that could occur due to tidal flood defence breach and thus accounting for the residual risk.

  For proposed developments within the breach range of the River Thames, an assessment analysing the residual risk should be considered as part of an FRA. The probability of residual risks linked to overtopping and flood defence asset failure is small; however, the potential damage extent and potential risk to life is significant. *Section 6.1* of this document contains further information on development requirements.

Sequential and Exception Tests

The NPPF requires that a sequential, risk-based approach to the location of development is taken to avoid, where possible, the risk of flooding to people and property. The approach needs to take both current and future impacts of climate change into account. To demonstrate that efforts have been made to steer development to areas with the lowest risk

of flooding, developers and applicants may be required to carry out the Sequential and Exception Tests as part of the site-specific FRA and/or Statement on SuDS.

The Sequential Test requires that proposed development sites are located within areas of lowest flood risk. Only if it can be demonstrated that there are no suitable sites within the wider search area then alternative sites (i.e., within areas that may potentially be at risk of flooding) can be considered. For this SFRA, the wider search area is defined as the entire borough extent, though there are locally defined search area exceptions depending on the location of the proposed development. Further information on search area exceptions can be found in *Section 6.2* and *Section 6.3.1*.

The NPPF recognises that it may not always be possible to locate development in areas with a lower risk of flooding. These developments may be proposed in established communities that require continued development to grow. For these types of proposals, the NPPF provides the Exception Test. The Exception Test is a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available. To pass the Exception Test, the following two conditions need to be passed in line with paragraph 160 of the NPPF:

- the development would provide wider sustainability benefits to the community that outweigh the flood risk; and
- 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.

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).

3. Site analysis

Site information

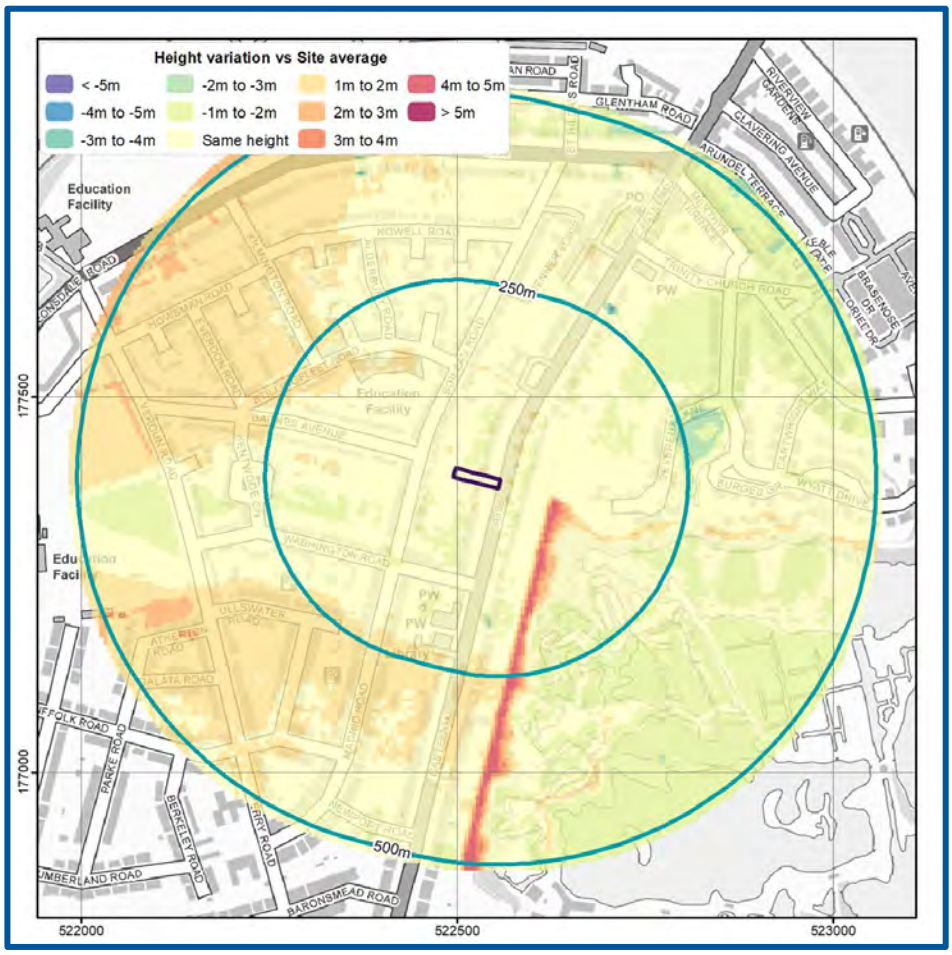
The Site is located in Barnes, SW13 9EL in a setting of residential land use at National Grid Reference TQ 22529 77368.

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

Figure 2 indicates that ground levels within 500m of the Site typically fall in a north easterly direction.

The general ground levels on the Site are between 4.411 mAOD and 5.40 mAOD with the Site falling gradually in a northwesterly 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)



Development

The Site is currently used within a residential capacity as a four-storey semi-detached, five-bedroom dwelling including associated access, car parking and landscaping. The Site has an existing basement.

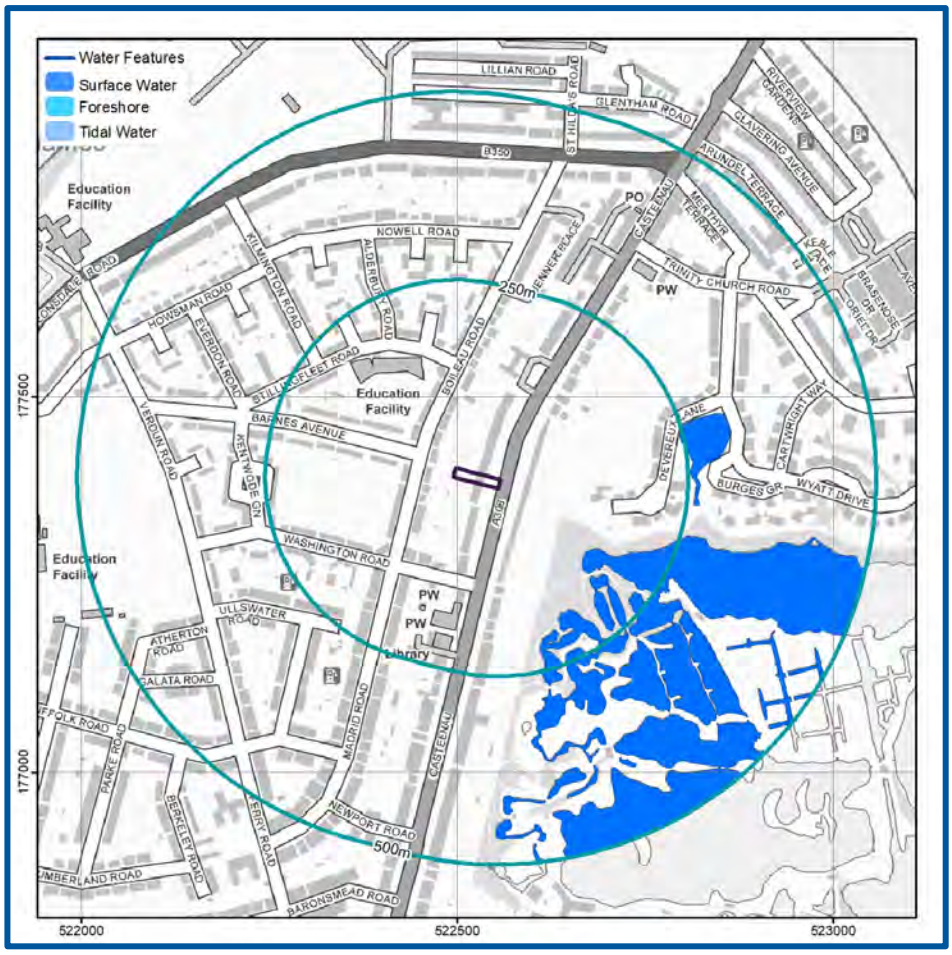
Development proposals comprise the construction of a 1.75 m ground floor extension to the existing dwelling with the retention of the existing access and landscaping. This extension includes a 0.15 m upstand to prevent future flood ingress. Site plans are included within Appendix A.

The effect of the overall development will not result in an increase in number of occupants and/or users of the Site and 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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The WWT London Wetland Centre is positioned from approximately 170 m to the southeast.

The River Thames is c. 700 m to the west, north and east of the Site.

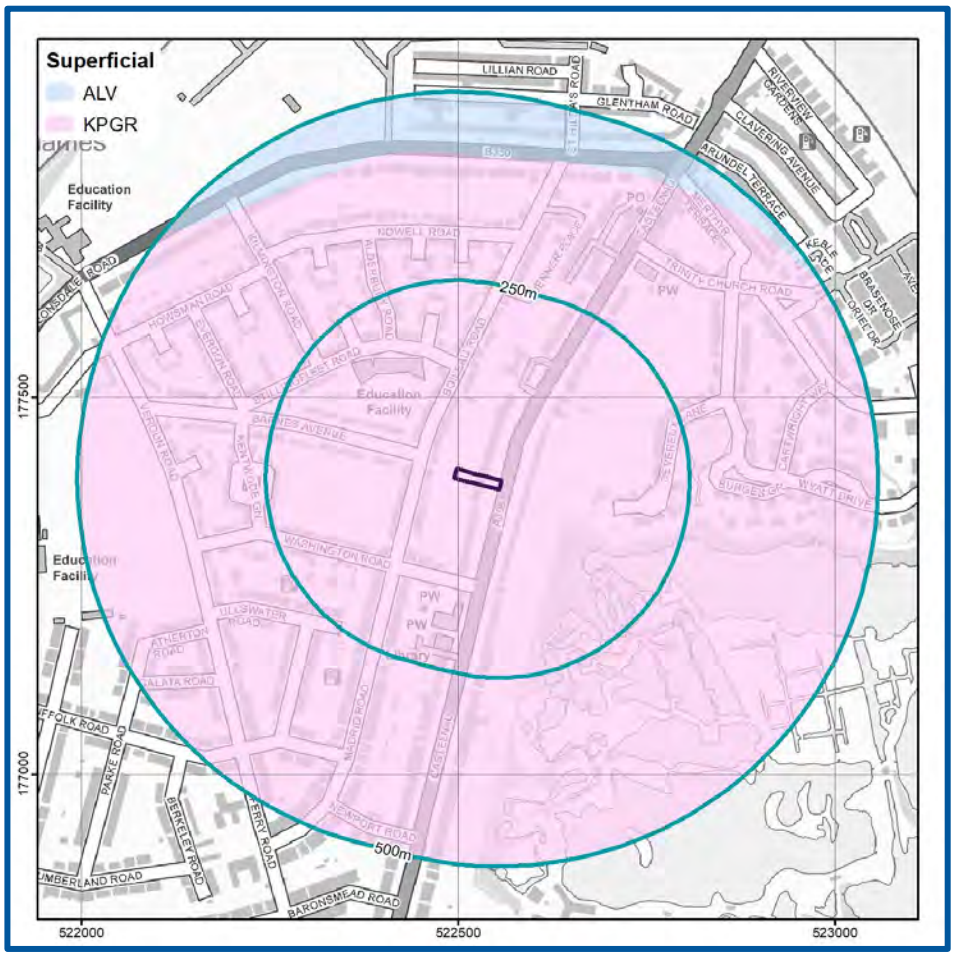
Proximity to relevant infrastructure

Hammersmith Bridge is located upstream of the Site approximately 700 m to the northeast.

Hydrogeological features

British Geological Survey (BGS) mapping indicates that the underlying superficial geology (Figure 4) consists of the Kempton Park Gravel Member (KPGR) (BGS, 2024) which is classified as a Secondary (A) Aquifer (EA, 2024).

Figure 4. Superficial Geology (BGS, 2024)



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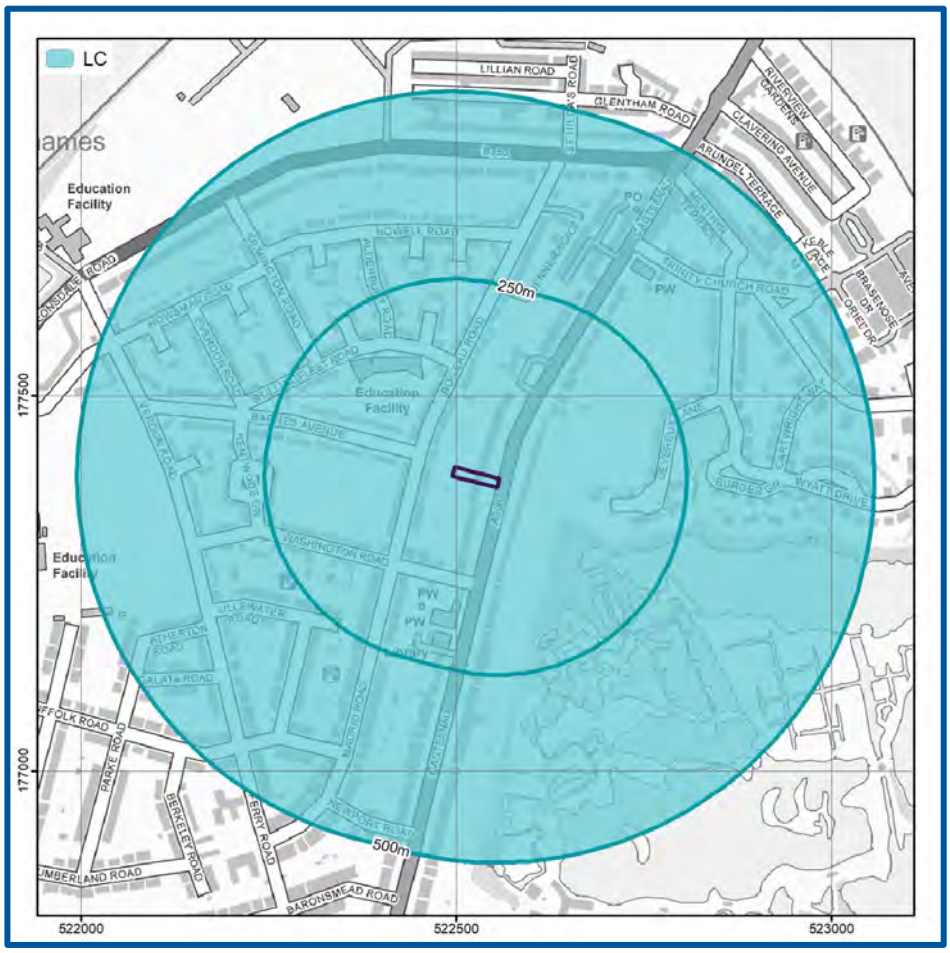
Contains British Geological Survey materials © NERC 2024

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

Figure 5. Bedrock Geology (BGS, 2024)



Geological conditions

A review of the BGS borehole database (BGS, 2024) indicates that the nearest and most relevant borehole to the Site (ref: TQ27NW310) is located c. 230 m to the south east of the Site boundary at an elevation of 33.61 mAOD. The corresponding borehole log indicates that the underlying geology consists of silt to a depth of 0.79 m below ground level (bgl), overlying gravel and sand to a depth of 5.18 m bgl, overlying London Clay to a depth of 9.63 m bgl. It is acknowledged that borehole ref: TQ27NW310 is situated some distance from the Site and may not therefore be representative of the geological conditions present beneath the study Site.

Groundwater

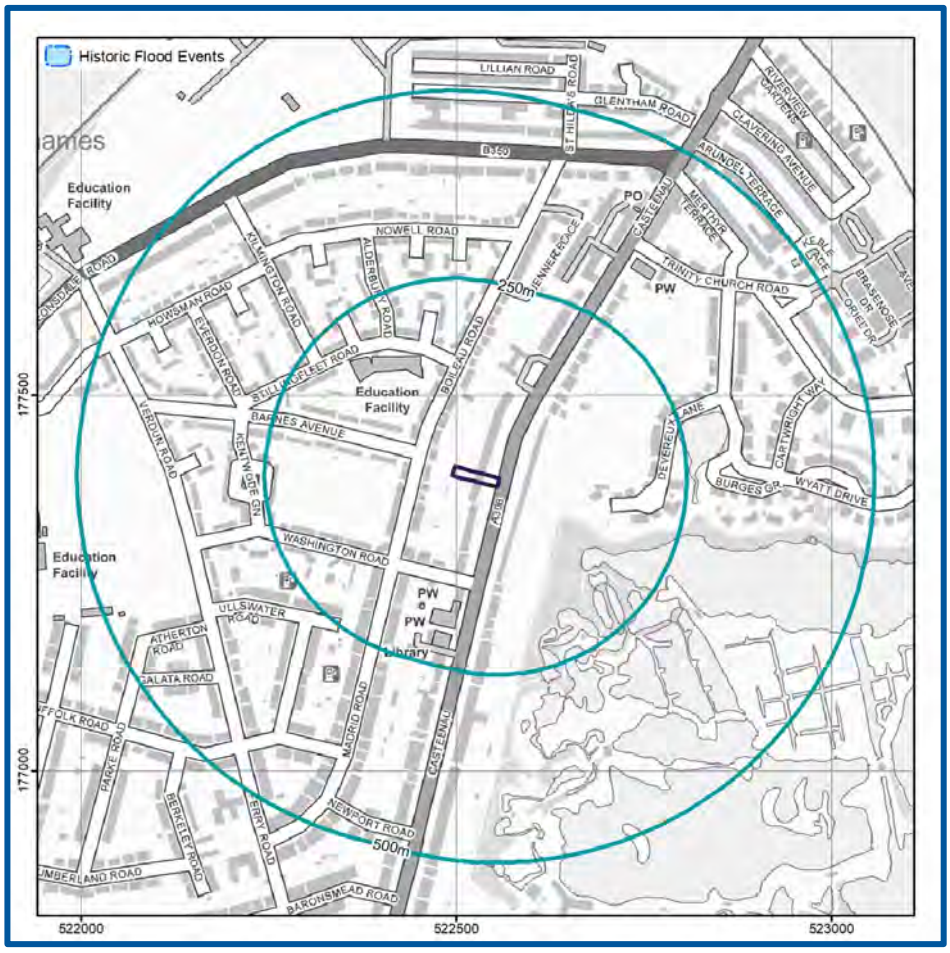
No groundwater levels are presented on the available BGS borehole record (ref: TQ27NW310). A shallow groundwater body may however be present within the Kempton Park Gravel deposits.

4. Flood risk to the development

Historical flood events

According to the EA's Historical Flood Map (Figure 6), there have been no recorded flooding events that have affected the Site

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



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

The Site is located in an estuarine location and flooding could occur from a combination of the sea, termed as coastal flooding and from rivers, termed as fluvial flooding. There may be a predominant effect from either the sea or from the river.

Estuarine flooding can occur from a combination of the sea, termed as coastal flooding and from rivers, termed as fluvial flooding. There may be a predominant effect from either the sea or from the river, through the following processes:

- High tide levels – variations in tidal levels due to gravitational effects of the sun and moon can result in higher sea levels – there is an approximate twice daily variation between high and low tide, onto which is superimposed a spring-neap tide cycle when extra high and low tides occur.
- Surge – an increase in sea level above tidal level caused by low atmospheric pressure which may be exacerbated by the wind acting on the sea. Tidal flooding is of greatest risk when tidal surges combine with high tides;

The Thames Estuary is one of the United Kingdom's major east-coast estuaries. It extends from the tidal limit of the River Thames at Teddington Lock in the west, through the heart of London, out to the North Sea. The character of the flooding changes from a fluvial dominance in the upstream reaches to the hazards posed by storm surges and waves in the downstream reaches. Furthermore, the Thames barrier changes the dynamic of the river depending on whether it is open (tidal dominant) and closed (fluvial dominant).

According to the EA's Flood Map for Planning Purposes (Figure 7), the Site is located within fluvial and tidal Flood Zone 3 and is therefore classified as having a High probability of fluvial and tidal (coastal) flooding from the River Thames (not taking into account the effects of flood defences).

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

Guidance

As defined in the NPPF (2023):

Ignoring the presence of any defences, land located in a Flood Zone 3 is considered to have High probability of flooding with a 1 in 100 year or greater annual probability of fluvial flooding or a 1 in 200 or greater annual probability of coastal flooding in any one year.

Development of "Water-Compatible" and "Less Vulnerable" land uses are suitable for this zone with "More Vulnerable" and "Essential Infrastructure" requiring an Exception test to be passed prior to development taking place. (see glossary for terminology).

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 located in the EA's Area Benefitting from Flood Defences (associated with the River Thames).
- There are no formal flood defences within 250 m of the Site.
- There are no proposed flood defences within 250 m of the Site.

Model data (Tidal)

As the Site is located within the EA's tidal floodplain, modelled flood elevation data was obtained from the EA. This data is more up to date than that which is included in the London Borough of Richmond upon Thames SFRA (Metis, 2021) and has been used to assess flood risk and to provide recommendations for mitigation for the proposed development. The data is included in Appendix B.

Thames Estuary 2100 (TE2100)

The Thames Barrier requires regular maintenance and with additional closures the opportunity for maintenance will be reduced. When this happens, river levels - for which the Barrier would normally shut for the 2008 epoch - will have to be allowed through to ensure the barrier is not shut too often. For this reason, levels upriver of the barrier will increase and the tidal walls will need to be heightened to match.

Thames Tidal Defences Study (Halcrow, 2006) and Thames Estuary 2100 Study (HR Wallingford, 2008)

In-channel flood level data has been taken from the nearest and most relevant node points (node 2.19, located c. 755 m to the north west in the River Thames; and node 2.20, located c. 815 m to the north east in the River Thames) to the Site.

- The current extreme water level at node point 2.19 is 5.03 mAOD whereas flood defences are set at 5.94 mAOD which will prevent overtopping occurring in this scenario.
- The current extreme water level at node point 2.20 is 5.01 mAOD and flood defences are set at 5.94 mAOD which will prevent overtopping occurring in this scenario.

The proposed flood defence levels (to allow for future 2100 flood events) will be raised to 6.40 mAOD with the predicted flood levels rising to between 5.93 and 5.92 mAOD. This indicates that even if the flood levels within the River Thames rise due to climate change, the defences are also going to be raised and therefore the Site will remain defended (EA, 2021).

Residual Tidal Flood Risk

Where flood defences are in good condition and are fully maintained, the Site is not considered to be at risk of flooding from overtopping, however, there is a residual risk related to a breach in the Thames flood defences.

Thames Tidal Upriver Breach Inundation Modelling Study (May, 2017)

Modelled breach flood level data has been taken from the Thames Tidal Upriver Breach Assessment (Teddington Weir to Thames Barrier) (Atkins, 2017) to assess flood risk and provide recommendations for mitigation measures.

The breach flood level data has been extracted from the EA's 2D floodplain grid data using QGIS (v3.16.10).

The mapped data indicates the Site would flood in the 2005 and 2100 breach flood scenarios.

Table 2. Modelled Breach Flood Levels

Ground levels on-Site (mAOD)	1 in 200 year scenario breach flood level (mAOD)	
	2005	2100
4.26 and 5.40	4.27	5.23
Flood depths (m)	0.01	Up to 0.97

As ground levels within the proposed development area are between 4.26 mAOD and 5.40 mAOD, the flood depth would be up to c. 0.97 m during a 1 in 200 year plus climate change allowance breach scenario event. It is noted that this residual risk only arises if a defence breach coincides with a design flood event.

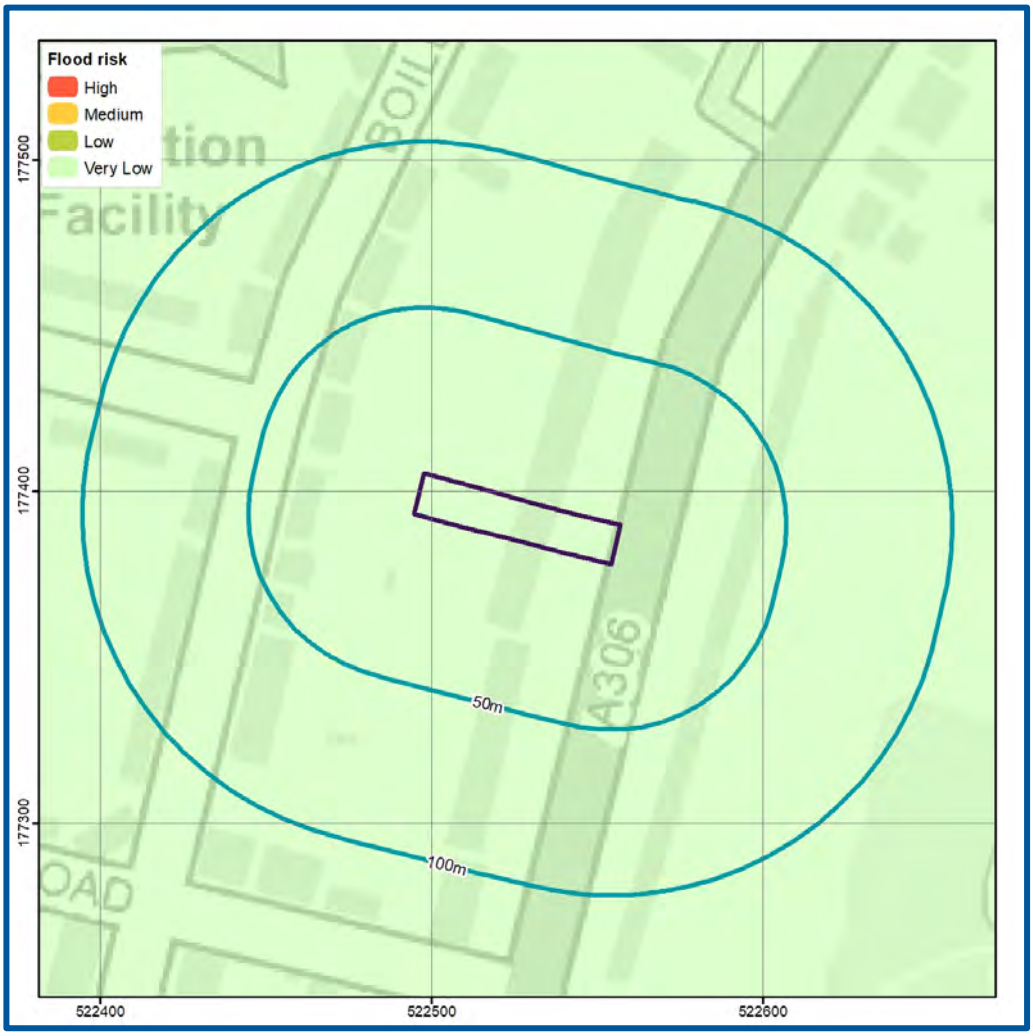
Flood risk including the benefit of defences

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 8), which considers the type, condition and crest height of flood defences, the Site has a Very Low risk from the River Thames.

Analysis of Site ground levels and modelled flood data (see above) indicates that the Site would not be impacted in the 1 in 200 year overtopping scenario. This confirms that the risks of flooding from rivers and sea are Very Low.

Figure 8. Risk of Flooding from Rivers and Sea map (EA, 2024)

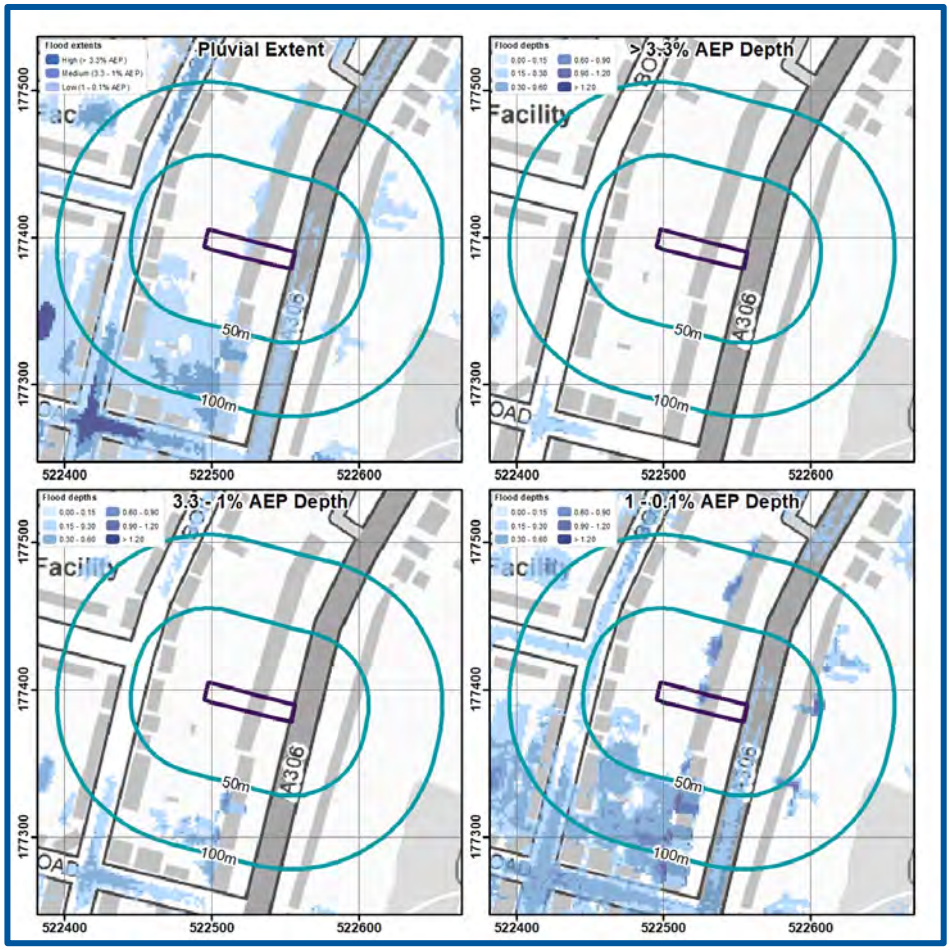


Surface water (pluvial) flooding

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 9), the Site has a Very Low to Low risk of pluvial flooding[1].

Figure 9. EA surface water flood extent and depth map (EA, 2024)



[1] Environment Agency. April 2019. What is the Risk of Flooding from Surface Water map? Version 2.0. Accessed from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/842485/What-is-the-Risk-of-Flooding-from-Surface-Water-Map.pdf

Guidance

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

- Low risk - chance of flooding of between a 1 in 1000 & 1 in 100 (0.1% and 1%).

The SFRA does not indicate any 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, 2021).

Figure 9 shows the extent and depth of flooding during various modelled flood scenarios. Flooding depths of up to 0.90 m would impact the area proposed for development in the 1 - 0.1% AEP (Low) risk event.

Flooding depths of up to 0.30 m would impact the access routes to and from the Site in the 1 - 0.1% AEP (Low) risk event.

Guidance

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

Flood Depths:

- 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.

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.

[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.

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.

Surface water flooding flow routes

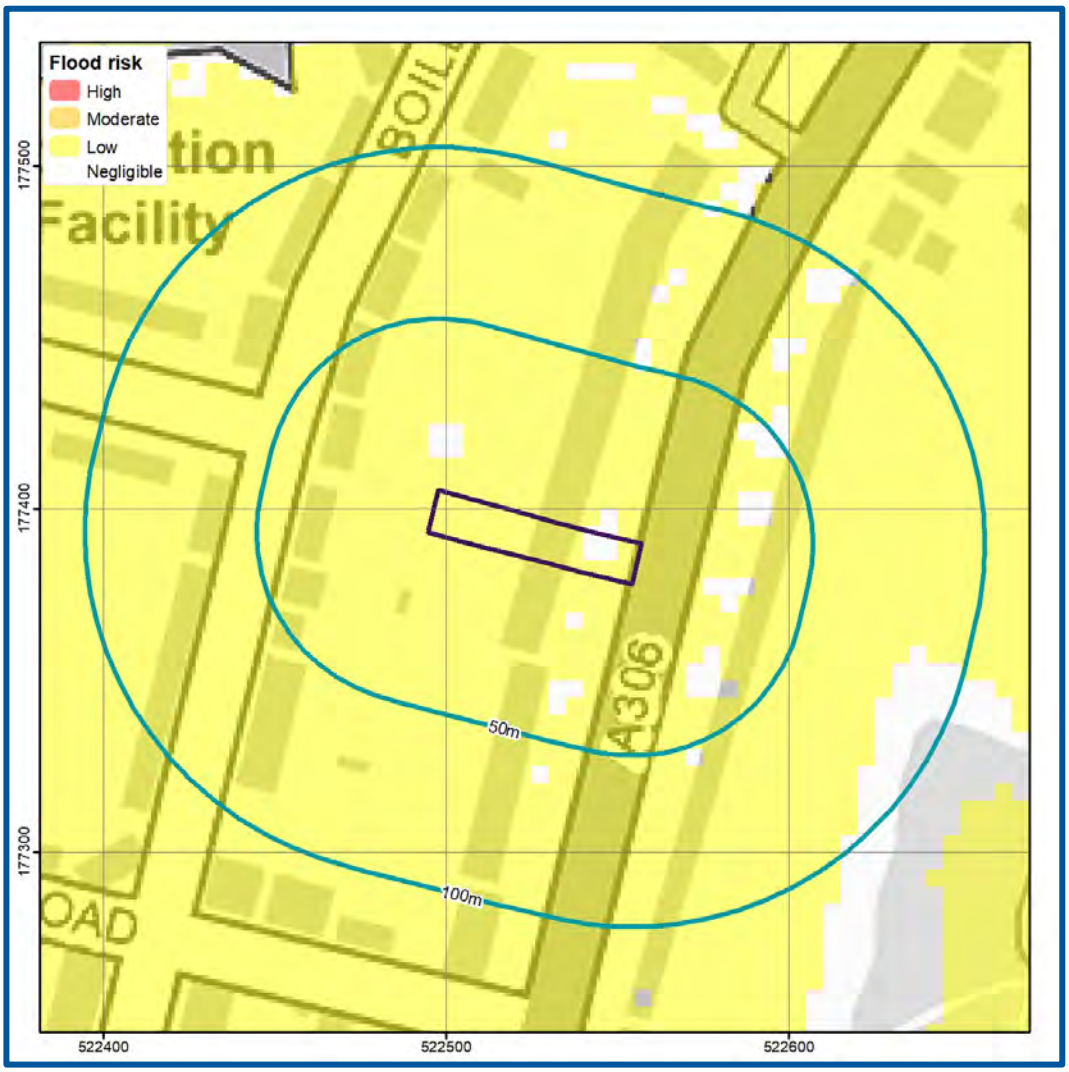
Analysis of OS mapping, ground elevation data and the EA's pluvial flow route mapping in the 1 in 1000-year (Low probability) event confirms the Site is not located on a potential overland flow route.

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 10) indicates there is a Low risk of groundwater flooding at surface in the vicinity from permeable superficial deposits during a 1 in 100 year event.

Figure 10. GeoSmart GW5 Groundwater Flood Risk Map (GeoSmart, 2024)



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 the Site contains an existing basement which is set a maximum of c. 4.5 m below the lower ground floor level. The proposed development will not affect the existing basement. It is noted that flood 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 may therefore exist within the superficial Kempton Park Gravel deposits.

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 and tidal events due to the potential hydraulic continuity with the nearby River Thames.

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

The design of the property extension should consider the groundwater pathway through permeable formations.

There are no nearby BGS boreholes from which the underlying groundwater depth can be inferred.

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

The hydrogeological characteristics suggest that there is potential for a groundwater table beneath the Site, although it is considered very unlikely that this will reach the ground surface.

On the basis of the site-specific assessment (including the absence of any proposed alterations to the existing basement level) the groundwater flood risk is considered to remain Low.

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 0.4 m 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 risk in both peak river levels and sea levels and also 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 SFRA does not include any information regarding flooding events from sewers (Metis, 2021) at 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 (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.

Culverts and bridges have not been identified within 50 m of the Site.

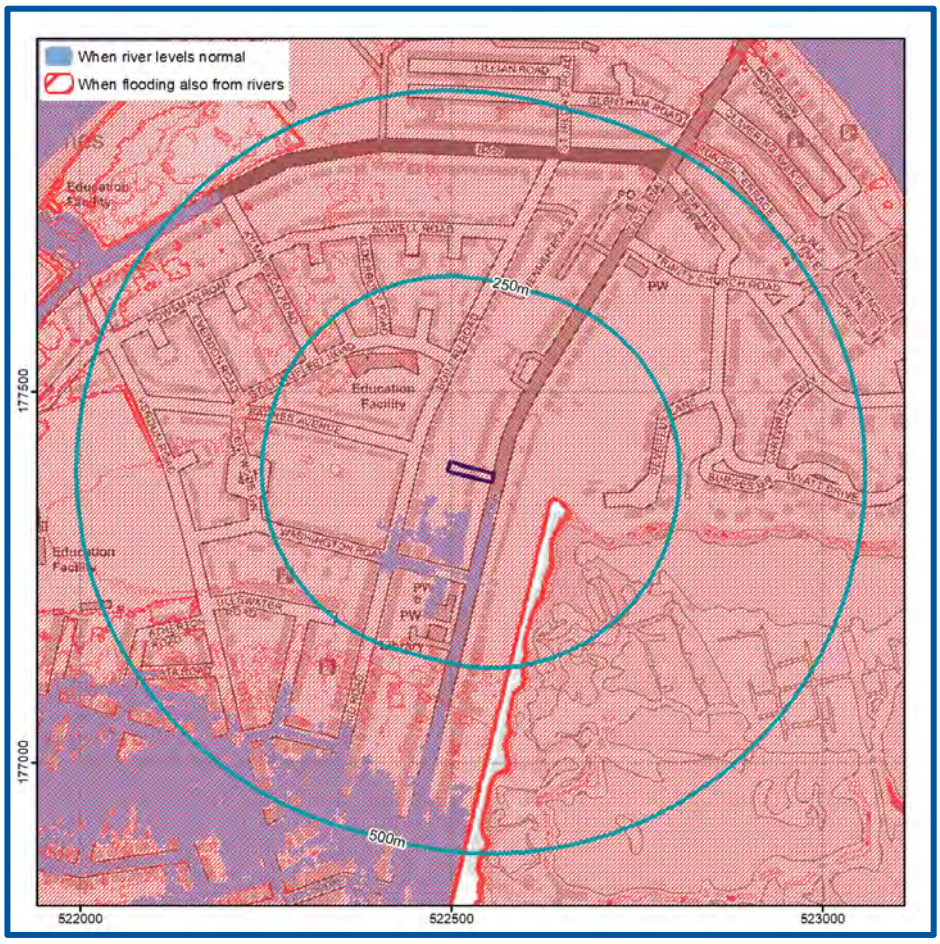
Reservoir flooding

According to the EA's Risk of Flooding from Reservoir mapping the Site is at risk of flooding from reservoirs (Figure 11) (EA, 2024), albeit only when coinciding with a fluvial flood event.

The Site is considered to be at risk of flooding from the following reservoirs:

- Brent (Welsh Harp Reservoir)
- King George VI
- Pen Pond Lower Lake, Richmond
- Pen Pond Upper Lake, Richmond
- Queen Elizabeth II
- Queen Mary
- Queen Mother
- Serpentine
- Staines North
- Staines South
- Walton – Knight
- Wimbledon Park Lake
- Wraysbury

Figure 11. EA Risk of Reservoir Flooding (EA, 2024)



Guidance

The risk of reservoir flooding is related to the failure of a large reservoir (holding over 25,000 m^3 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 tidal Flood Zone 3 and involves an increase in the proposed building footprint. However, in tidal areas, raising ground levels is unlikely to impact on maximum tidal levels so the provision of compensatory storage is not considered to be necessary (CIRIA C624 (2004)).

Drainage and run-off

Based on the topography and low surface water flood risk in the vicinity, interference or interaction with overland flow paths and inflows from off-Site is considered unlikely.

The proposed development will potentially lead to an increase of impermeable surfaces at the Site.

A Sustainable Drainage Strategy has been prepared separately by GeoSmart (ref: 83110.01) to manage the potential increase in runoff from the Site.

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 Richmond upon Thames Council NPPF (2023). However, due to the nature of the proposed development as a householder residential extension, a sequential test is not required (SFRA, 2021).

Table 3. 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)

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 5m^2.

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

The Site is located within an area which is potentially affected by flooding from tidal sources (albeit only during a breach of the current and proposed flood defences). It is noted that flood model data indicate that the River Thames flood defences will provide adequate protection from flooding during extreme events during both current and future flooding scenarios (including an allowance for climate change).

The following table shows the flood depths associated with the area proposed for development as a result of a breach event. It is acknowledged that a breach event is considered to be very unlikely.

Table 4. Breach flood levels compared to ground levels in the area proposed for development

Ground levels in the proposed development area (mAOD)	Modelled Flood Levels (mAOD)	
	2005	2100
4.26 to 5.40	4.27	5.23
Flood depths (m)	0.01	Up to 0.97

In the context of the above flood risks, it is recommended that finished floor levels for the proposed building extension should be set no lower than the existing building floor levels.

Where sleeping accommodation is proposed at ground level, this should be moved to a higher level of the building.

In addition, it may be appropriate to consider a water exclusion strategy (note: typically exclusion strategies are adopted where flood depths of up to 0.3 m are anticipated) in line with the EA's Standing Advice. A water exclusion strategy, using avoidance and resistance measures, is appropriate where floods are expected to last for short durations. Potential water exclusion strategies include:

- Passive flood door systems;
- Temporary flood barriers;

- Air brick covers (manual or automatic closing);
- Non-return flap valves on sewer outfalls.
- Sustainable Drainage Systems (SuDS) to store/intercept flood water;

Avoidance and resistance measures are unlikely to completely prevent floodwater entering a property, particularly during longer duration flood events. Therefore, the following flood resilience measures may also be considered.

- Flood resilient materials and designs:
    - Use of low permeability building materials up to 0.3 m such as engineering bricks (Classes A and B) or facing bricks;
    - Hard flooring and flood resilient metal staircases;
    - The use of internal lime plaster/render or where plasterboards are used these should be fitted horizontally instead of vertically and/or using moisture resistant plasterboard at lower levels;
    - Water, electricity and gas meters and electrical sockets should be located above the predicted flood level;
    - Communications wiring: wiring for telephone, TV, Internet and other services should be protected by suitable insulation in the distribution ducts to prevent damage.

Rivers (fluvial) flood mitigation measures

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

Surface water (pluvial) flood mitigation measures

A Low surface water (pluvial) flooding risk has been identified at the Site. In order to ensure the development includes sufficient flood mitigation measures to reduce the risk of pluvial flooding over its lifetime, the flood depths, levels and appropriate mitigation measures have been assessed.

It is recommended that the floor level within the proposed extension should be set as high as possible (and no lower than the existing building flooring). Consideration may also be given to the flood exclusion and resilience measures outlined above.

In addition, the following measures are recommended:

- The surrounding ground levels should be designed to slope away from the extension, where possible.
- The regular maintenance of any drains and culverts surrounding/on the Site under the riparian ownership of the Site owner should be undertaken to reduce the flood risk.

- A surface water drainage (SuDS) strategy has been prepared separately (ref: 83110.01) to ensure surface water runoff can be managed effectively over the lifetime of the proposed development. The strategy should be fully implemented and suitably maintained.

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

Groundwater flood mitigation measures

A low risk of groundwater flooding has been identified at the Site.

The mitigation measures identified for the pluvial flood risks (as outlined above) are likely to be sufficient in order to further reduce the groundwater flood risks.

Reservoir flood mitigation measures

According to EA data, the nearest reservoir is situated approximately 2 km to the northwest of the Site. The risk of a reservoir breach is considered to be Very Low.

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, in the unlikely event of a breach, 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.

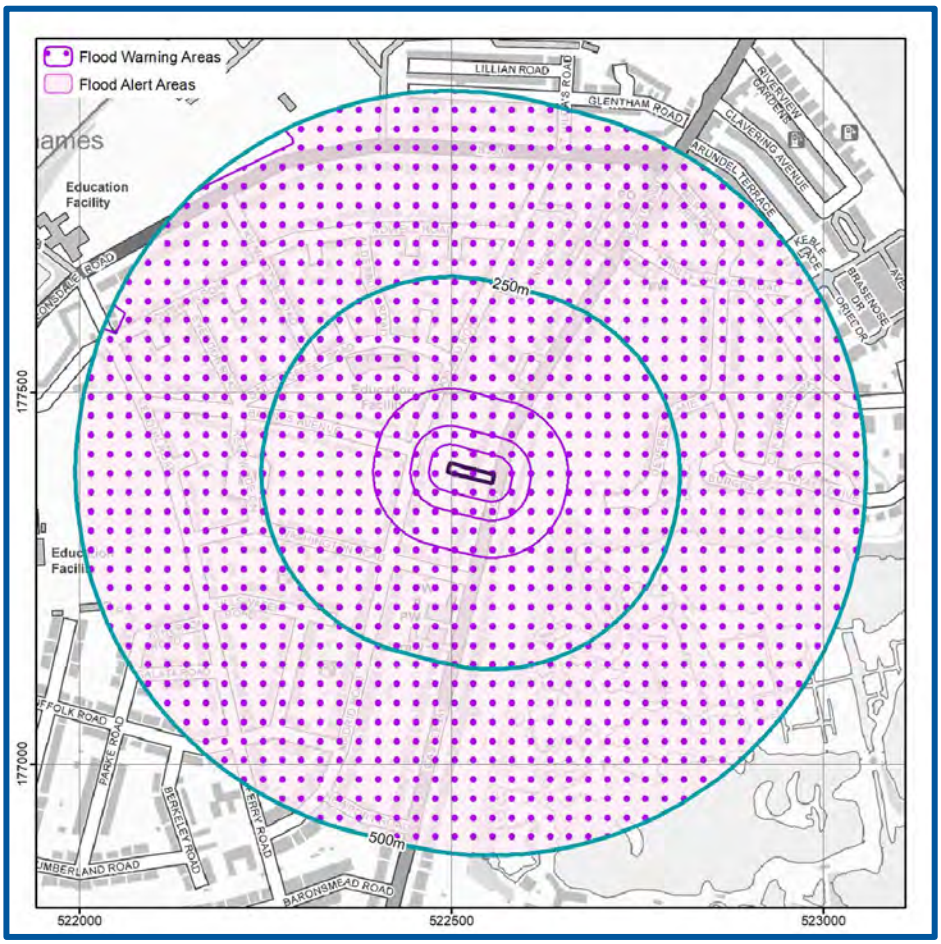
Emergency evacuation from the development and the Site should only be undertaken in strict accordance with any evacuation plans produced for the Site, with an understanding of the flood risks at the Site including available mitigation, the vulnerability of occupants and preferred evacuation routes.

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: 063FWT23Barnes) so is able to receive alerts and warnings (Figure 12). All warnings are also available through the EA's 24 hour Floodline Service 0345 917 4101.

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



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 Rocks Lane (c. 1.4 km south – 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 or above in a worst-case scenario as the residential areas of the development are situated on all floors

Other relevant information

Occupants should be signed up to receive EAs Flood Alerts and 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 5. Risk ratings following Site analysis

Source of Flood Risk	Baseline[1]	After analysis[2]	After Mitigation[3]
River (fluvial) flooding	Very Low		N/A
Sea (coastal/tidal) flooding	Very Low		Very Low
Surface water (pluvial) flooding	Low		Very Low
Groundwater flooding	Low		Very Low
Other flood risk factors present	Yes	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.

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.

Table 6 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 3 are acceptable according to the NPPF providing the recommended mitigation measures are put in place (see previous sections).

Table 6. Summary of responses to key questions in the report

Key sources of flood risks identified	Pluvial and groundwater (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 executive summary and Section 7).

9. Further information

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

Additional GeoSmart Products			
✓	Additional assessment: EnviroSmart Report		Provides a robust desk-based assessment of potential contaminated land issues, taking into account the regulatory perspective. 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. Ideal for pre-planning or for addressing planning conditions for small developments. Can also be used for land transactions. Please contact info@geosmartinfo.co.uk for further information.

10. References and glossary

References

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GeoSmart Information

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 ±0.25m 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

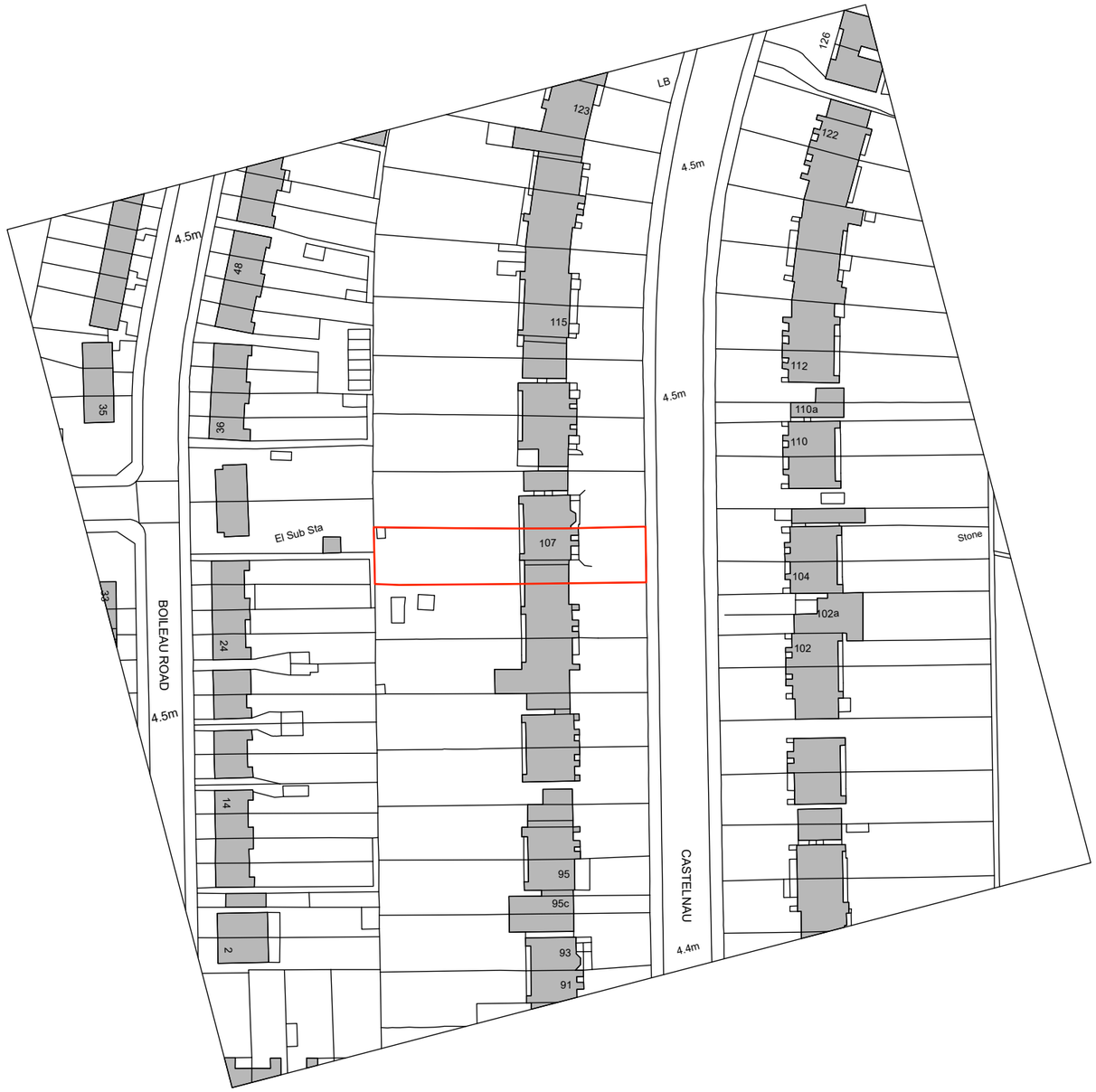
Aerial Photography	Contains Ordnance Survey data © Crown copyright and database right 2024 BlueSky copyright and database rights 2024
Bedrock & Superficial Geology	Contains British Geological Survey materials © NERC 2024 Ordnance Survey data © Crown copyright and database right 2024
Flood Risk (Flood 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

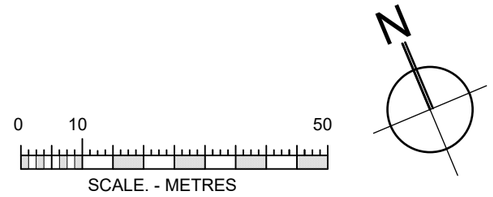
11. Appendices

GeoSmart Information

Appendix A

Site plans





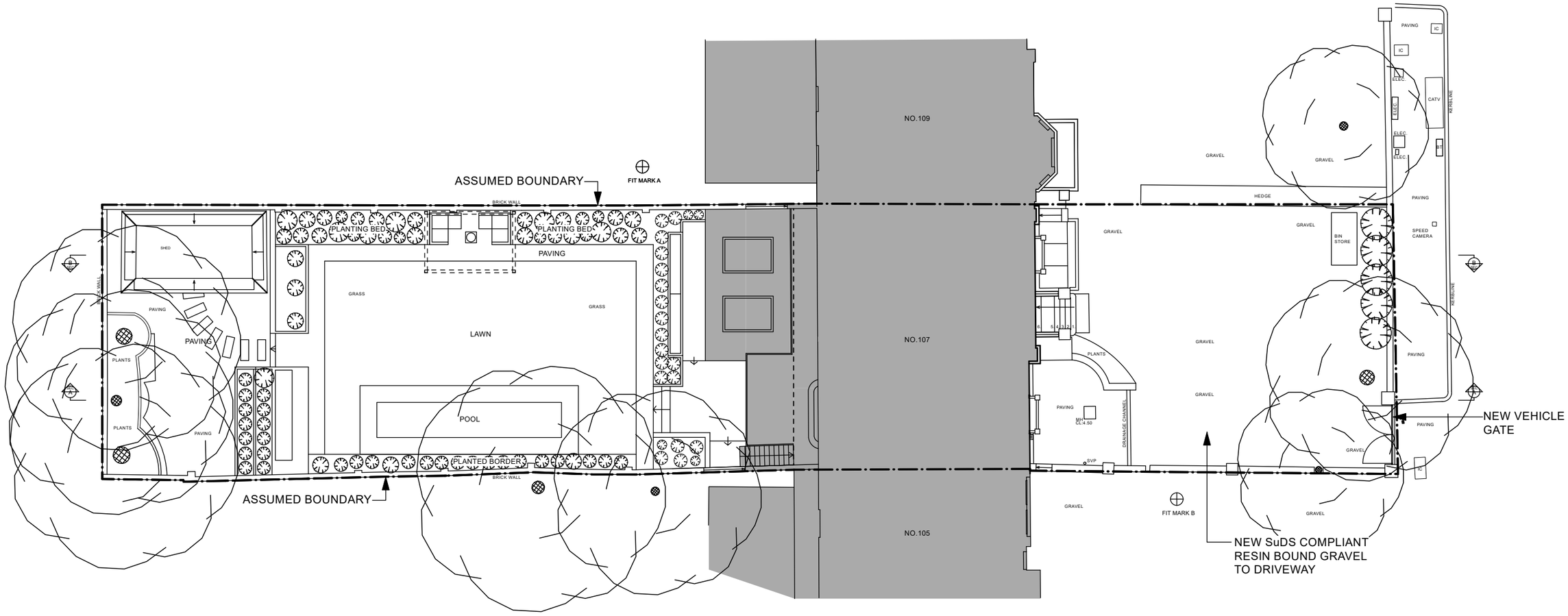
Revisions	

Client & Address
Mr and Mrs Harvey
107 Castelnau, Barnes,
London, SW13 9EL

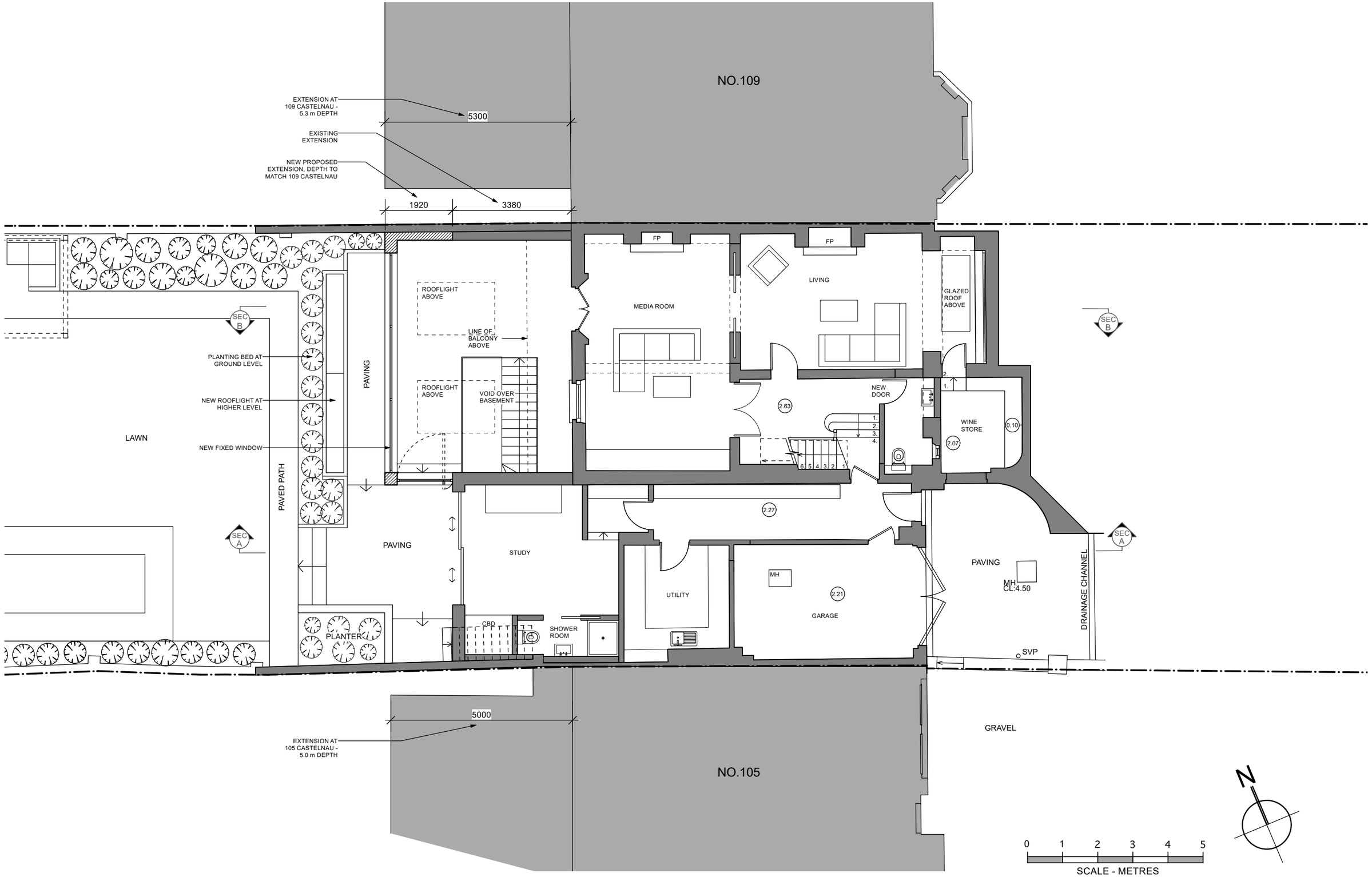
Title
Site Location Plan

Date	Scale	No.	Rev.
06.09.13	1: 1250 @ A3	0351(00)00	-

DYERGRIMES ARCHITECTS
The Old Boathouse, 1A Embankment,
Putney, London, SW15 1LB
T: 020 8780 5930
E: info@dyergrimesarchitects.com



Revisions	1. This drawing remains copyright of DyerGrimes Architects Limited and may not be reproduced or copied without consent in writing. 2. Do not scale drawing use figured dimensions only. 3. Any discrepancies between site and drawings to be reported to the architect immediately. 4. Read in conjunction with all relevant structural and mechanical & electrical engineers drawings. 5. Dimensions critical to proposed building works must be checked on site before building works commences, as certain assumptions have been made due to lack of accessibility and anomalies in the existing building.	Client & Address Mr Dyalan Nayager 107 Castelnau, Barnes, London, SW13 9EL	Title Proposed Site Plan **OPTION 2**		Dyer|Grimes Architecture | Studio 2, Three Eastfields Avenue Riverside Quarter, London, SW18 1GN T: 020 8874 0551 | info@dyergrimesarchitects.com dyergrimesarchitects.com
		Date 08.08.24	Scale 1: 200 @ A3	No. 0654(01)01	Rev. B



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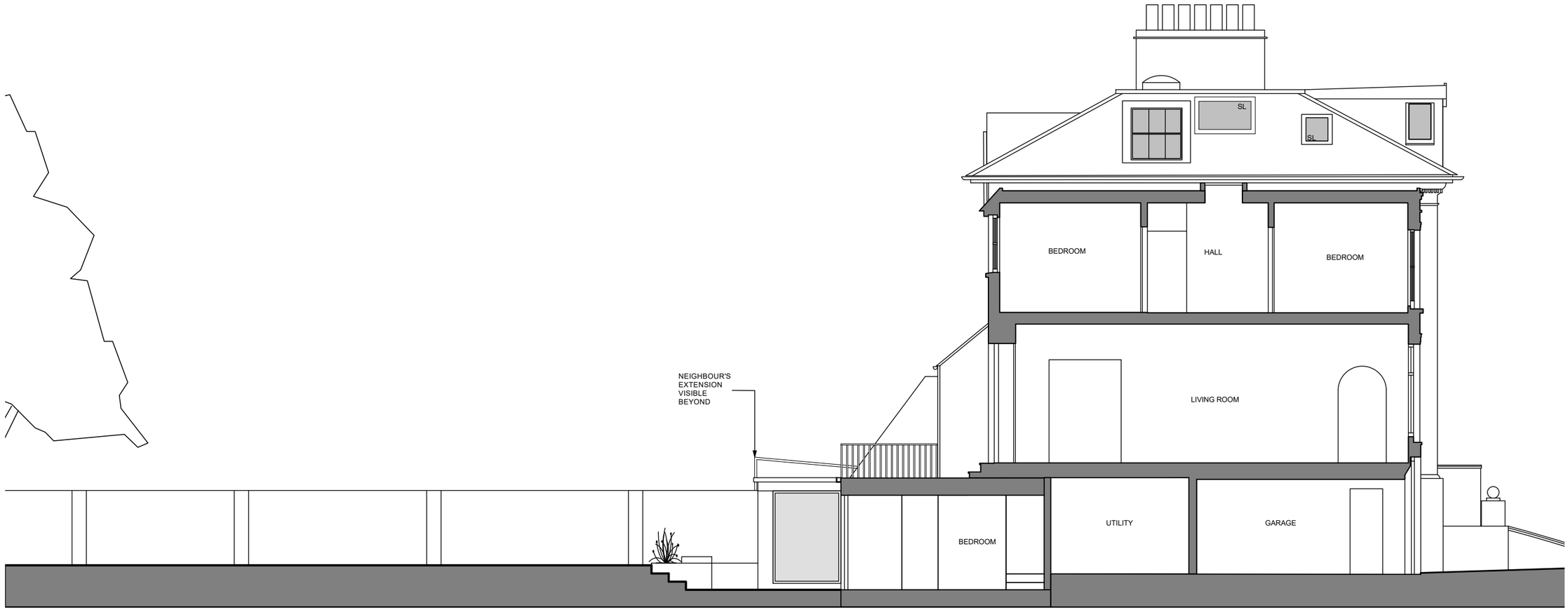
		Date 08.08.24	Scale 1: 100 @ A3	No. 0654(01)03 / Rev. B

Dyer|Grimes Architecture | Studio 2, Three Eastfields Avenue
Riverside Quarter, London, SW18 1GN
T: 020 8874 0551 | info@dyergrimesarchitects.com
dyergrimesarchitects.com



0 1 2 3 4 5

SCALE - METRES

Revisions

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2. Do not scale drawing use figured dimensions only.
3. Any discrepancies between site and drawings to be reported to the architect immediately.
4. Read in conjunction with all relevant structural and mechanical & electrical engineers drawings.
5. Dimensions critical to proposed building works must be checked on site before building works commences, as certain assumptions have been made due to lack of accessibility and anomalies in the existing building.

Client & Address
Mr Dyalan Nayager
107 Castelnau, Barnes,
London, SW13 9EL

Title
Proposed Section AA
OPTION 2

Date	Scale	No.	Rev.
08.08.24	1: 100 @ A3	0654(01)10	B

Dyer|Grimes Architecture | Studio 2, Three Eastfields Avenue
Riverside Quarter, London, SW18 1GN

T: 020 8874 0551 | info@dyergrimesarchitects.com
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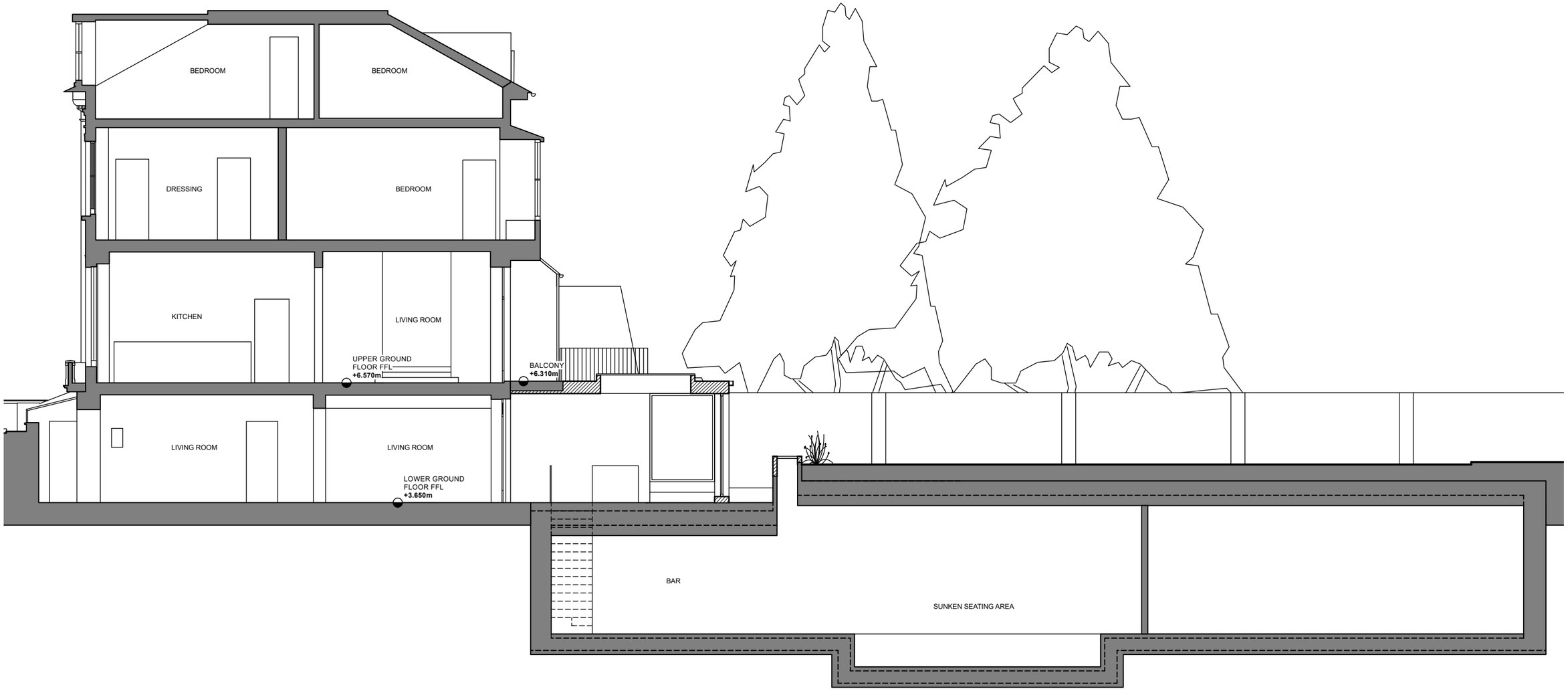

0 1 2 3 4 5

SCALE - METRES

Revisions	
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Client & Address
Mr Dyalan Nayager
107 Castelnau, Barnes,
London, SW13 9EL

Title
Proposed Section BB
OPTION 2

Date	Scale	No.	Rev.
08.08.24	1: 100 @ A3	0654(01)11	B

Dyer|Grimes Architecture | Studio 2, Three Eastfields Avenue
Riverside Quarter, London, SW18 1GN

T: 020 8874 0551 | info@dyergrimesarchitects.com
dyergrimesarchitects.com

GeoSmart Information

Appendix B

Environment Agency Data

Table 6.1 Defence levels upriver of the Thames Barrier

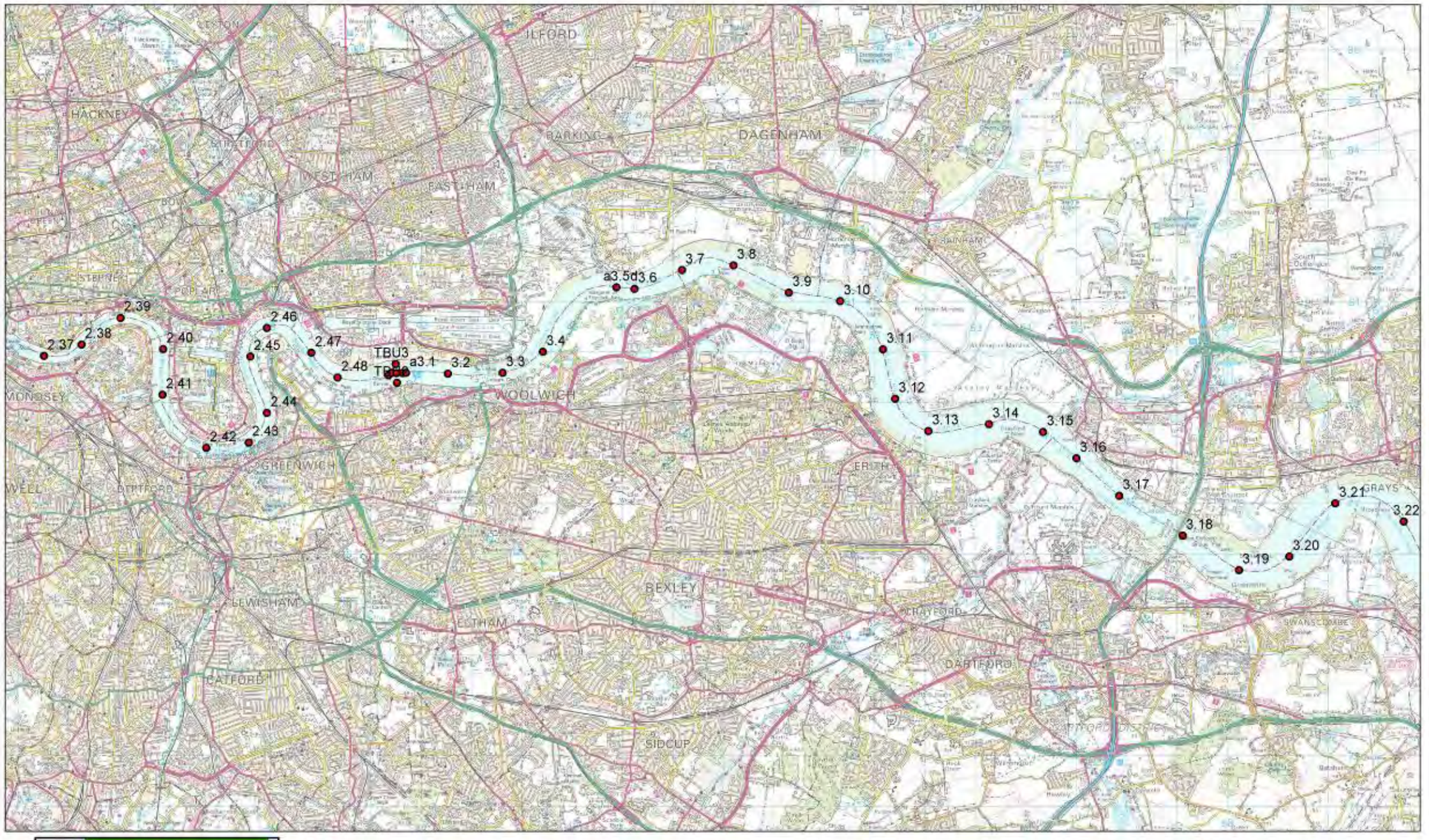
DEFENCE LEVELS Upriver of Barrier			Defence crest levels					
			Statutory		Levels required in 2065 (for the period to 2100)		Levels required in 2100 (for the period to 2135)	
Location	Node	Chainage (m)	LB	RB	LB	RB	LB	RB
Teddington	2.01	7419	6.10	6.10	6.45	6.45	6.90	6.90
	2.1	8084	6.10	6.10	6.45	6.45	6.90	6.90
	2.2	9104	6.10	6.10	6.45	6.45	6.90	6.90
		9544	6.10	6.10	6.45	6.45	6.90	6.90
	2.3	10124	6.02	6.02	6.45	6.45	6.90	6.90
	2.3a	10549	6.02	6.02	6.45	6.45	6.90	6.90
		10950	6.02	6.02	6.45	6.45	6.90	6.90
	2.4	10974	6.02	6.02	6.35	6.35	6.80	6.80
		11353	6.02	6.02	6.35	6.35	6.80	6.80
		11727	6.02	6.02	6.35	6.35	6.80	6.80
	2.5	12014	6.02	6.02	6.35	6.35	6.80	6.80
	2.6	12764	5.94	5.94	6.35	6.35	6.80	6.80
	a2.6	13027	5.94	5.94	6.35	6.35	6.80	6.80
		13041	5.94	5.94	6.35	6.35	6.80	6.80
Richmond sluice	a2.7	13314	5.94	5.94	6.35	6.35	6.80	6.80
		13324	5.94	5.94	6.35	6.35	6.80	6.80
		13580	5.94	5.94	6.35	6.35	6.80	6.80
	2.8	13594	5.94	5.94	6.25	6.25	6.70	6.70
	2.9	13844	5.94	5.94	6.25	6.25	6.70	6.70
	2.10	14174	5.94	5.94	6.25	6.25	6.70	6.70
	2.13	16314	5.94	5.94	6.25	6.25	6.70	6.70
		16840	5.94	5.94	6.25	6.25	6.70	6.70
		16850	5.94	5.94	6.10	6.10	6.55	6.55
	2.17	20354	5.94	5.94	6.10	6.10	6.55	6.55
		20840	5.94	5.94	6.10	6.10	6.55	6.55
		20850	5.94	5.94	6.00	6.00	6.40	6.40
		22642	5.94	5.94	6.00	6.00	6.40	6.40
		22651	5.54	5.94	6.00	6.00	6.40	6.40
	2.20	23394	5.54	5.94	6.00	6.00	6.40	6.40
		24420	5.54	5.94	6.00	6.00	6.40	6.40
	2.21	24434	5.54	5.94	5.90	5.90	6.30	6.30
		25503	5.54	5.94	5.90	5.90	6.30	6.30
		25552	5.54	5.54	5.90	5.90	6.30	6.30
	2.23	26424	5.54	5.54	5.90	5.90	6.30	6.30
		26509	5.54	5.54	5.90	5.90	6.30	6.30
		26520	5.41	5.41	5.90	5.90	6.30	6.30
	2.24	27424	5.41	5.41	5.90	5.90	6.30	6.30
	2.25	28424	5.41	5.41	5.90	5.90	6.30	6.30
		30260	5.41	5.41	5.90	5.90	6.30	6.30
		30270	5.41	5.41	5.80	5.80	6.30	6.30
	2.29	32004	5.41	5.41	5.80	5.80	6.30	6.30
	2.33	36174	5.41	5.41	5.80	5.80	6.30	6.30
	2.35	38204	5.41	5.41	5.80	5.80	6.30	6.30
		38418	5.41	5.41	5.80	5.80	6.30	6.30
		38430	5.28	5.28	5.80	5.80	6.30	6.30
	2.36	38904	5.28	5.28	5.80	5.80	6.30	6.30
		40050	5.28	5.28	5.80	5.80	6.30	6.30
		40060	5.28	5.28	5.70	5.70	6.20	6.20
	2.38	40964	5.28	5.28	5.70	5.70	6.20	6.20
		41364	5.28	5.28	5.70	5.70	6.20	6.20
		41415	5.28	5.28	5.70	5.70	6.20	6.20
		41430	5.23	5.23	5.70	5.70	6.20	6.20
	2.39	41984	5.23	5.23	5.70	5.70	6.20	6.20
	2.43	46064	5.23	5.23	5.70	5.70	6.20	6.20
		46100	5.18	5.18	5.70	5.70	6.20	6.20
		46400	5.18	5.18	5.70	5.70	6.20	6.20
		46410	5.18	5.18	5.60	5.60	6.10	6.10
	2.47	50144	5.18	5.18	5.60	5.60	6.10	6.10
Thames Barrier	a2.49	52029	5.18	5.18	5.60	5.60	6.10	6.10

Notes

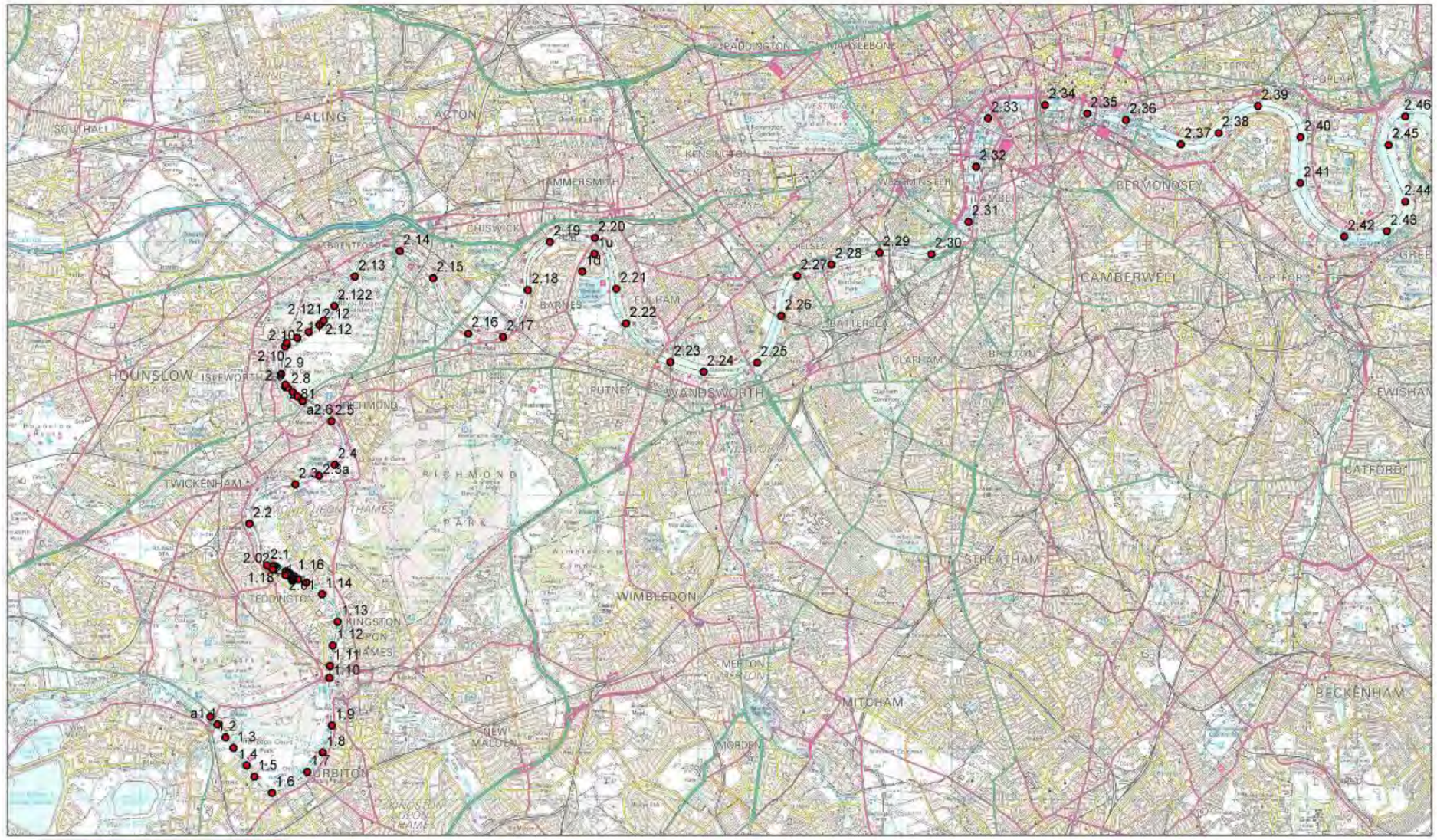
Defence levels are shown at ISIS model nodes. Policy Units are not indicated.

Map 1: Outer estuary

Map 2: Purfleet to Canvey

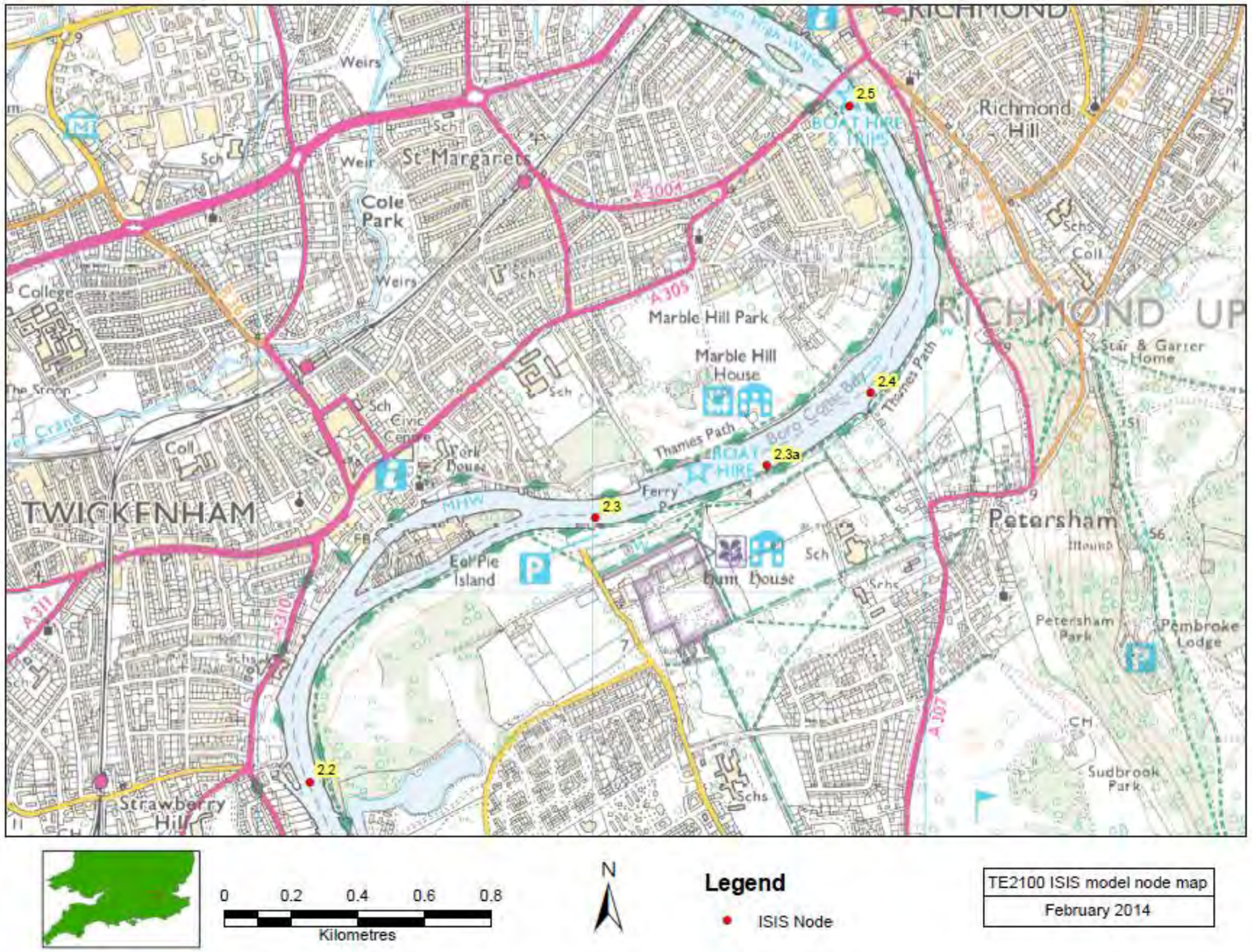


Map 3: Tower Bridge to Grays

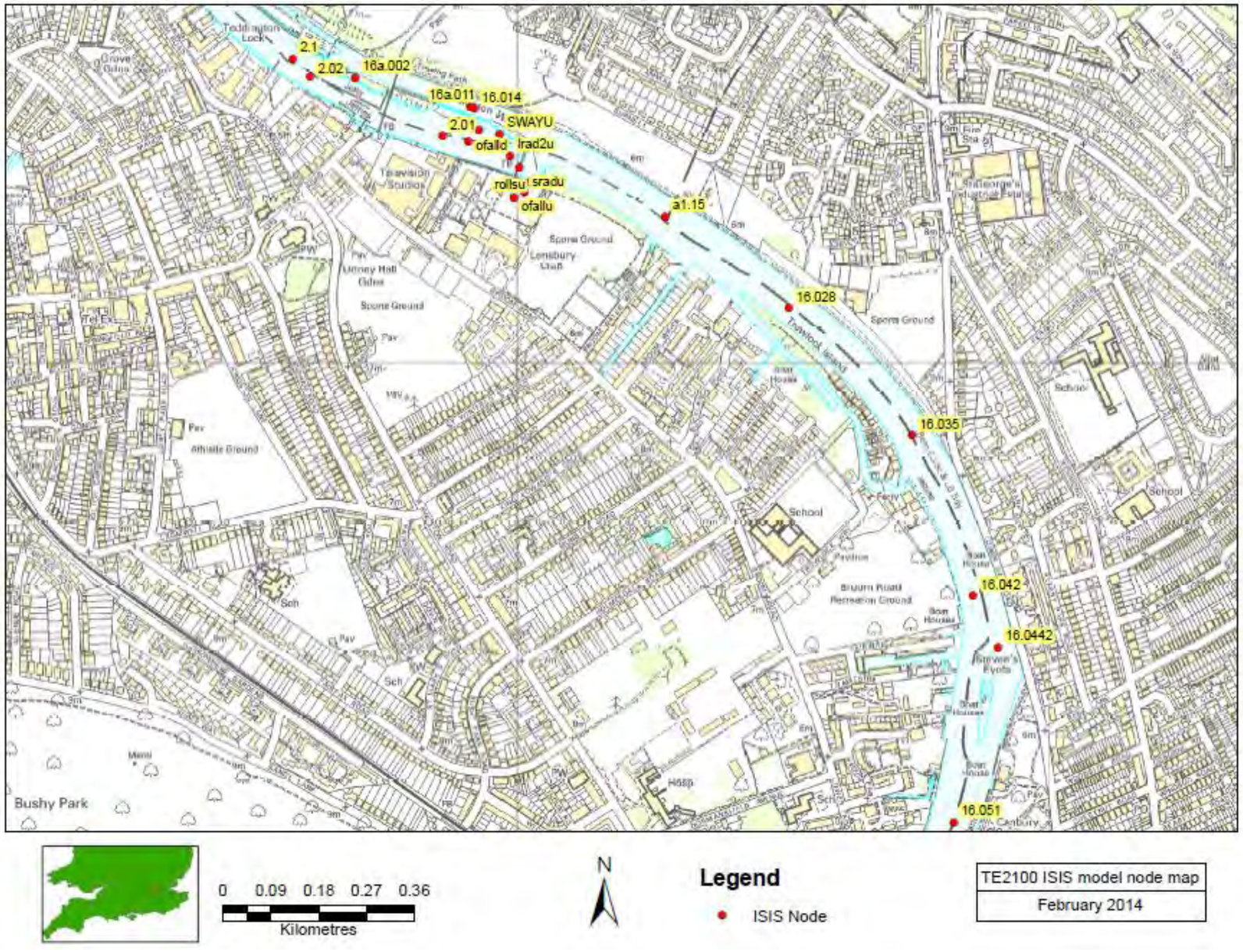


Map 4: Teddington to Greenwich

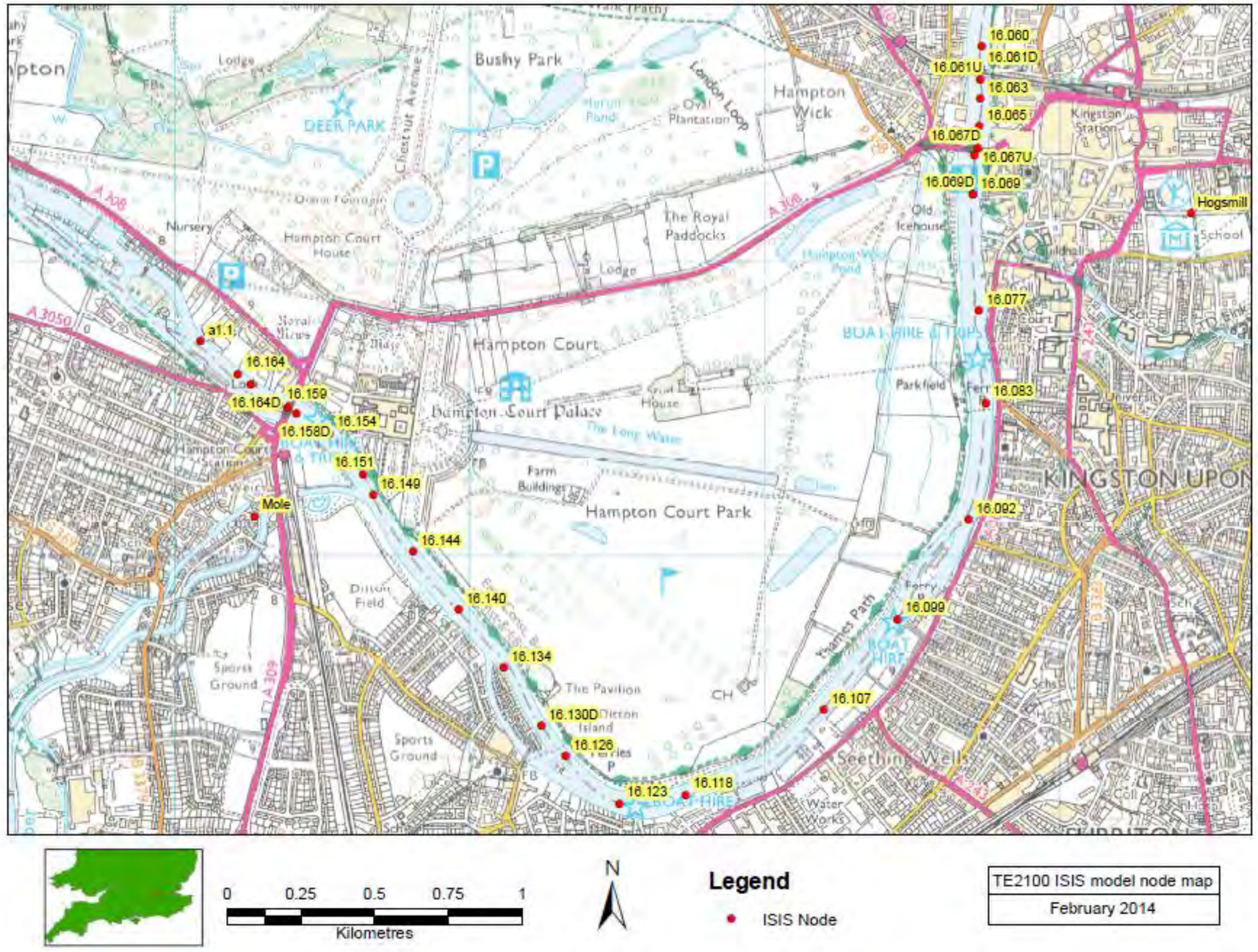
Map 5: Richmond to Kew - detail



Map 6: Twickenham to Richmond – detail



Map 7: Teddington to Kingston (upriver of TE2100 area)



Map 8: Kingston to Molesey (upriver of TE2100 area)

GeoSmart Information

Appendix C

Thames Water sewer flooding history

Sewer Flooding
History Enquiry

Property Searches

GeoSmart Information Ltd

Bellstone

Search address supplied	107 Castelnau London SW13 9EL
Your reference	83110
Our reference	SFH/SFH Standard/2024_5029332
Received date	**1 August 2024**
Search date	**1 August 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: 107,Castelnau,London,SW13 9EL

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

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

Thames Water Property Searches

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

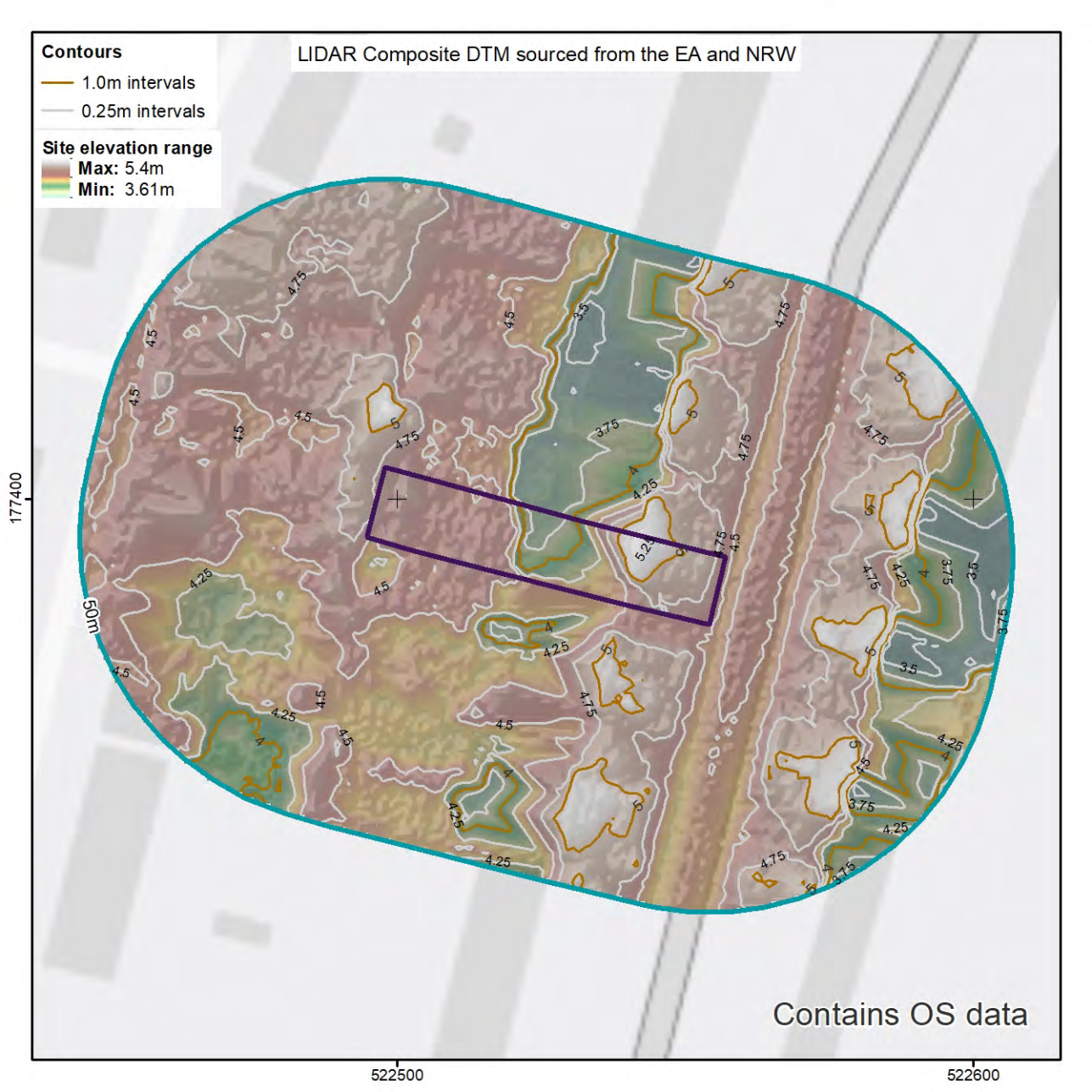
searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0800 009 4540

GeoSmart Information

Appendix D

Environment Agency LiDAR ground elevation data


Contours
1.0m intervals
0.25m intervals
Site elevation range
Max: 5.4m
Min: 3.61m
LIDAR Composite DTM sourced from the EA and NRW
177400
50m
522500
522600
Contains OS data

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.

The advice and opinions in this report should be read and relied on only in the context of the report as a whole, taking account of the terms of reference agreed with the client. The findings are based on the information made available to GeoSmart at the date of the report (and will have been assumed to be correct) and on current UK standards, codes, technology and practices as at that time. They do not purport to include any manner of legal advice or opinion. New information or changes in conditions and regulatory requirements may occur in future, which will change the conclusions presented here.

This report is confidential to the client. The client may submit the report to regulatory bodies, where appropriate. Should the client wish to release this report to any other third party for that party's reliance, GeoSmart may, by prior written agreement, agree to such release, provided that it is acknowledged that GeoSmart accepts no responsibility of any nature to any third party to whom this report or any part thereof is made known. GeoSmart accepts no responsibility for any loss or damage incurred as a result, and the third party does not acquire any rights whatsoever, contractual or otherwise, against GeoSmart except as expressly agreed with GeoSmart in writing.

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Tel: 01743 298 100

Email: info@geosmartinfo.co.uk

GeoSmart Information Limited is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom.
- sets out minimum standards which firms compiling and selling search reports have to meet.
- promotes the best practice and quality standards within the industry for the benefit of consumers and property professionals.
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.
- By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports.
- act with integrity and carry out work with due skill, care and diligence.
- at all times maintain adequate and appropriate insurance to protect consumers.
- conduct business in an honest, fair and professional manner.
- handle complaints speedily and fairly.
- ensure that products and services comply with industry registration rules and standards and relevant laws.
- monitor their compliance with the Code.

Complaints

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.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs contact details:

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

12. Terms and conditions, CDM regulations and data limitations

Terms and conditions can be found on our website:

http://geosmartinfo.co.uk/terms-conditions/

CDM regulations can be found on our website:

http://geosmartinfo.co.uk/knowledge-hub/cdm-2015/

Data use and limitations can be found on our website:

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