FLOOD RISK ASSESSMENT

Site Address
59 Bushwood Road
Richmond
TW9 3BG

Client
Vishal Jobanputra

Date
12/07/2024

1 Document Control

FLOOD RISK ASSESSMENT

Site Address:	59 Bushwood Road Richmond TW9 3BG
National Grid Reference:	519386, 177490
STM Reference:	FRA – 2024 – 000052
Version No:	1.0
Prepared for:	Vishal Jobanputra
Date:	12/07/2024
Report Author:	Joanna Hackett (BSc) **Graduate Flood Risk Consultant**
Reviewed By:	Georgia Travers (BSc) **Flood Risk and Drainage Consultant**
Authorised By:	Matthew Ashdown (BSc) **Senior Flood Risk and Drainage Consultant**

2 Contents

3 Abbreviations

Abbreviation	Description
STM	STM Environmental Consultants Limited
BGS	British Geological Survey
EA	Environment Agency
OS	Ordnance Survey of Great Britain
FRA	Flood Risk Assessment
NPPF	National Planning Policy Framework
FWD	Floodline Warning Direct
FRMS	Flood Risk Management Strategy
LBRT	London Borough of Richmond Upon Thames
SWMP	Surface Water Management Plan
SFRA	Strategic Flood Risk Assessment
CDA	Critical Drainage Area
AEP	Annual Exceedance Probability
CC	Climate Change
SuDS	Sustainable Urban Drainage Systems
GWSPZ	Groundwater Source Protection Zone
LLFA	Lead Local Flood Authority
mbgl	metres below ground level
DCLG	Department for Communities and Local Government
PPGPS	Planning practice guidance and Planning system

4 Disclaimer

This report and any information or advice which it contains, is provided by STM Environmental Consultants Ltd (STM) and can only be used and relied upon by Vishal Jobanputra. Any party other than the Client using or placing reliance upon any information contained in this report, do so at their own risk.

STM has exercised such professional skill, care and diligence as may reasonably be expected of a properly qualified and competent consultant when undertaking works of this nature. However, STM gives no warranty, representation or assurance as to the accuracy or completeness of any information, assessments or evaluations presented within this report.

5 Executive Summary

SECTION	SUMMARY
Location	59 Bushwood Road, Richmond, TW9 3BG Grid Reference: 519386, 177490
Area	172m^2
Proposed Development	Residential rear infill extension.
Flood Zone	The site is located in Flood Zone 3a.
Topography	The ground level at the site ranges from approximately 4.15mAOD (south) to 4.60mAOD (west). The approximate ground level of the existing building is 4.3 – 4.6mAOD.
Sequential and Exception Tests	The proposed development is minor and therefore is unlikely to require Sequential and Exception Tests to be undertaken.
Main Sources of Flooding	The River Thames, located approximately 60m northeast of the site.
Flood Defences	EA Mapping revealed a wall along the bank of the River Thames. The site also benefits from the Thames Barrier in East London; Providing protection up the 0.1% AEP tidal event.
Records of Historic Flooding	Inspection of the LLFA's PFRA shows that there has been between 1 to 5 sewer flooding incidents within the TW9 3 postcode. However, inspection of the LLFA's SFRA Interactive Map reveals just 1 incident in the TW9 3 postcode area.
Fluvial (River) and Tidal (Sea) Flood Risk	Low – The site is indicated to witness tidal flooding during the modelled breach 2005 and 2100 scenarios; Depths of up to 1.15m and 1.83m and levels of up to 5.22mAOD and 5.86mAOD respectively. Taking into account allowance for climate change, the flood level increases to 6.19mAOD.
Pluvial (Surface Water) Flood Risk	Very Low – The site remains dry during all modelled pluvial events.
Flood Risk from Artificial (Canals and Reservoirs) Sources	Low - No significant artificial sources identified within 5km of the site, but the site is at risk of reservoir flooding when there is also flooding from rivers.
Groundwater Flood Risk	Low to Medium – Examination of the LLFA's PFRA shows that the area in which the site is located has increased potential for elevated groundwater due to granular superficial deposits.
Development Impacts on Local Flood Risk	The development will increase the site impermeable and built-up area by 8m^2 and 16m^2 respectively. Therefore, given the minor scale of change and the fact the site remains dry during all events, excluding the residual breach flooding scenarios, it is likely to have a negligible impact to local flood risk.
Proposed Flood Risk Mitigation Measures	• Raising the finished floor level 300mm above the tidal breach 2100 plus CC estimated flood level (6.19mAOD) would be unfeasible due to the nature of the development being an extension; • Finished floor levels will be no lower than the existing FFL (4.60mAOD);

SECTION	SUMMARY
	• All bedrooms will remain above the tidal breach 2100 plus CC flood level (6.19mAOD) at a level of approximately 7.51mAOD • Construction will utilise flood resistant materials and services will be placed as high as practicable to reduce impact of flooding; • Occupants will sign up for EA Emergency Flood Warning Direct Service; • Safe Egress to Flood Zone 1 is an approximate 15-minute walk southwest to Sandycombe Road; It should be noted, a low hazard route during a breach event is not possible. • Safe refuge is available onsite within the upper floors of the building;
Surface Water Management (SuDS)	There is limited potential for SuDS implementation. It is recommended that rainwater harvesting (butts) and/or rain gardens are implemented to mitigate the minor increase in in runoff rates.
Conclusions	Based on the information reviewed and taking into account the proposed mitigation measures, it is considered that overall flood risk to the proposed development is acceptable and that it will not increase local flood risk. As such, the development is considered to be in compliance with local planning policy and the NPPF.

6 Introduction

STM Environmental Consultants Limited (STM) were appointed by Vishal Jobanputra to provide a Flood Risk Assessment (FRA) at a site located at 59 Bushwood Road, Richmond, TW9 3BG.

7 Development Proposal

The FRA is required to support a planning application to for a residential rear infill extension.

Further details including drawings of the development plans are available in Appendix 2.

8 Report Aims and Objectives

The purpose of this report is to establish the flood risk to the site from all potential sources and, where possible, to propose suitable mitigation methods to reduce any risks to an acceptable level. It aims to make an assessment of whether the development will be safe for its lifetime, taking into account climate change and the vulnerability of its users, without increasing flood risk elsewhere.

The FRA assesses flood risk to the site from tidal, fluvial, surface water, groundwater, sewers and artificial sources. The FRA has been produced in accordance with the National Planning Policy Framework (NPPF) and its supporting guidance.

9 Summary of Data Review Undertaken

The following research has been undertaken as part of the FRA:

- Desktop assessment of topographical, hydrological and hydrogeological settings through review of the information sourced from the British Geological Survey (BGS), the Environment Agency (EA) and the Ordnance Survey (OS);
- Review of publicly available flood risk mapping provided by the EA;
- Review of the Preliminary Flood Risk Assessment (PFRA) and Level 1 Strategic Flood Risk Assessment (SFRA) produced by the LLFA outlining flood risk from various sources within the borough.

10 Legislative and Policy Context

10.1 Legislative Context

The Flood and Water Management Act was introduced in 2010. The Act defines the role of lead local flood authority (LLFA) for an area. All LLFA are required to develop, maintain, apply and monitor a strategy for local flood risk management in its area, called “local flood risk management strategy”.

Alongside the Act, Flood Risk Regulations (2009) outline the roles and responsibilities of the various authorities, which include preparing Flood Risk Management Plans and identifying how significant flood risks are to be mitigated.

10.2 Policy Context

10.2.1 National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF) sets out the Government's economic, environmental and social planning policies for England. The policies set out in this framework apply to the preparation of local and neighbourhood plans and to decisions on planning applications.

The latest version of the NPPF can be view online here. The below text it extracted from the online document from paragraphs 165 – 179.

Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where

development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.

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

All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by:

- Applying the sequential test and then, if necessary, the exception test as set out below;
- Safeguarding land from development that is required, or likely to be required, for current or future flood management;
- Using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding, (making as much use as possible of natural flood management techniques as part of an integrated approach to flood risk management); and
- Where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development, including housing, to more sustainable locations.

The aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.

If it is not possible for development to be located in areas with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification.

Paragraph 173 of the National Planning Policy Framework (NPPF) states that:

When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment (See Note 1) Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location
- the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;
- it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
- any residual risk can be safely managed; and
- safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

Applications for some minor development and changes of use (See Note.2) should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments set out in (See Note 1).

Paragraph 175 states that:

Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

- take account of advice from the lead local flood authority;
- have appropriate proposed minimum operational standards;
- have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
- where possible, provide multifunctional benefits.

A major development is defined as:

- a residential development: 10 dwellings or more or residential development with a site area of 0.5 hectares or more where the number of dwellings is not yet known
- a non-residential development: provision of a building or buildings where the total floor space to be created is 1000 square metres or more or where the floor area is not yet known, a site area of 1 hectare or more.

Note. 1 - A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

Note. 2 - This includes householder development, small non-residential extensions (with a footprint of less than 250m^2) and changes of use; except for changes of use to a caravan, camping or chalet site, or to a mobile home or park home site, where the sequential and exception tests should be applied as appropriate.

Coastal Change Management Areas should only be considered appropriate where it is demonstrated that:

- Be clear as to what development will be appropriate in such areas and in what circumstances; and
- Make provision for development and infrastructure that needs to be relocated away from Coastal Change Management Areas.

- it will be safe over its planned lifetime and will not have an unacceptable impact on coastal change;
- the character of the coast including designations is not compromised;
- the development provides wider sustainability benefits;
- the development does not hinder the creation and maintenance of a continuous signed and managed route around the coast.

10.3 Local Planning Policy – London Borough of Richmond Upon Thames

10.3.1 Policy LP 21 - Flood Risk and Sustainable Drainage

A. 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. Development will be guided to areas of lower risk by applying the 'Sequential Test' as set out in national policy guidance, and where necessary, the 'Exception Test' will be applied. Unacceptable developments and land uses will be refused in line with national policy and guidance, the Council's Strategic Flood Risk Assessment (SFRA) and as outlined in the table below.

In Flood Zones 2 and 3, all proposals on sites of 10 dwellings or more or 1000sqm of non-residential development or more, or on any other proposal where safe access/egress cannot be achieved, a Flood Emergency Plan must be submitted.
Where a Flood Risk Assessment is required, on-site attenuation to alleviate fluvial and/or surface water flooding over and above the Environment Agency's floodplain compensation is required where feasible.

	Land uses and developments – restrictions	Sequential Test	Exception Test	Flood Risk Assessment
Zone 3b	The functional floodplain as identified in the Council's Strategic Flood Risk Assessment will be protected by not permitting any form of development on undeveloped sites unless it: • is for Water Compatible development; • is for essential utility infrastructure which has to be located in a flood risk area and no alternative locations are available and it can be demonstrated that the development would be safe, without increasing flood risk elsewhere and where possible would reduce flood risk overall. Redevelopment of existing developed sites will only be supported if there is no intensification of the land use and a net flood risk reduction is proposed; any restoration of the functional floodplain will be supported. Proposals for the change of use or conversion to a use with a higher vulnerability classification will not be permitted.	Required for essential utility infrastructure	Required for essential utility infrastructure	Required for all development proposals
Zone 3a	Land uses are restricted to Water Compatible, Less Vulnerable and More Vulnerable development. Highly Vulnerable developments will not be permitted. Self-contained residential basements and bedrooms at basement level will not be permitted.	Required for all developments unless exceptions outlined in the justification apply	Required for more vulnerable development	Required for all development proposals

Zone 2	No land use restrictions Self-contained residential basements and bedrooms at basement level will not be permitted.	Required for all developments unless exceptions outlined in the justification apply	Required for highly vulnerable development	Required for all development proposals unless for change of use from water compatible to less vulnerable
Zone 1	No land use restrictions	Not applicable	Not applicable	A Drainage Statement is required for sites all major developments. Required for all other development proposals where there is evidence of a risk from other sources of flooding, including surface water, ground water and sewer flooding.

Basements and subterranean developments

B. Basements within flood affected areas of the borough represent a particularly high risk to life, as they may be subject to very rapid inundation. Applicants will have to demonstrate that their proposal complies with the following:

Flood Zone 3b (Functional Floodplain)	Basements, basement extensions, conversions of basements to a higher vulnerability classification or self-contained units will not be permitted.
Flood Zone 3a (Tidal / Fluvial)	**In areas of Extreme, Significant and Moderate Breach Hazard** (as set out in the Council's SFRA): • **New basements:** o restricted to Less Vulnerable / Water Compatible use only. o 'More Vulnerable' uses will only be considered if a site-specific Flood Risk Assessment demonstrates that the risk to life can be managed. Bedrooms at basement levels will not be permitted. o 'Highly Vulnerable' such as self-contained basements/bedrooms uses will not be permitted. • **Existing basements:** o No basement extensions, conversions or additions for 'Highly Vulnerable' uses. o 'More Vulnerable' uses will only be considered if a site-specific Flood Risk Assessment demonstrates that the risk to life can be managed. **In areas of Low or No Breach Hazard** (as set out in the Council's SFRA): • **New basements:** if the Exception Test (where applicable) is passed, basements may be permitted for residential use where they are not self-contained or used for bedrooms. • **Existing basements:** basement extensions, conversions or additions may be permitted for existing developments where they are not self-contained or used for bedrooms.

	If a basement, basement extension or conversion is acceptable in principle in terms of its location, it must have internal access to a higher floor and flood resistant and resilient design techniques must be adopted.
Flood Zone 2	**In areas of Extreme, Significant and Moderate Breach Hazard** (as set out in the Council's SFRA): • **New Basements:** if the Exception Test (where applicable) is passed, basements may be permitted for residential use where they are not self-contained or used for bedrooms. • **Existing Basements:** basement extensions, conversions or additions maybe permitted for existing developments where they are not self-contained or used for bedrooms. If a basement, basement extension or conversion is acceptable in principle in terms of its location, it must have internal access to a higher floor and flood resistant and resilient design techniques must be adopted.
Flood Zone 1	No restrictions on new or extensions to existing basements

Sustainable drainage

C. The Council will require the use of Sustainable Drainage Systems (SuDS) in all development proposals. Applicants will have to demonstrate that their proposal complies with the following:

1. A reduction in surface water discharge to greenfield run-off rates wherever feasible.
2. Where greenfield run-off rates are not feasible, this will need to be demonstrated by the applicant, and in such instances, the minimum requirement is to achieve at least a 50% attenuation of the site's surface water runoff at peak times based on the levels existing prior to the development.

Flood defences

D. Applicants will have to demonstrate that their proposal complies with the following:

1. Retain the effectiveness, stability and integrity of flood defences, river banks and other formal and informal flood defence infrastructure.
2. Ensure the proposal does not prevent essential maintenance and upgrading to be carried out in the future.
3. Set back developments from river banks and existing flood defence infrastructure where possible (16 metres for the tidal Thames and 8 metres for other rivers).
4. Take into account the requirements of the Thames Estuary 2100 Plan and the River Thames Scheme, and demonstrate how the current and future requirements for flood defences have been incorporated into the development.

5. The removal of formal or informal flood defences is not acceptable unless this is part of an agreed flood risk management strategy by the Environment Agency.

10.4 Regional Planning Policy - London

10.4.1 Policy SI 12 - Flood Risk Management:

- Current and expected flood risk from all sources (as defined in paragraph 9.2.12) across London should be managed in a sustainable and cost-effective way in collaboration with the Environment Agency, the Lead Local Flood Authorities, developers and infrastructure providers.
- Development Plans should use the Mayor's Regional Flood Risk Appraisal and their Strategic Flood Risk Assessment as well as Local Flood Risk Management Strategies, where necessary, to identify areas where particular and cumulative flood risk issues exist and develop actions and policy approaches aimed at reducing these risks. Boroughs should cooperate and jointly address cross-boundary flood risk issues including with authorities outside London.
- Development proposals should ensure that flood risk is minimised and mitigated, and that residual risk is addressed. This should include, where possible, making space for water and aiming for development to be set back from the banks of watercourses.
- Developments Plans and development proposals should contribute to the delivery of the measures set out in Thames Estuary 2100 Plan. The Mayor will work with the Environment Agency and relevant local planning authorities, including authorities outside London, to safeguard an appropriate location for a new Thames Barrier.
- Development proposals for utility services should be designed to remain operational under flood conditions and buildings should be designed for quick recovery following a flood.
- Development proposals adjacent to flood defences will be required to protect the integrity of flood defences and allow access for future maintenance and upgrading. Unless exceptional circumstances are demonstrated for not doing so, development proposals should be set back from flood defences to allow for

- any foreseeable future maintenance and upgrades in a sustainable and cost-effective way.
- Natural flood management methods should be employed in development proposals due to their multiple benefits including increasing flood storage and creating recreational areas and habitat

10.4.2 Policy SI 13 - Sustainable Drainage:

Lead Local Flood Authorities should identify – through their Local Flood Risk Management Strategies and Surface Water Management Plans – areas where there are particular surface water management issues and aim to reduce these risks. Increases in surface water run-off outside these areas also need to be identified and addressed.

Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:

- rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
- rainwater infiltration to ground at or close to source
- rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
- rainwater discharge direct to a watercourse (unless not appropriate)
- controlled rainwater discharge to a surface water sewer or drain
- controlled rainwater discharge to a combined sewer.

Development proposals for impermeable surfacing should normally be resisted unless they can be shown to be unavoidable, including on small surfaces such as front gardens and driveways.

Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improved water quality, and enhanced biodiversity, urban greening, amenity and recreation.

10.5 EA Standing Advice on Flood Risk

The Environment Agency's standing advice lays out the process that must be followed when carrying out flood risk assessments for developments.

Flood Risk Assessments are required for developments within one of the Flood Zones. This includes developments:

- in Flood Zone 2 or 3 including minor development and change of use more than 1 hectare (ha) in Flood Zone 1;
- less than 1 ha in Flood Zone 1, including a change of use in development type to a more vulnerable class (for example from commercial to residential), where they could be affected by sources of flooding other than rivers and the sea (for example surface water drains, reservoirs);
- in an area within Flood Zone 1 which has critical drainage problems as notified by the Environment Agency.

11 Site Description and Environmental Characteristics

11.1 Site Location and Area

The site is located at 59 Bushwood Road, Richmond, TW9 3BG and is centred at national grid reference 519386, 177490. The site has an area of approximately 172m^2.

A site location map and aerial photo are shown below. Photographs of the site are available in Appendix 1.

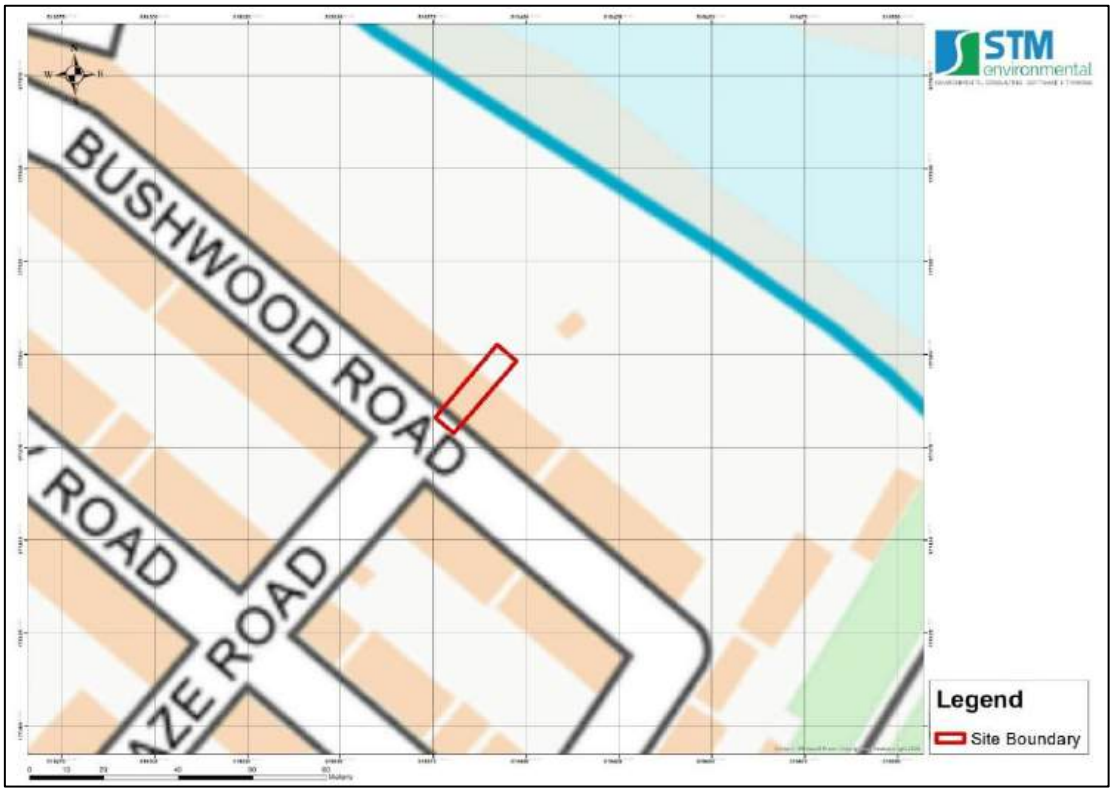


Figure 1: Site Location Map

Figure 2: Site Aerial Map

11.2 Site Access

The site is accessible via Bushwood Road.

11.3 Local Planning Authority

The site falls within the jurisdiction of the London Borough of Richmond Upon Thames (LBRT) in terms of the planning process.

11.4 Lead Local Flood Authority

LBRT is also the Lead Local Flood Authority (LLFA).

11.5 Flood Zone

For planning purposes, the site is located in Flood Zone 3a as defined by the EA and LLFA. The maps of the Flood Zones are available in Appendix 5.

11.6 Site and Surrounding Land Uses

11.6.1 Site Current Land Use

The site is currently used as residential property.

11.6.2 Surrounding Land Uses

A description of the current and surrounding land uses of the site is given in Table 1.

Table 1: Summary of surrounding land uses

Boundary	Land Use Description	
	Immediately Adjacent (Within 0 – 25m)	**General Local Area (Within 25 – 250m)**
Northern	Residential, Allotments	Footpath, River (River Thames)
Eastern	Residential, Footpath	Leisure (Bowling Green, Tennis Courts), Infrastructure (Kew Railway Bridge)
Southern	Road, Residential	Road, Residential
Western	Road, Residential	Road, Residential, Parkland (Kew Green)

11.7 Hydrology

The nearest main watercourse is the River Thames located approximately 60m northeast of the site. A map of the nearby hydrological features is present in Appendix 2.

11.8 Geology

Data from the British Geological Survey indicates that the underlying superficial geology is characterised as Alluvium (Clay, Silt, Sand and Peat). The underlying bedrock geology is characterized as London Clay Formation (Clay and Silt).

11.9 Hydrogeology

The site lies upon a Secondary (undifferentiated) superficial aquifer and an unproductive bedrock aquifer.

Appendix 3 provides BGS mapping showing the hydrogeology at the site location.

11.10 Topography

A LIDAR DTM map showing the topography of the site and surrounding area is available in Appendix 3. As a topographic survey was not available, site levels were estimated using this.

On a regional level, the site is located on relatively low-lying land with a strip of higher elevations along the bank of the River Thames.

There is an overall change in elevation of approximately 0.45m. The elevation ranges from a low of approximately 4.15mAOD along Bushwood Road to the south, to a high of approximately 4.60mAOD centrally in the position of the dwelling. The ground reduces to 4.4m along the northern boundary at end of the existing gardens.

The elevation in the region ranges from approximately 4.01mAOD, along Bushwood Road southwest of the site, to 5.01mAOD in the allotments northeast of the site.

12 The Sequential and Exception Tests

12.1 The Sequential Test

The Sequential Test aims to steer developments and redevelopments to areas of lower flood risk. The test compares the proposed development site with other available sites, in terms of flood risk, to aid the steering process. The Sequential Test is not required if the proposed development is a minor development or if it involves a change of use unless the development is a caravan, camping chalet, mobile home or park home site.

Based on Government Guidance, Minor Development means:

- minor non-residential extensions: industrial/commercial/leisure etc extensions with a footprint less than 250 square metre.
- alterations: development that does not increase the size of buildings eg alterations to external appearance.
- householder development: For example; sheds, garages, games rooms etc within the curtilage of the existing dwelling, in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling eg subdivision of houses into flats.

With regard to residential and commercial developments, major development, as defined by the Town and Country Planning (Development Management Procedure) means one or more of the following:

- c(i) - the number of dwelling houses to be provided is 10 or more; or
- c(ii) - the development is to be carried out on a site having an area of 0.5 hectares or more and it is not known whether the development falls within sub-paragraph (c)(i);
- the provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more;

- or development carried out on a site having an area of 1 hectare or more.

The development is considered to be minor and as such, the Sequential Test should not be required by the LLFA.

12.2 The Exception Test

Where the Sequential Test is undertaken and alternative sites of lower flood risk are not available, then the proposed development may require an Exception Test in order to be granted planning permission. Where the exception test is required, it should be applied as soon as possible to all local development document allocations for developments and all planning applications other than for minor developments. All three elements of the exception test have to be passed before development is allocated or permitted. For the exception test to be passed:

- It must demonstrate that the development provides wider sustainability benefits to the community that outweigh the flood risk, informed by an SFRA, where one has been prepared;
- The development should be on developed land or on previously developed land;
- A flood risk assessment must demonstrate that the development will be safe without increasing flood risk elsewhere, and where possible will reduce the overall flood risk.

The requirements for an Exception Test are given in Table 2 and are defined in terms of Flood Zone and development vulnerability classification.

Table 2: NPPF Flood Zone vulnerability compatibility (source: NPPF).

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required	✗	Exception Test required	✓	✓
Zone 3b	Exception Test required	✗	✗	✗	✓

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Given that the development is considered to be minor, the Exception Test should not be required by the LLFA.

13 Site Specific Flood Risk Analysis

The PFRA and Level 1 SFRA produced by the LLFA and maps from the EA provide information regarding historic flooding events and incidents as well as predictions of flood extents and depths during extreme rainfall events.

13.1 Fluvial (River) and Tidal (Sea) Flood Risk

13.1.1 Mechanisms for Fluvial Flooding

Fluvial, or river flooding, occurs when excessive rainfall over an extended period of time or heavy snow melt causes a river to exceed its capacity. The damage from a fluvial flood can be widespread as the overflow may affect downstream tributaries, overtopping defences and flooding nearby inhabited areas. Fluvial flooding consists of two main types:

- Overbank flooding – this occurs when water rises steadily and overflows over the edges of a river or stream;
- Flash flooding – this is characterized by an intense, high velocity torrent of water that occurs in an existing river channel with little to no notice. Flash floods are very dangerous and destructive not only because of the force of the water, but also the hurtling debris that is often swept up in the flow.

13.1.2 Definition of EA Modelled Fluvial Flood Risk Zones

Fluvial flood risk is assessed using flooding maps produced by the Environment Agency. These maps use available historic data and hydraulic modelling to define zones of flood risk. The maps allow a site to be defined in terms of its flood zone (e.g. 1, 2, 3) and in terms of the overall flood risk (very low, low, medium or high). It is important to note that existing flood defences are not taken into account within the models or the maps. The EA fluvial flood zones are defined as follows:

- Flood zone 1: Less than 1 in 1000 (0.1%) annual probability of flooding;
- Flood zone 2: Between 1 in 100 (1%) and 1 in 1000 (0.1%) annual probability of flooding;
- Flood zone 3: Greater than 1 in 100 (1%) annual probability of fluvial flooding.

Flood zone 3 is split into two sub-categories (3a and 3b) by LLFAs depending on whether the land is considered to be a functional flood plain (i.e. an important storage area for flood waters in extreme events).

- Flood zone 3a: Greater than 1 in 100 (1%) annual probability of fluvial flooding and/or greater than 1 in 200 (0.5%) annual probability of tidal flooding;
- Flood zone 3b: Functional flood plain (definition specific to the LLFA). Less than a 1 in 20 (5%) annual probability of fluvial and/or tidal flooding.

13.1.3 Mechanisms for Tidal Flooding

Tidal flooding may be described simply as the inundation of low-lying coastal areas by the sea, or the overtopping or breaching of sea defences. Tidal flooding may be caused by seasonal high tides, storm surges and where increase in water level above the astronomical tide level is created by strong on shore winds or by storm driven wave action.

13.1.4 Definition of EA Tidal Flood Risk Zones

As with fluvial flood risk, tidal flood risk is assessed using flooding maps produced by the Environment Agency. The difference is in the probability return periods used to define tidal flood zones. The EA tidal Flood Zones are defined as:

- Flood zone 1: Less than 1 in 1000 (0.1%) annual probability of flooding;
- Flood zone 2: Between 1 in 200 (0.5%) and 1 in 1000 (0.1%) annual probability of tidal flooding;
- Flood zone 3: Greater 1 in 200 (0.5%) annual probability of tidal flooding.

13.1.5 Main Potential Sources of Local Fluvial and Tidal Flooding

The nearest potential source of combined fluvial and tidal flooding is considered to be the River Thames, located approximately 60m northeast of the site.

13.1.6 Records of Historic Fluvial and Tidal Flooding Incidents

The EA's historic and recorded flood outline maps show the locations and extents of historic flooding. These maps indicate that there has not been historic fluvial or tidal flooding at or in the vicinity of the site. Copies of these maps are available in Appendix 4.

13.1.7 Designated Fluvial and Tidal Flood Risk Zone for the Site

The site is considered to be located within Flood Zone 3a as defined by the Environment Agency and the LLFA indicating that it has a greater than 1 in 100 (1%)

annual probability of fluvial flooding and greater than 1 in 200 (0.5%) annual probability of tidal flooding.

13.1.8 Flood Defences

The EA's flood defence map which is available in Appendix 7 shows that the site benefits from flood defences including a wall along the bank of the River Thames approximately 60m northeast of the site. The Thames Barrier in East London is also a defence designed to protect London from 1 in 1000-year (0.1% AEP) tidal events.

13.1.9 Peak River Flow Climate Change Allowances

The EA's climate change allowances for peak river flow maps show that the site is considered to be in the London Management Catchment. The climate change allowances for this catchment are available in Appendix 11.

In flood zones 2 or 3a for:

- essential infrastructure – use the higher central allowance
- highly vulnerable – use central allowance (development should not be permitted in flood zone 3a)
- more vulnerable – use the central allowance
- less vulnerable – use the central allowance
- water compatible – use the central allowance

In flood zone 3b for:

- essential infrastructure – use the higher central allowance
- highly vulnerable – development should not be permitted
- more vulnerable – development should not be permitted
- less vulnerable – development should not be permitted
- water compatible – use the central allowance

The central allowance for more vulnerable developments indicates that a climate change allowance of 17% should be used.

Given that the site is protected up to a 0.1% AEP standard and is only at risk of residual breach flooding. Therefore, the climate change allowance was calculated using for the 2096 - 2125 South East higher central sea level allowance of 13.1mm per year. This ensures the adequate climate change allowance has been applied without further modelling.

13.1.10 Climate Change - EA Modelled Predictions of Fluvial and Tidal Flood Levels and Extents

The EA Product 6 dataset which is presented in Appendix 11 provides modelled flood levels and flows for model node points close to the site. These are summarised in It should also be noted that there was slight variation in LiDAR figures between scenarios.

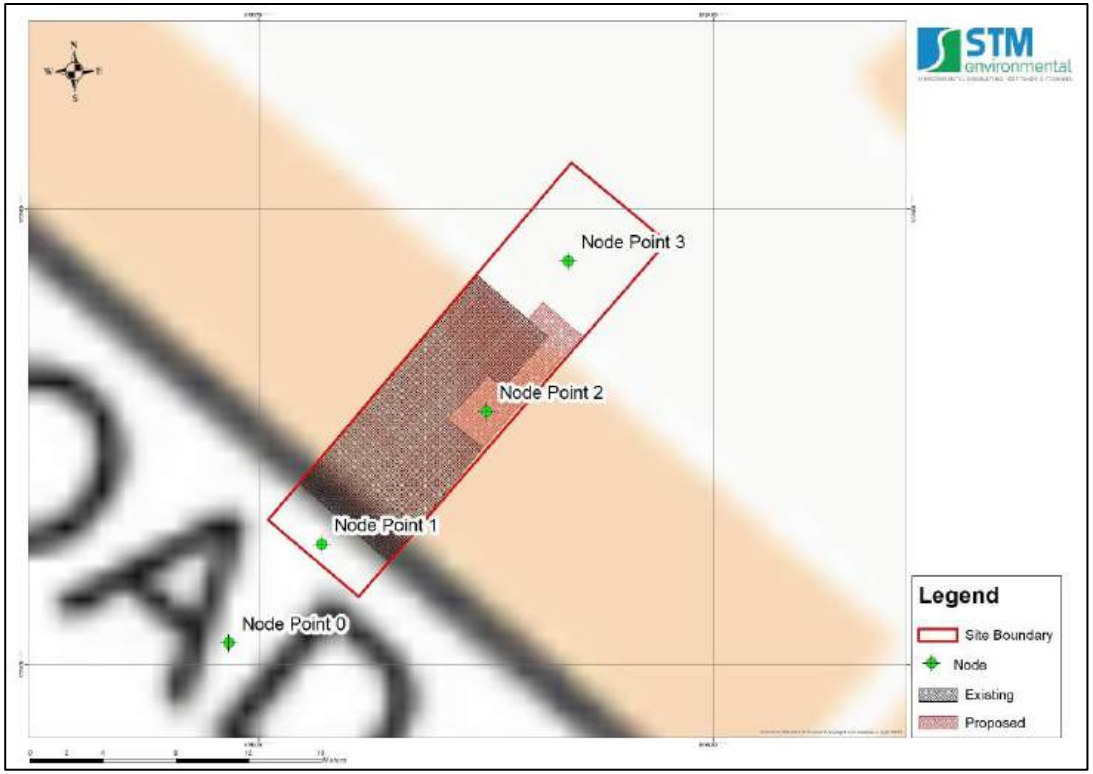
Table 3 below.

The ‘Thames Tidal Upriver Breach Inundation Modelling 2017’ dataset was reviewed, with the 2005_All Area and 2100_Main Area shown to impact the site. It should also be noted that there was slight variation in LiDAR figures between scenarios.

Table 3: EA modelled expected flood depths (m) and levels (mAOD) for different scenarios.

Thames Tidal Upriver Breach Inundation Modelling 2017											
Node	Easting	Northing	Topography (mAOD)			2005 Breach		2100 Breach		2100+CC Breach*	
			LiDAR DTM	2005 Modelled	2100 Modelled	Depth (m)	Level (mAOD)	Depth (m)	Level (mAOD)	Depth (m)	Level (mAOD)
0	519373.37	177476.14	4.13	4.10	4.03	1.10	5.20	1.83	5.86	2.15	6.18
1	519378.46	177481.57	4.22	4.05	4.20	1.15	5.20	1.66	5.86	1.98	6.18
2	519387.52	177488.84	4.48	4.27	4.27	0.94	5.21	1.59	5.86	1.91	6.18
3	519392.02	177497.11	4.40	4.39	4.41	0.83	5.22	1.46	5.86	1.79	6.19

**Based on the 2096-2125 south east higher central climate change allowance of 13.1mm per year*



Given that the Thames Tidal Defences protect up to a 1 in 1000-year event, the only impact to the site is residual risk through defence breach. It should be noted that the LLFA's Level 1 SFRA states that "the probability of residual risks linked to overtopping and flood defence asset failure is small". Therefore, it can be assumed that fluvial and tidal flood risk is considered to be low.

During the 2005 Breach scenario, the flood depth at the site reached a maximum of 1.15m and the flood level reached a maximum of 5.22mAOD. The proposed extension witnesses a flood depth of up to 0.94m to a level of 5.21mAOD.

During the 2100 Breach scenario, the flood depth reached a maximum of 1.83m and a flood level of 5.86mAOD. The proposed extension witnesses a flood depth of up to 1.59m to a level of 5.86mAOD during the same event.

13.1.11 Long Term Fluvial/Tidal Flood Risk Considering Flood Defences

The EA's long term flood risk maps give an indication of the actual risk associated with flooding after taking into account the effect of any flood defences in the area. Copies of maps for the site which are available in Appendix 9 indicate that the long-term risk from fluvial flooding to the site is low.

13.2 Pluvial (Surface Water) Flood Risk

A pluvial, or surface water flood, is caused when heavy rainfall creates a flood event independent of an overflowing water body. Surface water flooding occurs when high intensity rainfall leads to run-off which flows over the ground surface, causing ponding in low-lying areas when the precipitation rate or overland flow rate is greater than the rate of infiltration, or return into watercourses. Surface water flooding can be exacerbated when the underlying soil and geology is saturated (as a result of prolonged precipitation or a high-water table) or when the drainage network has insufficient capacity.

13.2.1 Mechanisms of Pluvial Flooding

The chief mechanisms for surface water flooding can be divided into the following categories:

- Runoff from higher topography;
- Localised surface water runoff – as a result of localised ponding of surface water;
- Sewer Flooding – areas where extensive and deep surface water flooding is likely to be influenced by sewer flooding. Where the sewer network has reached capacity, and surcharged, this will exacerbate the flood risk in these areas;
- Low Lying Areas – areas such as underpasses, subways and lowered roads beneath railway lines are more susceptible to surface water flooding;
- Railway Cuttings –railway infrastructure cut into the natural geological formations can cause extra surface run off and pooling disrupting service and potentially affecting adjacent structures;
- Railway Embankments – discrete surface water flooding locations along the up-stream side of the raised network rail embankments where water flows are interrupted and ponding can occur;
- Failure of artificial sources (i.e. man-made structures) such as such as canals and reservoirs.

13.2.2 Main Potential Sources of Local Pluvial Flooding

The main potential source of pluvial flooding to the site is considered to be surface water ponding and flooding associated with heavy rainfall.

13.2.3 Records of Historic Pluvial Flooding Incidents

Examination of the LLFA's PFRA revealed no evidence of pluvial flooding on or in the vicinity of the site.

A map showing the location of surface water flooding incidents is available in Appendix 4 .

13.2.4 Surface Water Flood Risk from Artificial Sources (Reservoirs and Canals)

The EA's reservoir flood risk map indicates that the site lies within an area that is at risk of reservoir flooding when there is also flooding from rivers. A map showing flood risk from reservoirs is available in Appendix 8.

An examination of OS mapping and the EA's mapping revealed no indications of significant reservoirs or canals within 5km of the site. Therefore, any risk is most likely from residual flooding from reservoirs upstream and/or downstream of the River Thames.

13.2.5 Sewer Flooding

Examination of the LLFA's PFRA revealed evidence of 1 and 5 sewer flood records in the TW9 3 postcode area. However, no specific sewer flood incident locations were shown. Examination of the LLFA's SFRA Interactive Map revealed evidence of 1 incident in the TW9 3 postcode area. However, no further details were provided.

A map showing recorded incidents of sewer flooding is available in Appendix 4.

13.2.6 Climate Change - Modelled Predictions of Surface Water Run-off Flooding

Mapping of the predicted extent and depth of surface water flooding for the 1in 30-year, 1 in 100-year, and 1 in 1000-year rainfall return periods provided by the EA are available in Appendix 6.

During all events, the site remains dry.

However, during the 1 in 1000-year event, Bushwood Road, immediately adjacent to the southwest site boundary, experiences flooding of up to 600mm.

13.2.7 Long Term Surface Water Flood Risk

The EA's long term flood risk maps which are available in Appendix 9 indicate that the long term risk of flooding from surface water is considered to be very low.

13.3 Groundwater Flood Risk

Groundwater flooding occurs when water rises from an underlying aquifer (i.e. at the location of a spring) to such a level where it intersects the ground surface and inundates the surrounding land. Groundwater flooding tends to occur after long periods of intense precipitation, in often low-lying areas where the water table is likely to be at a shallow depth. Groundwater flooding is known to occur in areas underlain by principal aquifers, although increasingly it is also being associated with more localised floodplain sands and gravels. A high groundwater table also has the potential to exacerbate the risk of surface water and fluvial flooding by reducing rainfall infiltration capacity, and to increase the risk of sewer flooding through sewer/groundwater interactions.

13.3.1 Historic Records of Groundwater Flooding

Examination of the LLFA's PFRA revealed no records of groundwater flooding on or within 500m of the site.

A map showing the locations of historic groundwater flooding incidents is available in Appendix 4.

13.3.2 Susceptibility to Groundwater Flooding

The Groundwater Flood Susceptibility Map provided by BGS and presented in Appendix 10 indicates that the site has potential for groundwater flooding of property situated below ground level for a small part of the northwestern corner of the site. There is no information regarding the rest of the site. The Groundwater Depth Map also provided by BGS indicates that the groundwater level may be approximately less than 3mbgl.

Examination of the LLFA's PFRA shows that the area in which the site is located has increased potential for elevated groundwater in permeable (granular) superficial deposits. A map showing the locations of increased potential for elevated groundwater is available in Appendix 4.

13.4 Critical Drainage Area

A Critical Drainage Area (CDA) may be defined as "a discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure". A CDA is defined in the Town and Country Planning (General Development Procedure) (Amendment) (No. 2) (England) Order 2006 as "an area within Flood Zone 1 which has critical drainage problems and which has been notified to the local planning authority by the Environment Agency".

The site is not located within a Critical Drainage Area. A map showing the extent of critical drainage areas is available in Appendix 10.

14 Potential Impacts of the Development on Local Flood Risk

14.1 Changes to Impermeable Area and Building Footprint

Changes in ground cover arising from the development are presented in **Error! R eference source not found.** and Table 5 below.

Table 4: Existing and proposed site ground cover*.

	Impermeable Area (m^2)	Permeable Area (m^2)	Total Area (m^2)
Existing	120	52	172
Proposed	128	44	172

**It should be noted that these figures are not accurate due to lack of available site information regarding patio and garden space*

Table 5: Break down of existing and proposed site uses*.

Use	Existing (m^2)	Proposed (m^2)	Difference (m^2)
Building	85	101	16

Impermeable Paving	35	27	-8
Permeable Paving	-	-	-
Garden	52	44	-8
Total	172	172	-

**It should be noted that these figures are not accurate due to lack of available site information regarding patio and garden space*

The development increases the impermeable area of the site by 8m^2. Therefore, it is considered that it may have a negative impact upon flood flow and runoff rates. However, due to the minor increase as an infilled extension, these impacts are deemed to be negligible.

14.2 Impacts on Flood Storage and Flood Flow Routes

As the development will increase the site's built-up area by 16m^2, it has the potential to have an impact upon local flood storage and flood flow pathways. However, it is only anticipated to witness residual flooding during modelled tidal breach events. Therefore, this impact is deemed to be negligible.

15 Flood Risk Mitigation Measures

15.1 SuDS

Planning practice guidance (PPG) which is prepared by the Ministry of Housing, Communities and Local Government (DCLG) states that developers and Local Authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

As such, the developer has the option to implement a SuDS strategy in line with the drainage hierarchy as outlined in Table 6 below to reduce surface water discharges from the site.

Table 6: SuDS Options

- Store rainwater for later use;
- Use infiltration techniques, such as porous surfaces in non-clay areas;
- Attenuate rainwater in ponds or open water features for gradual release;
- Attenuate rainwater by storing in tanks or sealed water features for gradual release;
- Discharge directly to a water course;
- Discharge rainwater directly to a surface water sewer/drain;
- Discharge to a combined sewer.

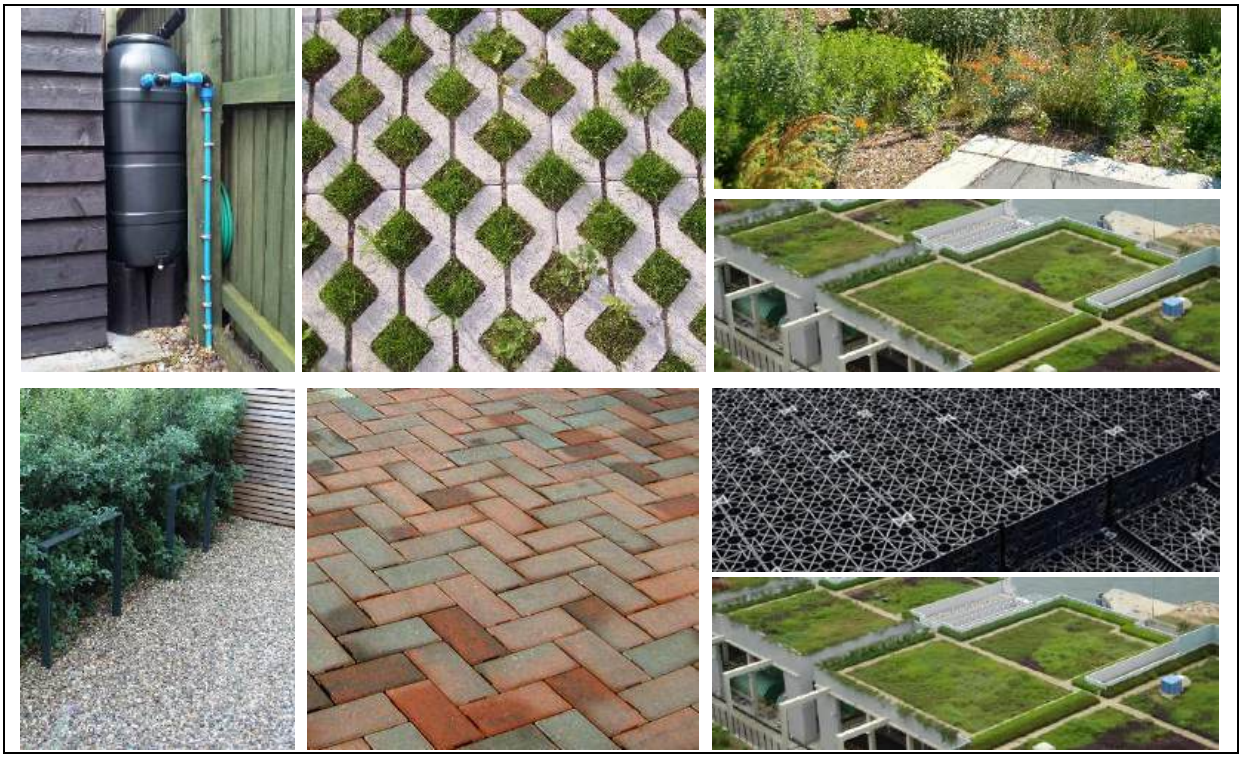


Figure 3: Surface water storage facilities and potential SuDS features - rainwater harvesting, on-site tank storage, rain garden soak-away and green roofs. (Source: UK SuDS Manual)

Given the nature of the development and the size of the site, it is considered that there are limited opportunities for implementing SuDS. Measures such as rainwater harvesting (butts) and rain gardens are recommended to mitigate the minor increase in impermeable area.

A full SuDS strategy is outside the scope of works of this FRA.

15.2 Flood Resilience

Flood resilient construction uses methods and materials that reduce the impact from a flood, ensuring that structural integrity is maintained, and the drying out and cleaning required, following inundation and before reoccupation, is minimised.

15.2.1 Finished Floor Levels

The approximate ground level of the existing building is 4.31mAOD.

Based on the existing development plans, the LiDAR ground levels and the steps (appox 250mm) into the ground floor; The approximate Finished Floor Level of the existing development is 4.45mAOD.

For **vulnerable developments**, the EA's Standing Advice states that the finished floor level of the lowest habitable room in any building, Finished Floor Levels (FFL) should be a minimum of 600mm above one of the following, whichever is higher;

- Approximate Ground Level 4.31mAOD; Or
- Estimate Flood Level for Tidal Breach 2100 plus CC event 6.19mAOD: Or
- The Adjacent Roadway 4.01mAOD;

During all pluvial flood events, the proposed development remains dry. The proposed development is only anticipated to witness residual flooding during modelled tidal breach events. Therefore, the FFL should be raised 600mm above the tidal breach 2100 plus CC estimated flood level (6.19mAOD). However, due to the nature of the proposed development being an extension, this is not feasible.

Therefore, it is recommended that the FFL should be set no lower than the existing FFL of 4.60mAOD.

It should be noted that all habitable bedrooms are located upon the upper floors, above the tidal breach 2100 plus CC flood level (6.19mAOD), at a level of approximately 7.51mAOD.

15.2.2 Compensatory Flood Storage (CFS)

All new development within Flood Zone 3 must not result in a net loss of flood storage capacity. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage.

Where proposed development results in a change in building footprint, the developer must ensure that it does not impact upon the ability of the floodplain to store water, and should seek opportunities to provide a betterment with respect to floodplain storage.

The site is only indicated to be impacted by residual flooding from the modelled breach tidal flood events. Therefore, CFS is not possible.

15.2.3 Flood Resilience Construction Measures

In terms of achieving resilience, there are two main strategies, whose applicability is dependent on the water depth the property is subjected to. These are:

- Water Exclusion (Flood Resistance) Strategy - should be employed where predicted flood depths are less than 0.3m and are likely to be for short duration. Emphasis is placed on minimising water entry and giving occupants time to relocate ground floor contents, maintaining structural integrity, and on using materials and construction techniques to facilitate drying and cleaning;
- Water Entry (Flood Resilience) Strategy - Flood resilience measures are designed to allow water in but to limit damage and allow rapid re-occupancy. Resilience measures should be employed where flood depths are greater than 0.6m and where it is likely that structural damage will occur due to excessive water pressure.

Given that flood depths greater than 0.6m are predicted in extreme scenarios, the water entry strategy is considered most applicable for this site. However, as this is only under breach scenarios some elements of water exclusion may also be feasible, assuming water entry points are formed above the protection level provided as to ensure no damage to the structural integrity of the building occurs.

Water Entry Strategy:

There are a range of options for implementing the Water Entry Strategy including:

- Use materials with either good drying and cleaning properties, or, sacrificial materials that can easily be replaced;
- Designing for water to drain away;
- Designing access to all spaces to permit drying and cleaning;
- Ground supported floors with concrete slabs coated with impermeable membrane;
- Plastic water resistant internal doors.

Flood resilience design and measures that may be implemented are outlined below. Water-resistant and resilient materials that should be utilized throughout the construction to minimize the flood risk and potential impacts.

Floor construction:

- Use of resilient flooring materials as ceramic tiles or stone floor finishes;
- Use of a concrete slab 150mm thick;
- Use of ceramic tiles or stone floor finishes is recommended;
- Maintain existing under floor ventilation by UPVC telescopic vents above 400 mm to external face of extension;
- Damp proof membrane of impermeable polythene at least 1200 gauge;
- Avoid the use of MDF carpentry.

Wall construction:

- Include in the external face of the extension a damp – proof course, 250 mm above ground level, to prevent damp rising through the wall;
- Use rigid closed – cell material for insulation above the DPC;
- Spread hardcore over the site within the external walls of the building to such thickness as required to raise the finished surface of the site concrete. The hardcore should be spread until it is roughly level and rammed until it forms a

- compact bed for the oversite concrete. This hardcore bed will be 100 mm thick and composed by well compacted inert material, blinded with fine inert material.

Doors:

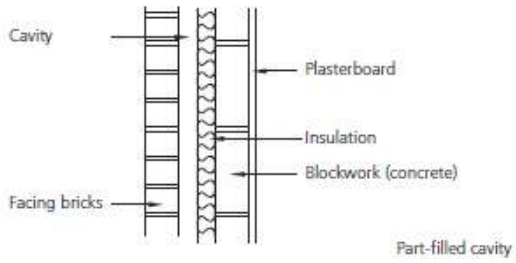
- Seal doors around edges and openings. UPVC or composite material will be used with passive protection meaning that minimal intervention will be required in the event of flooding.

Underground drainage:

- Avoid use of metal for any underground piping;
- Use closed cell insulation for pipes that are below the predicted flood level;
- Provide non – return valves for the drainage system to prevent back water flow;
- Use UPVC or clay pipework for fouls and surface water drainage.

Figure 4: Cavity External Walls

Figure 6.10 Cavity External Walls – Part-filled cavity with sacrificial plasterboard



Part-filled cavity

- External face consisting of engineering bricks up to required level for flood protection (up to d.p.c.). Other external facing materials can be used above this level, but ensure transition is watertight.
- Rigid insulation
- Internal cement based render, preferably with lime content. Composition depends on masonry; the following mix is effective:

  1 cement : 6 sand: 1 lime on concrete blocks.
- Stainless steel wall ties should be used to minimise corrosion and consequent staining.
- Sacrificial plasterboard can be used, but it needs to be removed between ground floor to flood level. The board should be laid horizontally to make removal easier.

As well as the above the following flood resilience features should be applied as part of the development:

- Electrical sockets should be installed above flood level for the ground floor;

- Utility services such as fuse boxes, meters, main cables, gas pipes, phone lines and sockets will be positioned as high as practicable;
- All external openings for pipes or vents below 400mm to be sealed around pipe or vent with expanding foam and mastic.

15.3 Emergency Plan

15.3.1 Assessment of Danger to People

The dangers associated with flood water to people are possible injury and/or death. This can occur as a result of drowning or being carried along by the waters into hard objects or vice versa. The risk to life is largely a function of the depth and velocity of the floodwater as it crosses the floodplain. Fast flowing deep water that contains debris would represent the greatest hazard.

The assessment of danger to people from walking in floodwater is described in the Flood Risks to People guidance documents (FD2321_TR1 and FD2321_TR2) by DEFRA/EA.

Danger can be estimated by the simple formula:

$$HR = d \times (v + 0.5) + DF$$

where, HR = (flood) hazard rating; d = depth of flooding (m); v = velocity of floodwaters (m/sec); and DF = debris factor.

The scoring methodology and calculation matrix for this is summarised in Appendix 13.

The LLFA's Level 1 SFRA indicates that the site remains dry up the 1 in 1000-year scenario given the presence of the Thames Tidal Barrier, and is only impacted by residual tidal breach flooding. Therefore, the Hazard is considered to be low while the defences are operating.

When considering the EA Product 6 Tidal Breach Event (2100), the maximum Hazard Rating is indicated to be 2.53, which is an Extreme hazard, which would provide Danger for All.

The use of a flood emergency plan is therefore sufficient for the proposed development. The key elements of the emergency plan are described below.

15.3.2 EA Flood Warnings Direct Service Subscription

The occupants will subscribe to the EA Flood Warnings Direct Service which is a free service offered by the EA providing flood warnings direct to people by telephone, mobile, email, SMS text message and fax. The EA aims to provide 2 hours' notice of flood, day or night, allowing timely evacuation of the site.

The agency operates a 24-hour telephone service on 0345 988 1188 that provides frequently updated flood warnings and associated floodplain information. In addition, this information can also be found at https://fwd.environment-agency.gov.uk/app/olr/home along with recommendations on what steps should be taken to prepare for floods, what to do when warnings are issued, and how best to cope with the aftermath of floods.

15.3.3 Access and Safe Egress

Safe egress to Flood Zone 1 will pass through an area of Extreme Hazard when considering the modelled residual tidal breach 2100 flooding. The safest route is available by an approximate 15-minute walk southwest to Sandycombe Road. This is accessible via Maze Road, Haverfield Gardens, Forest Road and Leyborne Park and Kew Gardens Road/B353. Directions of this route are presented in Appendix 12 .

15.3.4 Safe Refuge

The proposed development has internal connections to upper floors in the property which will act to provide sufficient safe refuge in the event of an extreme flood event.

16 Conclusions and Recommendations

This assessment has considered the potential risks to the application site associated with flooding from fluvial, tidal, surface water, artificial and groundwater sources and the potential impacts of climate change.

A review of LLFA's PFRA and SFRA as well as data provided by the EA was undertaken. The main findings of the review and assessment are provided below:

- The site is classified as a minor development and is therefore unlikely to require a Sequential or Exception Test to be undertaken;
- The main source of potential flooding to the site is the River Thames located approximately 60m northeast of the site;
- The EA define the site as being within Flood Zone 3a;
- The finished floor level is recommended to be set no lower the existing FFL at a minimum of 4.60mAOD;
- All bedrooms will remain above the tidal breach 2100 plus CC flood level (6.19mAOD) at a level of approximately 7.51mAOD;
- CFS was not required because the development is only impacted by modelled tidal breach flooding events;
- EA mapping indicates that the site benefits from a wall along the bank of the River Thames. The site also benefits from the Thames Barrier in East London;
- The site is not within a CDA. It is in the TW9 3 post code area that has had between 1 to 5 sewage flooding incidents according to the PFRA with 1 incident recorded on the SFRA Interactive Map;
- The development will result in increases of 16m^2 in the built-up area and 8m^2 in the impermeable area of the site. However, the impact on local flood risk is deemed to be negligible due to the minor nature of the development and that the site is only anticipated to witness residual flooding in modelled tidal breach events;
- There is limited opportunity for implementing SuDS mitigation measures. Rainwater harvesting (butts) and rain gardens are recommended.

- Flood resilient materials and construction methods will be used so as to ensure that the impacts of any potential flooding are minimised as much as possible;
- Occupants will subscribe to the EA Flood Warnings Direct Service;
- Safe egress to Flood Zone 1 is accessible via an approximate 15 minute walk southwest to Sandycombe Road;
- In the event that evacuation is not possible, safe refuge is available in the upper floors of the building which are accessible via an internal staircase.

The proposed development is considered to be in general compliance with local planning policy and the NPPF.

17 References

1. Communities and Local Government - National Planning Policy Framework NPPF, July 2021.
2. Communities and Local Government - Planning Practice Guidance: Flood Risk and Coastal Change, Updated 06 March 2014.
3. London Borough of Richmond Upon Thames, Local Plan, July 2018.
4. London Borough of Richmond Upon Thames, Preliminary Flood Risk Assessment, May 2011.
5. London Borough of Richmond Upon Thames, Surface Water Management Plan, 2011.
6. London Borough of Richmond Upon Thames, Strategic Flood Risk Assessment – Level 1, March 2021.
7. London Borough of Richmond Upon Thames, Strategic Flood Risk Assessment Interactive Map, available at: https://mapping.richmond.gov.uk/map/Aurora.svc/run?script=%5CAurora%5Cpublic_SFRA_Groundwater_Etc_LBRUT.AuroraScript%24&resize=always [Accessed: 3 July 2024]
8. CIRIA, Defra, Environment Agency – UK SuDS Manual, 2015.
9. London Plan (2021) - Mayor of London

18 Appendices

18.1 Appendix 1 – Site Photographs

18.2 Appendix 2 – Development Plans

See next page.

Existing Front Elevation 1:50

Existing Rear Elevation 1:50

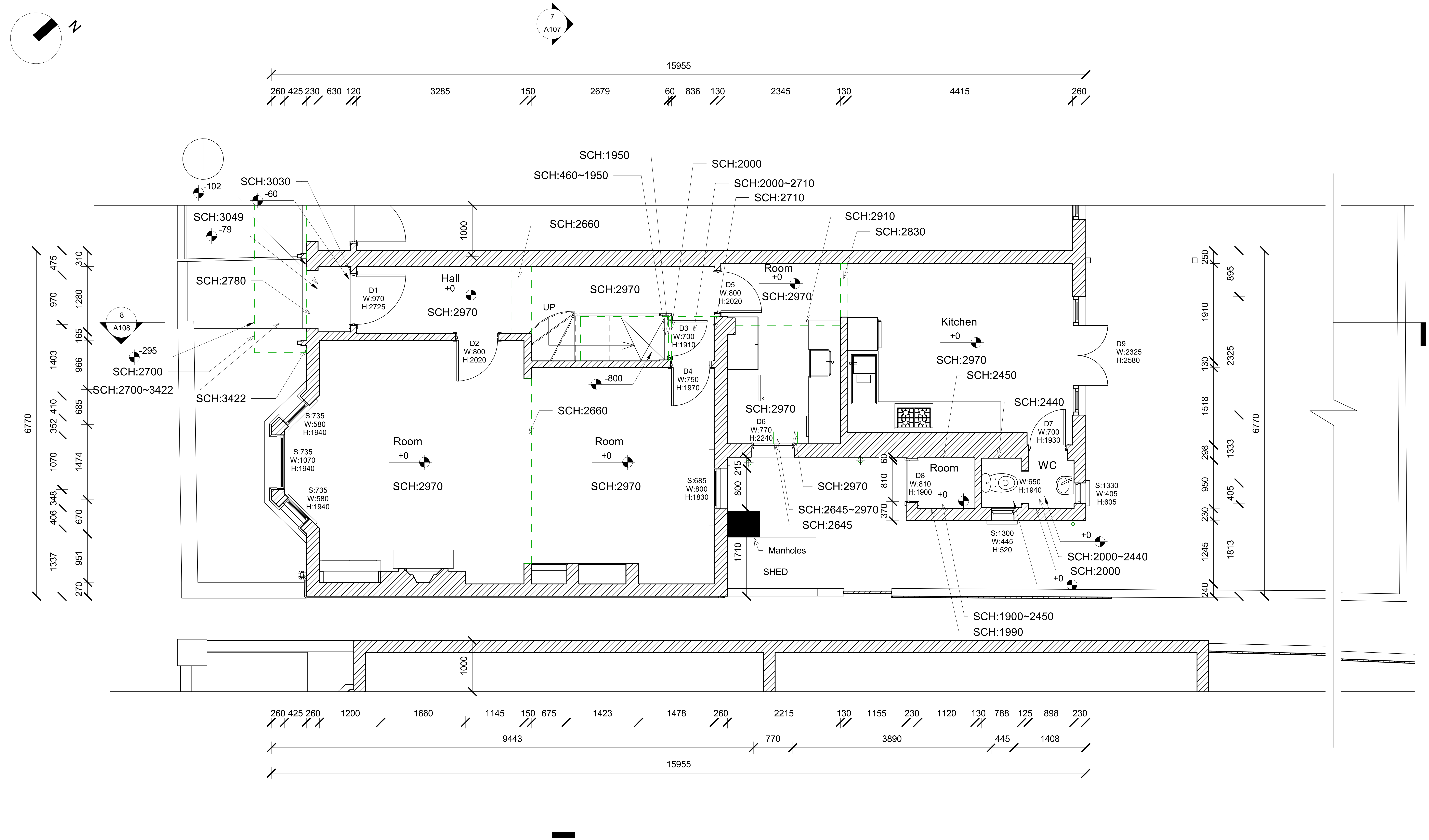
Existing Side Elevation 1:50

TBD

Client
Mrs + Mr Jobanputra
Project Title
59 Bushwood Road
Drawing Title
Existing Elevations

0m 0.5 1 1.5 2 2.5 1:50 N

Date
23/05/2024
Scale
1:50
2324BWR10B Blank - Existing Elevations.dwg



1 GROUND FLOOR PLAN

1 : 50

0m 2m 4m 6m 8m 10m

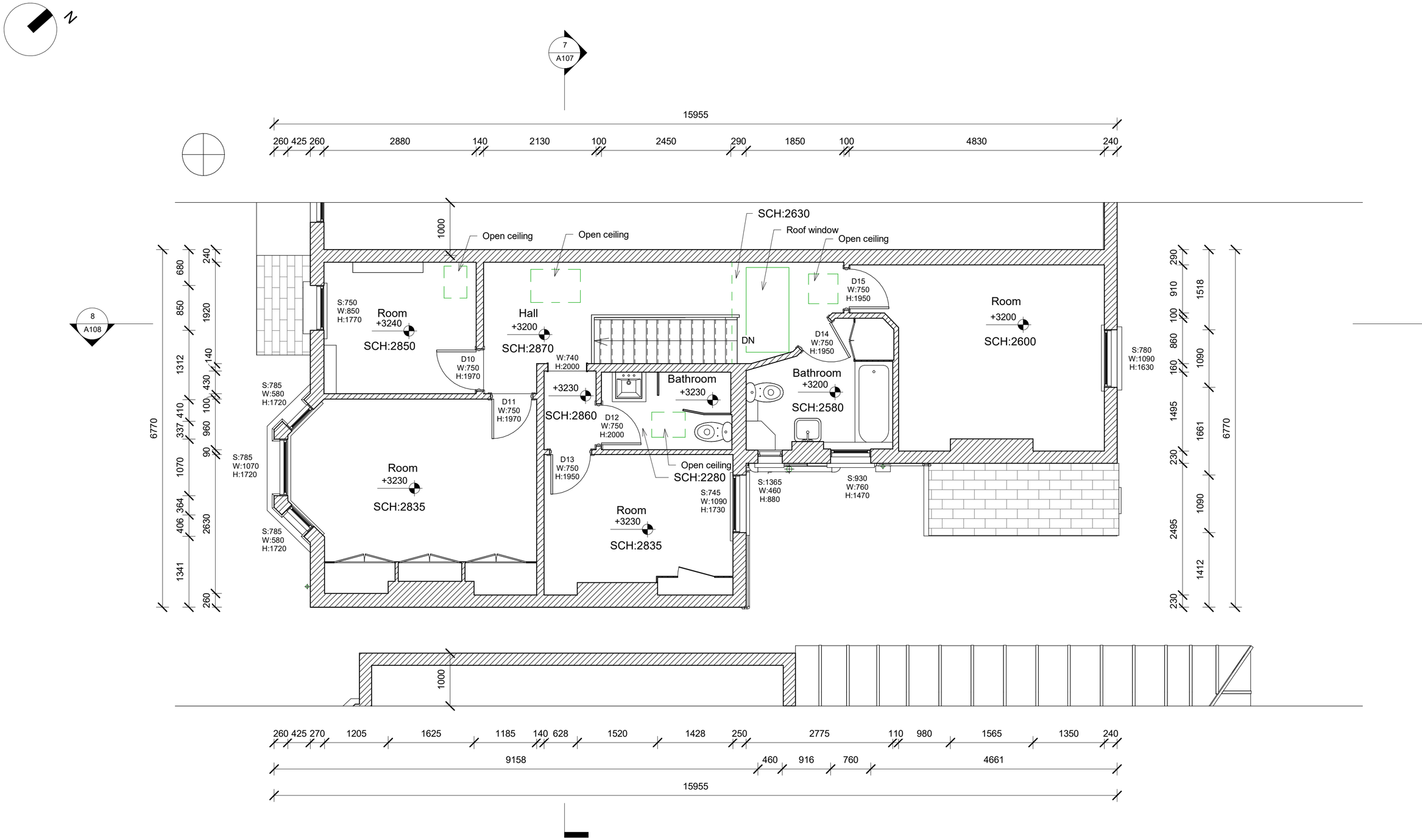
SPACE SURVEY

www.spacephoto.co.uk

GENERAL NOTES:
This drawing is prepared co-ordination purposes. It is not intended for manufacturing purposes (ie windows, kitchens wardrobes etc) It is always advisable the supplier/installer to visit site and carry out their own survey suitable for the intended purposes.

PROJECT 59 Bushwood Road, Richmond	CLIENT			
	Date Issue Date	Project number	Scale (@ A2)	
SHEET GROUND PLAN	Drawn by Author	DRAWING NUMBER		REV
	Checked by Checker	A101		

	Hatch
	Roof Window
	Ceiling line/Beam
	Wall Hatch Pattern
W:	Width of Opening
H:	Height of Opening
S:	Sill Height for Window
SCH:	Room Height in mts
D#.	Door Number



2 FIRST FLOOR PLAN

1 : 50

0m 2m 4m 6m 8m 10m

SPACE SURVEY

www.spacephoto.co.uk

GENERAL NOTES:
This drawing is prepared co-ordination purposes. It is not intended for manufacturing purposes (ie windows, kitchens wardrobes etc) It is always advisable the supplier/installer to visit site and carry out their own survey suitable for the intended purposes.

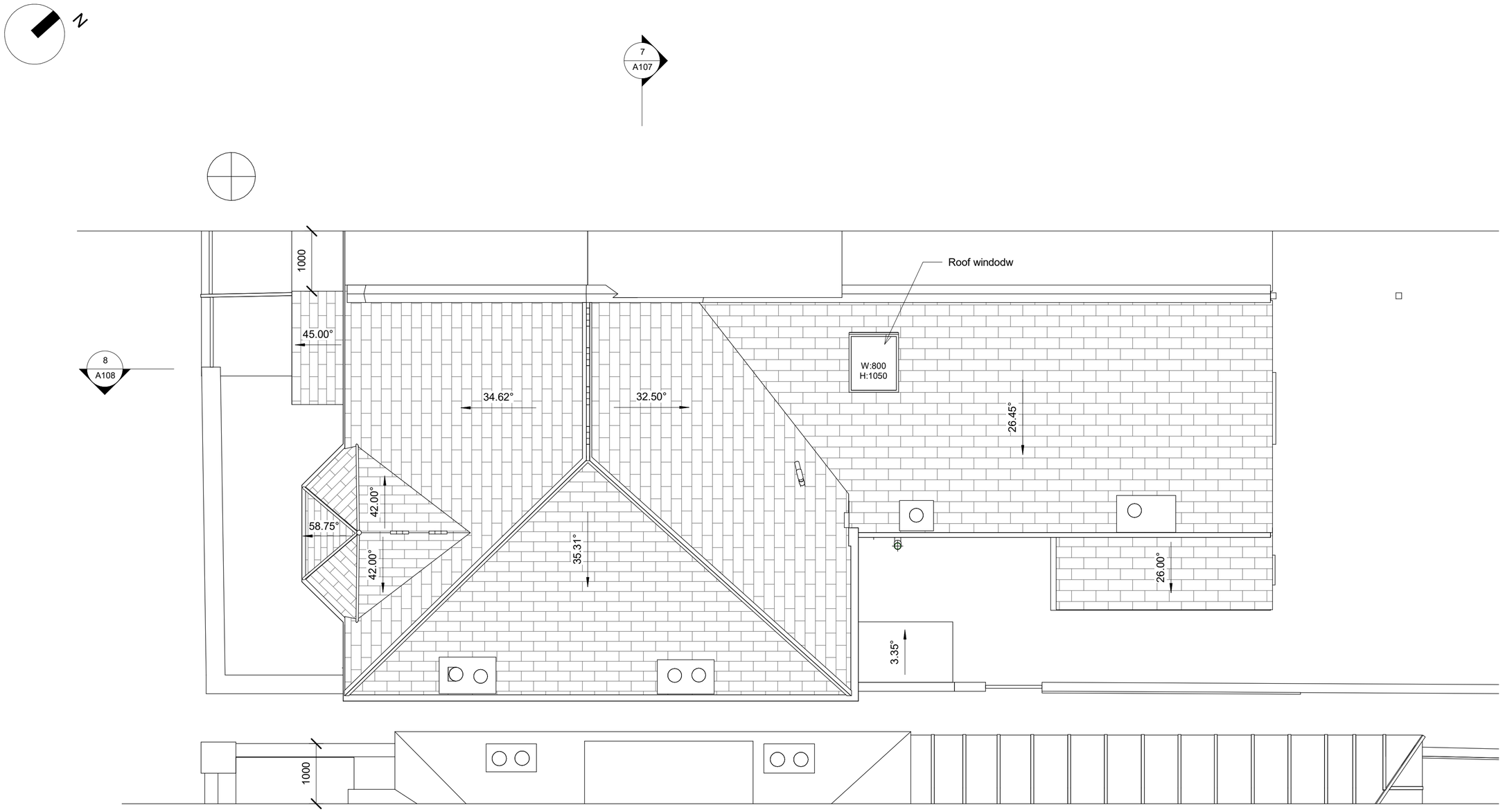
PROJECT
59 Bushwood Road, Richmond

SHEET
FIRST PLAN

CLIENT

Date	Project number	Scale (@ A2)
Issue Date		
Drawn by: Author	DRAWING NUMBER: A102	REV
Checked by: Checker		

— · —	Hatch
———	Roof Window
— — —	Ceiling line/Beam
▨	Wall Hatch Pattern
W:	Width of Opening
H:	Height of Opening
S:	Sill Height for Window
SCH:	Room Height in mts
D#.	Door Number



3 ROOF PLAN

1 : 50

0m 2m 4m 6m 8m 10m

SPACE SURVEY

www.spacephoto.co.uk

GENERAL NOTES:
This drawing is prepared co-ordination purposes. It is not intended for manufacturing purposes (ie windows, kitchens wardrobes etc) It is always advisable the supplier/installer to visit site and carry out their own survey suitable for the intended purposes.

PROJECT
59 Bushwood Road, Richmond

SHEET
ROOF PLAN

CLIENT

Date	Project number	Scale (@ A2)
Issue Date		

Drawn by	DRAWING NUMBER	REV
Author	A103	

Checked by
Checker

	Hatch
	Roof Window
	Ceiling line/Beam
	Wall Hatch Pattern
W:	Width of Opening
H:	Height of Opening
S:	Sill Height for Window
SCH:	Room Height in mts
D#.	Door Number

4 FRONTT ELEVATION

1 : 50

0m 2m 4m 6m 8m 10m

SPACE SURVEY

www.spacephoto.co.uk

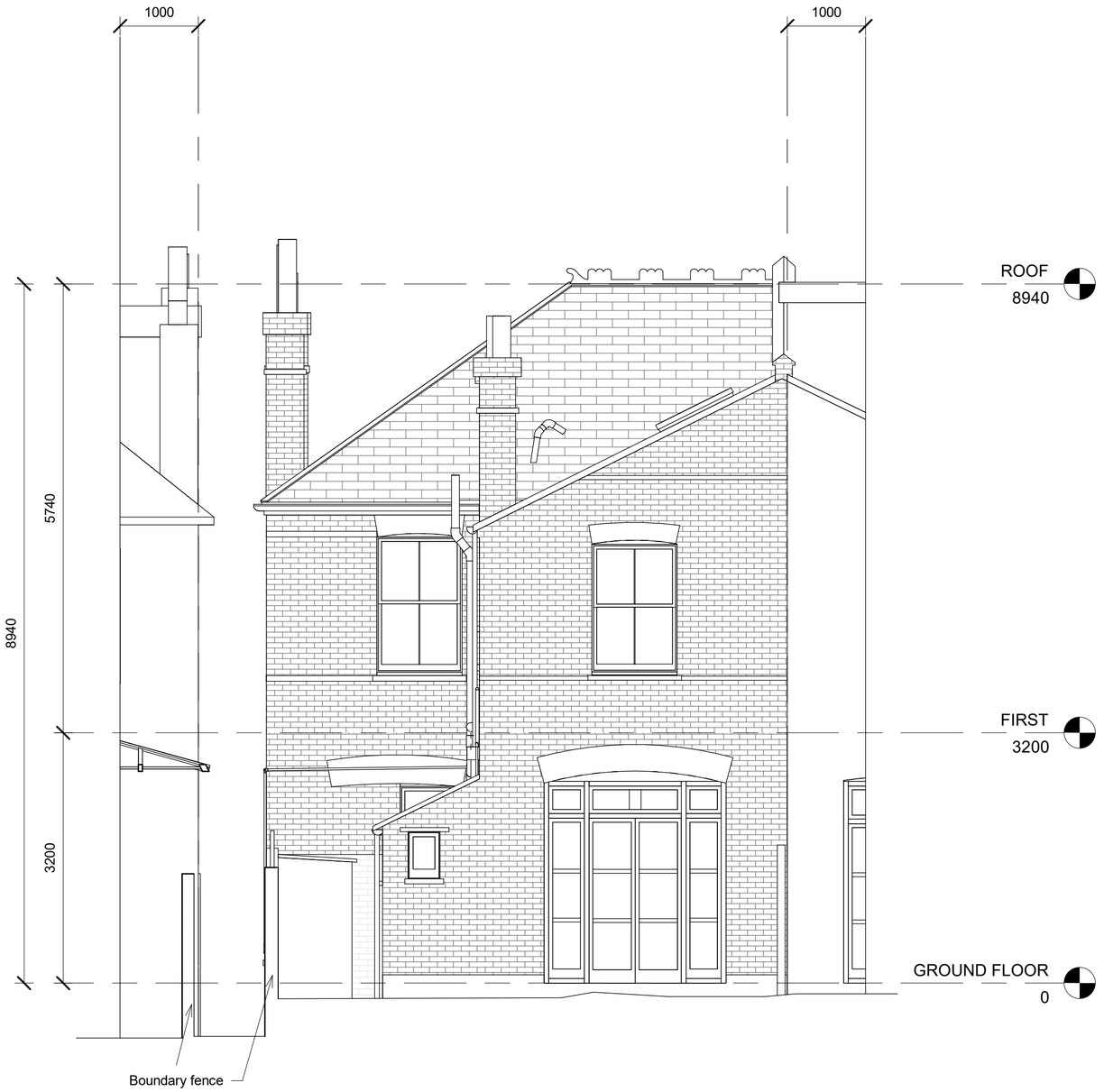
GENERAL NOTES:
This drawing is prepared co-ordination purposes. It is not intended for manufacturing purposes (ie windows, kitchens wardrobes etc) It is always advisable the supplier/installer to visit site and carry out their own survey suitable for the intended purposes.

PROJECT
59 Bushwood Road, Richmond

SHEET
FRONT ELEVATION

CLIENT

Date	Project number	Scale (@ A2)
Issue Date		
Drawn by: Author	DRAWING NUMBER: A104	REV
Checked by: Checker		



5 REAR ELEVATION

1 : 50

0m 2m 4m 6m 8m 10m

SPACE SURVEY

www.spacephoto.co.uk

GENERAL NOTES:
This drawing is prepared co-ordination purposes. It is not intended for manufacturing purposes (ie windows, kitchens wardrobes etc) It is always advisable the supplier/installer to visit site and carry out their own survey suitable for the intended purposes.

PROJECT
59 Bushwood Road, Richmond

SHEET
REAR ELEVATION

CLIENT

Date	Project number	Scale (@ A2)
Issue Date		

Drawn by	DRAWING NUMBER	REV
Author	A105	

Checked by
Checker

6 SIDE ELEVATION

1 : 50

0m 2m 4m 6m 8m 10m

SPACE SURVEY
www.spacephoto.co.uk

GENERAL NOTES:
This drawing is prepared co-ordination purposes. It is not intended for manufacturing purposes (ie windows, kitchens wardrobes etc) It is always advisable the supplier/installer to visit site and carry out their own survey suitable for the intended purposes.

PROJECT
59 Bushwood Road, Richmond

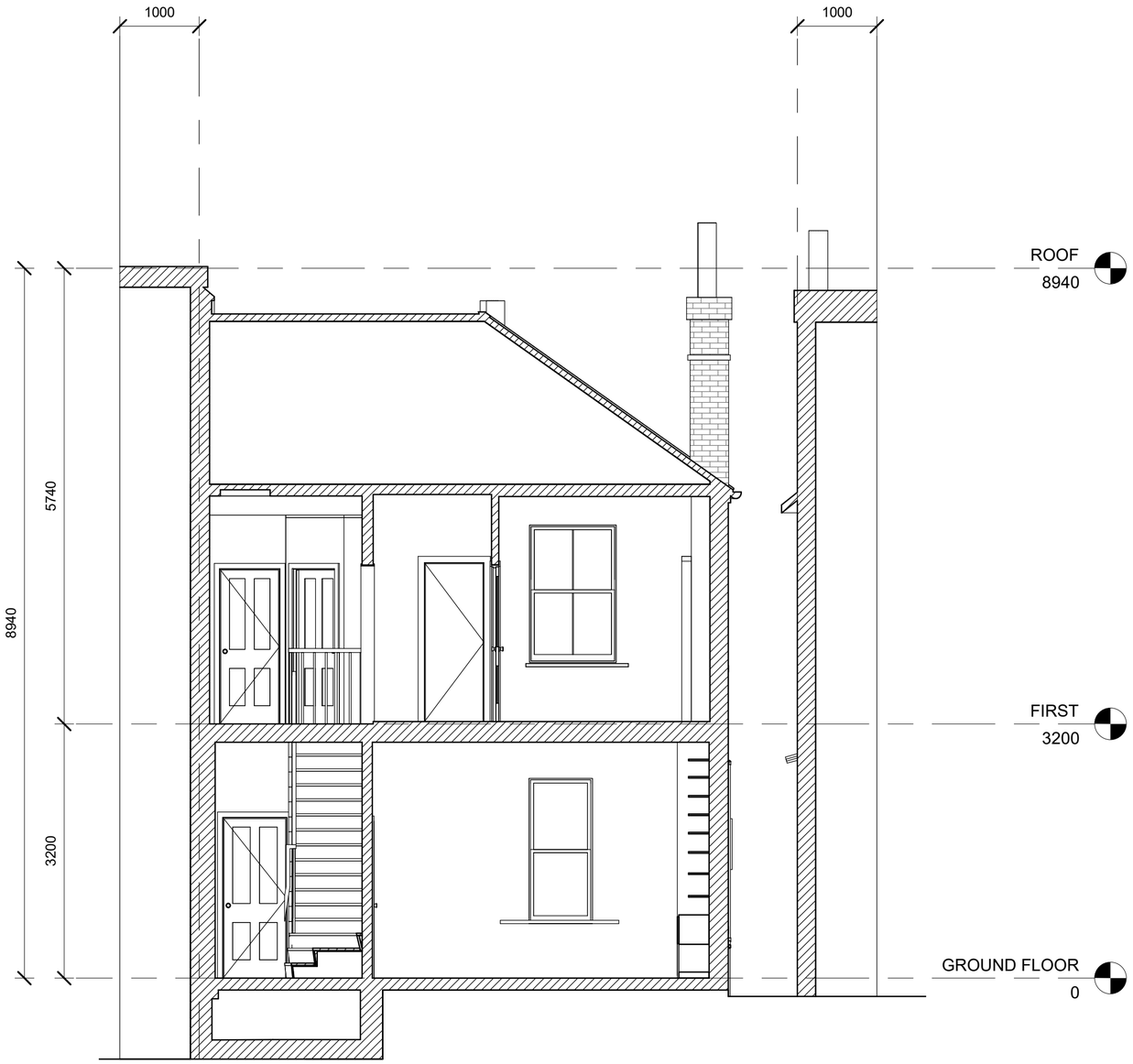
SHEET
RIGHT ELEVATION

CLIENT

Date	Project number	Scale (@ A2)
Issue Date		

Drawn by	DRAWING NUMBER	REV
Author	A106	

Checked by
Checker



7 CROSS SECTION

1 : 50

0m 2m 4m 6m 8m 10m

SPACE SURVEY

www.spacephoto.co.uk

GENERAL NOTES:
This drawing is prepared co-ordination purposes. It is not intended for manufacturing purposes (ie windows, kitchens wardrobes etc) It is always advisable the supplier/installer to visit site and carry out their own survey suitable for the intended purposes.

PROJECT
59 Bushwood Road, Richmond

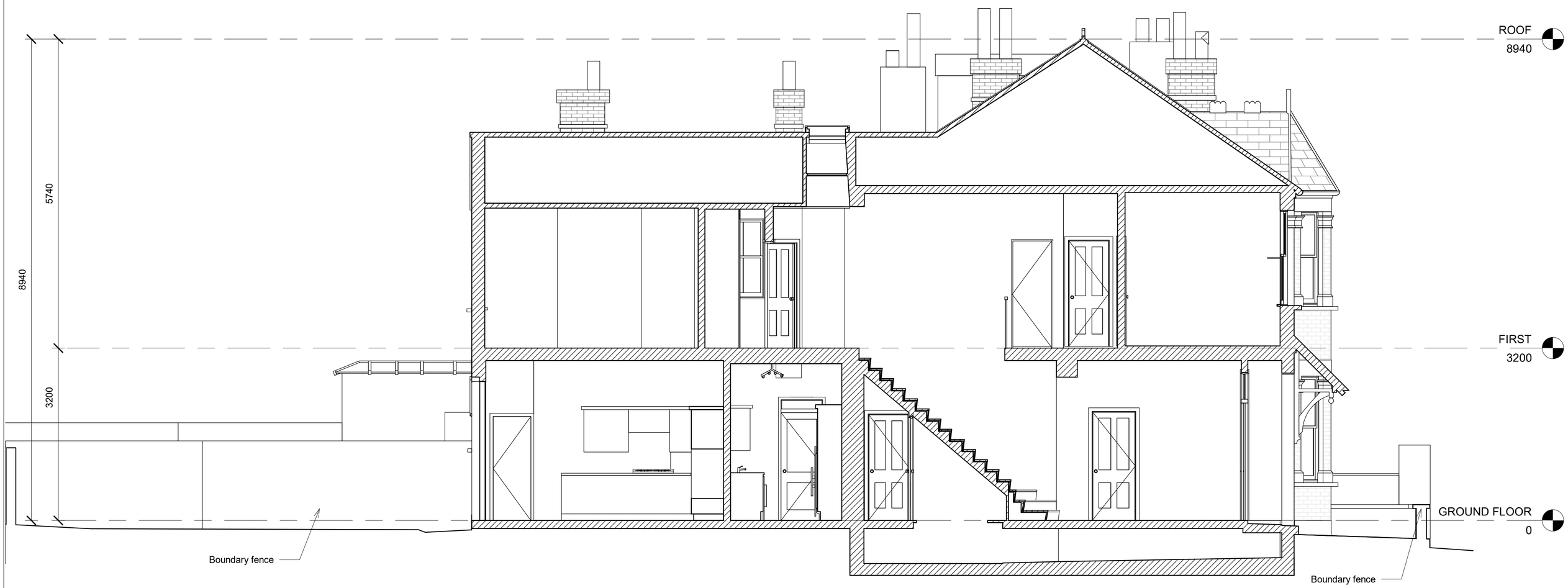
SHEET
CROSS SECTION

CLIENT

Date	Project number	Scale (@ A2)
Issue Date		

Drawn by	DRAWING NUMBER	REV
Author	A107	

Checked by
Checker



8 LONG SECTION

1 : 50

0m 2m 4m 6m 8m 10m

SPACE SURVEY
www.spacephoto.co.uk

GENERAL NOTES:
This drawing is prepared co-ordination purposes. It is not intended for manufacturing purposes (ie windows, kitchens wardrobes etc) It is always advisable the supplier/installer to visit site and carry out their own survey suitable for the intended purposes.

PROJECT
59 Bushwood Road, Richmond

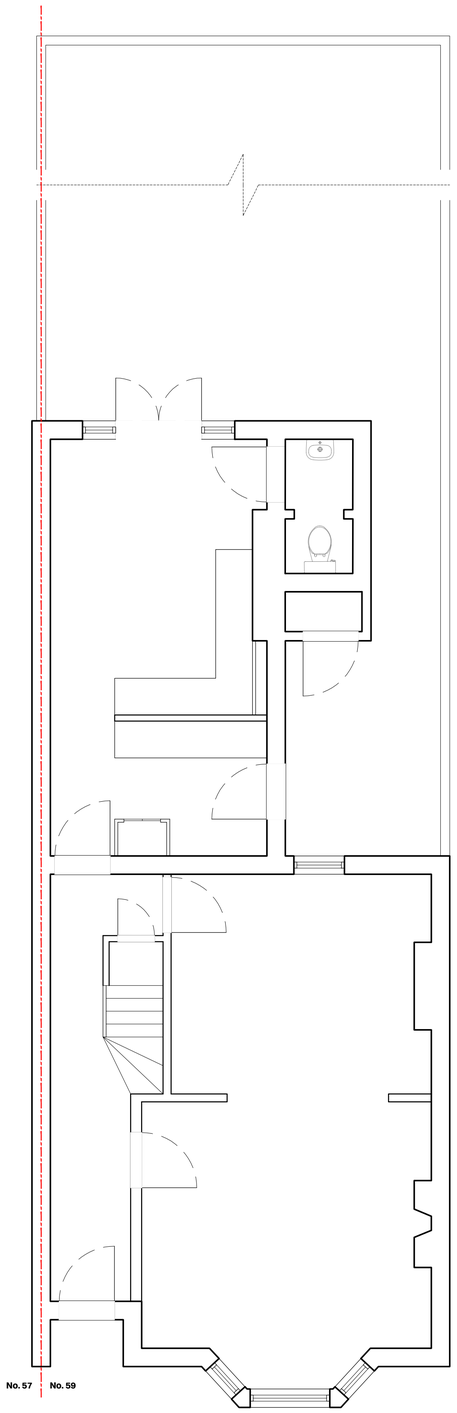
SHEET
LONG SECTION

CLIENT

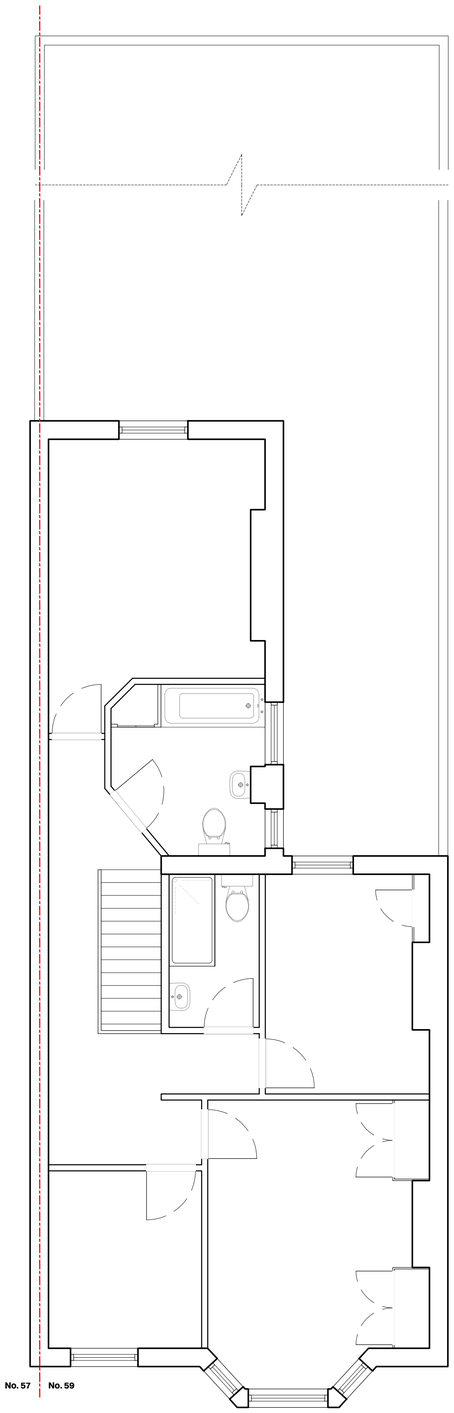
Date	Project number	Scale (@ A2)
Issue Date		

Drawn by	DRAWING NUMBER	REV
Author	A108	

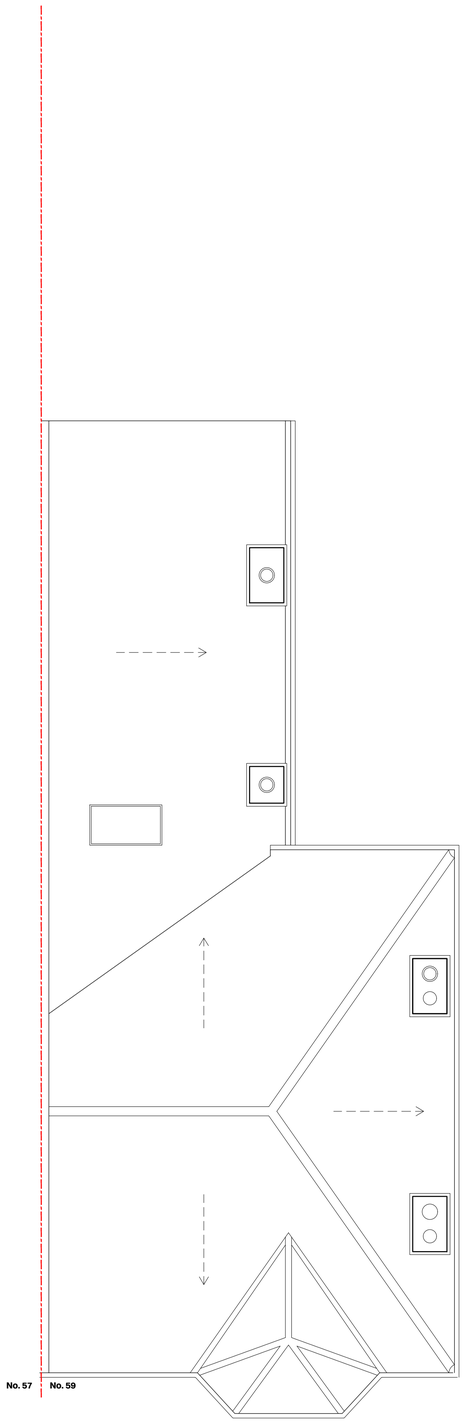
Checked by
Checker



Ground Floor 1:50



First Floor 1:50



Roof Plan 1:50

TBD

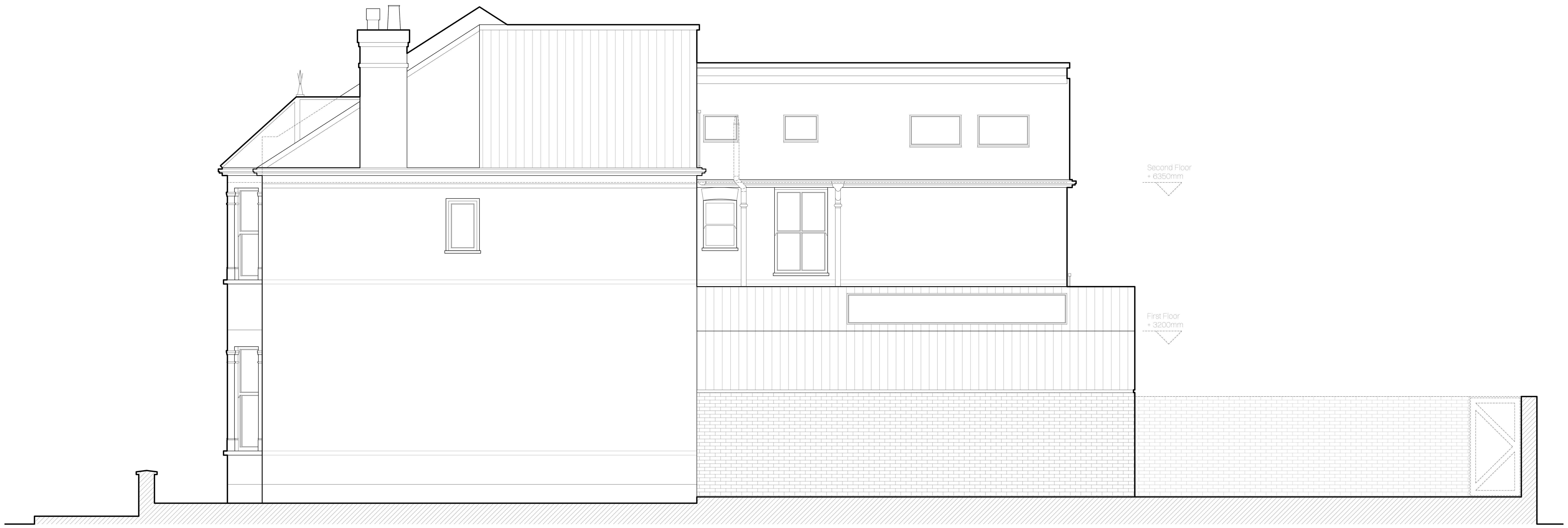
Client
Mrs + Mr Jobanputra
Project title
59 Bushwood Road
Drawing title
Existing Floor Plans

0m 0.5 1 1.5 2 2.5 1:50 N

Date
23/05/2024
Scale @ A1
1:50

Proposed Front Elevation 1:50

Proposed Rear Elevation 1:50



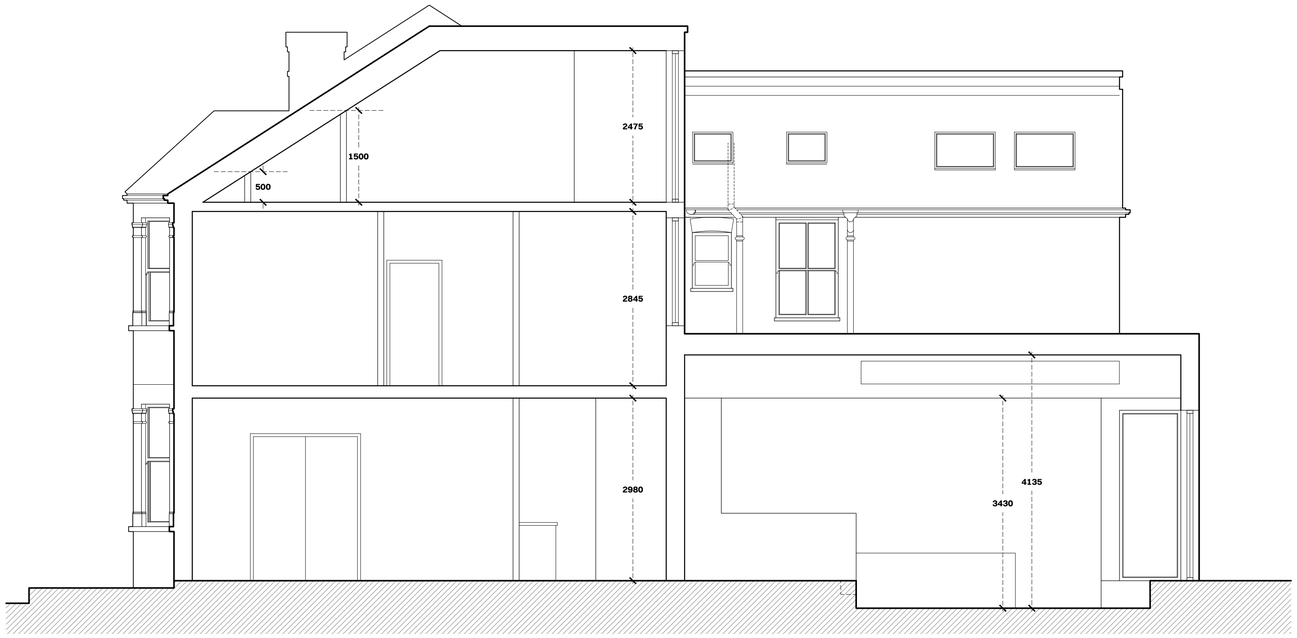
Proposed Side Elevation 1:50

TBD

Client
Mrs + Mr Jobanputra
Project Title
59 Bushwood Road
Drawing Title
Proposed Elevations

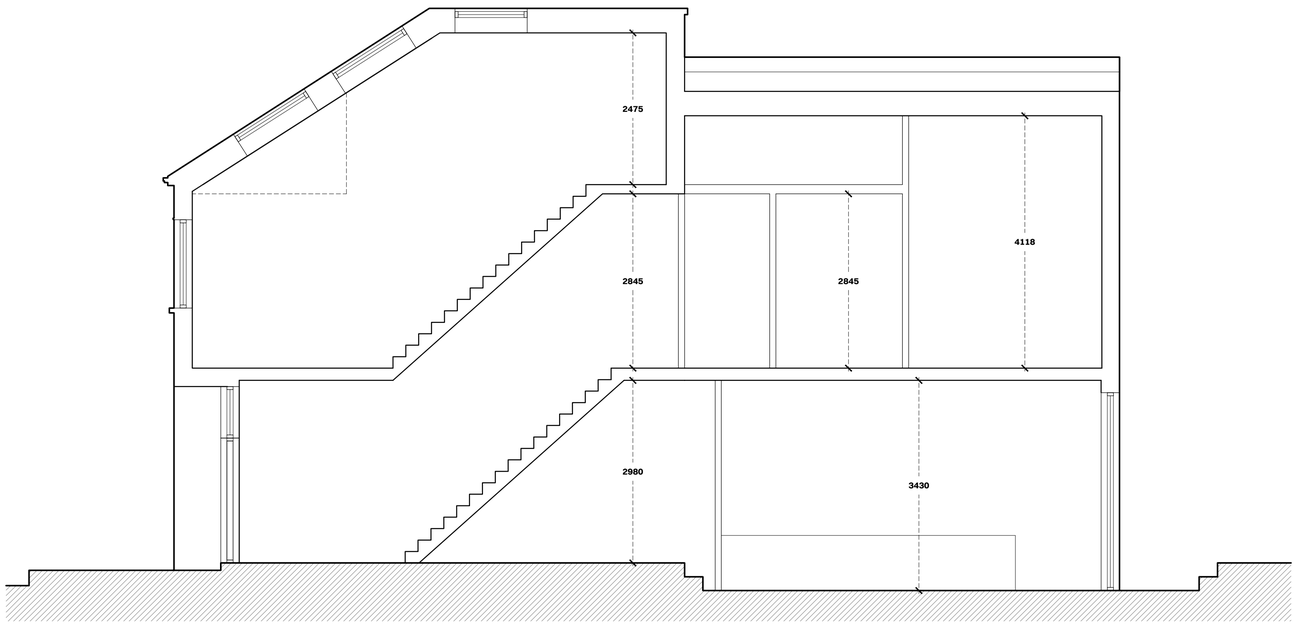
0m 0.5 1 1.5 2 2.5 1:50
N

Date
23/05/2024
Scale @ A1
1:50
D:\59BWR\59 BWR - Proposed Elevations.dwg



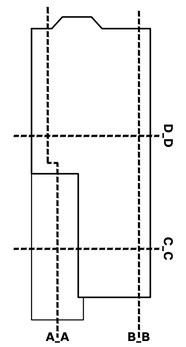
Proposed Section A_A 1:50

Proposed Section C_C 1:50



Proposed Section B_B 1:50

Proposed Section D_D 1:50



Key Plan

0m 0.5 1 1.5 2 2.5 1:50 N

TBD

Client
Mrs + Mr Jobanputra
Project No
59 Bushwood Road
Drawing No
Proposed Sections - Rev A

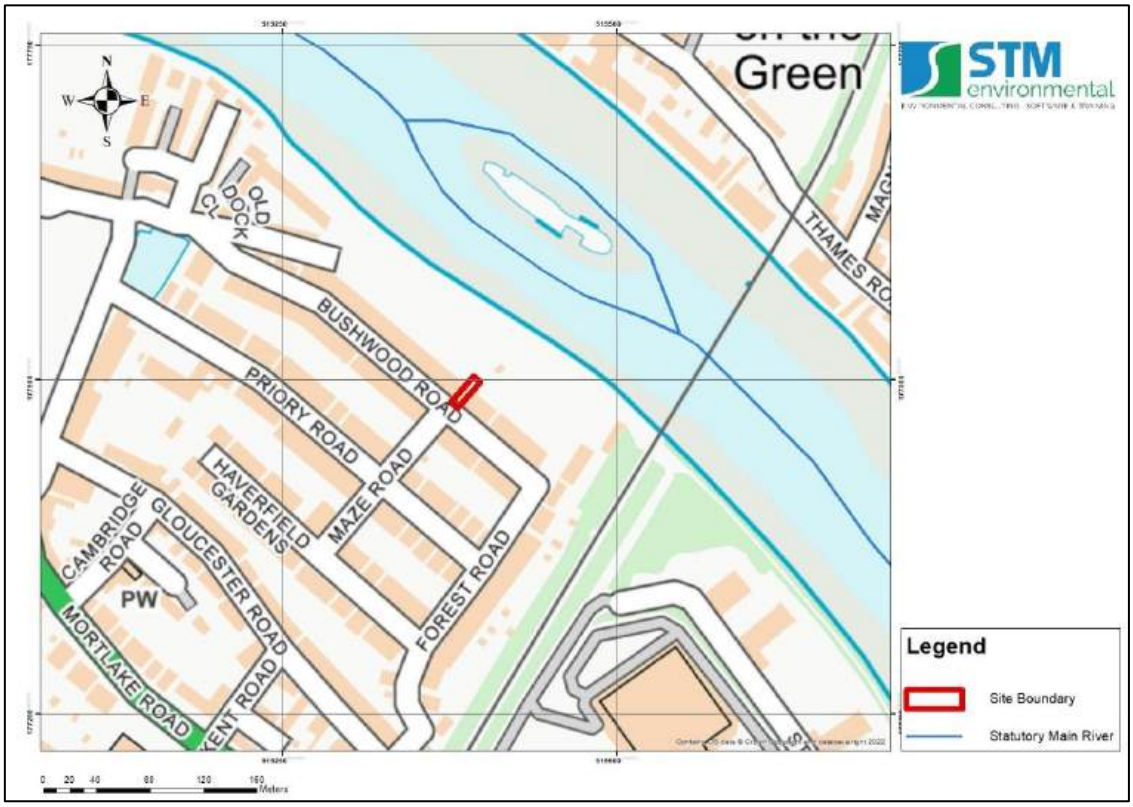
Date
30/05/2024
Scale
1:50

18.3 Appendix 3 – Environmental Characteristics

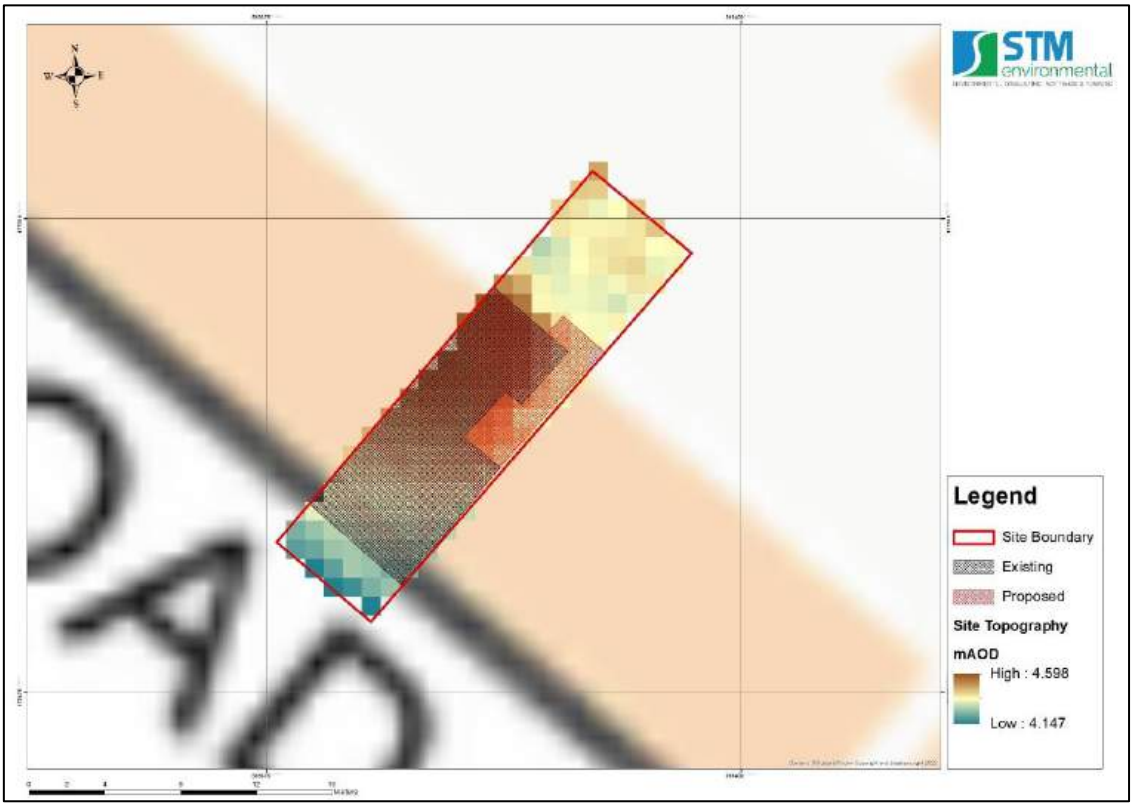
18.3.1 Superficial Hydrogeology Map

18.3.2 Bedrock Hydrogeology Map

18.3.3 Hydrology Map



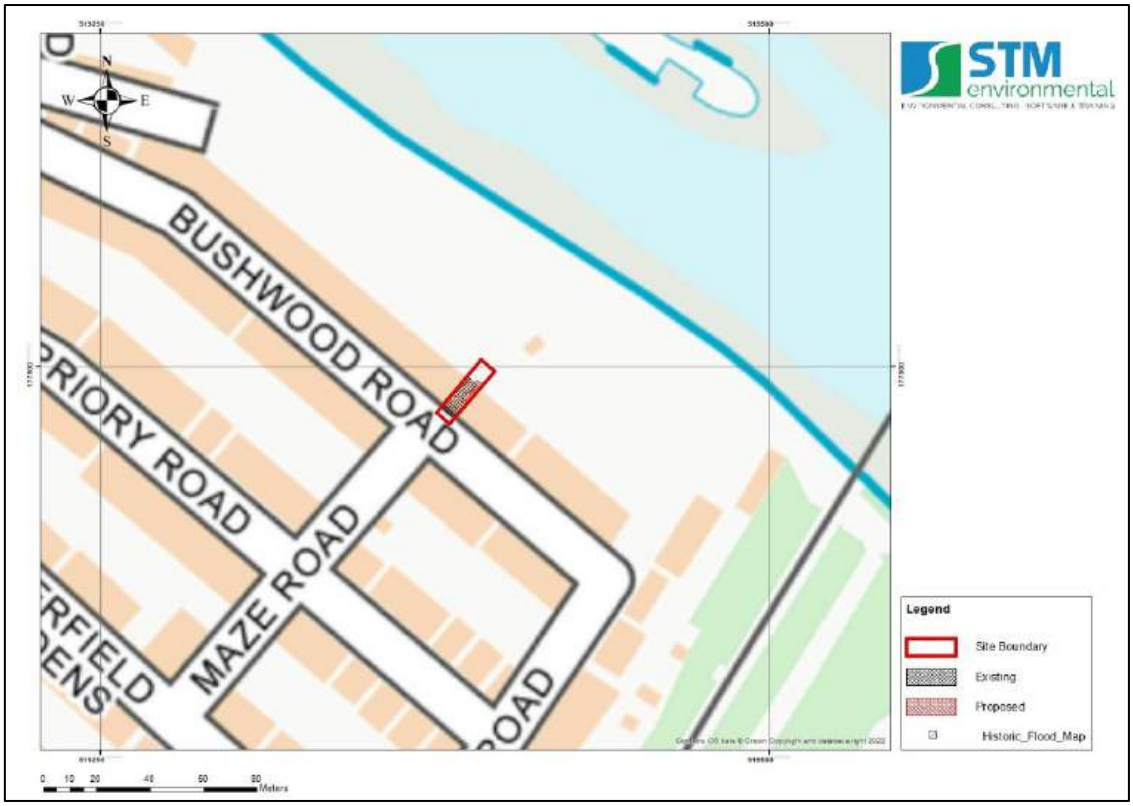
18.3.4 Topography Map



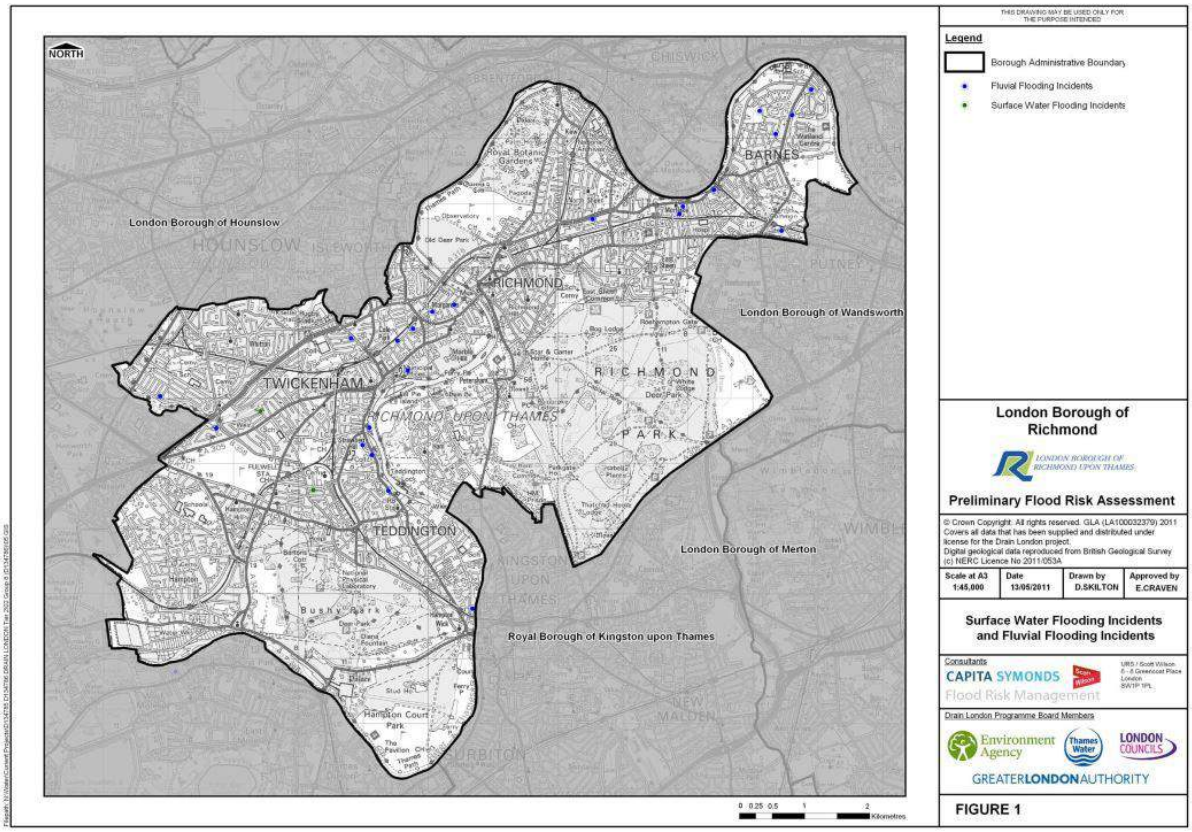

BUSHWOOD ROAD
ROAD
ZE ROAD
Legend
Site Boundary
Existing
Proposed
Topography
Value
High : 10.589
Low : 1.72

18.4 Appendix 4 – Historical Flood Incident Maps

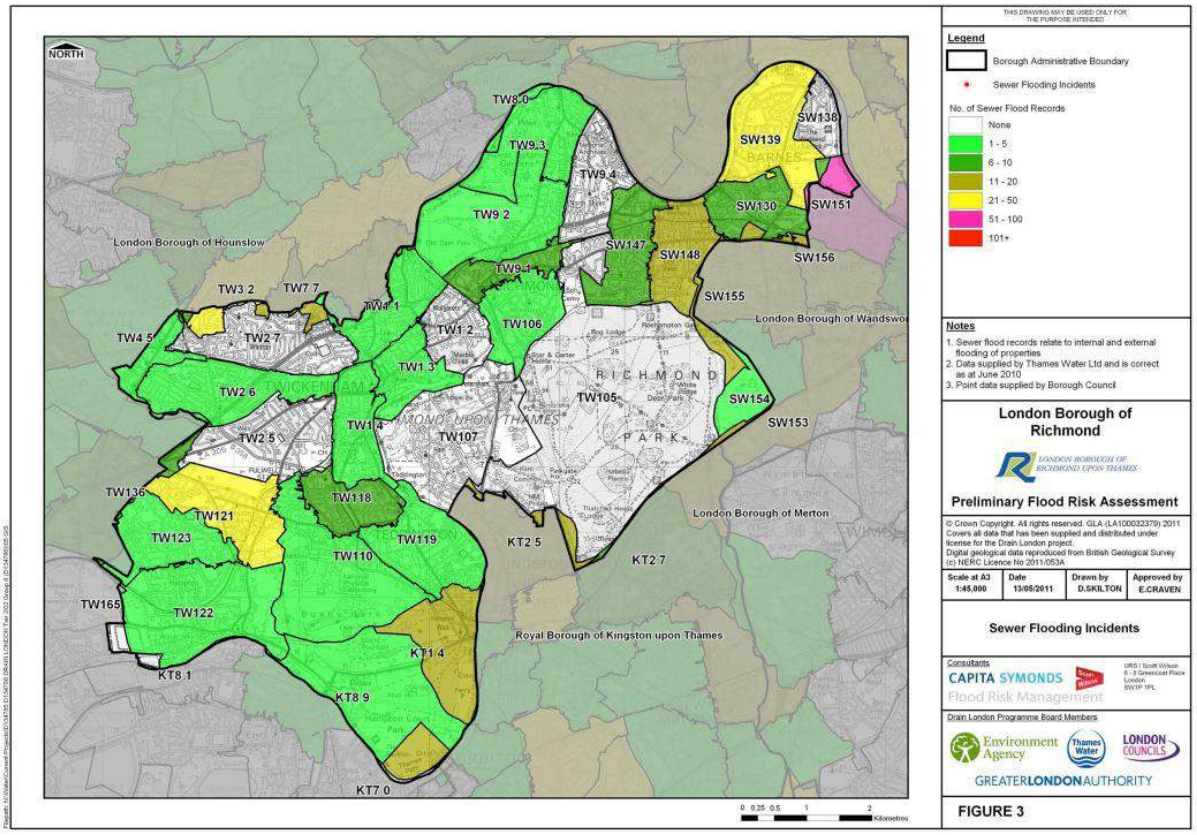
18.4.1 EA Historic and Recorded Flood Outlines



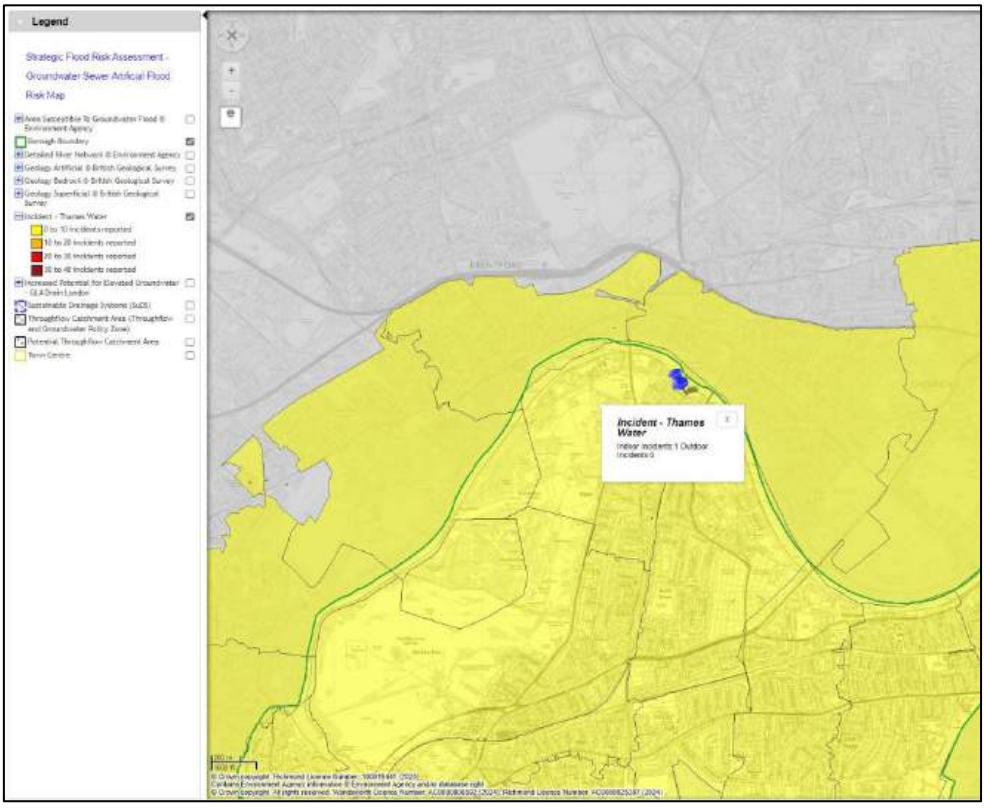
18.4.2 Map Recorded Historic Flooding



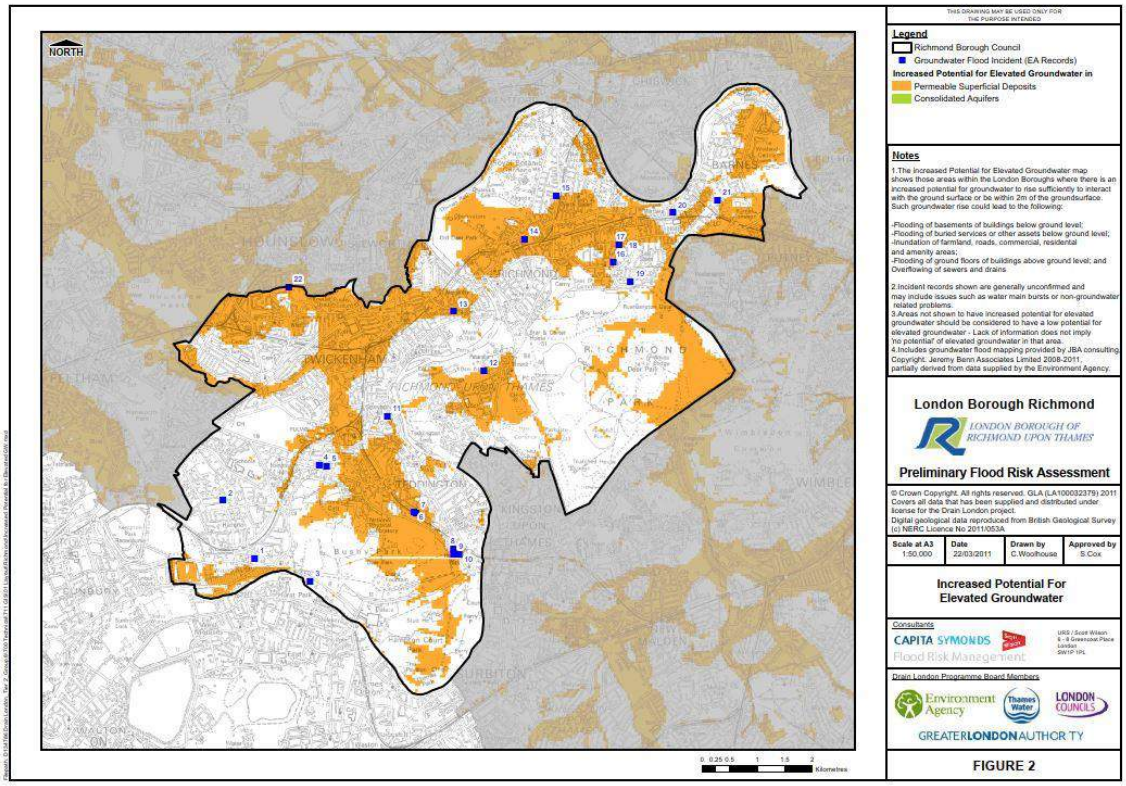
18.4.3 PFRA Map of Recorded Sewer Flooding



18.4.4 SFRA Map of Recorded Sewer Flooding



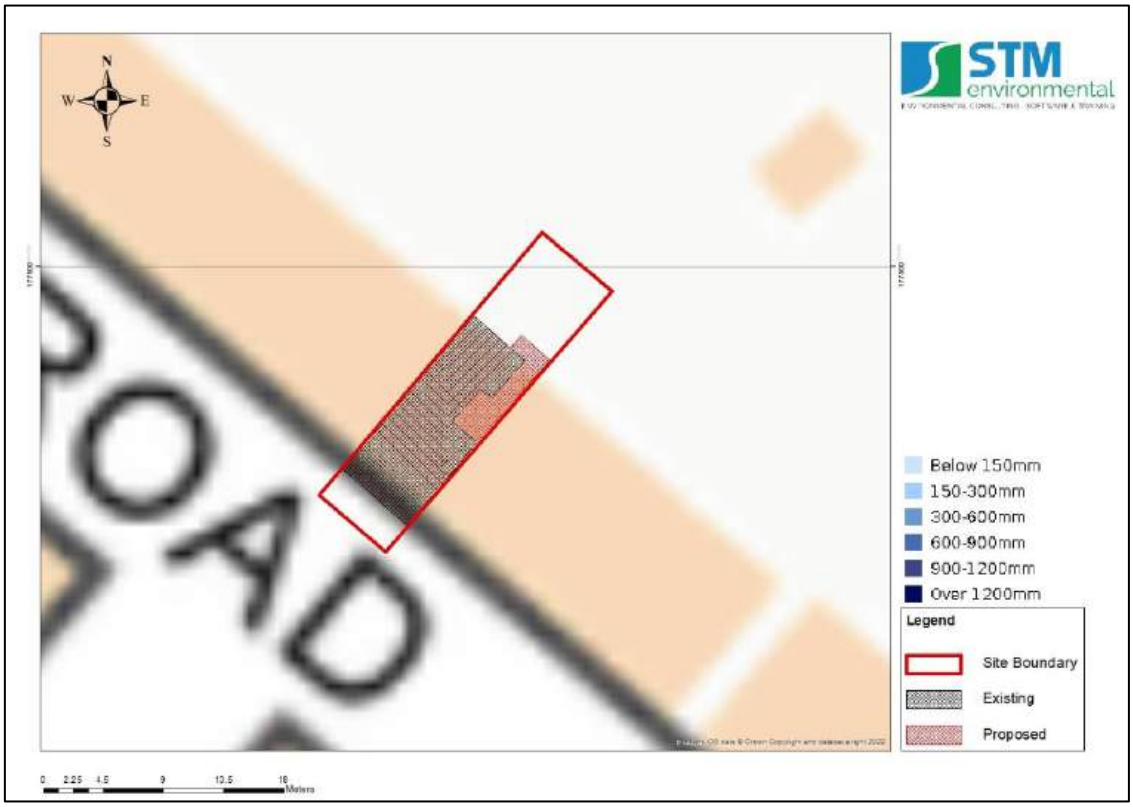
18.4.5 Map of Recorded Groundwater Flooding and Increased Potential for Elevated Groundwater

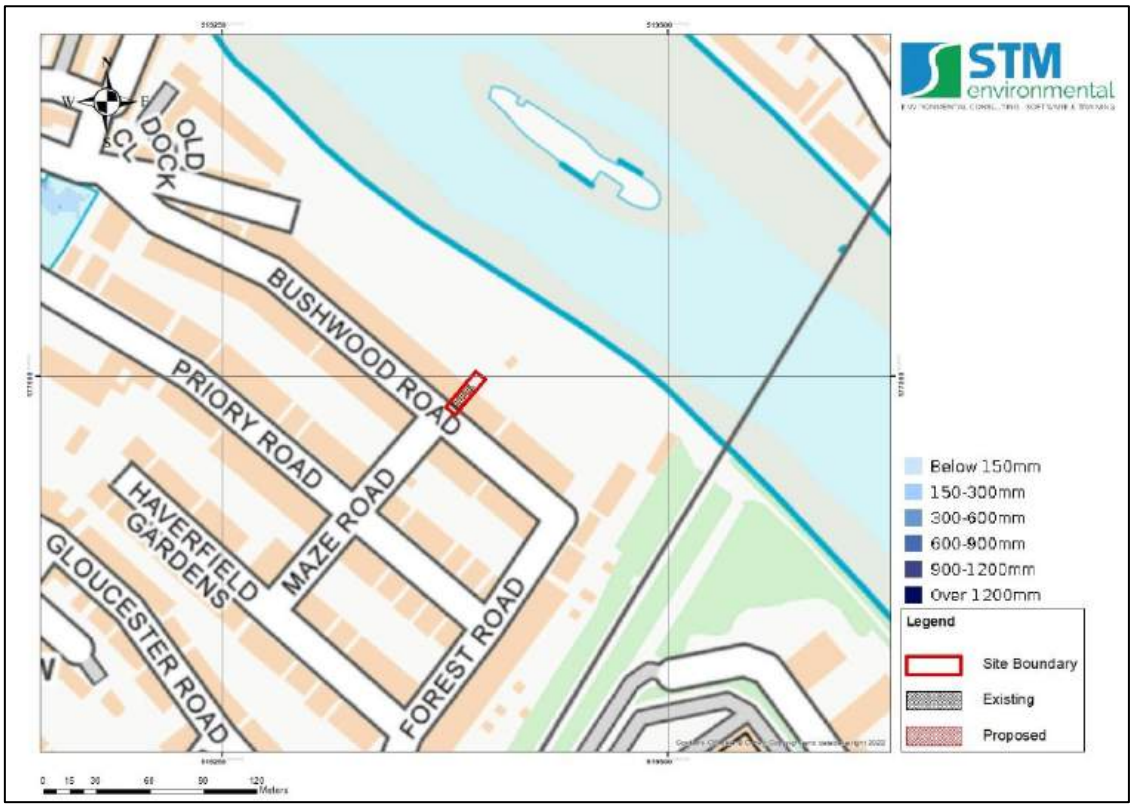


18.5 Appendix 5 - EA Flood Zone Map

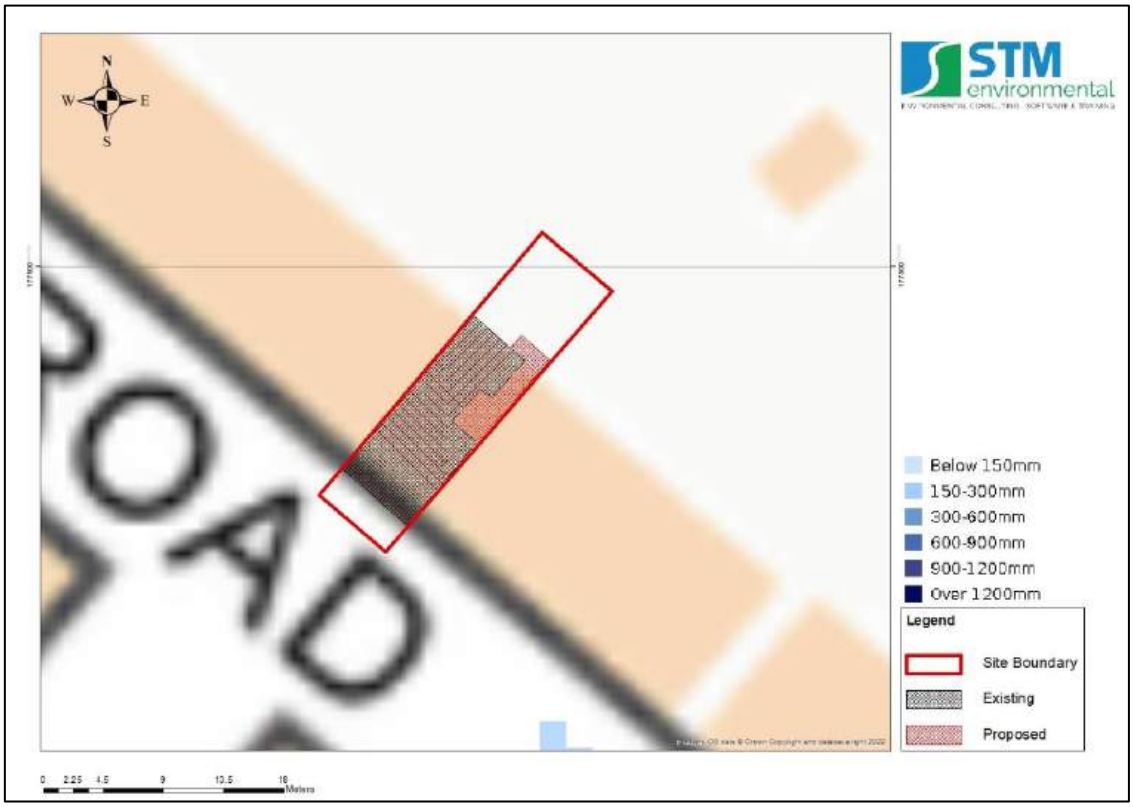
18.6 Appendix 6 – Surface Water Flood Extent and Depth Maps

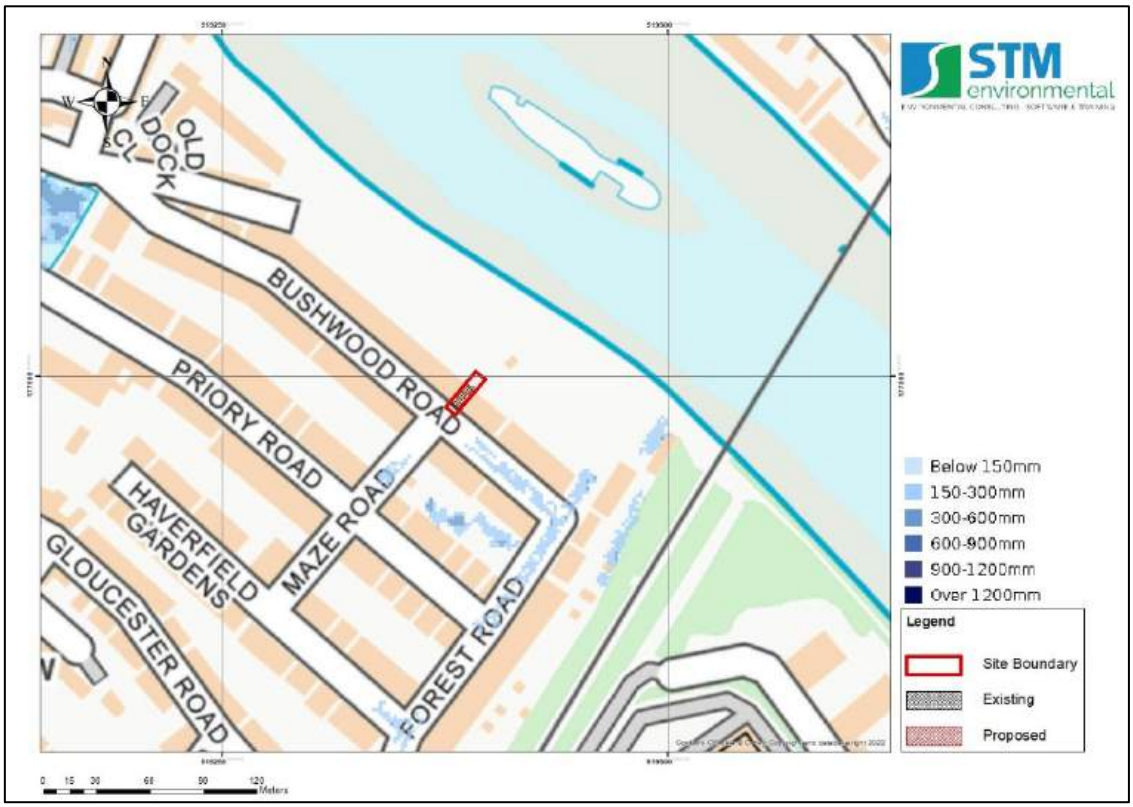
18.6.1 Predicted surface water flood depth for the 1-in-30-year return period (Source: EA, 2016).



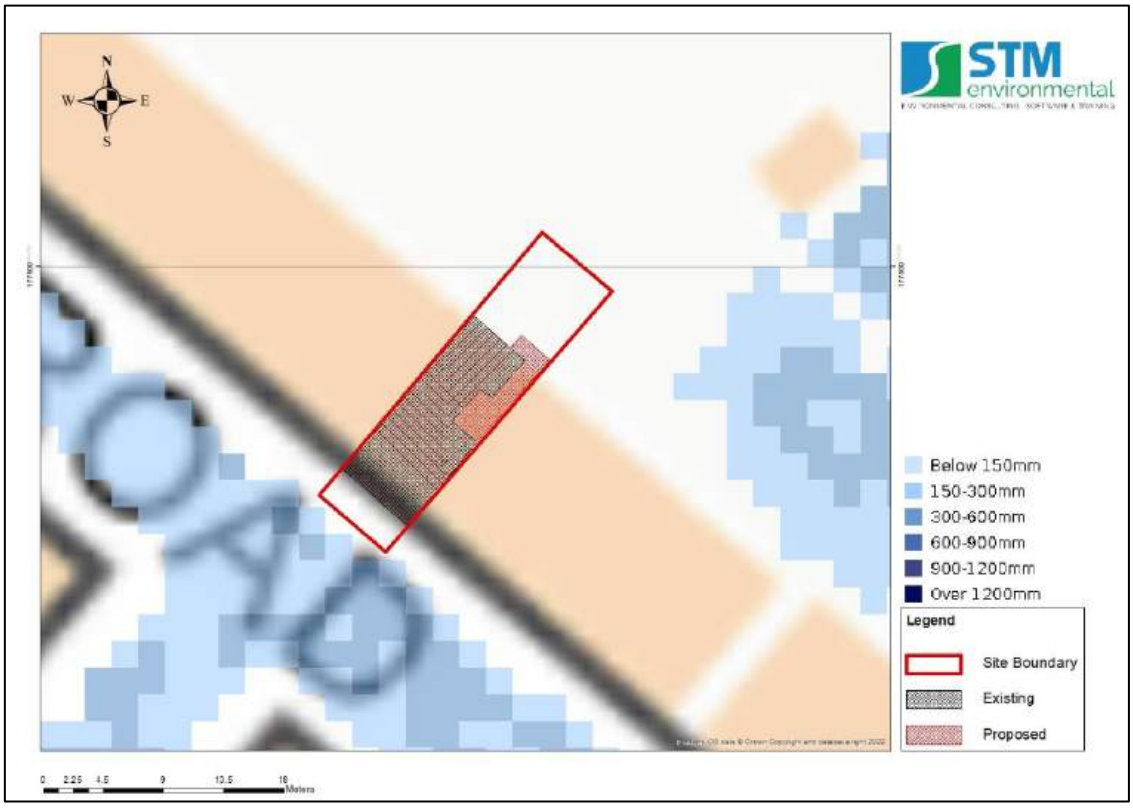


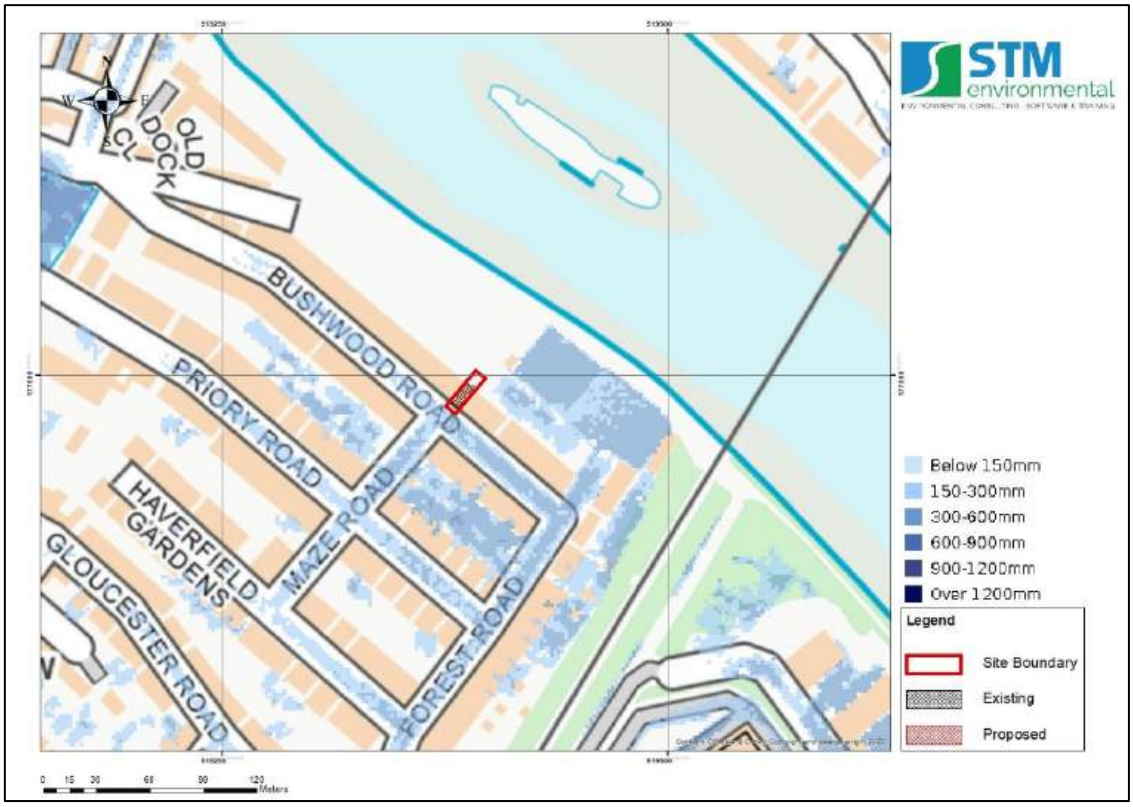
18.6.2 Predicted surface water flood depth for the 1-in-100-year return period (Source: EA, 2016).





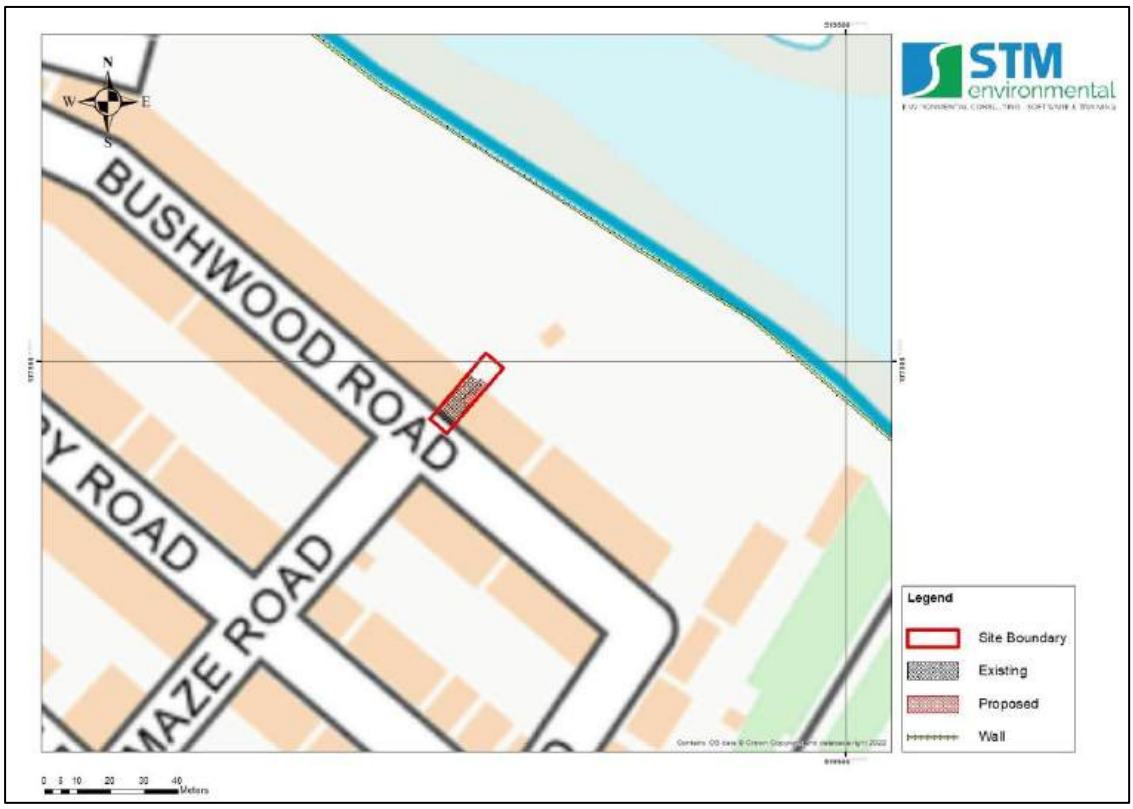
18.6.3 Predicted surface water flood depth for the 1-in-1000-year return period (Source: EA, 2016).



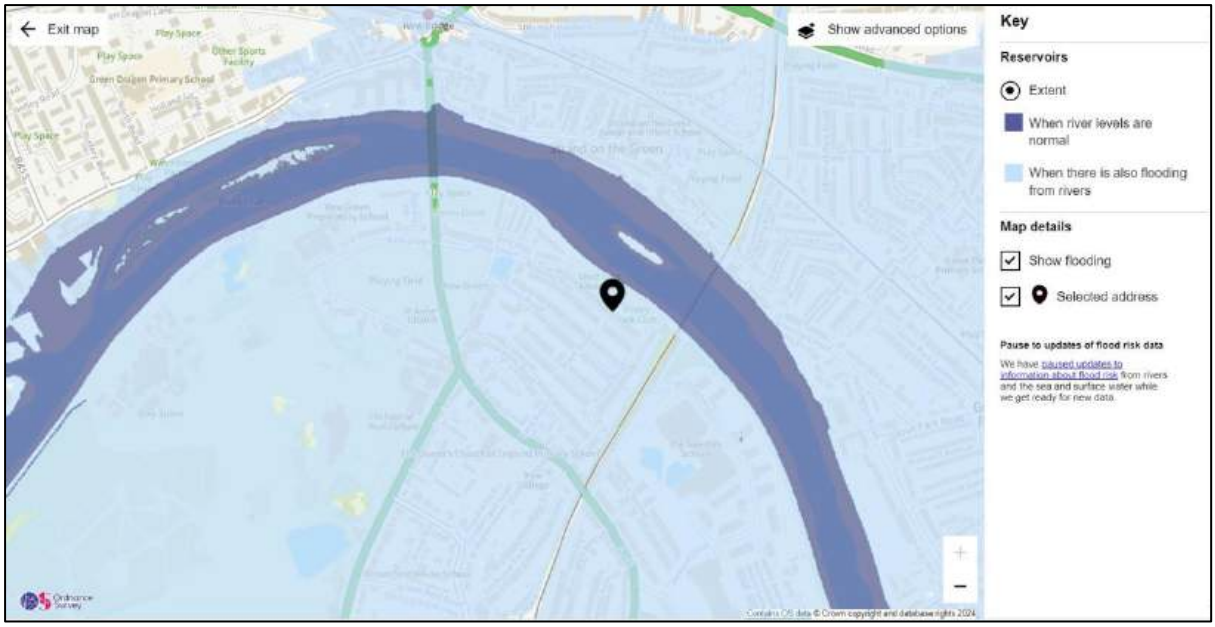


18.7 Appendix 7 –Flood Defence and Reservoir Flood Risk Maps

18.7.1 EA flood defence map

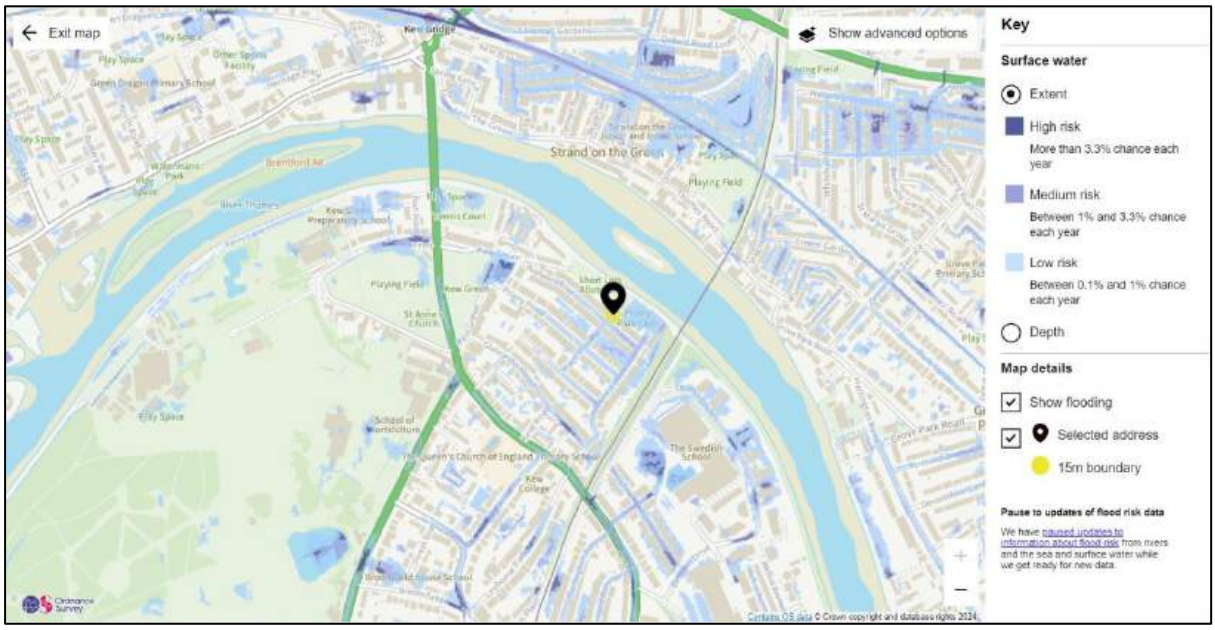


18.8 Appendix 8 – Risk of Flooding from Artificial Sources Map

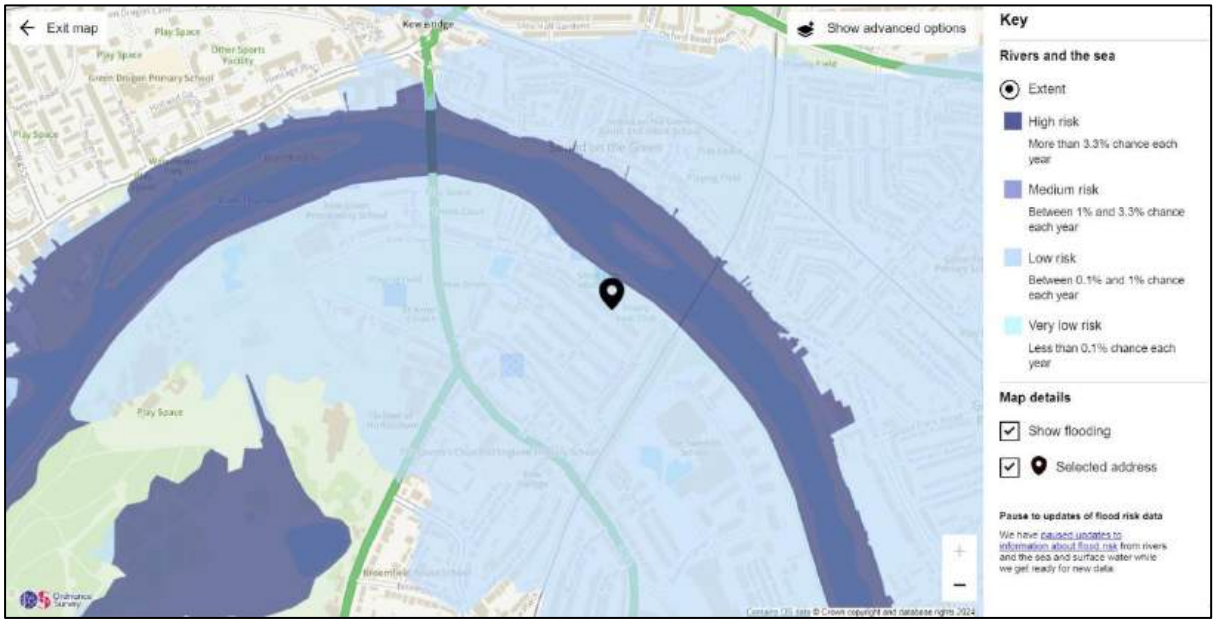


18.9 Appendix 9 – EA's Long Term Flood Risk Maps

18.9.1 Surface Water

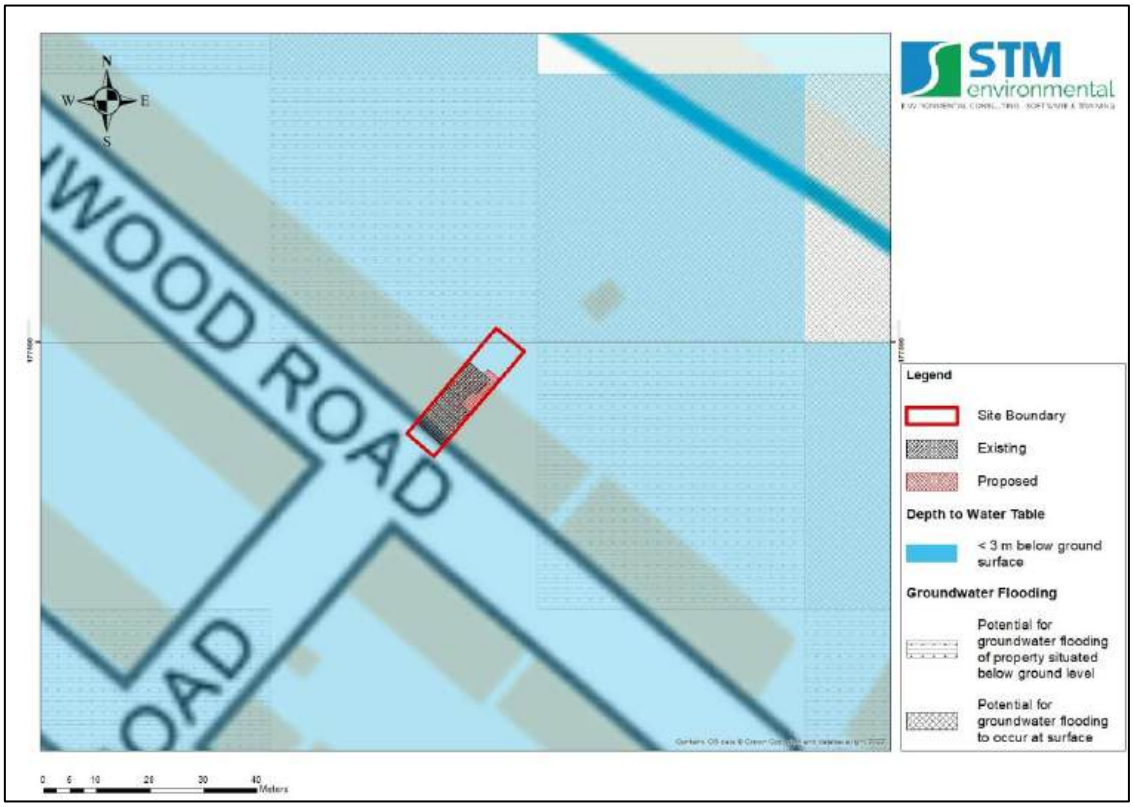


18.9.2 Rivers and the Sea

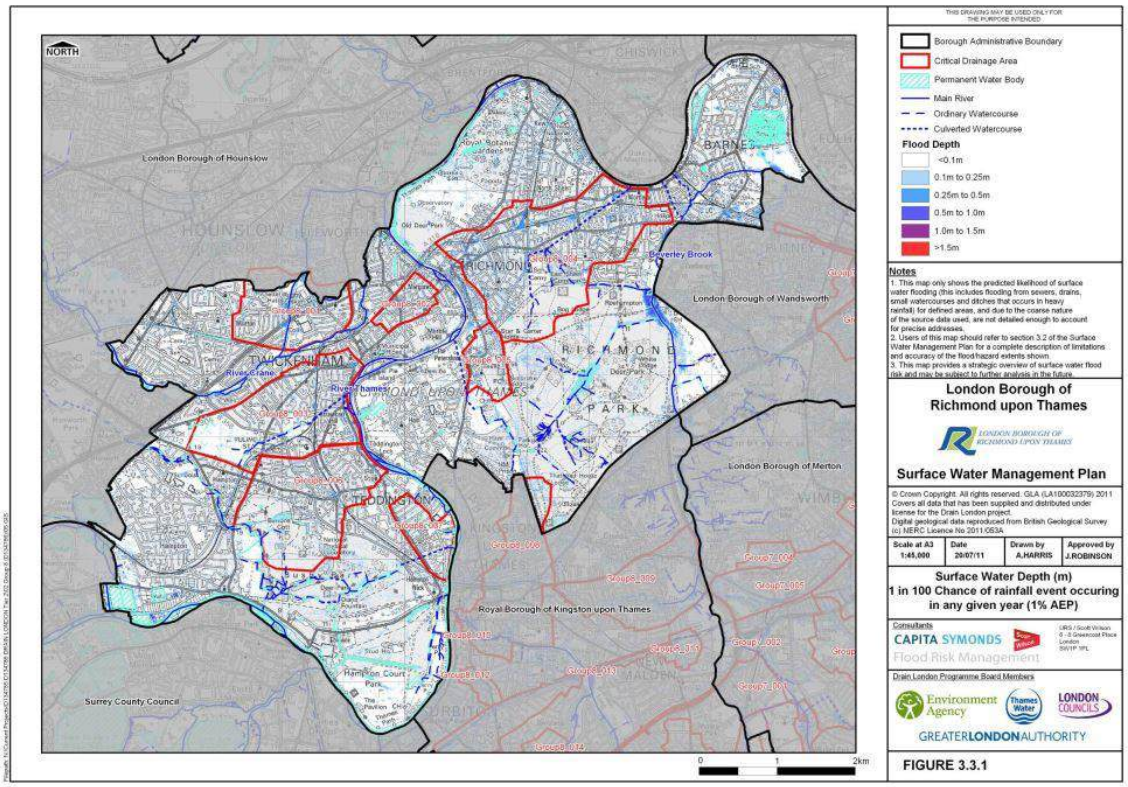


18.10 Appendix 10 – Groundwater Flood Maps

18.10.1 Groundwater Flooding (Susceptibility) Map (BGS) and Potential Depth to the Groundwater Water Map (BGS)



18.10.2 Critical Drainage Area Map

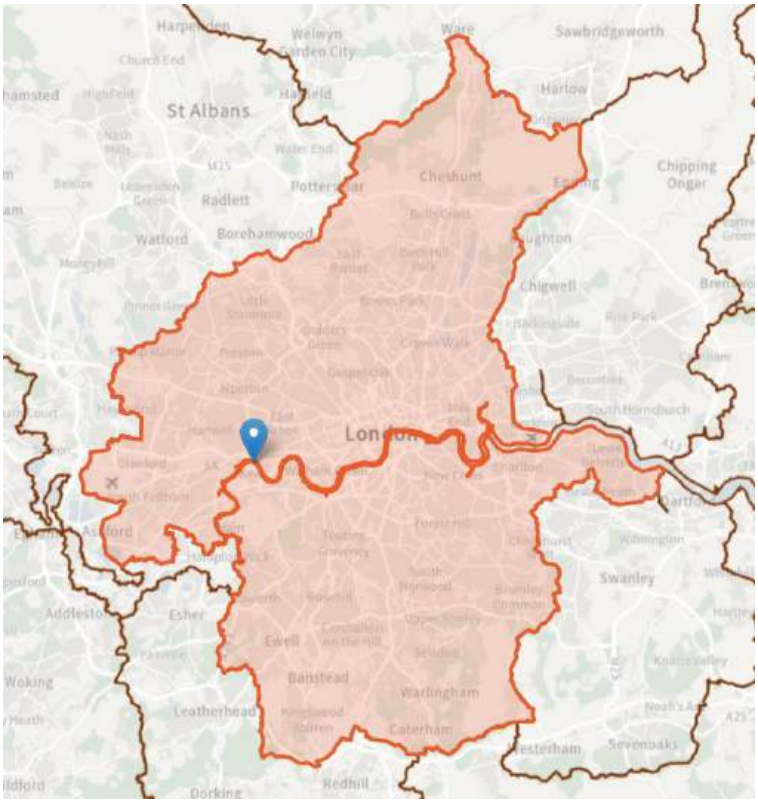


18.11 Appendix 11 - EA Product 6 (Detailed Flood Risk) Data

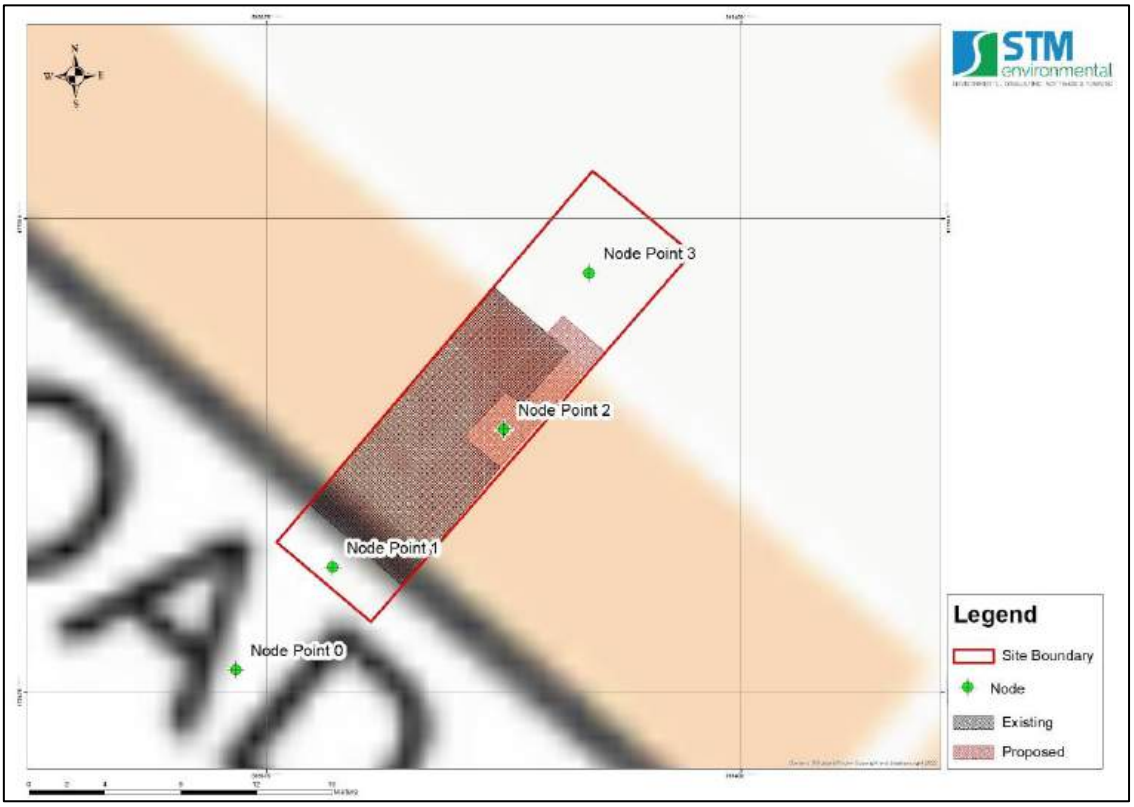
18.11.1 EA Climate Change Allowances for Peak River Flow

London Management Catchment peak river flow allowances

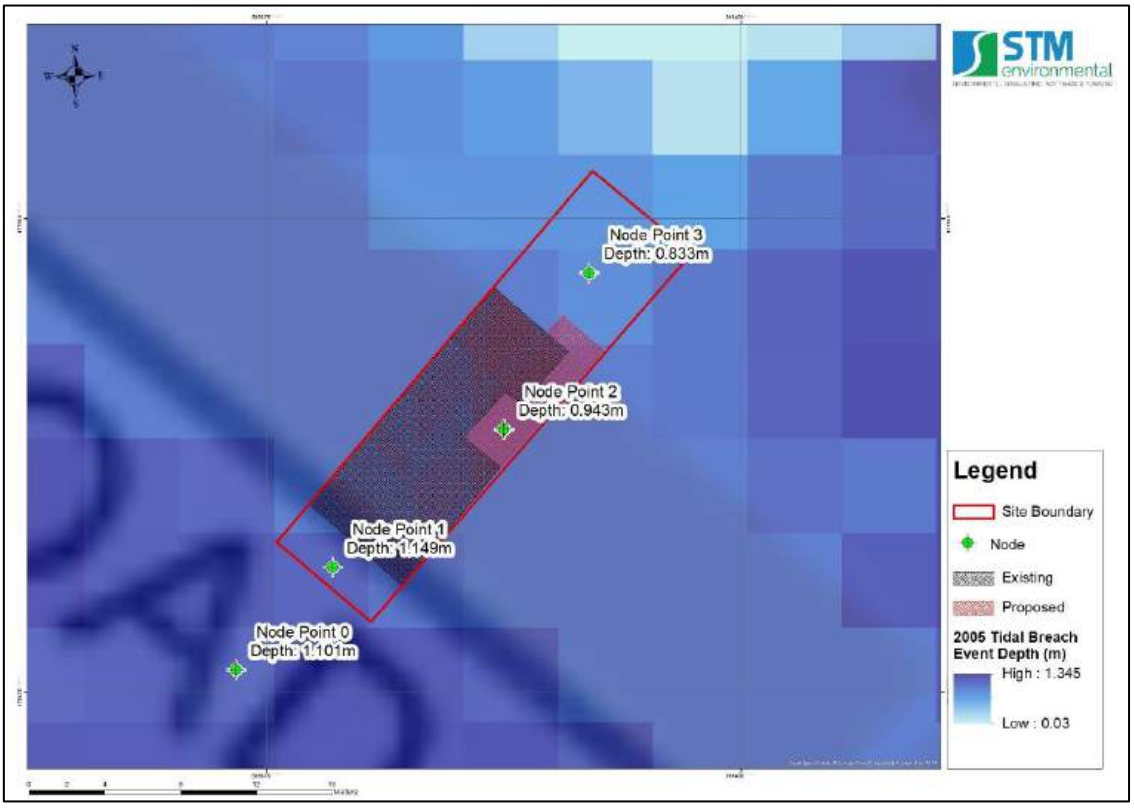
	Central	Higher	Upper
2020s	10%	14%	26%
2050s	7%	14%	30%
2080s	17%	27%	54%

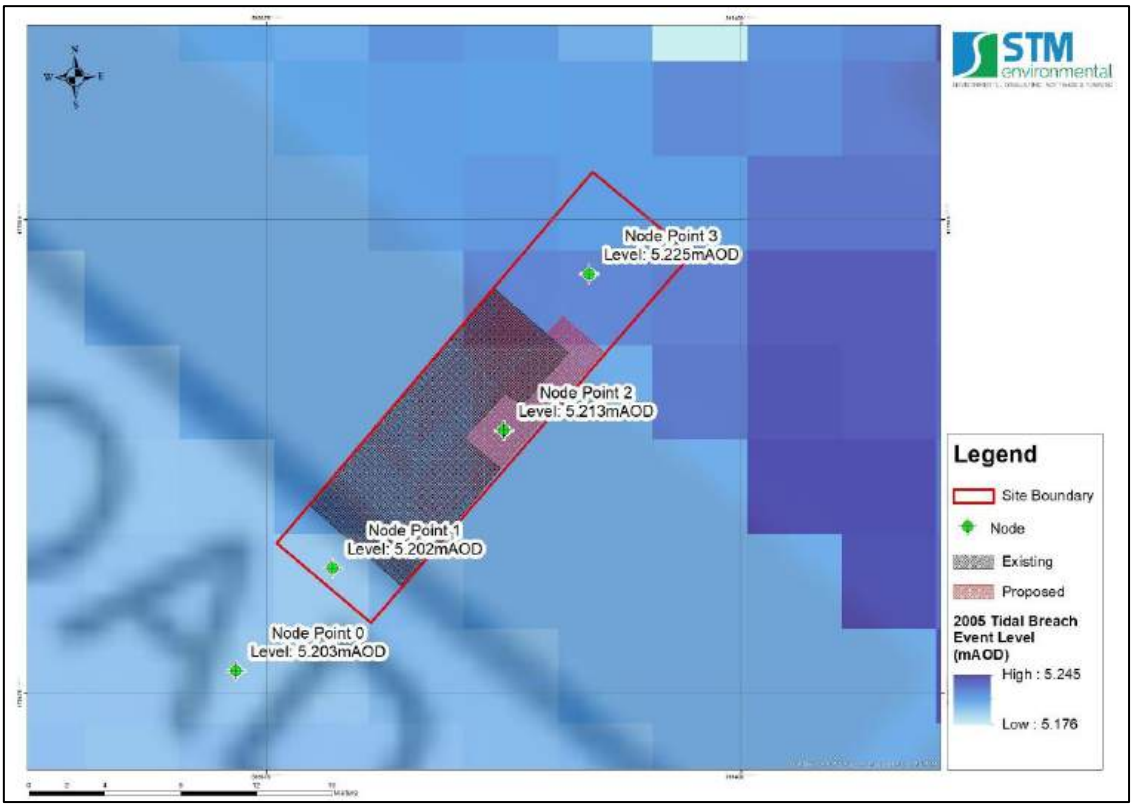


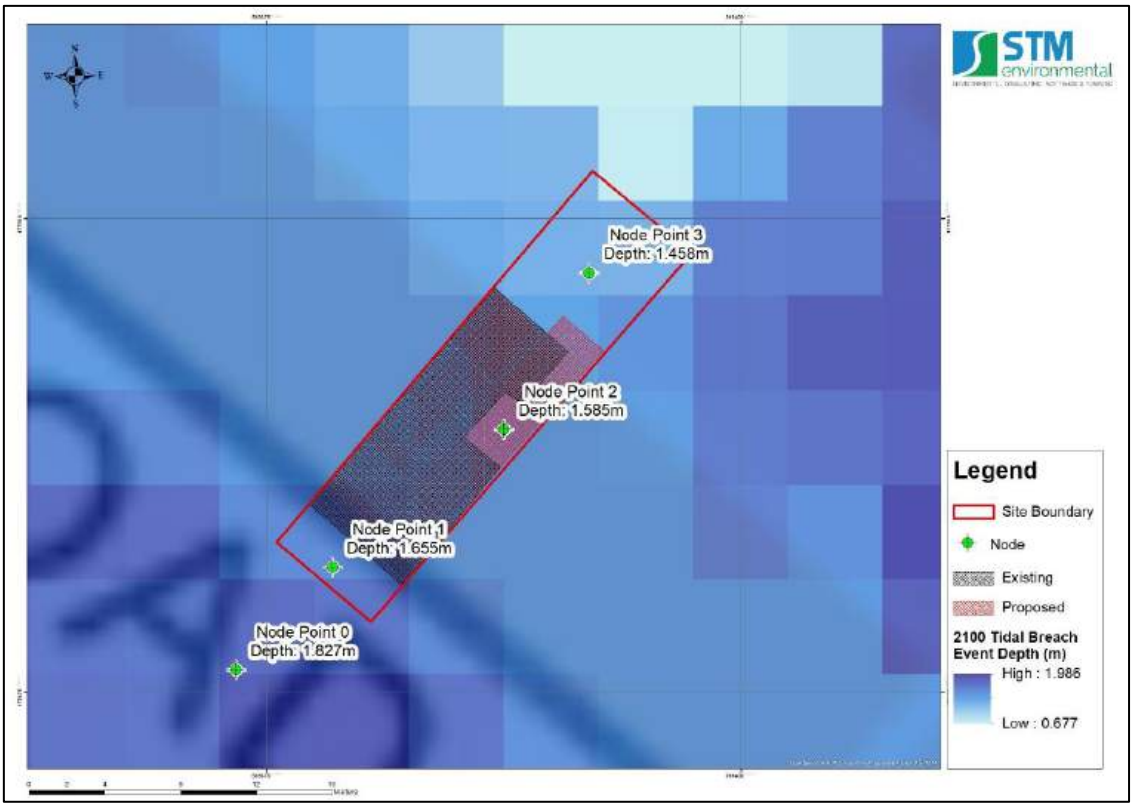
18.11.2 Node Location Map

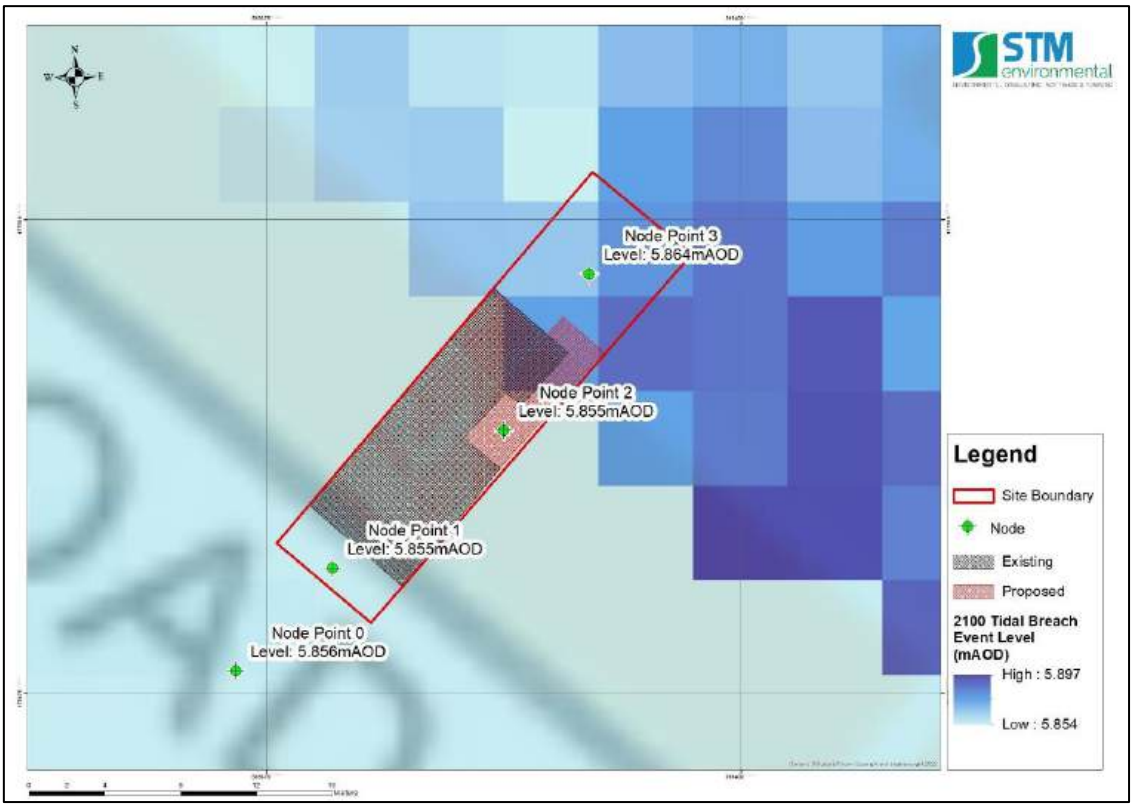


18.11.3 Tidal Flood Depths and Levels during Breach 2005 and Breach 2100 Scenario Map

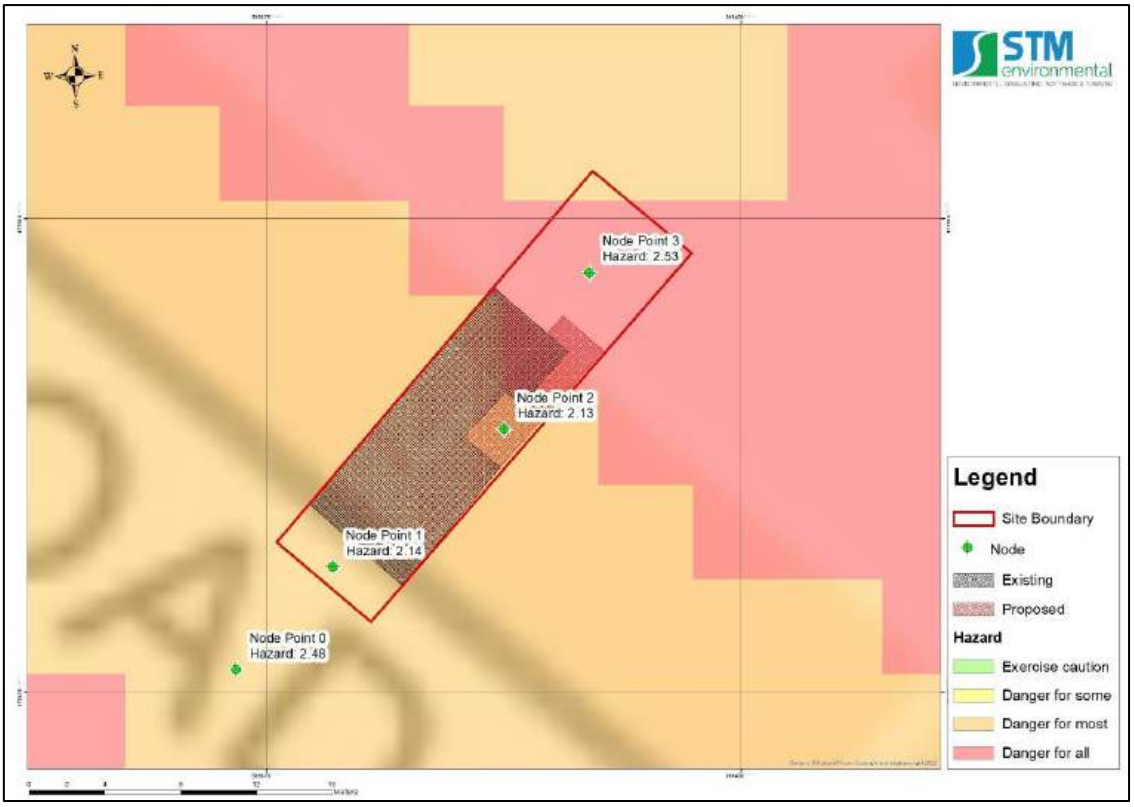


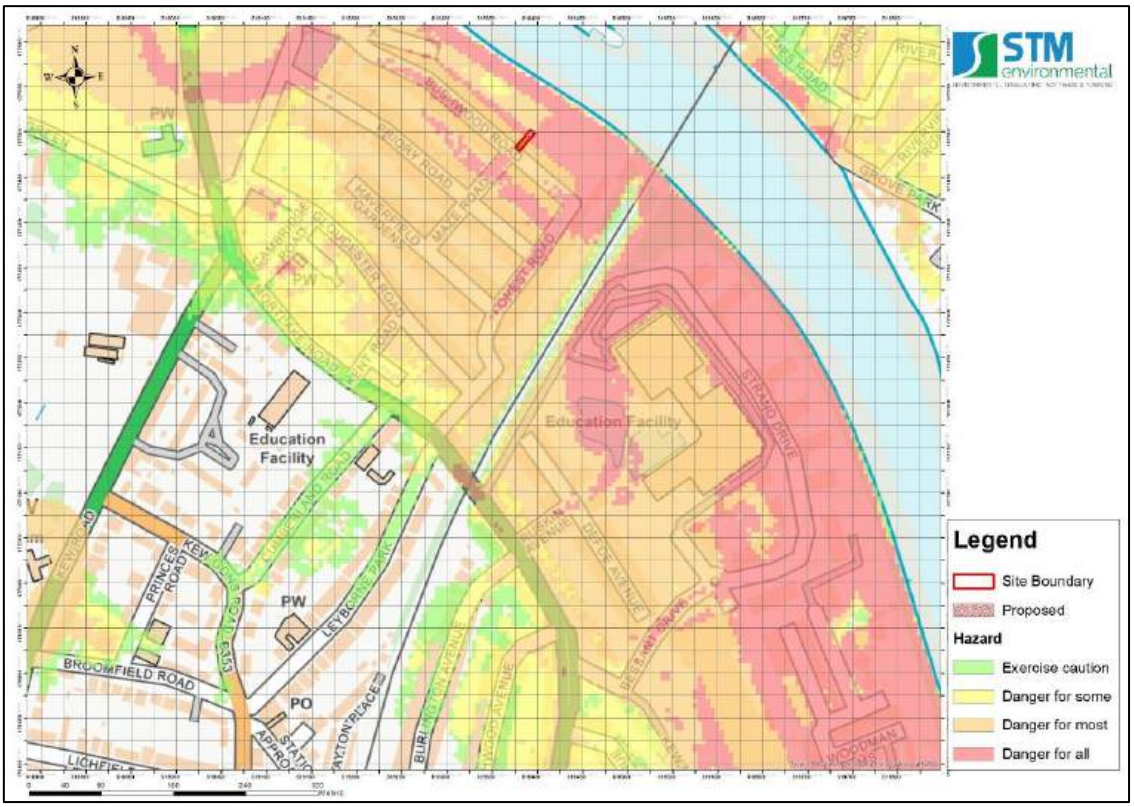

Node Point 3
Level: 5.225mAOD
Node Point 2
Level: 5.213mAOD
Node Point 1
Level: 5.202mAOD
Node Point 0
Level: 5.203mAOD
Legend
Site Boundary
Node
Existing
Proposed
2005 Tidal Breach Event Level (mAOD)
High : 5.245
Low : 5.176


Node Point 3
Depth: 1.458m
Node Point 2
Depth: 1.585m
Node Point 1
Depth: 1.655m
Node Point 0
Depth: 1.827m
Legend
Site Boundary
Node
Existing
Proposed
2100 Tidal Breach Event Depth (m)
High : 1.986
Low : 0.677

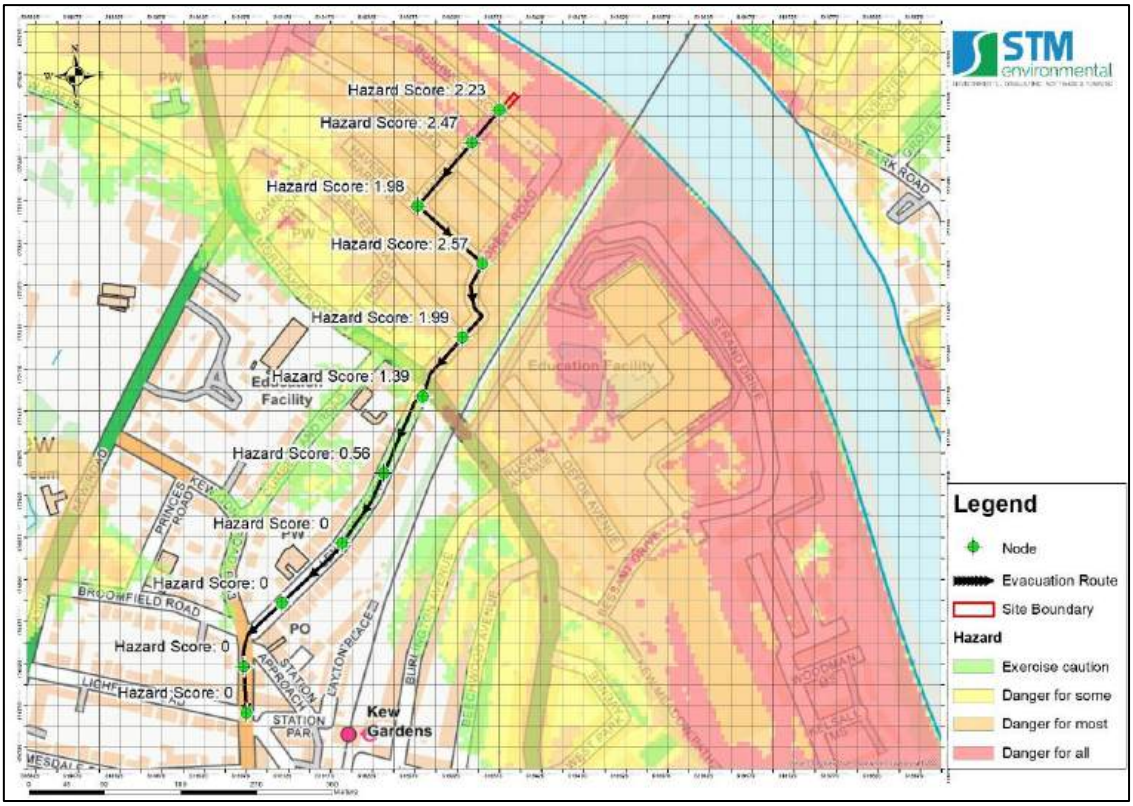


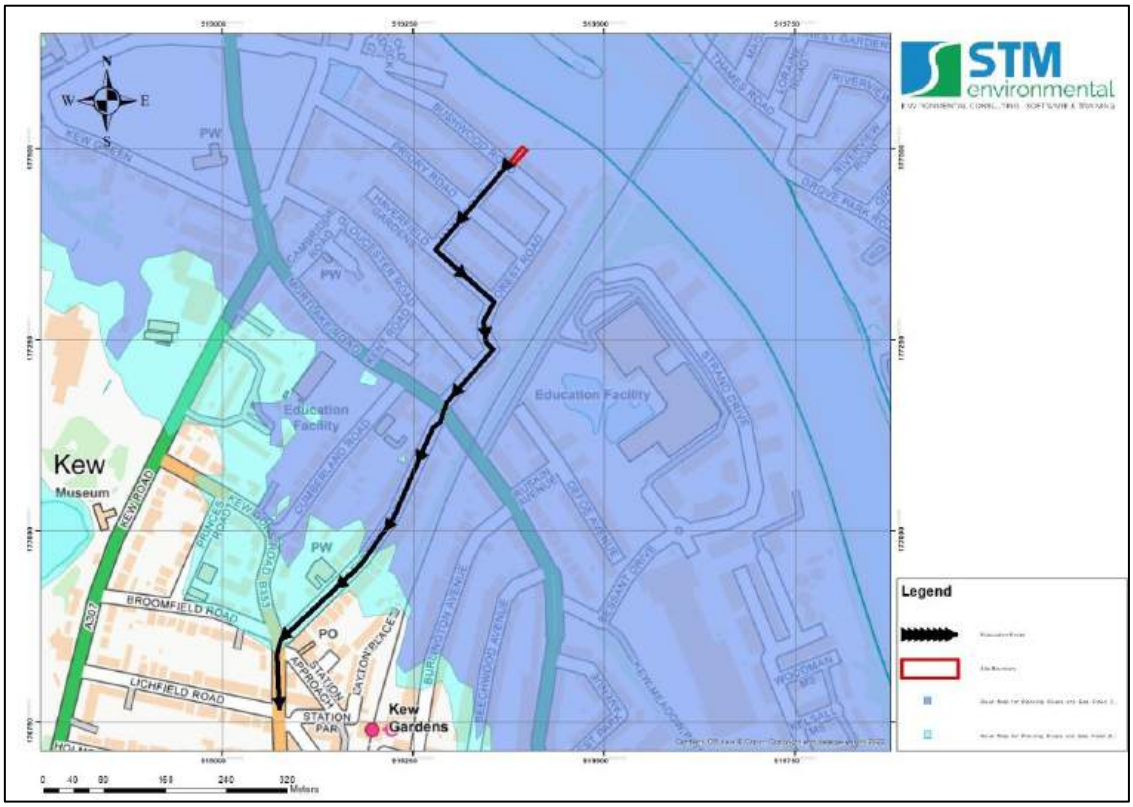
18.11.4 Hazard Rating During the Tidal Breach 2100 Flood Scenario Map




Education Facility
Education Facility
PW
PW
PO
BROOMFIELD ROAD
PRINCES ROAD
LETCHWORTH PARK
Legend
Site Boundary
Proposed
Hazard
Exercise caution
Danger for some
Danger for most
Danger for all

18.12 Appendix 12 – Safe Egress to Flood Zone 1 Map





18.13 Appendix 13 – Calculation of Flood Hazard Rating

Flood Hazard Rating Scores – based on DF score of 0

Velocity	Depth									
	0.25	**0.50**	**0.75**	**1.00**	**1.25**	**1.50**	**1.75**	**2.0**	**2.25**	**2.50**
0.0	0.13	0.25	0.38	0.50	0.63	0.75	0.88	1.00	1.13	1.25
0.5	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
1.0	0.38	0.75	1.13	1.50	1.88	2.25	2.63	3.00	3.38	3.75
1.5	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00
2.0	0.63	1.25	1.88	2.50	3.13	3.75	4.38	5.00	5.63	6.25
2.5	0.75	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50
3.0	0.88	1.75	2.63	3.50	4.38	5.25	6.13	7.00	7.88	8.75
3.5	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
4.0	1.13	2.25	3.38	4.50	5.63	6.75	7.88	9.00	10.13	11.25
4.5	1.25	2.50	3.75	5.00	6.25	7.50	8.75	10.00	11.25	12.50
5.0	1.38	2.75	4.13	5.50	6.88	8.25	9.63	11.00	12.38	13.75

Summary of Scores

	Score From	Score To	Flood Hazard	Description
	<0.75	0.75	Low	Exercise Caution
Class 1	0.75	1.5	Moderate	Danger for some
Class 2	1.5	2.5	Significant	Danger for most
Class 3	2.5	20.0	Extreme	Danger for all

Values for Debris Factor for different flood depths

Depths	Pasture/Arable Land	Woodland	Urban
0 to 0.25	0	0	0
0.25 to 0.75	0.5	1	1
d>0.75 and/or v > 2	0.5	1	1

- The “danger to some” category includes vulnerable groups such as children, the elderly and infirm. “Danger: Flood zone with deep or fast
- flowing water”
- The “danger to most” category includes the general public.

- The danger to all category includes the emergency services.

A flood emergency plan is considered to be an acceptable way of managing flood risk where the flood hazard has been given a “very low hazard” rating. In some instances, flood emergency plans may also be acceptable where the rating is “danger for some”. However, it is unlikely to be an acceptable way of managing residual flood risk where the hazard to people classification is “danger for most” or “danger for all”.