FLOOD RISK ASSESSMENT

Site Address
20 Heath Road
Twickenham
TW1 4BZ

Client
Edward Prior
Greenwood Nursery School

Date
05/04/2024

1 Document Control

FLOOD RISK ASSESSMENT

Site Address:	20 Heath Road Twickenham TW1 4BZ
National Grid Reference:	516083, 173173
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Prepared for:	Edward Prior Greenwood Nursery School
Date:	05/04/2024
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2 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
RBC	Richmond Borough Council
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

3 Disclaimer

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4 Executive Summary

SECTION	SUMMARY
Location	20 Heath Road, Twickenham, TW1 4BZ Grid Reference: 516083, 173173
Area	160m^2
Proposed Development	Alterations to existing shop front, including replacement of existing retractable awning and installation of wooden lockers. Alterations to rear elevation including installation of living wall on rear elevation and modular living fence. Installation of two storage sheds, protective balustrade and handrails to existing external stairs and replacement door. (ref.no. 24/0644/FUL).
Flood Zone	The site is located in Flood Zone 1.
Topography	The rear of the development forms a carpark situated at 8.48mAOD, and ground level of the building (at street level) situated at approximately 7.31mAOD.
Sequential and Exception Tests	Development is minor so Sequential and Exception Tests should not be required.
Main Sources of Flooding	River Thames, 205m south.
Flood Defences	EA Mapping reveals walls and embankments on the south bank of the River Thames.
Records of Historic Flooding	SFRA Mapping revealed 1-5 recorded sewer flood events in the TW1 4 postcode area.
Fluvial (River) and Tidal (Sea) Flood Risk	Very Low – The site remains dry during all modelled fluvial events.
Pluvial (Surface Water) Flood Risk	Medium – The site remains dry during the 1 in 100 year modelled pluvial event; the property is impacted during the 1 in 1000 year event up to 600mm;
Flood Risk from Artificial (Canals and Reservoirs) Sources	Low - Site lies within an area that is at risk of reservoir flooding when there is also flooding from rivers.
Groundwater Flood Risk	Low – According to the BGS, the site is potentially susceptible to groundwater flooding, no recorded incidents have been identified.
Development Impacts on Local Flood Risk	The development will not increase the impermeable area of the site as the proposed takes place on existing hard-standing. The development will not impact upon local flood storage or alter flood flow paths.
Proposed Flood Risk Mitigation Measures	• The construction of the cycle and scooter storage units will be at the relative ground levels in the front and rear of the site; • CFS is not required as the site is within flood zone 1 and does not flood during the 1 in 100 year event; • Safe egress to Flood Zone 1 is available onsite;

SECTION	SUMMARY
Surface Water Management (SuDS)	Due to the scale and nature of the proposed, there is limited potential to introduce SuDS. However, measures such as living green walls will be incorporated;
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.

5 Introduction

STM Environmental Consultants Limited (STM) were appointed by Edward Prior (Client) to provide a Flood Risk Assessment (FRA) at a site located at 20 Heath Road, Twickenham, TW1 4BZ.

6 Development Proposal

The FRA is required to support a planning application for the alterations to existing shop front, including replacement of existing retractable awning and installation of wooden lockers. Alterations to rear elevation including installation of living wall on rear elevation and modular living fence. Installation of two storage sheds, protective balustrade and handrails to existing external stairs and replacement door. (ref.no. 24/0644/FUL).

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

7 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.

8 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.

9 Legislative and Policy Context

9.1 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.

9.2 Policy Context

9.2.1 National Planning Policy Framework (NPPF)

The NPPF (updated July 2021) sets out the government’s planning policies for England and how these are expected to be applied. It also provides a set of guidelines and philosophy with which local planning authorities (LPAs) can build their own unique policies to appropriately regulate development within their jurisdictions.

Section 14 entitled “Meeting the challenge of climate change, flooding and coastal change” deals specifically with flood risk.

Paragraph 159 states that “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”.

In addition, Paragraph 161 outlines that “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);
- 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 NPPF then states in Paragraph 163 that “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”.

It further states that when determining any planning application, LPAs should "ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment[55]. 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;
- development is appropriately flood resilient and resistant;
- 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 minor development and changes of use 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 footnote 55.

Footnote 55 states: "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."

The NPPF also lays out requirements for how LPAs should deal with planning applications in coastal areas. They should ensure that should they "reduce risk from coastal change by avoiding inappropriate development in vulnerable areas or adding to the impacts of physical changes to the coast."

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

- 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.

9.2.2 Local Planning Policy – Richmond Borough Council

Policy LP 21 - Flood Risk and Sustainable Drainage

"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)".

Sustainable drainage

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.

Also relevant is policy S1 12 of the London Plan (2020) which outlines Flood Risk Management, it states that:

- Current and expected flood risk from all sources 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.

9.3 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.

10 Site Description and Environmental Characteristics

10.1 Site Location and Area

The site is located at 20 Heath Road, Twickenham, TW1 4BZ and is centred at national grid reference 516083, 173173. The site has an area of 160m^2

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

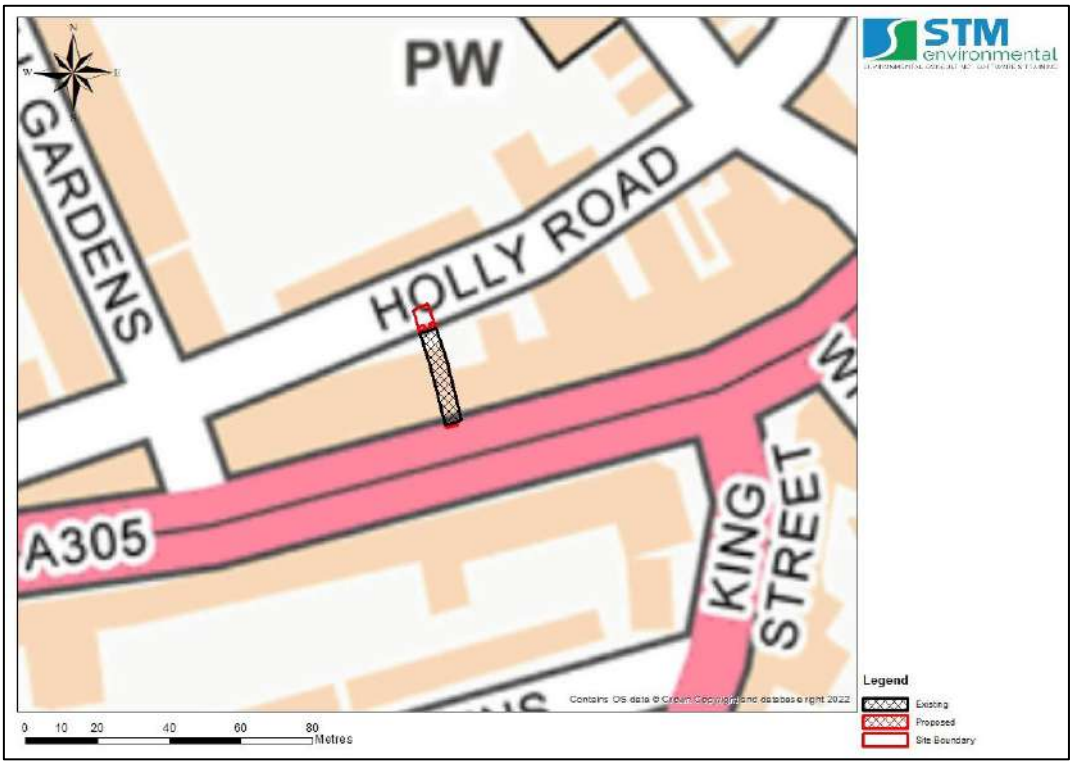


Figure 1: Site Location Map

Figure 2: Site Aerial Map

10.2 Site Access

The site is accessible via Heath Road to the south and Holly Road in the north.

10.3 Local Planning Authority

The site falls within the jurisdiction of Richmond Borough Council in terms of the planning process.

10.4 Lead Local Flood Authority

Richmond Borough Council is also the Lead Local Flood Authority (LLFA).

10.5 Flood Zone

For planning purposes, the site is located in Flood Zone 1 as defined by the EA and LLFA. The map of the Flood Zones is available in Appendix 5.

10.6 Site and Surrounding Land Uses

10.6.1 Site Current Land Use

The site is currently a commercial retail unit with car parking to the rear.

10.6.2 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, Commercial,	Residential, Commercial
Eastern	Residential, Commercial	Residential, Commercial
Southern	Residential, Commercial	Residential, Commercial
Western	Residential, Commercial	Residential, Commercial

10.7 Hydrology

The nearest main watercourse is the River Thames which is located 205m southeast of the site. A map of the nearby hydrological features is present in Appendix 2.

10.8 Geology

Data from the British Geological Survey indicates that the underlying superficial geology is characterised as Langley Silt Member (Silt). The underlying bedrock geology is characterized as London Clay (Clay).

10.9 Hydrogeology

The site lies upon an unproductive superficial and bedrock aquifer.

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

10.10 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.

The carpark located to the rear, in the north on Holly Road, is situated at 8.48mAOD whilst the ground level of the building is situated at approximately 7.31mAOD and has level access to Heath Road.

11 The Sequential and Exception Tests

11.1 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 located in Flood Zone 1 and is considered to be minor. As such, the Sequential Test should not be required by the LLFA.

11.2 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 minor and located in Flood Zone 1, an Exception Test should not be required by the LLFA.

12 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.

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

12.1.1 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.

12.1.2 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.

12.1.3 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.

12.1.4 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.

12.1.5 Main Potential Sources of Local Fluvial and Tidal Flooding

The nearest potential source of combined fluvial and tidal flooding to the site is considered to be from the River Thames.

12.1.6 Records of Historic Fluvial and Tidal Flooding Incidents

The EA informed that they do not have any information on recorded fluvial and tidal flood incidents in the vicinity (500m) of the site.

12.1.7 Designated Fluvial and Tidal Flood Risk Zone for the Site

The site is considered to be located within Flood Zone 1 as defined by the Environment Agency and the LLFA indicating that it has less than 0.1% annual probability of fluvial and tidal flooding.

12.1.8 Flood Defences

The EA's flood defence map, which is available in Appendix 7, shows that the site benefits from walls and embankments along the banks of the River Thames.

12.1.9 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 Thames 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 minor developments indicates that a climate change allowance of 17% should be used.

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

As the site is located in Flood Zone 1, no modelled data was provided.

12.1.11 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 very low.

12.2 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.

12.2.1 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.

12.2.2 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.

12.2.3 Records of Historic Pluvial Flooding Incidents

Examination of the LLFA's Level 1 SFRA revealed no evidence of pluvial flooding on or in the vicinity of the site (1km).

12.2.4 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.

An examination of OS mapping and the EA's mapping revealed that there are significant reservoirs upstream of the site which may exacerbate fluvial flooding if they overtop.

12.2.5 Sewer Flooding

Examination of the LLFA's Level 1 SFRA revealed evidence of 1-5 recorded sewer flood events in the TW1 4 postcode area.

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

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

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

The maps show that the site would remain dry during the 1 in 30 and 100-year events.

During the 1 in 1000-year event the existing property is impacted to depths of up to 600mm. The indicative flood level witnessed here is likely due to lower ground level witnessed within the rear of the existing retail shop and neighbouring properties when compared to the road level along Holly Road. There is stepped access down from the car parking area. As such this is likely to influence the flow routes witnessed within extreme model scenario.

12.2.7 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 low.

12.3 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.

12.3.1 Historic Records of Groundwater Flooding

Examination of the LLFA's Level 1 SFRA revealed no records of groundwater flooding at or within 500m of the site.

12.3.2 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 to occur at the surface. The Groundwater Depth map also provided by BGS indicates that the groundwater level may be at approximately 3mbgl.

12.4 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 located within a Critical Drainage Area, Group8_001 Twickenham. Details regard this are provided Appendix 8.

13 Potential Impacts of the Development on Local Flood Risk

13.1 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 3: Existing and proposed site ground cover.

	Impermeable Area		Permeable Area		Total Area
	m^2	%	m2	%	m^2
Existing Site	160	100	0	0	160
Proposed Site	160	100	0	0	160
Difference	0	0	0	0	

Table 4: Break down of existing and proposed site uses

Ground Cover	Existing Development Area		Proposed Development Area		Difference (m2)
	m^2	%	m^2	%	
Buildings	128	80	136	85	8
Driveways/Patio	32	20	24	15	-8
Gardens/ Soft landscaping	0	0	0	0	0
Total	160	100	160	100	

The development will not increase the impermeable area of the site as the proposed takes place on existing hard-standing. As such, it is considered unlikely that it will impact upon flood flow rates.

13.2 Impacts on Flood Storage and Flood Flow Routes

As the proposed development does not flood during any modelled fluvial, tidal or pluvial event, it will have a negligible impact on local flood storage and flood flow pathways.

14 Flood Risk Mitigation Measures

14.1 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 5: 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.

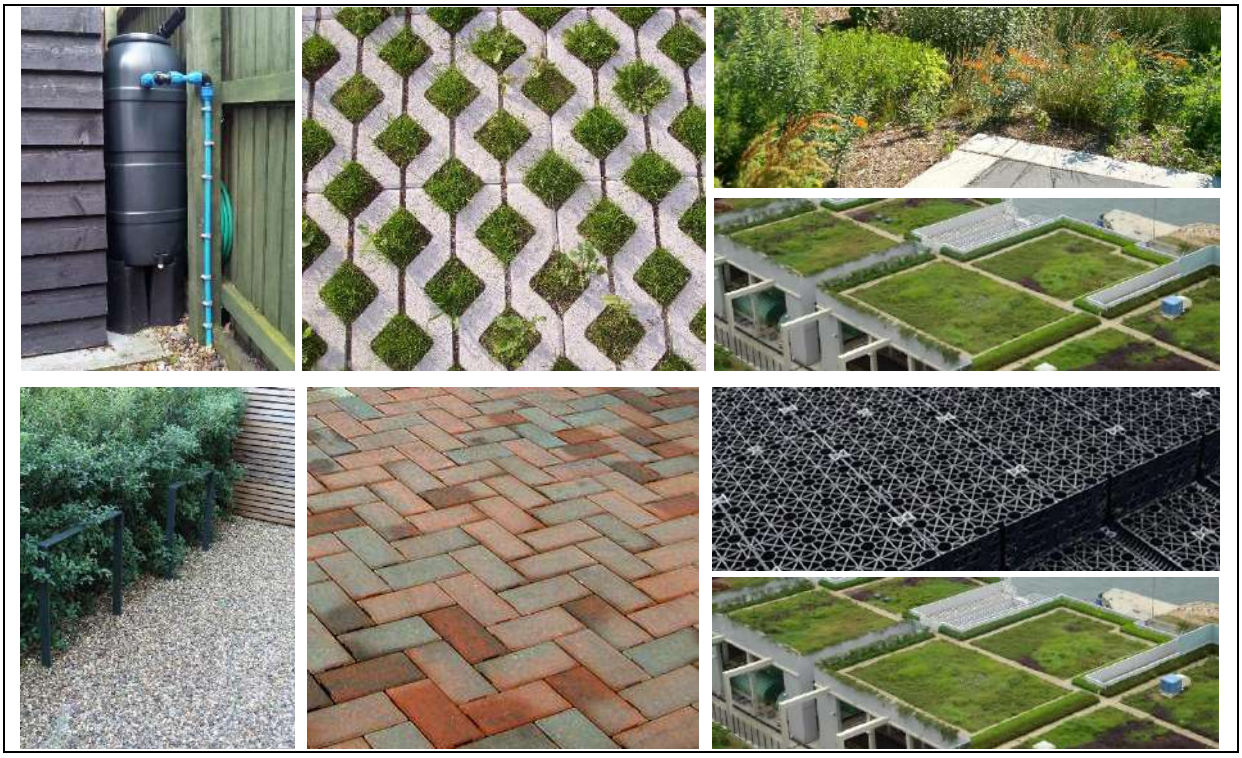


Figure 3: Surface water storage facilities and potential SuDS features - rainwater harvesting, on-site tank storage, rain garden soak-away and green roofs. (Source: UK SuDS Manual)

Given the nature of the development and the size of the site, it is considered that there are limited opportunities for implementing SuDS due to the small size of the site. The proposal will introduce a new living green wall to the rear replacing existing fencing. A full SuDS strategy is outside the scope of works of this FRA.

14.2 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.

14.2.1 Finished Floor Levels

The approximate ground level of the existing is 7.55mAOD.

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 300mm above one of the following, whichever is higher;

- Average Ground level; Or
- Estimated flood level 1% AEP plus CC; Or
- The Adjacent roadway;

As the site does not flood the FFL should be set no lower than the existing carpark level at approximately 8.42mAOD.

14.2.2 Compensatory Flood Storage

CFS is not required as the site is within flood zone 1 and is not impacted by the 1 in 100 year pluvial event.

14.2.3 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 less than 0.3m are predicted in extreme scenarios, the water exclusion is considered most applicable for this site.

Water Exclusion Strategy:

There are a range of flood protection devices/methods that can be used in the Water Exclusion Strategy including:

- Using materials and construction with low permeability;

- Landscaping e.g. creation of low earth bunds (subject to this not increasing flood risk elsewhere);
- Raising thresholds and finished floor levels (e.g. porches with higher thresholds than main entrance);
- Flood gates with waterproof seals;
- Sump and pump for floodwater to remove waste water faster than it enters;
- Door guards and airbrick covers.

Flood resilience design and measures which 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:

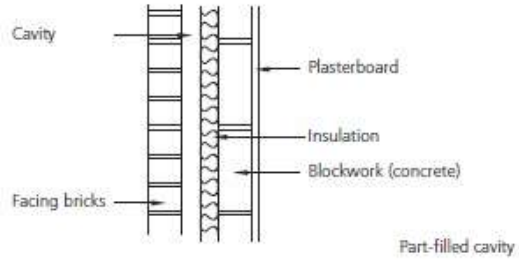
- Seal doors around edges and openings. UPVC or composite material will be used with passive protection meaning that minimal intervention will be required in the event of flooding.

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.

14.3 Emergency Plan

14.3.1 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.7

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

As the site is located in Flood Zone 1, the Hazard at the site is considered to be Low.

14.3.2 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.

14.3.3 Access and Safe Egress

Safe egress to Flood Zone 1 is available on site.

14.3.4 Safe Refuge

The proposed development is commercial and will be closed prior to a flood event warning from the EA Flood warning Direct Service.

15 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 Sequential and Exception Tests to be undertaken;
- The main sources of potential flooding to the site are considered to be from the River Thames, 205m south.
- The EA define the site as being within Flood Zone 1;

- The construction of the cycle and scooter storage units will be at the relative ground levels in the front and rear of the site;
- CFS is not required as the propose development does not flood during any modelled fluvial, tidal or pluvial event;
- EA mapping indicates that the site benefits from walls and embankments on the River Thames;
- The site is within a CDA - Group8_001 Twickenham;
- It is in an area that has had 1-5 sewage flooding incidents in the TW1 4 postcode;
- The development will result in no change of impermeable area and will increase built-up area by 8m^2.
- Given that the development remains dry during all modelled events, it is considered unlikely to increase local flood risk;
- There is limited opportunity for implementing SuDS mitigation measures. However, living green walls will be introduce to the rear of the site;
- Safe egress routes to Flood Zone 1 is accessible on site;
- The occupants will subscribe to the EA Flood Warnings Direct Service;

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

16 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. Strategic Flood Risk Assessment, Richmond borough Council, 2021.
4. Local Plan, Richmond borough Council, 2018.
5. Surface Water Management Plan, Richmond borough Council, 2011.
6. CIRIA, Defra, Environment Agency – UK SuDS Manual, 2015.
7. Greater London Authority – London Sustainable Drainage Action Plan, 2015.
8. London Plan (2021) - Mayor of London
9. London Regional Flood Risk Appraisal (2018) - Mayor of London

17 Appendices

17.1 Appendix 1 – Site Photographs

17.2 Appendix 2 – Development Plans

See next page.

PROPOSED

BUTTERFIELD DESIGN

Client: EDWARD PRIOR - GREENWOOD NURSERY SCHOOL

Project: 20 HEATH ROAD, TWICKENHAM. TW1 4BZ

Drawing title: HOLLY ROAD ELEVATION

Drawing number: GNS220224/07

Scale: USE SCALE BAR

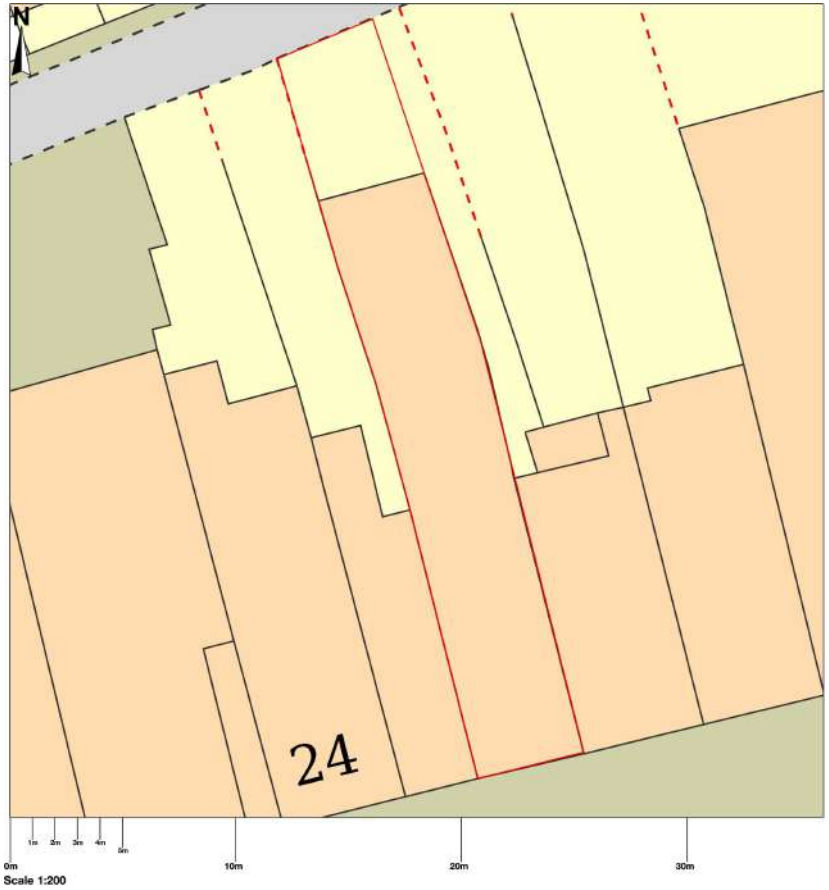
Date: 22-02-2024

Greenwood, 20 Heath Road, Twickenham, TW1 4BZ

Ordnance Survey Licensed Mapping

LOCATION PLAN

Greenwood, 20 Heath Road, Twickenham, TW1 4BZ



Ordnance Survey Licensed Mapping

SITE PLAN

BUTTERFIELD DESIGN

Client: EDWARD PRIOR – GREENWOOD NURSERY SCHOOL
Project: 20 HEATH ROAD, TWICKENHAM. TW1 4BZ
Drawing title: LOCATION/SITE
Drawing number: GNS220224/01
Scale: 1:200/1:1250
Date: 22-02-2024

BUTTERFIELD DESIGN

Client: EDWARD PRIOR – GREENWOOD NURSERY SCHOOL

Project: 20 HEATH ROAD, TWICKENHAM. TW1 4BZ

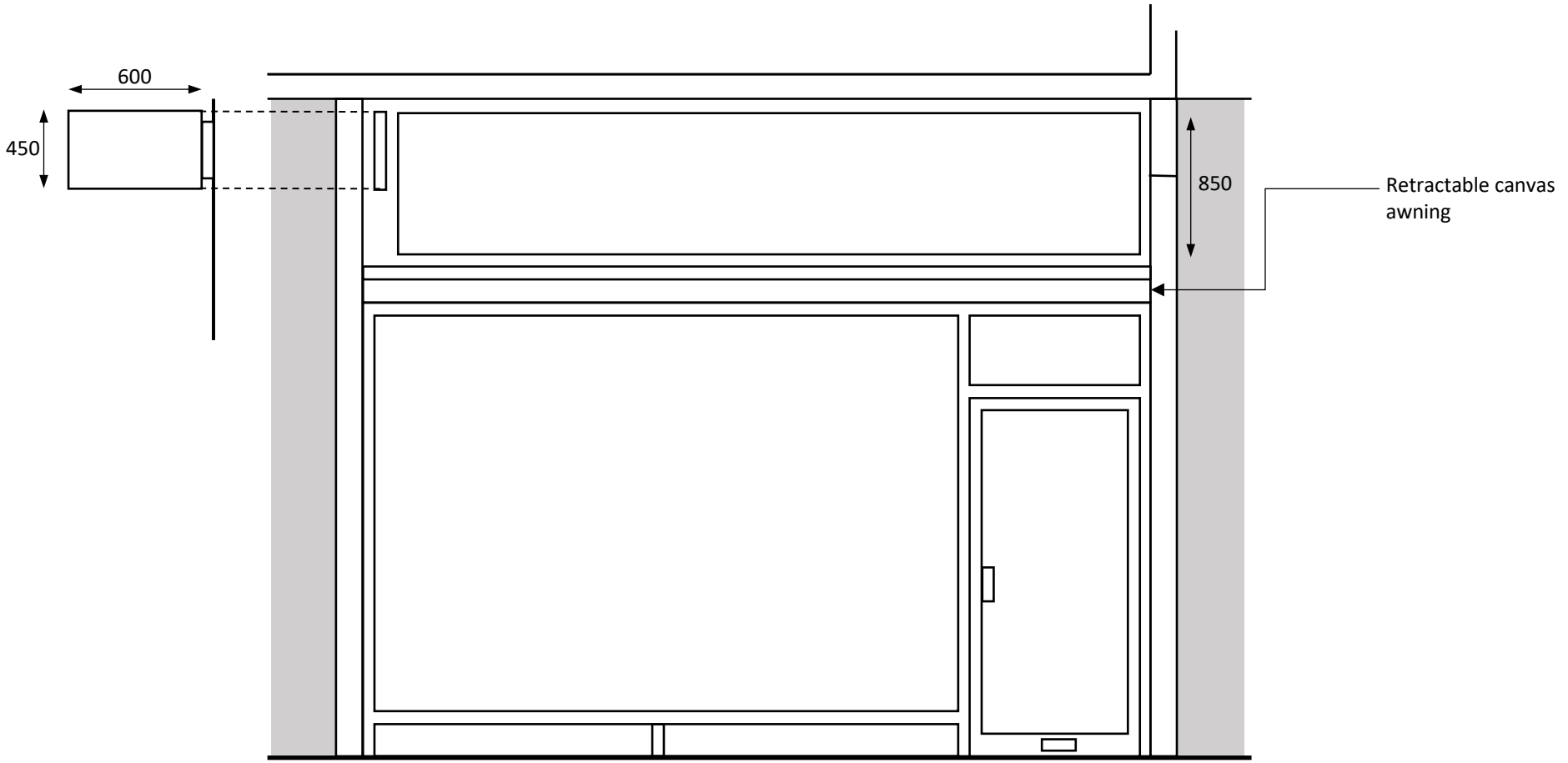
Drawing title: FLOOR PLANS

Drawing number: : GNS220224/02

Scale: USE SCALE BAR

Date: 22-02-2024

EXISTING SHOPFRONT



SCALE BAR - METRES

0 0.5 1 2 3 4 5

BUTTERFIELD DESIGN

Client: EDWARD PRIOR – GREENWOOD NURSERY SCHOOL

Project: 20 HEATH ROAD, TWICKENHAM. TW1 4BZ

Drawing title: EXISTING SHOPFRONT

Drawing number : GNS220224/03

Scale: USE SCALE BAR

Date: 22-02-2024

BUTTERFIELD DESIGN

Client: EDWARD PRIOR - GREENWOOD NURSERY SCHOOL

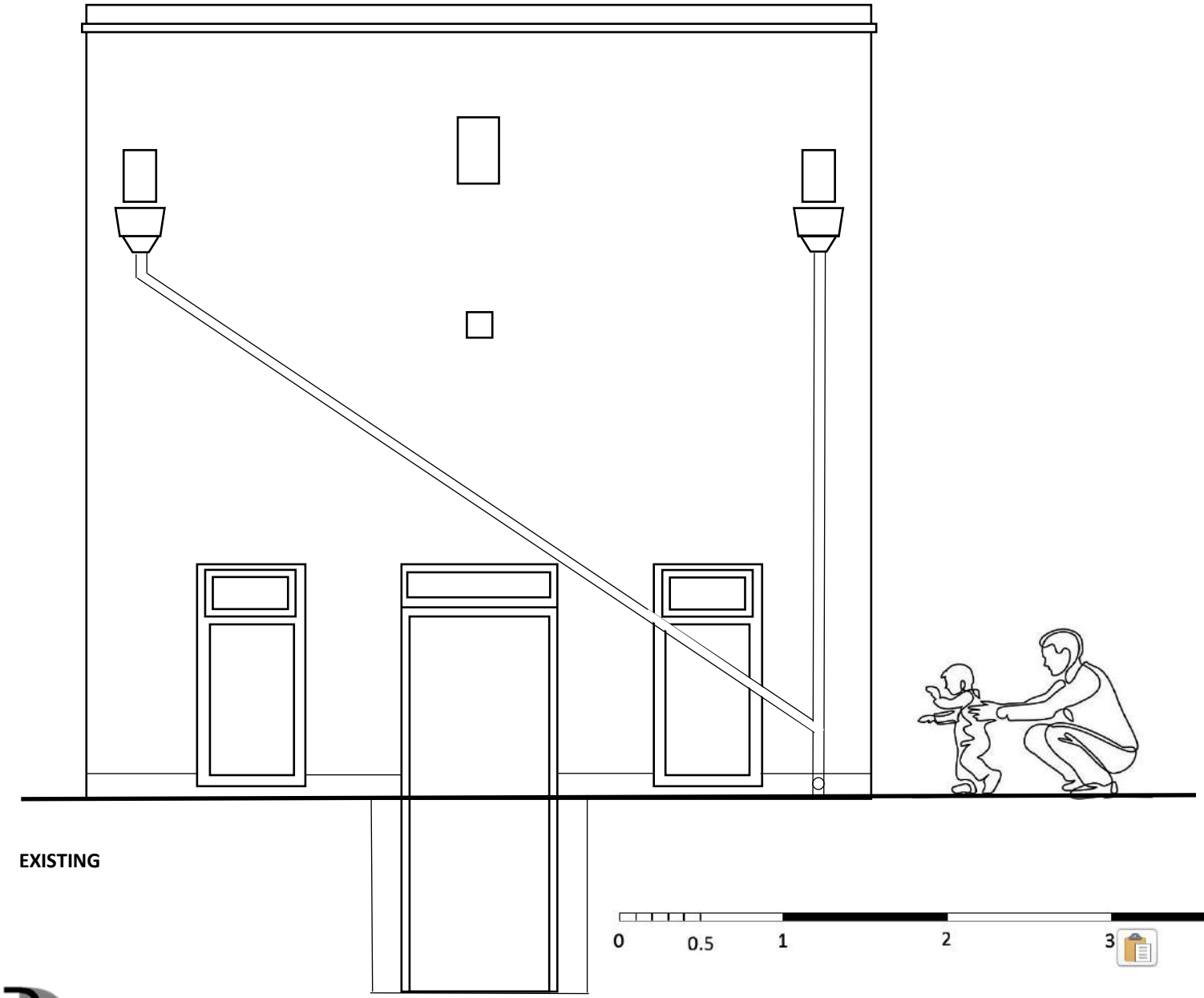
Project: 20 HEATH ROAD, TWICKENHAM. TW1 4BZ

Drawing title: PROPOSED SHOPFRONT

Drawing number: : GNS220224/04

Scale: USE SCALE BAR

Date: 22-02-2024



EXISTING

SCALE BAR - METRES

0 0.5 1 2 3 4 5

BUTTERFIELD DESIGN

Client: **EDWARD PRIOR – GREENWOOD NURSERY SCHOOL**

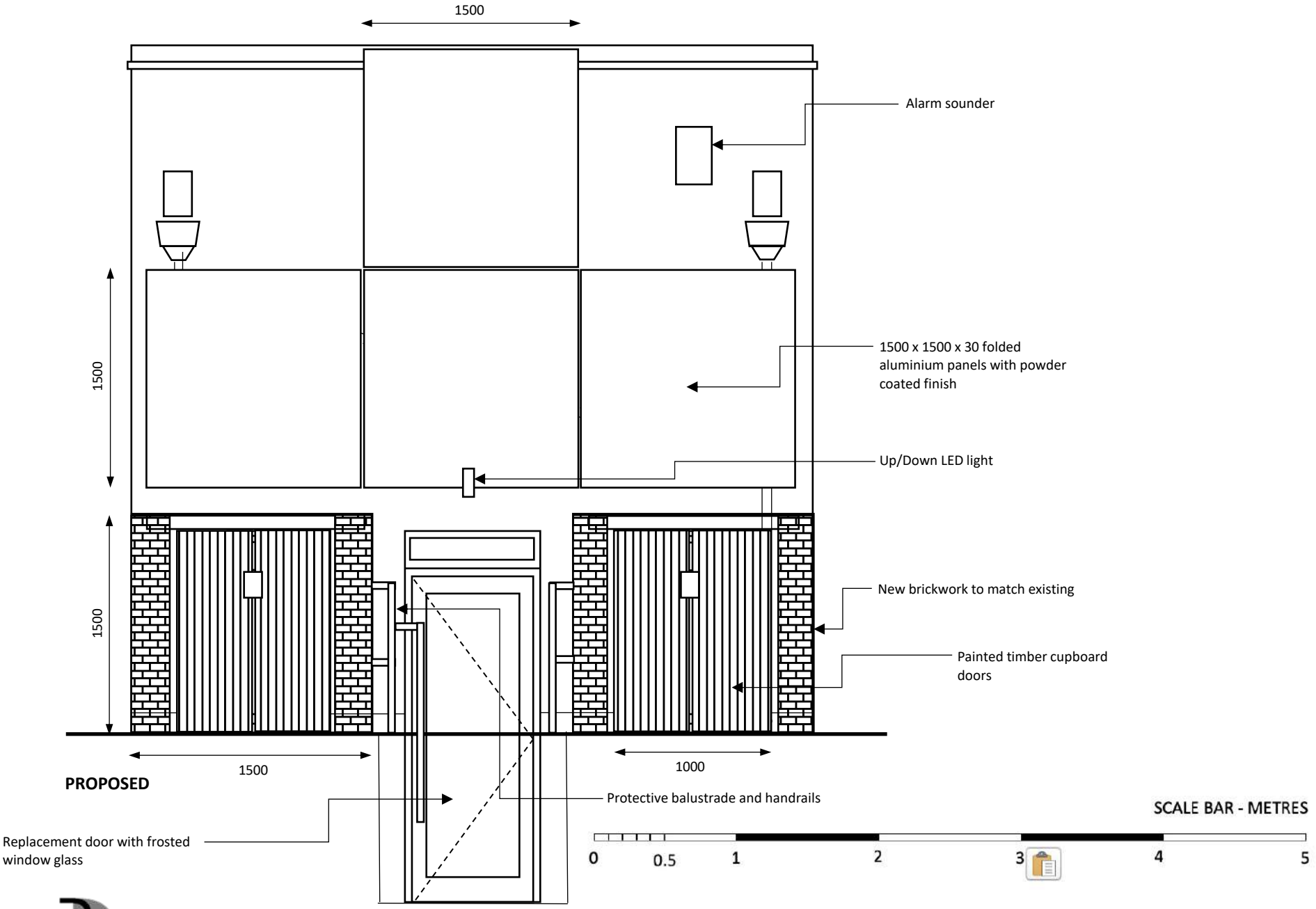
Project: **20 HEATH ROAD, TWICKENHAM. TW1 4BZ**

Drawing title: **HOLLY ROAD ELEVATION**

Drawing number: : **GNS220224/05**

Scale: **USE SCALE BAR**

Date: **22-02-2024**



BUTTERFIELD DESIGN

Client: EDWARD PRIOR - GREENWOOD NURSERY SCHOOL

Project: 20 HEATH ROAD, TWICKENHAM. TW1 4BZ

Drawing title: HOLLY ROAD ELEVATION

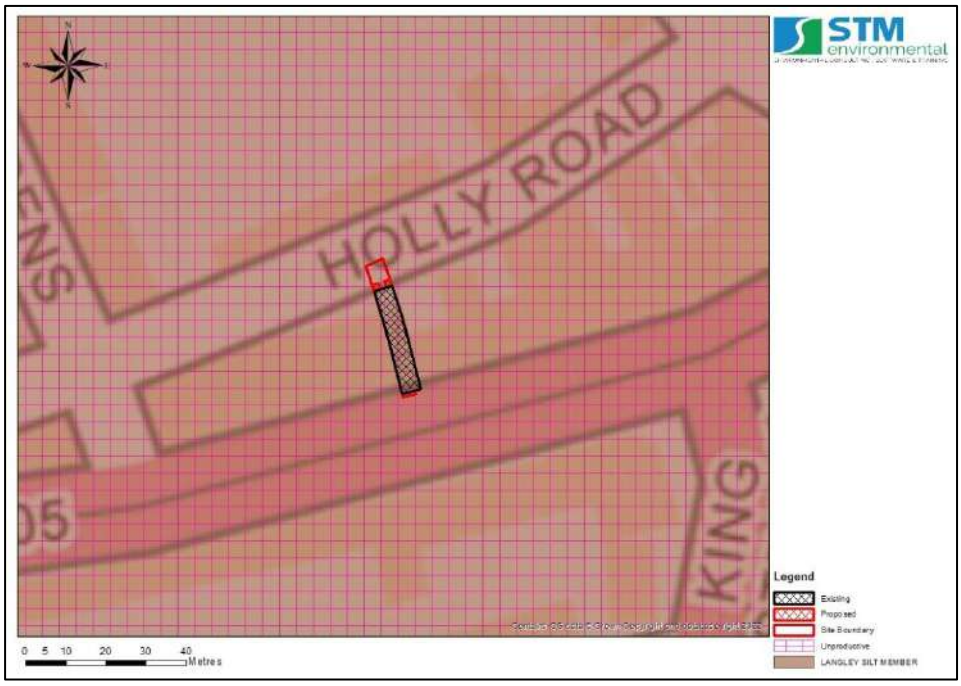
Drawing number: : GNS220224/06

Scale: USE SCALE BAR

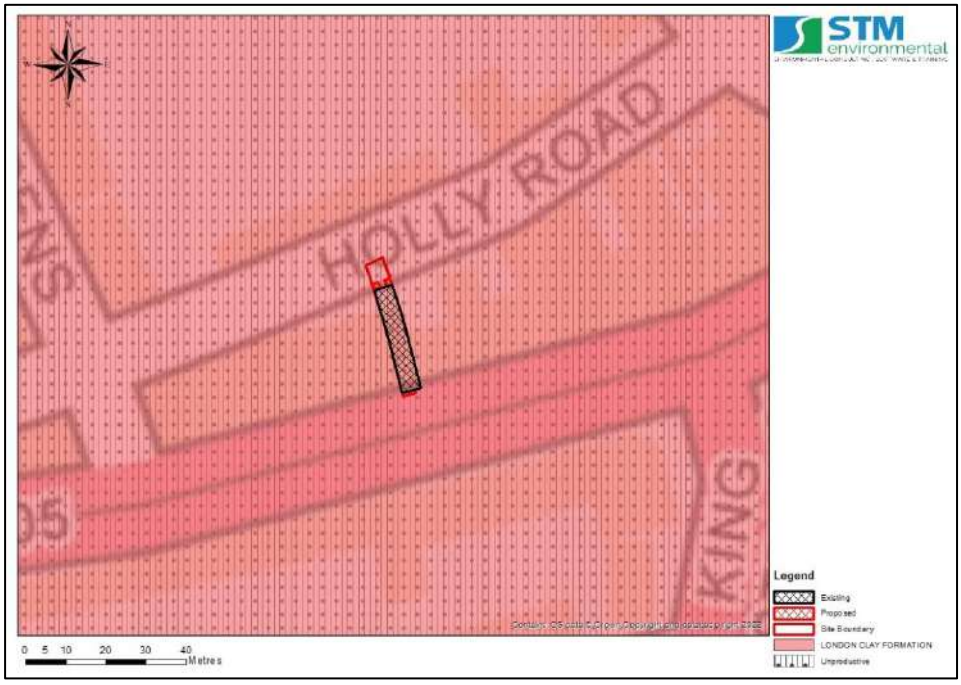
Date: 22-02-2024

17.3 Appendix 3 – Environmental Characteristics

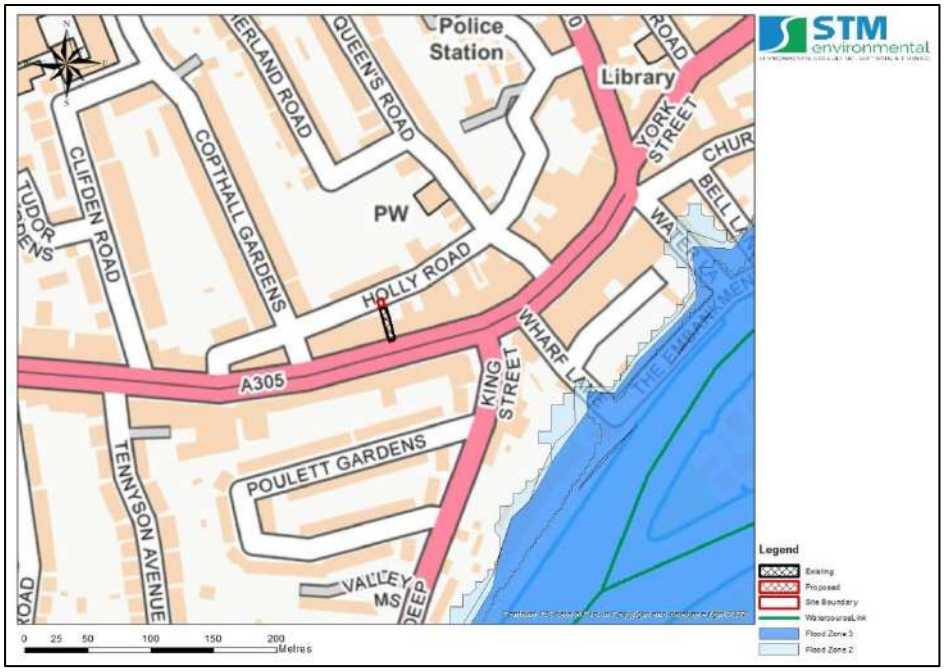
17.3.1 Superficial Hydrogeology Map



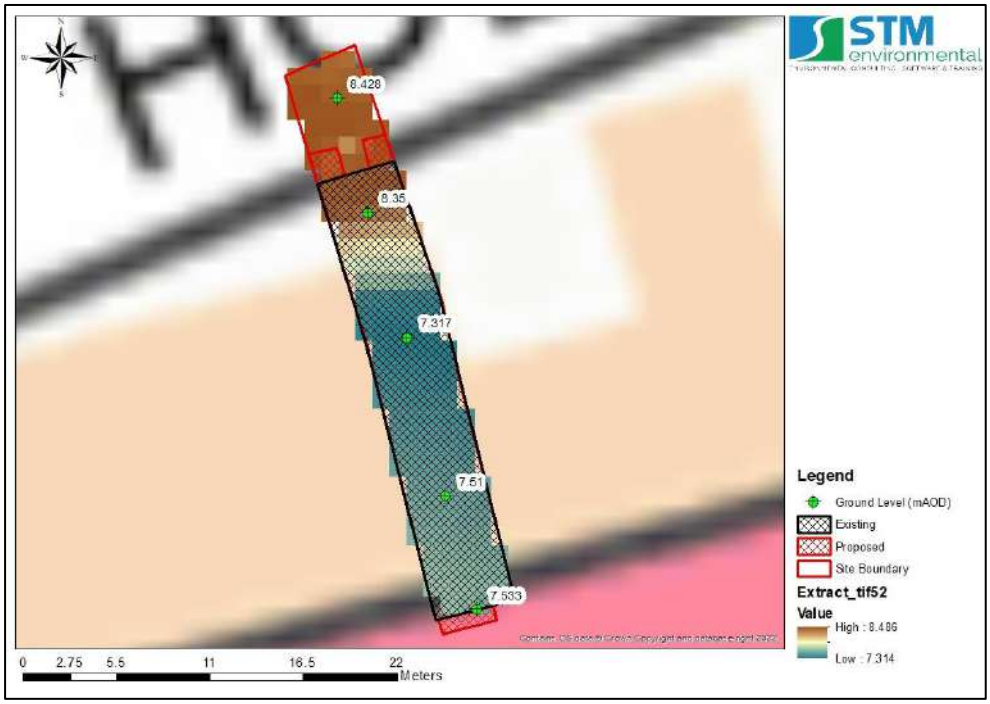
17.3.2 Bedrock Hydrogeology Map

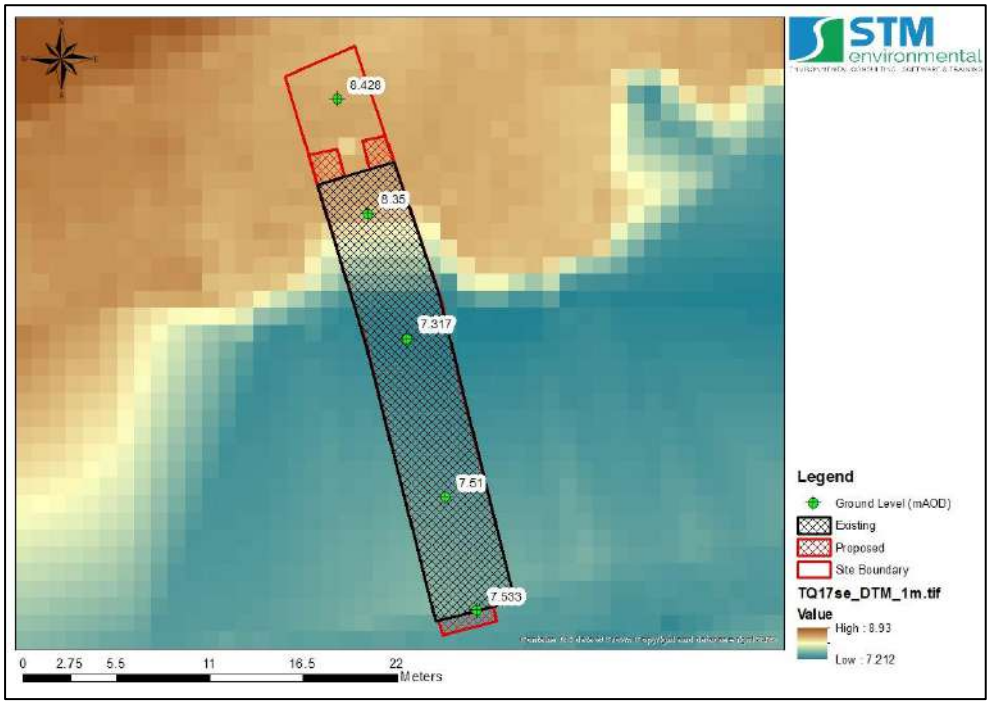


17.3.3 Hydrology Map



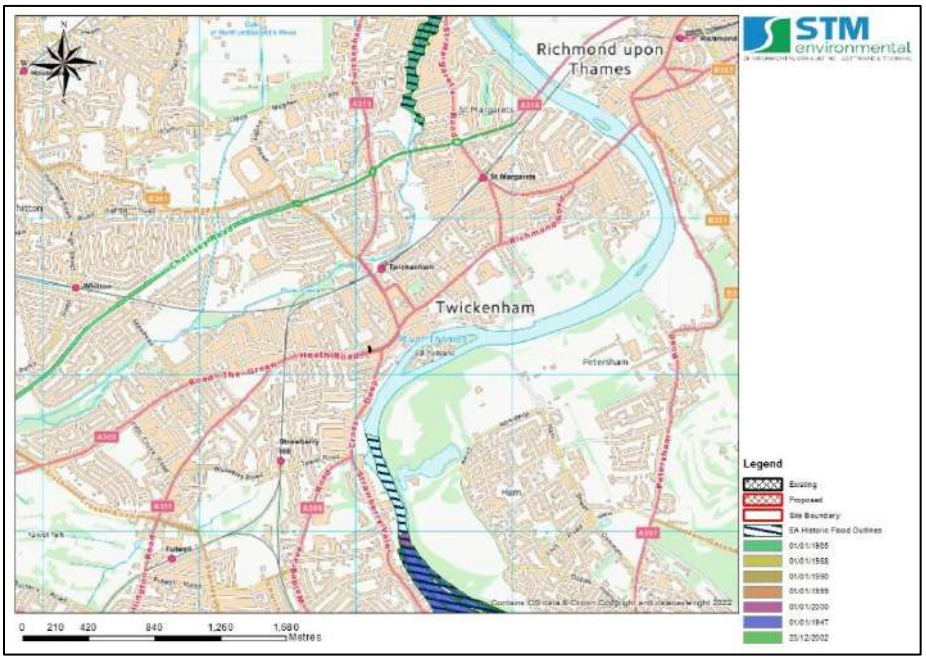
17.3.4 Topography Map





17.4 Appendix 4 – Historical Flood Incident Maps

17.4.1 EA Historic and Recorded Flood Outlines



17.4.2 Map Recorded Historic Flooding

See next page.

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

NORTH

London Borough of Hounslow

London Borough of Wandsworth

London Borough of Merton

Royal Borough of Kingston upon Thames

Surrey County Council

0 0.25 0.5 1 2 Kilometres

Legend

- Borough Administrative Boundary
- Surface Water Flooding Incidents

Flood Depth

- <0.1m
- 0.1m to 0.25m
- 0.25m to 0.5m
- 0.5m to 1.0m
- 1.0m to 1.5m
- >1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.
3. This map provides a strategic overview of surface water flood risk and may be subject to further analysis in the future.

London Borough of Richmond upon Thames

LONDON BOROUGH OF RICHMOND UPON THAMES

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:45,000	20/07/2011	D.SKILTON	E.CRAVEN

Surface Water Flooding Incidents and Surface Water Depth (m) 1 in 100 Chance of rainfall event occuring in any given year (1% AEP)

Consultants
CAPITA SYMONDS Flood Risk Management
Scott Wilson
URS / Scott Wilson
6 - 8 Greencoat Place
London
SW1P 1PL

Drain London Programme Board Members

Environment Agency · Thames Water · LONDON COUNCILS · GREATERLONDONAUTHORITY

FIGURE D - 2

Filepath: N:\Current Projects\D1347785 D1347786 DRAIN LONDON Tier 2\02 Group 8 (D1347786)\05 GIS\WOR - General Figures

17.4.3 Map of Recorded Sewer Flooding

See next page.

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

NORTH

London Borough of Hounslow

TW8 0
TW9 3
TW9 4
TW9 2
TW9 1
TW3 2
TW7 7
TW1 1
TW4 5
TW2 7
TW1 2
TW106
TW1 3
TW2 6
TW1 4
TW2 5
TW107
TW105
TW136
TW121
TW123
TW118
TW119
TW110
TW165
TW122
KT1 4
KT8 1
KT8 9
KT2 5
KT2 7
KT7 0

SW138
SW139
SW130
SW151
SW147
SW148
SW156
SW155
SW154
SW153

London Borough of Wandsworth
London Borough of Merton
Royal Borough of Kingston upon Thames
Surrey County Council

0 0.25 0.5 1 2 Kilometres

Legend

Borough Administrative Boundary

No. of Sewer Flood Records

- None
- 1 - 5
- 6 - 10
- 11 - 20
- 21 - 50
- 51 - 100
- 101+

Notes

1. Sewer flood records relate to internal and external flooding of properties
2. Data supplied by Thames Water Ltd and is correct as at June 2010

London Borough of Richmond upon Thames

LONDON BOROUGH OF RICHMOND UPON THAMES

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:45,000	20/07/2011	D.SKILTON	E.CRAVEN

Recorded Incidents of Sewer Flooding

Consultants
CAPITA SYMONDS Flood Risk Management
Scott Wilson
URS / Scott Wilson
6 - 8 Greencoat Place
London
SW1P 1PL

Drain London Programme Board Members

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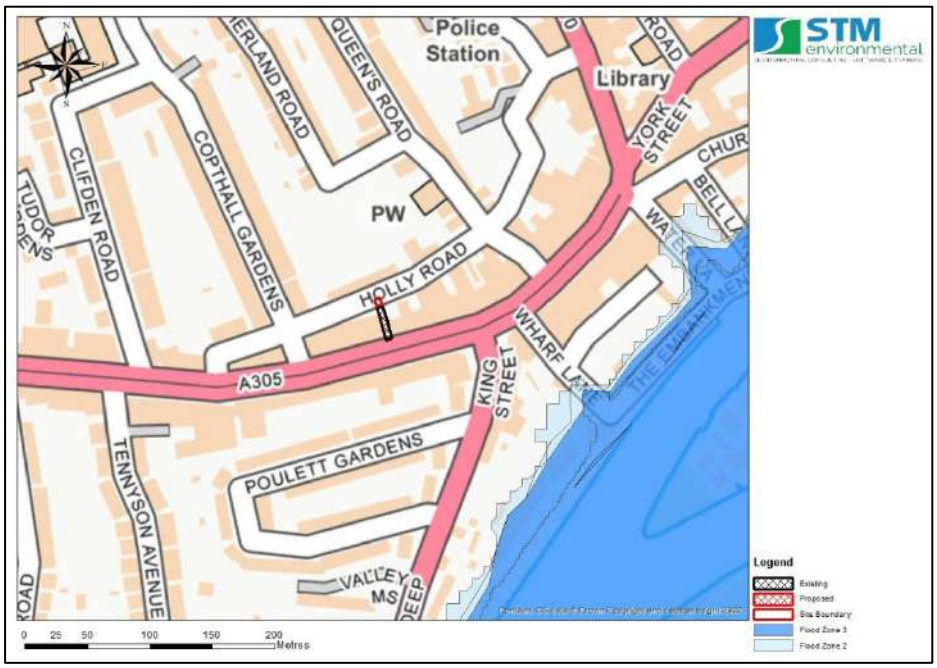
FIGURE D - 5

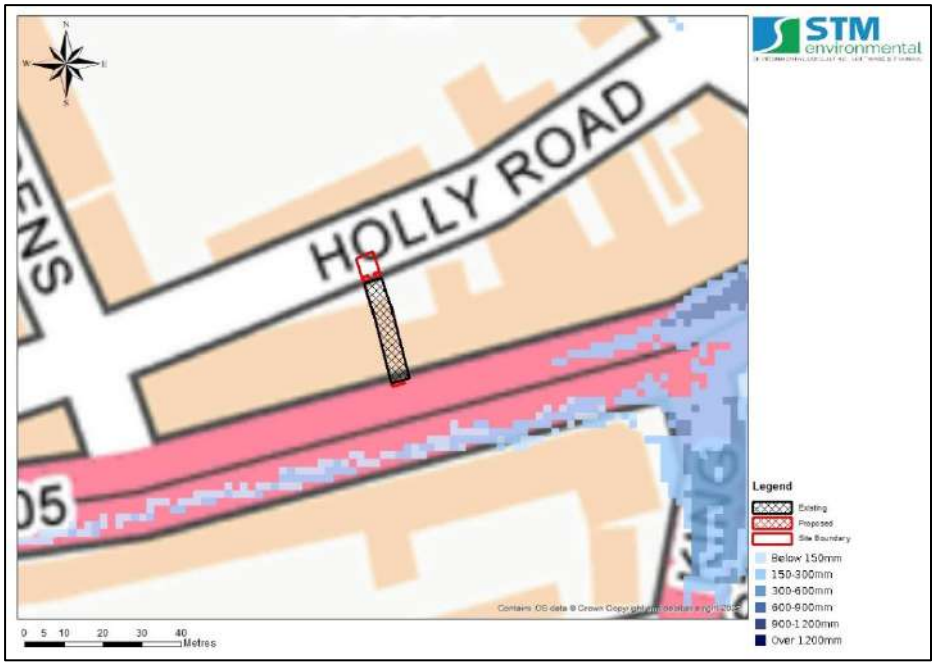
Filepath: N:\Current Projects\D134785 D134786 DRAIN LONDON Tier 2\02 Group 8 (D134786)\05 GIS\WOR - General Figures

17.5 Appendix 5 - EA Flood Zone Map

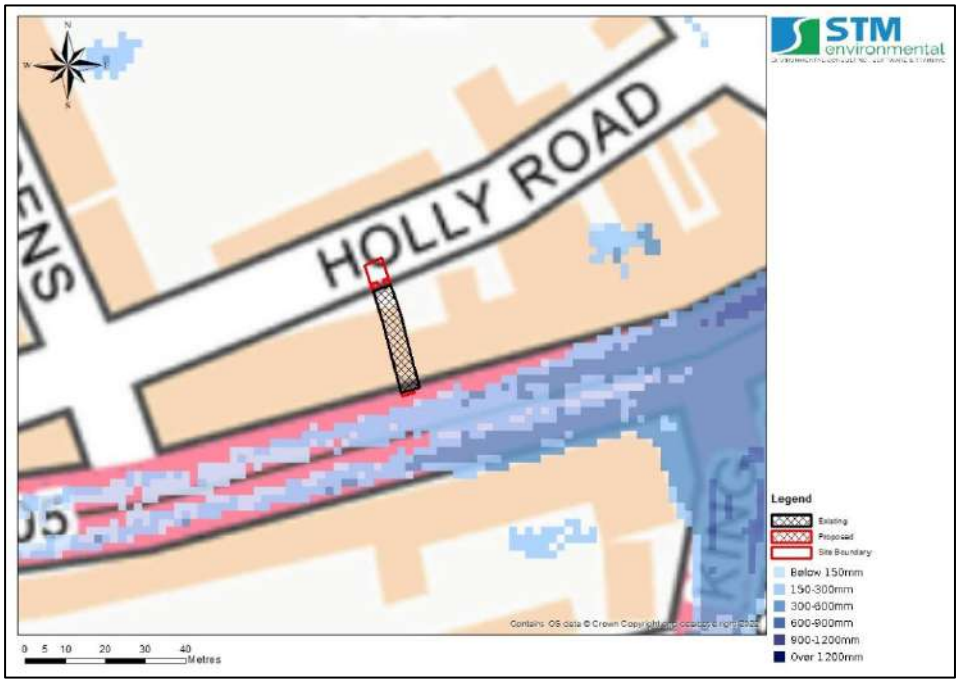


17.6 Appendix 6 – Surface Water Flood Extent and Depth Maps

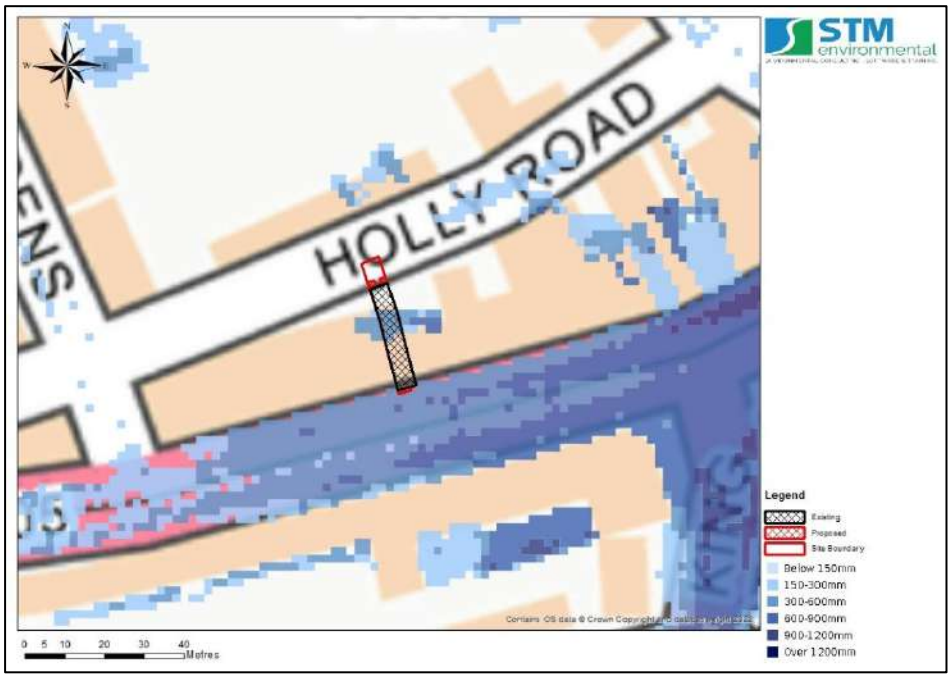
17.6.1 Predicted surface water flood depth for the 1 in 30-year return period (Source: EA, 2016).



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

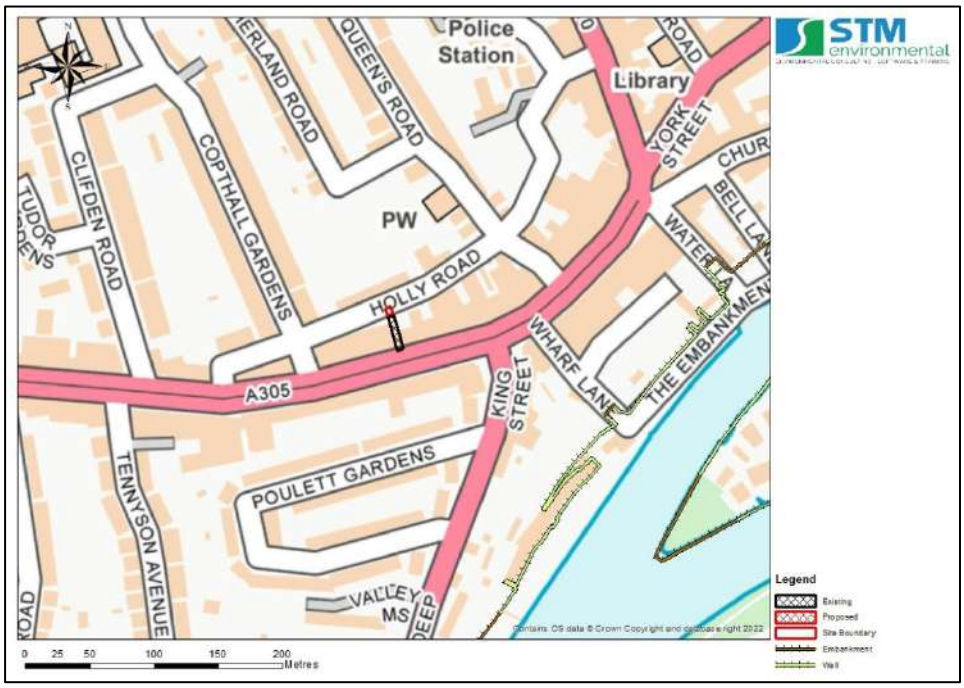


17.6.3 Predicted surface water flood depth for the 1 in 1000-year return period (Source: EA, 2016).



17.7 Appendix 7 –Flood Defence and Reservoir Flood Risk Maps

17.7.1 EA flood defence map



17.7.2 Reservoir Flood Risk Map

17.8 Appendix 8 – Critical Drainage Area

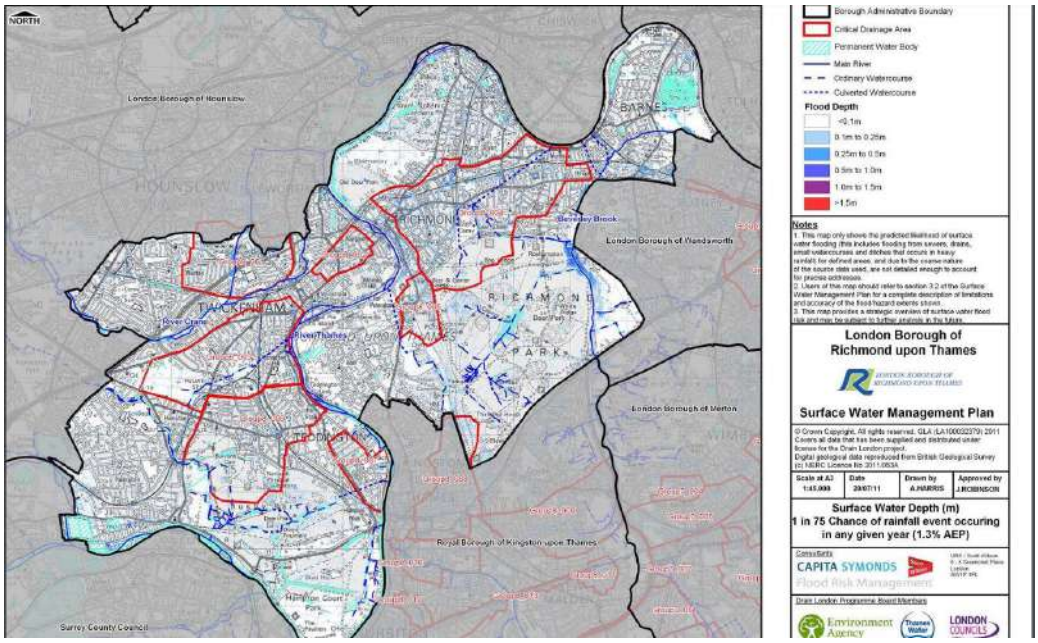
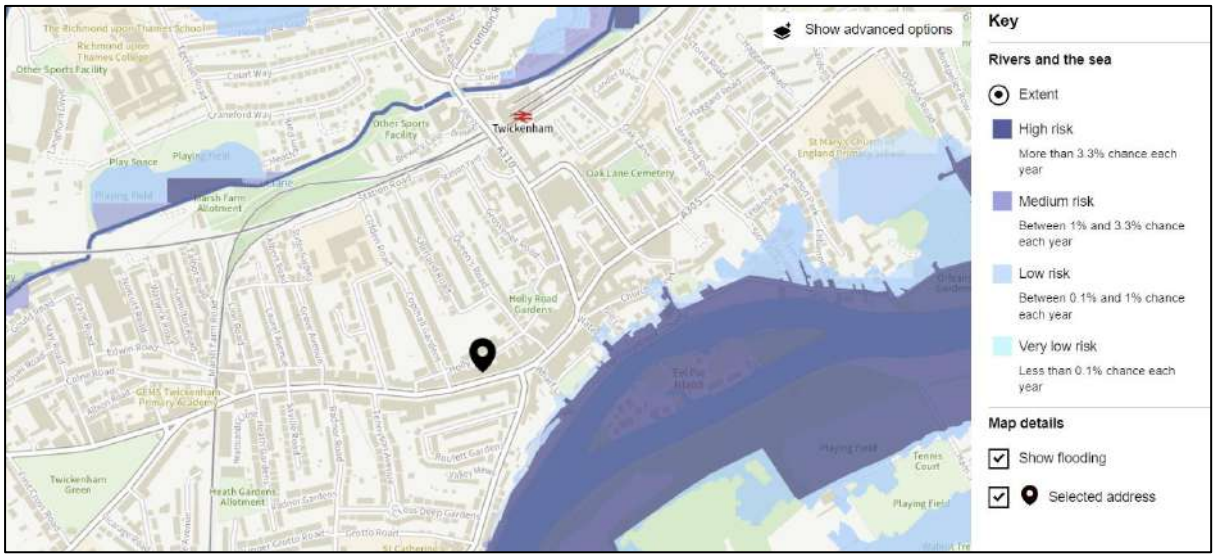
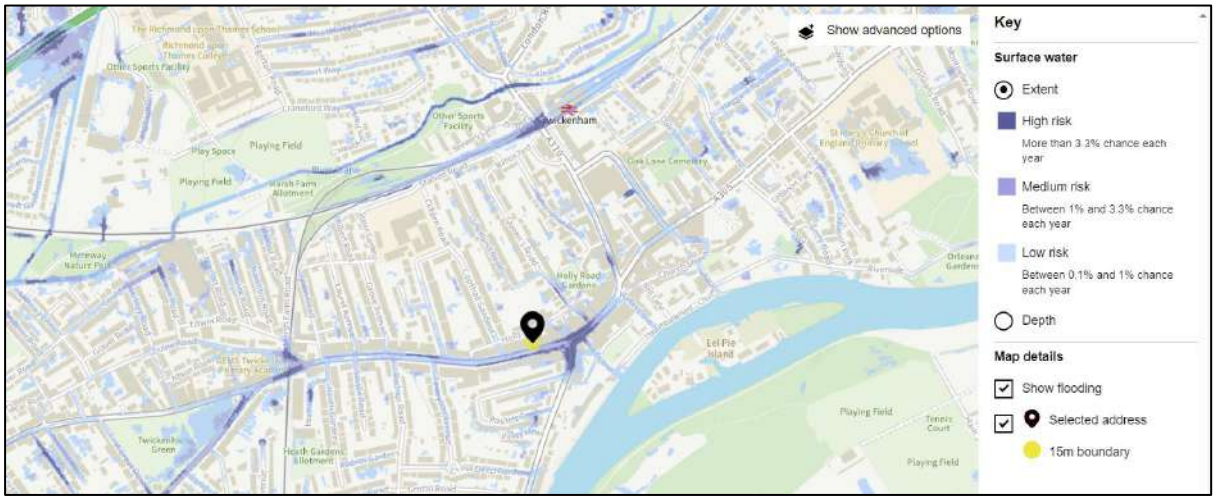


Table 1 Critical Drainage Areas at greatest risk in London Borough of Richmond upon Thames

CDA ID & Name	Infrastructure			Households		Commercial	
	Essential	Highly Vulnerable	More Vulnerable	Non-Deprived	Non-Deprived (Basements)	All	Basements
Group8_004 Richmond Centre	7	1	23	5566	664	575	239
Group8_006 Teddington	3	1	8	2076	147	258	124
Group8_003 Strawberry Hill	1	2	14	1967	56	141	31
Group8_001 Twickenham	1	0	3	1417	8	44	7
Group8_002 St Margaret's	0	0	2	927	174	43	23
Group8_007 Hampton Wick	1	0	1	442	9	15	6
Group8_005 Petersham	0	0	0	55	1	4	1

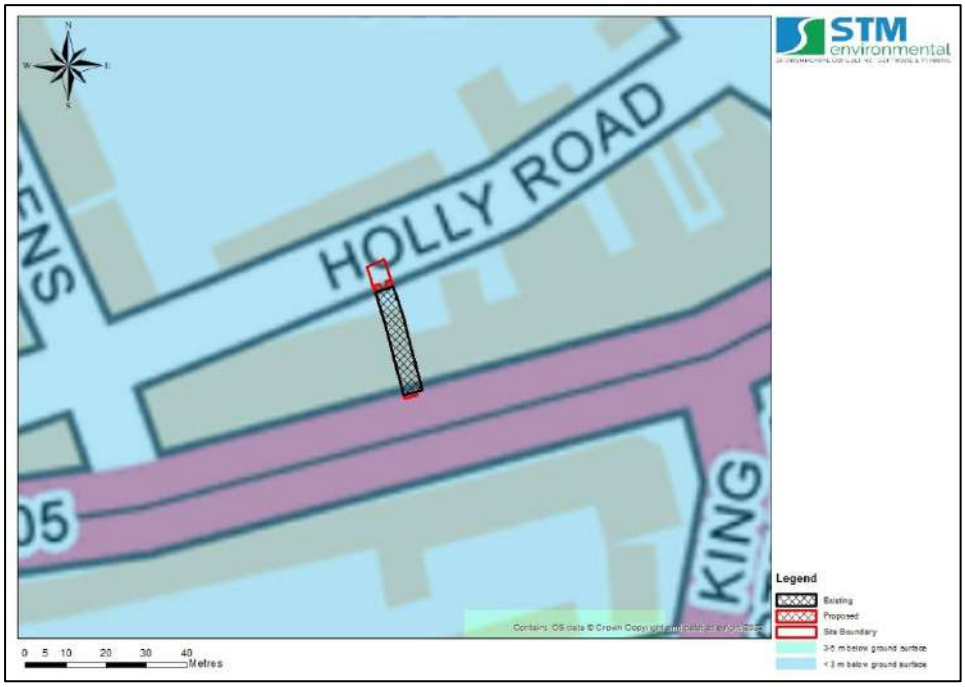
17.9 Appendix 9 – EA's Long Term Flood Risk Maps





17.10 Appendix 10 – Groundwater Flood Maps

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



17.11 Appendix 11 – 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”.