

SEQUENTIAL TEST REPORT



PREPARED FOR THE LONDON BOROUGH OF RICHMOND UPON
THAMES

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Date May 2022
Version 1.2

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REVISION HISTORY

Version	Date	Description	Prepared	Approved
1.0	Dec 2021	First Issue	SG	DC
1.1	Dec 2021	Second Issue	SG	DC
1.2	May 2022	Updated Site Assessments	SG	DC

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ACRONYMS AND ABBREVIATIONS

Abbreviation	Definition
CDA	Critical Drainage Area
EA	Environment Agency
NPPF	National Planning Policy Framework
NPPG	National Planning Policy Guidance
Richmond	London Borough of Richmond upon Thames
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
TW	Thames Water Utilities Limited
WMS	Web Mapping Service

1 INTRODUCTION

1.1 Background

- 1.1.1 The London Borough of Richmond upon Thames (Richmond) is subject to fluvial and tidal flooding from the River Thames. The borough is also at risk of flooding from other flood risk sources, including surface water and groundwater.
- 1.1.2 The purpose of this flood risk Sequential Test Report is to act as a supporting document to the borough's new draft Local Plan. It applies the Sequential Test to the draft Local Plan site allocations to determine their suitability / compatibility for the proposed uses in terms of flood risk. The report (and accompanying site assessments) provides spatial planning and site-specific recommendations to support any potential development opportunities, ensuring that planning policy requirements are met.
- 1.1.3 The outputs of the Sequential Test Report include a Screening Assessment which identifies which site allocations require a detailed Site Assessment, the Sequential Test and the Exception Test. It also includes details covering each flood source (fluvial, tidal, surface water, sewer, groundwater and artificial sources), planning considerations and potential mitigation measures for each assessed site.

1.2 The Local Plan

- 1.2.1 The Local Plan is the key planning document for the borough of Richmond. It sets out policies and guidance to shape the built environment, plan and manage growth and guide development across the borough over a 15-year period.
- 1.2.2 The Pre-Publication Version Local Plan was brought to committee and adopted in November 2021. It includes 37 sites which have been identified to accommodate a range of uses in accordance with the policies contained within the Local Plan document. The proposed land uses set out in this report should be read in conjunction with the Pre-Publication Version Local Plan.
- 1.2.3 To determine the most suitable areas in terms of flood risk, the Sequential Test has been applied to all 37 sites. Any changes to the Local Plan as it moves towards Examination may require reconsideration of the Sequential Test.

1.3 Level 1 SFRA

- 1.3.1 The Richmond [Level 1 Strategic Flood Risk Assessment](#) (SFRA) was last updated during 2020-2021. The final version was published in March 2021. The SFRA outlines the planning and flood risk requirements as defined by the [National Planning Policy Framework](#) (NPPF) and provides a strategic overview of all forms of flood risk throughout the borough, now and in the future. The SFRA includes an online map that defines areas of flooding in the borough according to various levels of risk from the River Thames, its tributaries, and other sources such as surface water. Local requirements were also addressed as a part of this SFRA including climate change impacts, localised flood issues, and specific policies and interpretations of the Flood Zones.

1.3.2 Flood Risk Assessment Guidance in Section 6 of the [SFRA](#) defines the requirements for the Sequential and Exception Tests and includes borough specific policies relating to flood risk. This guidance forms the basis for the Screening Assessment and Site Assessments which were produced as a part of this Sequential Test Report.

1.4 Sequential Test

1.4.1 The [NPPF](#) requires that a sequential, risk-based approach to the location of development is taken to avoid, where possible, the risk of flooding to people and property. The Sequential Test requires that proposed development sites are located within areas of lowest flood risk. Only if it can be demonstrated that there are no suitable sites within the wider search area then alternative sites (i.e., within areas that may potentially be at risk of flooding) can be considered. In this case, the Exception Test is required to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available. The methodology for the application of the Sequential and Exception Tests are outlined in Section 6.3.1 of the [SFRA](#).

1.4.2 In line with local policy and requirements, Richmond has adopted its own local Sequential Test approach and development requirements for town centres, local centres and islands. The application of this approach is outlined in Section 6.2 of the [SFRA](#) and summarised in [Section 4](#) of this Report. *Figure 1-1* shows the sequential approach applied in this report

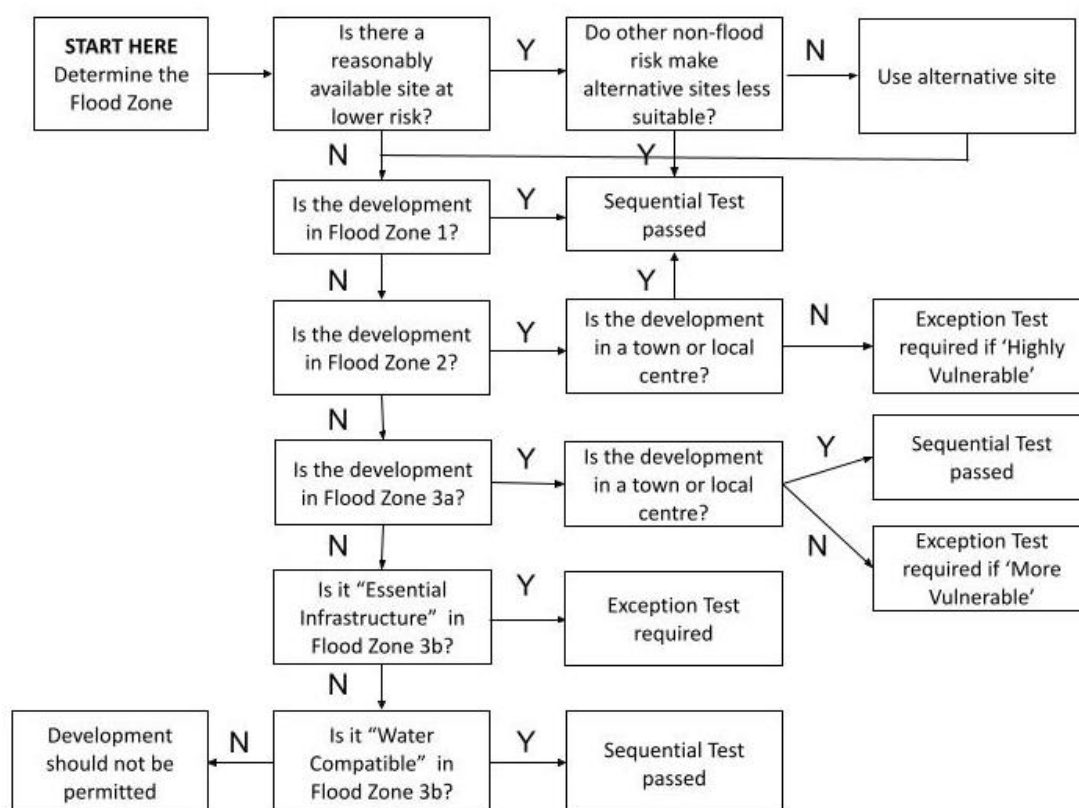


Figure 1-1 Sequential Test Methodology (following NPPF approach)

2 PLANNING AND POLICY FRAMEWORK

2.1 National, Regional and Local Policy Context

- 2.1.1 This Sequential Test Report has been produced in line with national, regional, and local policy. The purpose of these policies is to ensure that development does not increase the risk of flooding. They ensure that property development is steered away from areas of greater flood risk to keep people safe from flooding. Although, the policies referenced as part of the Level 1 SFRA are relevant to this assessment, there are several other policy documents that provide specific guidance and requirements that relate to this Sequential Test Report.
- 2.1.2 [The National Planning Policy Framework](#) (NPPF) and associated [National Planning Practice Guidance](#) (NPPG) is the national policy that require Local Authorities to use the flood risk 'Sequential Test' in the planning system. They introduce the purpose and requirements of the Sequential and Exception Tests, while the Level 1 SFRA provides the basis for their application.
- 2.1.3 The Sequential Test is designed to steer development to areas at low risk from flooding, in preference to areas at higher risk, and should be applied to all prospective development areas and sites. The Exception Test is designed to follow the Sequential Test where necessary. It should be applied if it has been determined that a development cannot be in an area with a lower risk of flooding.
- 2.1.4 The London Plan and the draft Local Plan include policies which require developments to avoid, minimise or mitigate the impacts of all kinds flooding taking into account the expected effects of climate change. Development will be guided to areas of lower risk of flooding by applying the 'Sequential Test', as set out in national policy guidance, and where necessary, the 'Exception Test' will be applied. This is set out in Policy 8 'Flood Risk and sustainable drainage' (LP8) in the draft Local Plan.
- 2.1.5 The Level 1 [SFRA](#) provides a section on Planning and Policy Framework. This section provides an informative breakdown of the national, regional, sub-regional and local policy that LPAs, planners, and developers should follow as part of the development proposal process.

2.2 Vulnerability Classifications

- 2.2.1 The flood risk vulnerability classification that is required for the Sequential Test is outlined in Annex 3 of the NPPF. It is summarised in *Table 2-1*.

Table 2-1 Flood risk vulnerability classification (as outlined in Annex 3 of the NPPF)

Essential Infrastructure
<ul style="list-style-type: none"> • Essential transport infrastructure which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons e.g., infrastructure for electricity supply (including generation, storage and distribution systems) • Wind turbines. • Solar farms.
Highly Vulnerable
<ul style="list-style-type: none"> • Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent.
More Vulnerable
<ul style="list-style-type: none"> • Hospitals • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non-residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Holiday or short-let caravans and camping sites (subject to a specific warning/evacuation plan.)
Less Vulnerable
<ul style="list-style-type: none"> • Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops; financial, professional, and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place. • Car parks.
Water Compatible
<ul style="list-style-type: none"> • Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas and wharves. • Navigation facilities. • Ministry of Defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

2.3 Flood Zones

2.3.1 The EA have defined Flood Zones to show the probability of tidal and / or fluvial flooding. Providing indicative flood risk information, the Flood Zones are a tool used in the Sequential and Exception test, as a part of the planning process. The Flood Zones are defined within PPG 'Flood Risk and Coastal Change', [Table 1](#). They are defined as:

- **Flood Zone 1** (Low Probability): Land having a less than 1 in 1,000 annual probabilities of river or sea flooding.
- **Flood Zone 2** (Medium Probability): Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between 1 in 200 and 1 in 1,000 annual probability of sea flooding.
- **Flood Zone 3a** (High Probability): Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.

As recommended in the [SFRA](#), Richmond have also implemented the 1 in 100 year surface water extent as Flood Zone 3a (surface water) for the purpose of applying the Sequential and Exception Tests.

- **Flood Zone 3b** (Functional Floodplain): This zone is comprised of land where water must flow or be stored in times of flood. This should be defined by Local Planning Authorities within their SFRAs. Flood Zone 3b is defined in Section 5.5.1 of Richmond's [SFRA](#) as the following:

"Land within EA modelled fluvial and tidal flood risk extents predicted for up to and including 1 in 20-year return period events, allowing for the impact of flood defences. It also includes land featured as part of the EA's Flood Storage Areas dataset."

2.3.2 The borough contains several islands in the River Thames. For the purpose of planning and in line with LP8 in the draft Local Plan, the islands which have their access and egress routes in Flood Zone 3b (functional floodplain) should be “*considered and treated as functional floodplain (Zone 3b), even if parts of the islands may be within an area of lower probability of flooding.*” More information of island development requirements and other borough specific policies is provided in [Section 4](#).

2.4 Flood Risk Vulnerability and Flood Zone Compatibility

2.4.1 The PPG Flood Risk Vulnerability and Flood Zone Compatibility table provides guidance on the types of development that may be considered as suitable within each Flood Zone. It sets out some circumstances where the Exception Test will need to be applied following the Sequential Test. This shown in *Table 2-2* below.

Table 2-2 Flood risk vulnerability and Flood Zone Compatibility

Flood Zone	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 †	X	Exception Test Required	✓	✓
Zone 3b	Exception Test Required *	X	X	X	✓*

Key

✓ Development is appropriate

X Development should not be permitted

† In Flood Zone 3a essential infrastructure should be designed and constructed to remain operation and safe in times of flood.

* In Flood Zone 3b essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

- Remain operational and safe for users in time of flood
- Result in no net loss of floodplain storage
- Not impede water flows and not increase flood risk elsewhere

3 SCREENING ASSESSMENT

3.1 Methodology

- 3.1.1 A high-level screening assessment of current site allocations within Richmond was undertaken as part of this Sequential Test Report. This assessment included a spatial analysis of the proportion of site area within each of the defined Flood Zones, the potential impact of climate and proximity to local and town centres. It included an initial appraisal on whether the Sequential Test and Exception Test were required. It indicated whether a more detailed site assessment was needed. Specific recommendations for the allocated sites are included in Appendix 3 in a spreadsheet format that can be filtered on assessment parameters as required.
- 3.1.2 The assumptions applied for the assessment are summarised below:
- Flood Zone 3a (surface water) is defined using the full 1 in 100-year extent from the EA Risk of Flooding from Surface Water Map as per the SFRA.
 - Site allocations with proposed uses across multiple vulnerability classification have been given the most conservative (vulnerable) classification.
 - Sites with 0% of areas in Flood Zones 2 and 3a/b do not require the Sequential Test (on the basis that other forms of flood risk are generally manageable on a site-by-site basis)
 - 'Less Vulnerable' sites within Flood Zone 2 and 3a/b require the Sequential Test except if they are within a town or local centre.
 - 'More Vulnerable' sites within Flood Zone 2 and 3a/b require the Sequential Test except if they are within a town or local centre.
 - 'More Vulnerable' sites within 3a require the Exception Test.
 - A detail assessment is required for any site which is within Flood Zone 2, 3a or 3b (fluvial/ tidal) or which 25% of the site area was within the climate allowance extent (1 in 100-year flood event +35% CC). These sites have not yet passed the Sequential Test and there is a need to consider whether the Exception Test needs to be implemented through a site assessment. The site can still be deemed suitable for the proposed development should it pass further stages of the Sequential and Exception Tests.

3.2 Screening Summary

- 3.2.1 All 37 site allocations in the draft Local Plan were included in the Screening Assessment. Sites required a Sequential Test if they were situated partially or fully within fluvial/tidal Flood Zone 2, 3a or 3b or Flood Zone 3a (surface water). Sites which were 'More Vulnerable' and fully or partially in Flood Zone 3a (fluvial/tidal and surface water) also required an Exception Test.
- 3.2.2 The screening process determined that 21 sites required the Sequential Test and of these, 14 also required the Exception Test. Sites within town or local centres did not require a Sequential or Exception Test. Site Assessments were completed for the sites with the highest risk of flooding. Sites with fluvial/tidal flooding were prioritised and a site assessment was carried out for all sites within Flood Zone 2, 3 or 3a. 10 sites were triggered for a site assessment by fluvial/tidal flooding. Sites with an area greater than 25% in the RoFSW 1 in 100-year flood extent were also included in the trigger criteria for a detailed Site Assessment. However, no further sites were triggered by this. *Table 3-1* summarises the results of the screening assessment and **highlights in bold** which sites have more detailed assessment in Appendix 4

Table 3-1 Summary of all the site included in Screening Assessment

SFRA ID	Site Name	Site Assessment	Sequential Test	Exception Test
SA1	Hampton Square	No	Yes	Yes
SA2	Platts Eyot, Hampton	Yes	Yes	No
SA3	Hampton Traffic Unit	No	No	No
SA4	Hampton Delivery Office	No	No	No
SA5	Carpark for Sainsburys	No	Yes	No
SA6	Telephone Exchange, Teddington	No	No	No
SA7	Teddington Delivery Office, Teddington	No	No	No
SA8	Strathmore Centre	No	No	No
SA9	Teddington Police Station	No	No	No
SA10	St Mary's University, Strawberry Hill	Yes	Yes	Yes
SA11	Richmond upon Thames College, Twickenham	Yes	Yes	Yes
SA12	Harlequins Rugby Football Club	No	Yes	Yes
SA13	Twickenham Stadium	Yes	Yes	Yes
SA14	Mereway Day Centre	Yes	Yes	No
SA15	Station Yard, Twickenham	No	No	No
SA16	Twickenham Telephone Exchange	No	No	No
SA17	Twickenham Police Station	No	No	No
SA18	Twickenham Riverside and Water Lane/King Street	Yes	No	No
SA19	Whitton Telephone Exchange	No	Yes	No
SA20	Kneller Hall, Whitton	No	Yes	No
SA21	Whitton Community Centre and Car Park	No	No	No
SA22	Ham Close	No	Yes	Yes
SA23	Cassel Hospital	No	Yes	Yes
SA24	Richmond Station	No	No	No
SA25	Former House of Fraser	No	No	No

SFRA ID	Site Name	Site Assessment	Sequential Test	Exception Test
SA26	Richmond Telephone Exchange	No	Yes	Yes
SA27	American University	No	Yes	Yes
SA28	Homebase	No	Yes	Yes
SA29	Sainsburys, Lower Richmond Road	No	No	No
SA30	Kew Retail Park	Yes	Yes	Yes
SA31	Kew Biothane Plant	Yes	Yes	Yes
SA32	Pools on the Park and surroundings	No	No	No
SA33	Richmond Athletic Association Ground	No	Yes	No
SA34	Stag Brewery	Yes	Yes	Yes
SA35	Mortlake and Barnes Delivery Office	Yes	Yes	No
SA36	Telephone Exchange, East Sheen	No	No	No
SA37	Barnes Hospital, East Sheen	No	Yes	Yes

4 KEY SPECIFIC POLICIES

4.1 Background

- 4.1.1 Richmond has several borough specific policy zones which have locally defined development requirements. This includes the River Thames islands, the town and local centres and throughflow catchment areas.
- 4.1.2 The islands within the River Thames are a valued feature of Richmond. However, these islands are all entirely within Flood Zone 2, and a large proportion of their total area coverage is within Flood Zone 3a and Flood Zone 3b. To manage this flood risk while preserving the Island's unique character, the borough has defined specific requirements for developing on them.
- 4.1.3 Many of the borough's properties are located in and around town centres and local centres. Some centres are within Flood Zone 2 and 3, however relocating development away from these centres is not always a realistic option due to the community role these areas play in the borough. To sustain the continuing role of these centres, development can be used as a way to help manage and reduce flood risk in these areas. As a result, the EA has approved a local Sequential Test approach to be applied in these areas.
- 4.1.4 Finally, an initial investigation into subsurface flooding in the Richmond Hill area identified groundwater influenced throughflow as a potential risk of flooding. A further three catchments were identified by the 'Further Groundwater Investigations' project (2020) as having increased risk of flooding due to throughflow. These four 'throughflow catchment areas' have specific policies to reduce this potential flood risk.

4.2 Dry Islands and Islands

Islands

- 4.2.1 There are ten sets of islands under the administration of the London Borough of Richmond upon Thames. These islands are listed, along with additional information, in Section 6.2.4 in the [SFRA](#). The specific policies which affect development on these islands are summarised below:
- Islands with site access and egress routes within the functional floodplain are considered Flood Zone 3b, even if parts of the islands may be within an area of lower probability of flooding.
 - New developments are restricted to 'Water Compatible' and 'Essential Infrastructure' as per the application of the Sequential and Exception Tests where required.
 - Redevelopment of a building on a 'like for like' basis is permitted.
 - Building redevelopment must ensure that there is no increase in the number of people at risk, therefore the number of dwellings cannot be increased if redevelopment required a building to be knocked down and another one built in its place.

Dry Islands

- 4.2.2 'Dry Islands' refers to locations that are surrounded by areas at higher risk of flooding (i.e., areas falling within Flood Zone 2 and 3). 'Dry Islands' are considered flood risk areas due to the potential loss of important local services during flood events and lack of safe access routes.
- 4.2.3 The specific policies which affect development on these 'dry islands' are as follows:
- 'Dry Islands' require safe access and egress routes to be developed for the lifetime of the property, factoring the impacts of climate change.
 - An emergency plan must be submitted along with the planning application and must address this risk and provide appropriated management measures.

4.3 Local and Town Centres

- 4.3.1 There are five designated town centres and seven local centres in the borough. They are listed, along with further information, in Section 6.2 in the [SFRA](#). The local Sequential Test approach dictates that the Sequential Test or Exception Test will not be required if the development proposal meets at least one of the following:
- It is within a town centre or local centre boundary.
 - It is for residential development or a mixed-use scheme and within the 800m buffer area identified within the town centre or local centre (*This was not included in the Screening Assessment to ensure that all sites at high risk were properly assessed*).

4.4 Throughflow and Groundwater Policy

- 4.4.1 More information on the 'throughflow catchment areas' is outlined in Section 7.3 in the [SFRA](#). The specific policies which affect development within these catchments are as follows:
- A Basement Screening Assessment must be carried out for all basement and cellar proposals in the throughflow catchment areas. [The Basement Assessment User Guide](#) and the [Further Groundwater Investigations](#) Report (2021) provides details of questions which should be addressed for proposed developments within the 'throughflow catchment areas'. In general, the Screening Assessment should address the following:
 - a. Subterranean characteristics
 - b. Land stability (including site slope)
 - c. Flood risk and drainage (including throughflow, groundwater and surface water)
 - Basement and cellar developments within these throughflow and groundwater policy zones must be confined to the curtilage of the site.
 - If the proposed subsurface development may have an impact on the local environment, or if further investigation work is required, then a Basement Impact Assessment, carried out and signed off by a chartered professional, is required.

5 MITIGATION REQUIREMENTS

Table 5-1 Mitigation Requirements for sites

No.	Mitigation Requirement	Applicable Area
5.1	Only water compatible or essential infrastructure (subject to an exception test) are permitted	Flood Zone 3b
5.2	Finished floor levels are set no lower than 300mm above the 1 in 100 year + 35 CC return period event.	Flood Zone 2 and 3 (Fluvial flood risk)
5.3	Finished floor levels of all developments are set above the modelled Thames tidal breach flood level for the year 2100. As a minimum, any sleeping accommodation must be located above this breach level. 400mm freeboard should be added to the design water levels.	Flood Zone 2 and 3 (Tidal flood risk)
5.4	Proposed new developments must be 8m away from the Main River. Developments within this buffer zone require a flood risk activity permit from the EA in addition to planning permissions.	8m buffer area around Main Rivers
5.5	Proposed new developments must be 16m away from the Thames tidal defences. Any development within this distance from tidal defence structures or culverts require a flood risk activity permit from the EA in addition to planning permissions.	16m buffer area around Thames tidal defences
5.6.	Development sites within 5m of ordinary watercourses require an approved ordinary watercourse consent in addition to planning permission. The consent, a variation of Section 23 of the Land Drainage Act 1991, is regulated and enforced by the Lead Local Flood Authority at the London Borough of Richmond upon Thames	5m buffer area around ordinary watercourses
5.7	Flood Emergency Plan are required for all major developments and for minor developments where safe access / egress cannot be achieved and demonstrated as part of the FRA. This should be submitted along with planning application to be approved by the London Borough of Richmond upon Thames'.	Flood 2 and 3, RoFSW 1 in 100 years, any proposal where safe access / egress cannot be achieved.
5.8	If the development decreases the volume of a fluvial flood plain, flood storage compensation must be provided. The storage provided must be equal to or exceed the storage loss to ensure there will be no net loss of flood storage. The EA's climate change allowances must also be used in the calculation of flood plain storage compensation. In most case the 'higher central' allowance should be used, but the 'upper end' allowance should be used if the catchment is 1) particularly sensitive to small changes in volume or 2) affected area contains essential infrastructure or vulnerable uses.	Flood Zone 3a and 3b

6 SITE ASSESSMENTS

6.1 Analysis

- 6.1.1 Site Assessments were completed using datasets from the SFRA Level 1 [Web Maps](#) as well as updated data from the EA and data provided by Richmond. Flooding from surface water, sewer, fluvial/tidal, groundwater and artificial sources was analysed using the predicted proportion of each flood risk type within each site. The assessments for fluvial and surface water flood risk are based on the Flood Zones defined in the Level 1 [SFRA](#). The Flood Zones are shown in the SFRA Level 1 [Web Maps](#) and are explained in Section 2.3.
- 6.1.2 For sites within the tidal Thames, tidal risk was assessed using the Thames Tidal Defence Breach Model for the year 2100. No fluvial depth or hazard data was available for the River Thames. This only impacted SA2: Platt's Eyot and Flood Zone mapping has been used as an alternative for this site. The groundwater vulnerability classification and the flood hazard rating used in the assessments can be interpreted as shown in *Table 6-1* and *Table 6-2* respectively. The Site Assessments are included in [Appendix 4](#).

Table 6-1 Groundwater vulnerability classifications

Classification	Description
A	Limited potential for groundwater flooding to occur based on rock type and estimated groundwater level during periods of extended intense rainfall.
B	Potential for groundwater flooding of property situated below ground level: based on rock type and estimated groundwater level during periods of extended intense rainfall. Where this may have an impact, you are advised to check that this has not been a problem in the past at this location and/or that measures are in place to sufficiently reduce the impact of the flooding
C	Potential for groundwater flooding to occur at surface: based on rock type and estimated groundwater level during periods of extended intense rainfall. You are advised to check that this has not been a problem in the past at this location and / or that measures are in place to sufficiently reduce the impact of the flooding.
Elsewhere	Not considered to be prone to groundwater flooding: based on rock type.

Table 6-2 Surface water flood risk hazard rating (HR) categories

Category	Definition
Low	$0.5 \geq HR < 0.75$ Caution – Flood zone with shallow flowing water or deep standing water
Moderate	$0.75 \geq HR \leq 1.25$ Dangerous for some (i.e., children) – Danger: flood zone with deep or fast flowing water
Significant	$1.25 > HR \leq 2.0$ Dangerous for most people – Danger: flood zone with deep fast flowing water
Extreme	$HR > 2.0$ Dangerous for all – Extreme danger: flood zone with deep fast flowing water

6.2 Assessment Template

6.2.1 Site assessments were conducted using a proforma to ensure consistency. The sections included on the proforma are summarised in *Table 6-3*. Seven site-specific maps (six for Platts Eyot) are appended to each assessment proforma. These are summarised in *Table 6-4*.

Table 6-3 Site Assessment template details

Section	Contents
Current and proposed use	Development use of each site
Risk summary	Percentage of site area under each risk level for different types of flooding
Risk assessment	Data on risk from each flooding source, including flood depth, speed, hazard, duration, etc.
Flood mechanisms	For each flood source, how flood water behaves within the site
Site access / egress routes	Where flood-safe entry and exit routes should be located
Mitigation requirements	A list of mitigation measures to alleviate the flood risk for potential developments at the site. To be used in conjunction with the guidance provided in Section 5 of the Level 1 SFRA
Safety of development	Analysis of how secure the development is against future flooding, including climate change considerations and the effect of nearby development

Table 6-4 Summary of Flood Risk Maps

No.	Figure	Description
1*	Fluvial Flood Depth (1% AEP + 35% Climate Change Allowance Event)	Provides the maximum flood depth for the fluvial defended 1% AEP + 35% climate change flood event. Data was extracted from EA model for the River Crane. The 35% climate change event was chosen to review the maximum fluvial flood depth at the sites as it represents the central case climate change allowance for peak river flow allowance for the Thames River Basin District.
	Tidal Defence Breach Flood Depth for the 2100 epoch	Provides the predicted maximum flood depth for the year 2100. If an individual breach of the Thames Tidal Defence was to occur at any point. This represents the worst-case scenario.
2	Fluvial Flood Hazard (1% AEP + 35% Climate Change Allowance Event)	Provides the maximum flood hazard for the fluvial defended 1% AEP + 35% climate change flood event. Data was extracted from EA models for River Crane.
3	Surface Water Flood Depth (1% AEP Rainfall Event)	Provides the predicted surface water flood depth across a site using EA RoFSW data for a 1% AEP event.
4	Surface Water Flood Hazard (1% AEP Rainfall Event)	Provides information on the predicted hazard of surface water flooding, based on EA RoFSW mapping for a 1% AEP event.
5	Thames Water (TW) Sewer Flooding Records	Provides the sewer flood incidences recorded by TW at four-digit postcode resolution.

No.	Figure	Description
6	Susceptibility to Groundwater Flooding Map	Provides the potential for groundwater to occur. It is classed into three categories (A, B, C) as described in <i>Table 6-1</i> .
7	EA Reservoir Flood Maps	Provide the potential Flood Extent for the unlikely event of a dam or reservoir failure.
* For Platt's Eyot, the map shows Fluvial Flood Zones extents		

APPENDICES

Appendix 1: Data Sources

Category	File name	Description	Data source	Purpose
Base map	OS District Map	Raster of streets, buildings, and other features in the area	OS Open Data 2021	Map creation
	Richmond_borough_Boundary	Polygon demarcating the boundary of Richmond	OS Open Data 2021	Defining study area; geographical bound for other data needed
	Site_Allocations 2021	Polygons giving outlines of 37 priority sites in borough	Richmond 2021	Conducting screening and site level assessments
Digital Terrain Model	LiDAR	Raster containing ground elevation data	EA 2017	Determining low elevation areas susceptible to surface water flooding
Detailed River Network	EA_DRN	Line files showing main rivers and ordinary watercourses, both overground and culverted.	EA WMS	Determining locations of watercourses
Flood defences	Spatial_Flood_Defences	Lines of EA-owned flood defences	EA WMS	Analysing how flood defences affect current and future fluvial flooding.
	Areas_Benefitting_From_Defences	Polygons showing the areas that would benefit from the presence of defences in a 1% chance of flooding each year from rivers	EA WMS	
Groundwater	Groundwater_Flooding	Polygons categorising borough into polygons show their potential for groundwater flooding	BGS 2021	Analysing current groundwater flood risk
Flood Map for Planning	Flood_Zone_2	Polygons showing land with annual probability of river flooding between 1% and 0.1%	EA WMS	Prioritising sites for assessment

Category	File name	Description	Data source	Purpose
	Flood_Zone_3	Polygons showing land having a 1% or greater annual probability of river flooding	Created using EA WMS data	Prioritising sites for assessment
	Flood_Zone_3b	Polygons showing land within the Tidal Thames, River Crane and Beverley Brook 1 in 20-year extents.		
Risk of Flooding from Surface Water	RoFSW_1inXX_Extent	Polygons showing flood extent, depth, and hazard values for rainfall scenarios with a 1 in 30 (3.33% AEP), 1 in 100 (1% AEP) and 1 in 1000 (0.1% AEP) chance of occurring in any given year. Hazard calculated from flood depth and velocity.	EA WMS	Prioritising sites for assessment; Analysing current and future surface water flood risk; Creating surface water flood risk mitigation plan.
	RoFSW_1inXX_Depth			
	RoFSW_1inXX_Hazard			
Risk of Flooding from Reservoirs	Reservoir_Flood_Extent_Wet_Day_2	Map showing the largest area that might be flooded if a reservoir were to fail and release the water it holds on to a wet day i.e., rivers are at capacity	EA WMS	Analysing current flood risk from reservoir breach
Sewer flood records	Partial_Postcodes	Database of historic sewer flooding incidents by postcode	TW 2021	Sewer flood risk assessment
River model data	River Crane	Data from EA-generated models of River Crane and Thames tidal (no sites on the Beverly Brook).	EA 2016	Fluvial flood risk assessment (current and future); Creating fluvial flood risk mitigation plan; Applying exception test
	Thames tidal		EA 2017	

Appendix 2: Site Allocation Map

Refer to Site_Allocation_Map_v1.0 file.

Appendix 3: Screening Assessment

Refer to the Screening_Assessment_v1.1 file.



Appendix 4: Site Assessments

Refer to the relevant document in the Appendix 4 folder, as follows:

- SA2 Platt's Eyot v1.2
- SA10 St Mary's University v1.2
- SA11 Richmond upon Thames College v1.2
- SA13 Twickenham Stadium v1.2
- SA14 Mereday Day Centre v1.2
- SA18 Twickenham Riverside v1.2
- SA30 Kew Retail Park v1.2
- SA31 Kew Biothane Plant v1.2
- SA34 Stag's Brewery v1.2
- SA35 Mortlake and Barnes v1.2



Legend

-  Borough Boundary
-  Site Allocations
-  Flood Defences
-  Areas Benefiting from Flood Defences
- EA Flood Zones**
 -  Flood Zone 2
 -  Flood Zone 3a
 -  Flood Zone 3b (functional floodplain)

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Sequential Test Report

Appendix 2: Overview map of borough
including flood zones and site allocations

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Drawing Size:
A3

Appendix 2

SFRA ID	Name	Address	Proposed Use	Vulnerability Classification	Site Area (ha)	FZ1 (% of site area)	FZ2 (% of site area)	FZ3a (Fluvial & Tidal - % of Site Area)	FZ3b (Fluvial & Tidal- % of Site Area)	RoFSW - 1 in 100 year (%of site area)	Thames Tidal Breach Zone - (%of Site Area)	Main River 1 in 100yr + 35% CC (% of site area)	Town Centre or Local Centre	Located on an Island?	Located within a dry Island? - fully surrounded by FZ2/3	Site Assessment required?	Sequential Test required?	Exception Test required?
SA1	Hampton Square	Hampton, TW12 3YH	Retail, local services, employment and residential uses.	More Vulnerable	2.9	100.0	0.0	0.0	0.0	1.0	0.0	0.0	NO	NO	NO	NO	YES	YES
SA2	Platts Eytot, Hampton	off Lower Sunbury Road, TW12 2HF	Enhancing existing river-dependent and river-related uses or business and industrial uses	Less Vulnerable	3.8	43.2	56.8	11.1	20.3	1.0	0.0	31.4	NO	YES	NO	YES	YES	NO
SA3	Hampton Traffic Unit	60-68 Station Road, Hampton, Middlesex, TW12 2AX	Commercial or social infrastructure uses	More Vulnerable	0.3	100.0	0.0	0.0	0.0	0.0	0.0	0.0	YES	NO	NO	NO	NO	NO
SA4	Hampton Delivery Office	Rosehill, Hampton, TW12 2AA	Social and community infrastructure uses	Less Vulnerable	0.1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	NO	NO	NO	NO	NO	NO
SA5	Carpark for Sainsburys	Uxbridge Road, Hampton, TW12 1AW	Affordable housing	Less Vulnerable	2.0	100.0	0.0	0.0	0.0	1.8	0.0	0.0	NO	NO	NO	NO	YES	NO
SA6	Telephone Exchange, Teddington	88 High Street, Teddington, TW1 18JD	Commercial, retail, employment or residential	More Vulnerable	0.2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	YES	NO	NO	NO	NO	NO
SA7	Teddington Delivery Office, Teddington	19 High Street, Teddington, TW11 8HH	Commercial, retail, employment or residential	More Vulnerable	0.1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	YES	NO	NO	NO	NO	NO
SA8	Strathmore Centre	Strathmore Road, Teddington, TW11 8UH	Childcare, affordable housing	More Vulnerable	0.6	100.0	0.0	0.0	0.0	0.0	0.0	0.0	NO	NO	NO	NO	NO	NO
SA9	Teddington Police Station	Park Road, Teddington, TW11 0AQ	community/social infrastructure, residential	More Vulnerable	0.2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	YES	NO	NO	NO	NO	NO
SA10	St Mary's University, Strawberry Hill	Waldegrave Road, Twickenham, TW1 4SX	Education, sport and student accomodation	More Vulnerable	12.1	98.7	1.3	0.6	0.0	1.0	0.6	0.5	NO	NO	NO	YES	YES	YES
SA11	Richmond upon Thames College, Twickenham	Egerton Road, Twickenham, TW2 7SJ	Education and residential	More Vulnerable	8.7	85.2	14.8	0.0	0.0	0.9	0.0	0.0	NO	NO	NO	YES	YES	YES
SA12	Harlequins Rugby Football Club	Stoop Memorial Ground, Craneford Way, Twickenham, TW2 7SX	Sport, leisure, hotel	More Vulnerable	4.6	100.0	0.0	0.0	0.0	2.8	0.0	0.0	NO	NO	NO	NO	YES	YES
SA13	Twickenham Stadium	Twickenham Rugby Ground, Whitton Road , Twickenham, TW2 7BA	Sport, leisure, hotel	More Vulnerable	12.6	12.4	87.6	0.0	0.0	8.1	0.0	54.2	NO	NO	NO	YES	YES	YES
SA14	Mereway Day Centre	Mereway Road, Twickenham, TW2 6RF	Social and community infrastructure uses	Less Vulnerable	0.2	20.6	79.4	0.0	1.1	8.9	0.0	1.1	NO	NO	NO	YES	YES	NO
SA15	Station Yard, Twickenham	Land at Station Yard, Railway Approach, Twickenham	Residential	More Vulnerable	0.2	100.0	0.0	0.0	0.0	0.7	0.0	0.0	YES	NO	NO	NO	NO	NO
SA16	Twickenham Telephone Exchange	Garfield Road, Twickenham	Employment, commerical, retail	More Vulnerable	0.2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	YES	NO	NO	NO	NO	NO
SA17	Twickenham Police Station	41 London Road, TW1 3SY	Retail, residential	More Vulnerable	0.2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	YES	NO	NO	NO	NO	NO
SA18	Twickenham Riverside and Water Lane/King Street	The Embankment, TW1 3LE	Leisure/Community use, residential, open space	More Vulnerable	1.1	81.4	18.6	0.9	8.6	0.1	28.4	22.7	YES	NO	NO	YES	NO	NO
SA19	Whitton Telephone Exchange	Ashdale Close, Whitton, TW1 7BE	Employment and social infrastructure	Less Vulnerable	0.4	100.0	0.0	0.0	0.0	9.4	0.0	0.0	NO	NO	NO	NO	YES	NO
SA20	Kneller Hall, Whitton	Royal Military School of Music, Kneller Road, TW2 7DN	mixed use within protected landscape	Less Vulnerable	9.7	100.0	0.0	0.0	0.0	10.5	0.0	0.0	NO	NO	NO	NO	YES	NO
SA21	Whitton Community Centre and Car Park	Percy Road, Whitton, TW2 6LL	community facilities with affordable housing	More Vulnerable	0.1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	NO	NO	NO	NO	NO	NO
SA22	Ham Close	Ham	Residential with affordable housing	More Vulnerable	4.3	100.0	0.0	0.0	0.0	2.1	0.0	0.0	NO	NO	NO	NO	YES	YES
SA23		1 Ham Common, Ham	Social and community infrastructure uses, residential	More Vulnerable	4.0	100.0	0.0	0.0	0.0	0.3	0.0	0.0	NO	NO	NO	NO	YES	YES
SA24	Cassel Hospital Richmond Station	Kew Road, Richmond, TW9 2NA	Transport, commercial, community and residential	More Vulnerable	2.0	100.0	0.0	0.0	0.0	24.3	0.0	0.0	YES	NO	NO	NO	NO	NO
SA25	Former House of Fraser	16 Paved Court 20 King Street 4 To 8 And 10 Paved Court And 75 - 81 George Street Richmond	Retail, office/workspace, leisure/community	More Vulnerable	0.2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	YES	NO	NO	NO	NO	NO
SA26	Richmond Telephone Exchange	Spring Terrace, Richmond	Residential- affordable housing	More Vulnerable	0.3	100.0	0.0	0.0	0.0	10.7	0.0	0.0	NO	NO	NO	NO	YES	YES
SA27	American University	Queens Road, Richmond, TW10 6JP	Education, community	More Vulnerable	ttbc	100.0	0.0	0.0	0.0	1.9	0.0	0.0	NO	NO	NO	NO	YES	YES
SA28	Homebase	Manor Road, East Sheen, TW9 1YB	Residential	More Vulnerable	1.8	100.0	0.0	0.0	0.0	22.6	0.0	0.0	NO	NO	NO	NO	YES	YES
SA29	Sainsburys, Lower Richmond Road	Lower Richmond Road, Richmond, TW9 4LT	Retail and residential	More Vulnerable	2.6	100.0	0.0	0.0	0.0	0.0	0.0	0.0	NO	NO	NO	NO	NO	NO
SA30	Kew Retail Park	Bessant Drive, Kew, TW9 4AD	Residential, retail, office, leisure	More Vulnerable	3.9	0.0	100.0	100.0	0.0	1.7	100.0	0.0	NO	NO	NO	YES	YES	YES
SA31	Kew Biothane Plant	Kew Biothane, Melliss Avenue, TW9 4BA	Residential, open space	More Vulnerable	0.7	0.0	100.0	100.0	0.0	0.0	100.0	0.0	NO	NO	NO	YES	YES	YES
SA32	Pools on the Park and surroundings	Old Deer Park Twickenham Road Richmond TW9 2SF	Leisure/community use, open space	Less Vulnerable	2.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	NO	NO	NO	NO	NO	NO
SA33	Richmond Athletic Association Ground	Old Deer Park, Richmond, TW9 2AZ	sporting, leisure	Less Vulnerable	9.9	100.0	0.0	0.0	0.0	1.5	0.0	0.0	NO	NO	NO	NO	YES	NO
SA34	Stag Brewery	Lower Richmond Road, Mortlake, SW14 7ET	Education, residential, employment, commercial, retail health facilities, community and social, sport and leisure	More Vulnerable	8.8	0.0	100.0	69.8	1.2	7.0	66.9	1.2	NO	NO	NO	YES	YES	YES
SA35	Mortlake and Barnes Delivery Office	2-12 Mortlake High Street, London, SW14 8JB	Employment, commercial, retail	More Vulnerable	0.1	0.0	100.0	100.0	0.0	0.0	100.0	0.0	NO	NO	NO	YES	YES	YES
SA36	Telephone Exchange, East Sheen	172-176 Upper Richmond Road West, East Sheen, SW14 8AW	Employment, commercial, community, social, housing	More Vulnerable	0.4	100.0	0.0	0.0	0.0	4.7	0.0	0.0	YES	NO	NO	NO	NO	NO
SA37	Barnes Hospital, East Sheen	South Worple Way, Barnes, London, SW14 8SU	social and community infrastructure uses, Education	More Vulnerable	1.4	100.0	0.0	0.0	0.0	3.2	0.0	0.0	NO	NO	NO	NO	YES	YES

Key Assumptions

1. If proposed use of site is unknown, then vulnerability classification is assumed to be 'more vulnerable'
2. If proposed use is 'Other' these have been given an unknown vulnerability classification
3. If proposed use is 'Commercial' these have been given an unknown vulnerability classification as these sites could be either 'More vulnerable' or 'Less Vulnerable' dependent on the use
4. Sites with 0% of areas in FZ2 and FZ3a/b do not require the Sequential Test (on the basis that other forms of flood risk are generally manageable on a site by site basis)
5. A Sequential and Exception test is required for essential utility infrastructure in FZ3b unless it is within a Local or Town centre (other vulnerability classes are not permitted)
6. A Sequential test is required for all developments (exceptions outlined in SFRA) within FZ2/FZ3 unless they are within a town or local centre
7. An exception test is required for more vulnerable developments within FZ3a unless they are within a town or local centre
8. An exception test is required for highly vulnerable developments within FZ2 unless they are within a town or local centre
9. Highly vulnerable sites are not suitable in FZ3 a/b
10. All developments in FZ2, FZ3A, FZ3B require a site assessment
11. A Sequential test is required for Areas at Risk of Flooding from Surface water 1 in 100 year event
12. If the site is on island, it is considered FZ3b
13. If the site is a dry island, it is considered the FZ which surrounds it.

SITE ASSESSMENT - Platts Eyot Island

Address: off Lower Sunbury Road, TW12 2HF	Area: 3.8 Ha
	Site Reference: SA2

Current Use	Proposed Use
Docks, Moorings, Industrial, Storage and Office Uses	Enhancing existing river-dependent and river-related uses or business and industrial uses

Current Vulnerability Classification	Proposed Vulnerability Classification
Water Compatible	Less Vulnerable

Current Risk Summary							
Fluvial / Tidal			Groundwater			Sewer Flooding	
FZ1	43.2	% of Site	A**	48.6	% of Site	No. Incidents	1
FZ2	56.8	% of Site	B	21.5	% of Site	Dry Islands and Islands	
FZ3a	11.1	% of Site	C	29.9	% of Site	Dry Island?	N
FZ3b	20.3	% of Site	**BGS classification (refer Fig 6)			Island?	Y
Surface Water			Policy Zone?		N	Residual Risk	
3.33%*	0	% of Site	Artificial			Article 4 Zone?	Y
1% AEP	1	% of Site	Reservoir	Y	At risk?	N/A	% of site
0.1% AEP	1.1	% of Site	Canal	N	At risk?	Town or Local Centres	
*Annual Exceedance Probability (AEP)			Other	N	At risk?	Within buffer?	Y

FLUVIAL / TIDAL

Risk Assessment (Defended)				
Parameter	FZ3b	FZ3a	*FZ3a+CC	Units
Speed of inundation	N/A	N/A	N/A	Hrs
Min. Depth	N/A	N/A	N/A	m
Max. Depth	N/A	N/A	N/A	m
Max. Velocity	N/A	N/A	N/A	m/s
Max Flood Level	7.78	8.49	10.23	m AOD
Max Ground Level	17.96	17.96	17.96	m AOD
Min Ground Level	6.21	6.21	6.21	m AOD
Max Flood Hazard	N/A	N/A	N/A	N/A
Duration of Flood	N/A	N/A	N/A	Hrs

* The +70% Climate Change Allowance event (upper end allowance extreme case) is reviewed

Risk Assessment (Undefended)			
Parameter	FZ3a	FZ3a+CC*	Units
Min. Depth	N/A	N/A	m
Max. Depth	N/A	N/A	m
Max. Velocity	N/A	N/A	m/s
Max. Hazard	N/A	N/A	N/A
Max Ground level	17.96	17.96	m AOD
Max Flood Level	8.56	N/A	m AOD

Description of flood mechanism

- This site is an island within the River Thames and all edges of the site are at risk of fluvial flooding.
- The predicted max flood level for the 1 in 100-year flood event is 8.49 mAOD.
- Climate change is predicted to increase the max flood level to 10.23 mAOD.
- The max depth, velocity and hazard data is unavailable for this site as Islands are outside the River Thames model boundary. Maximum flood levels from the River Thames model boundary surrounding the site were interpolated to provide estimates of the flood levels predicted on-site.

Figure 1 - Fluvial / Tidal Flood Depth Map

Site Access / Egress

- The only access and egress route to/from this site is a bridge which connects the island with Lower Sunbury road.
- The base of this bridge is also within Flood Zone 3b so cannot be considered safe.
- Safe refuge sites should be provided on site.

Figure 2 - Fluvial Flood Hazard Map

Mitigation / FRA Requirements

- Since the access/egress routes are within Flood Zone 3b, the entire site must be treated as flood zone 3b regardless if the development is located in an area of lower flood risk.
- Development should be restricted to 'Water Compatible' or 'Essential infrastructure'.
- Site specific FRA must demonstrate that the development will not impede flowing water.
- See Report section 5.8 for flood plain compensation storage requirements.
- Request further information on flood depth, velocity, hazard from the EA. This must be assessed to ensure all risks are considered.
- See Report section 5.2 for finished floor levels.
- Flood Warning and Emergency Plans are required.
- See Report mitigation 5.4 for Main River requirements.
- Site users should register for the EA Flood Warnings.

SURFACE WATER

Risk Assessment				
Parameter	3.33% AEP	1% AEP	*0.1% AEP	Units
Min. Depth	N/A	0.00-0.15	0.00-0.15	m
Max. Depth	N/A	0.30-0.60	0.30-0.60	m
Max. Velocity	N/A	0.25-0.50	0.25-0.50	m/s
Max. Hazard	N/A	1.25-2.00	1.25-2.00	N/A

*The 0.1% annual probability extent represents the potential climate change adjusted impact of current risk

Description of Flood Mechanism

- Only a very small proportion of the site is at risk of surface water flooding.
- Climate change is predicted to increase this risk marginally.

Figure 3 - RoFSW Flood Depth Map

Site Access / Egress

Safe egress routes should be routed towards the Bridge which connects to Lower Sunbury road (north-west edge of site)

Figure 4 - RoFSW Flood Hazard Map

Mitigation - Surface Water Drainage

- SuDS must be included and comply with the criteria set out in Local Plan Policy LP 8(B).
- Developments should apply the Sustainable Drainage Hierarchy set out in Policy SI13 of the London Plan.
- The actions in the London Sustainable Drainage Action Plan (LSDAP) should also be taken.
- Ground investigations are required to confirm whether infiltration based SuDS are suitable.

SITE ASSESSMENT - Platts Eyot Island

SEWER	GROUNDWATER	ARTIFICIAL
Risk Assessment	Risk Assessment	Risk Assessment
<p>This site is located with a postcode which has 1 previous report of sewer flooding.</p> <p>Figure 5 - Thames Water Sewer Flood Map</p>	<ul style="list-style-type: none"> The edges of this site are located in an area classified as having a potential for groundwater to occur at the surface. In the centre of the Island, the south western section has limited potential for groundwater flood and the north eastern section has a potential for groundwater of properties located below ground. The site is underlain by artificial deposit geology. The site is not located in a throughflow catchment area. <p>Figure 6 - Potential for Groundwater Flood Map</p>	<ul style="list-style-type: none"> This site is at risk of flooding from the Queen Elizabeth II, Walton-Bessborough and Staines north reservoir reservoirs. The reservoir flood extent map predicts that if the reservoir breaches on a wet day (rivers are at capacity), 56.4% of the site is at high risk of flooding. There is a number of other smaller reservoirs in the vicinity of this site which are not mapped but may be a source of flood risk. <p>Figure 7 - Outline Reservoir Flood Map</p>
Mitigation Requirements	Mitigation Requirements	Mitigation Requirements
<p>No mitigation required.</p>	<ul style="list-style-type: none"> Restrict development to the centre of the island, where flood risk is lower. Applicant must ensure the development does not increase groundwater related flood to neighbouring development and that it does not disrupt the flow profile to downstream areas. 	<ul style="list-style-type: none"> Identify all the reservoirs which may impact flood risk at the site including smaller local reservoir that may not be mapped. Implement appropriate and proportionate risk management measures.

PLANNING CONSIDERATIONS

Safety of Development

A. Can the development be future proofed for climate change considerations?

- Yes - See Report section 5.2 for the finished floor levels.

B. Can the development be designed safe throughout its lifetime without increasing flood risk elsewhere?

- Yes - See Report section 5.8 for compensatory flood storage requirements.
- The development must use surface water drainage techniques to manage surface water as close to the source as possible in line with Local Plan Policy LP 8(B). Green drainage infrastructure should be prioritised to provide wider ecological/biodiversity benefits as per London Plan Policy SI 13.

C. What is the cumulative impact of the development land use change and will flood risk increase?

- The development land use is changing from 'Water Compatible' to 'Less Vulnerable'. This is due to the proposal of business and industrial uses.
- The site has a number of green areas throughout and building over these will increase the impermeable surface area and therefore the risk of surface water flooding.
- Any changes to the island boundaries may increase flood risk.

D. How can the development reduce risk overall?

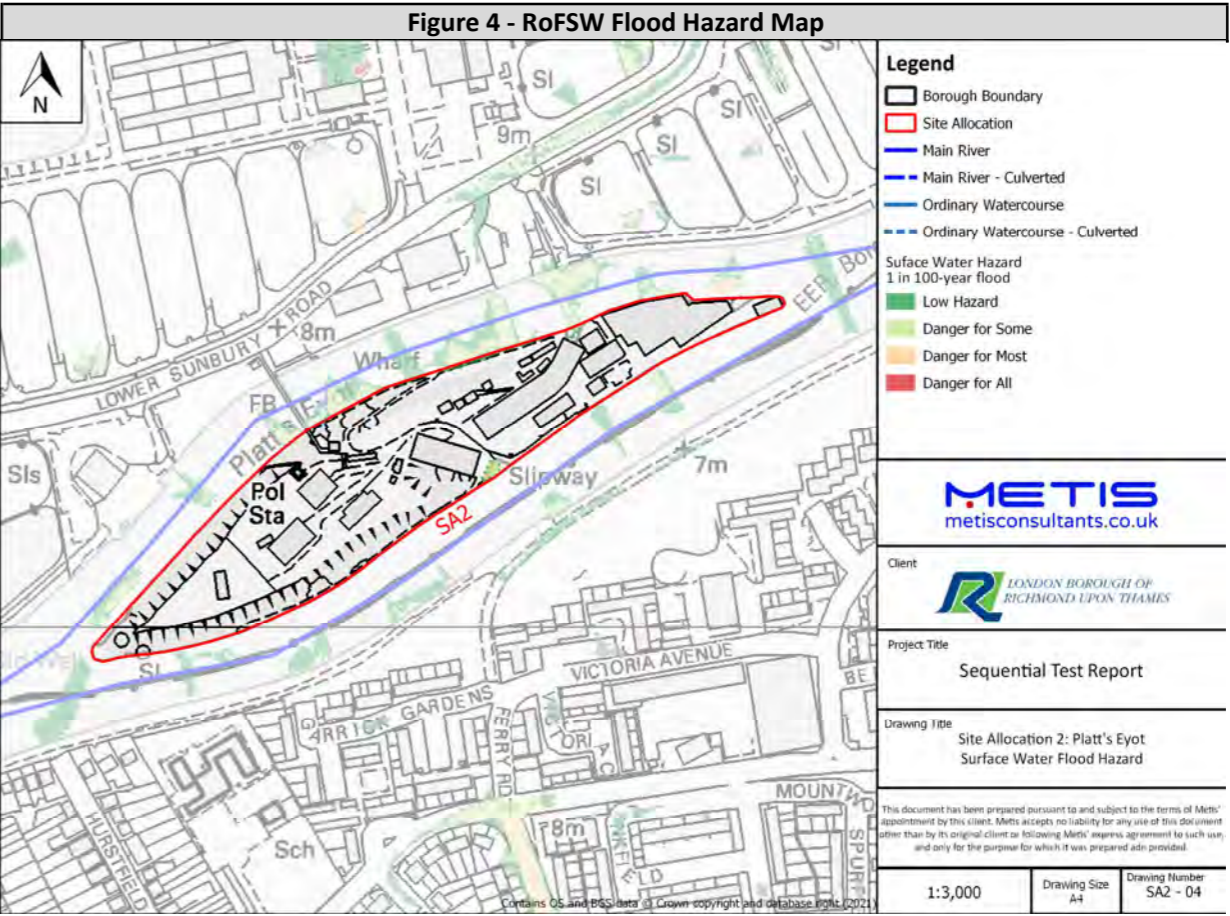
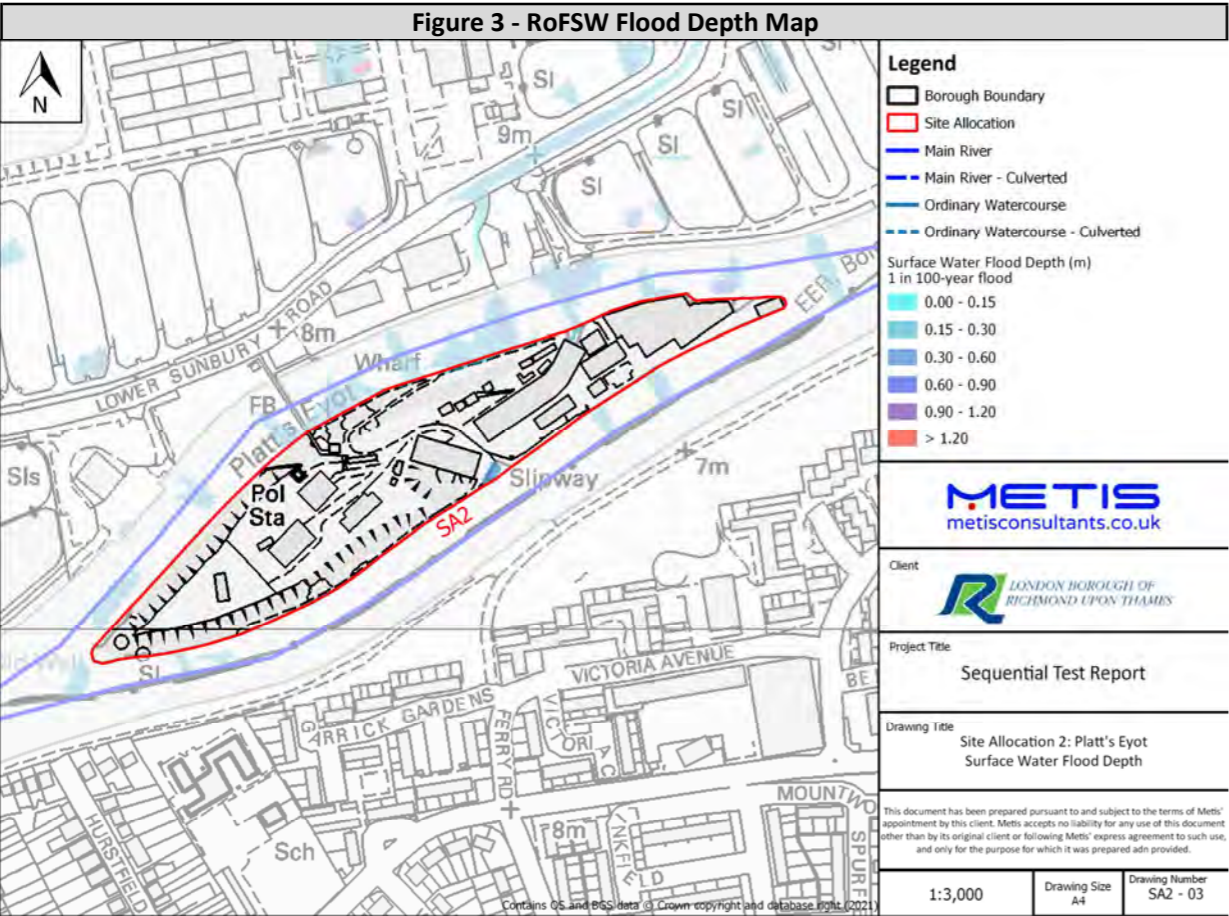
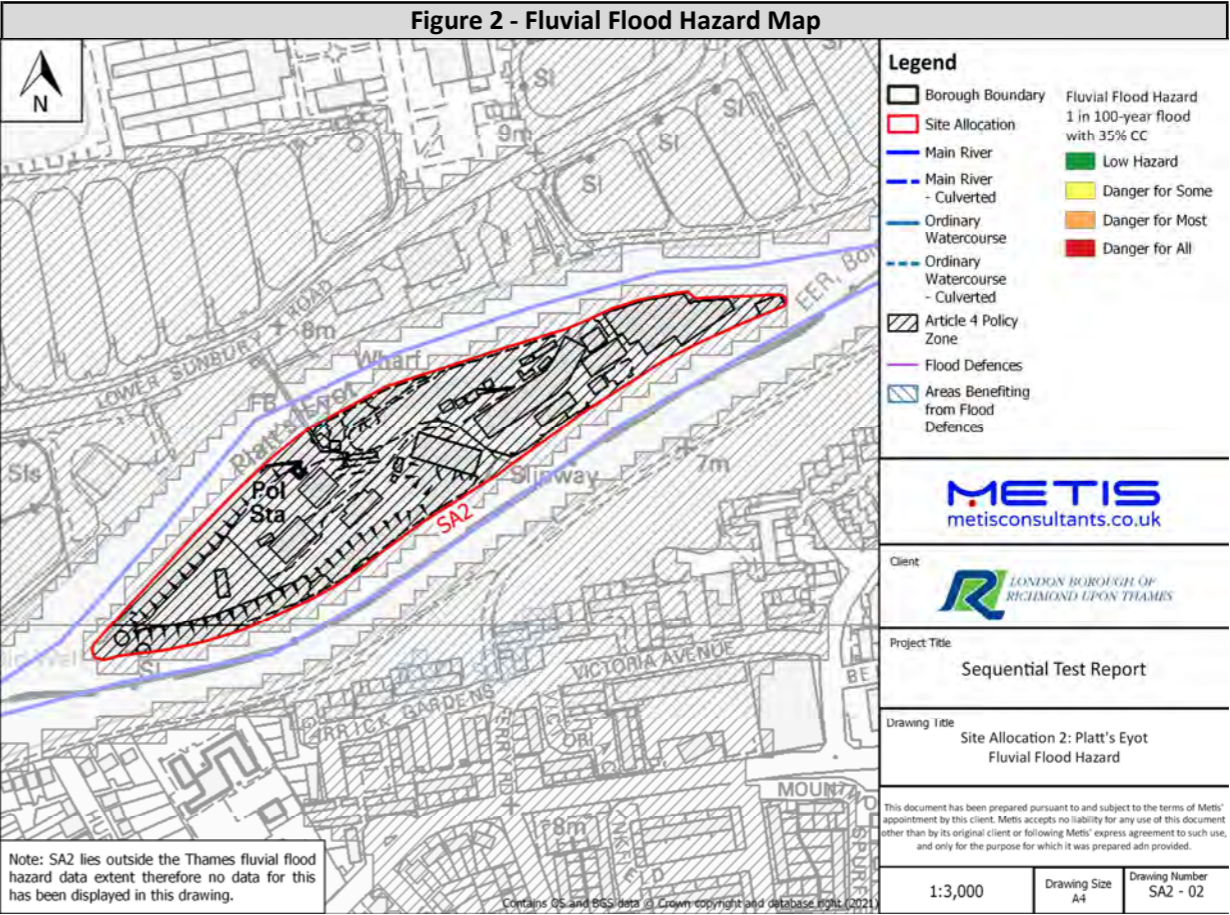
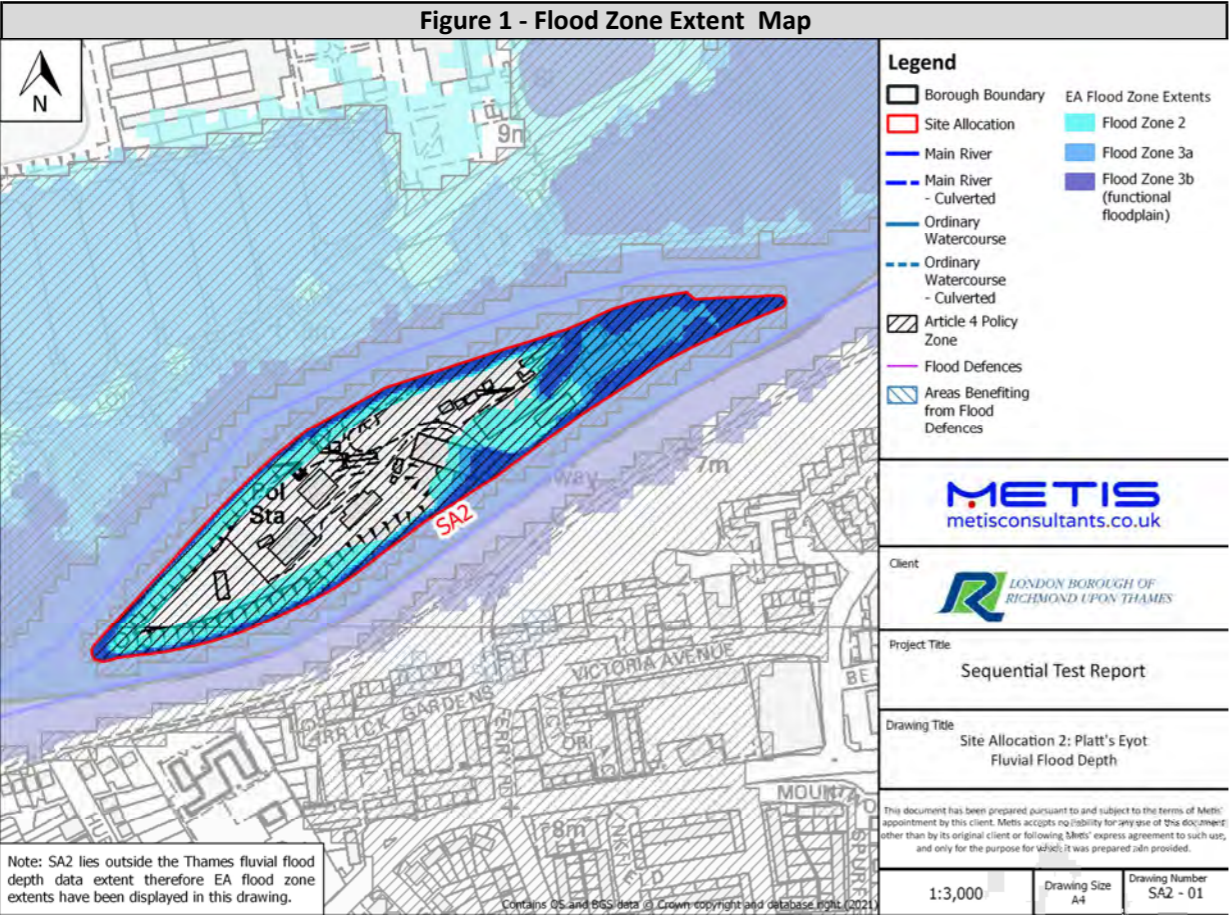
- By only permitting 'essential infrastructure' and 'water compatible' developments.
- By restricting all developments to outside the 8m Main River buffer zone.
- Providing flood plain compensation and run-off storage for new developments.
- Include SuDS to manage all surface water runoff on site as per the Local Plan Policy LP 8(B).

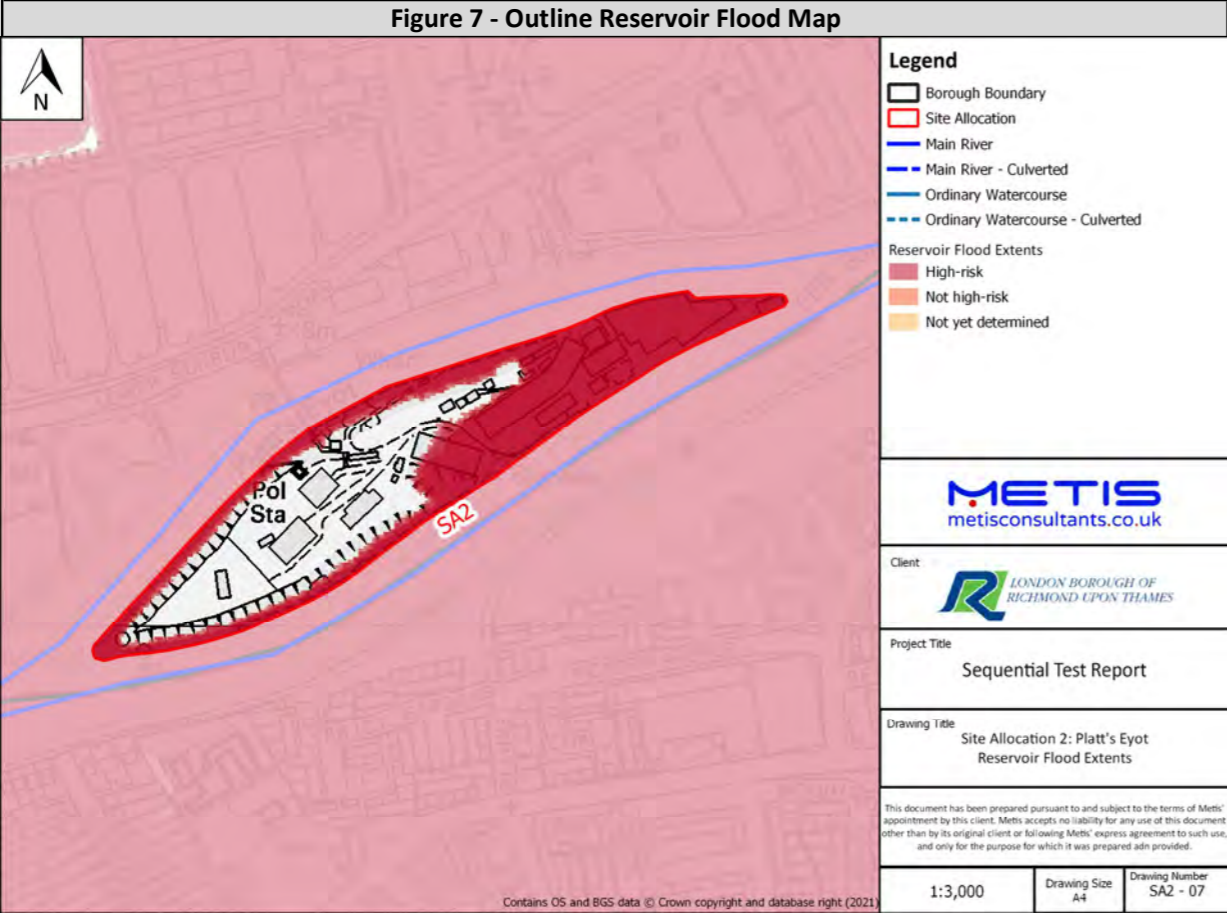
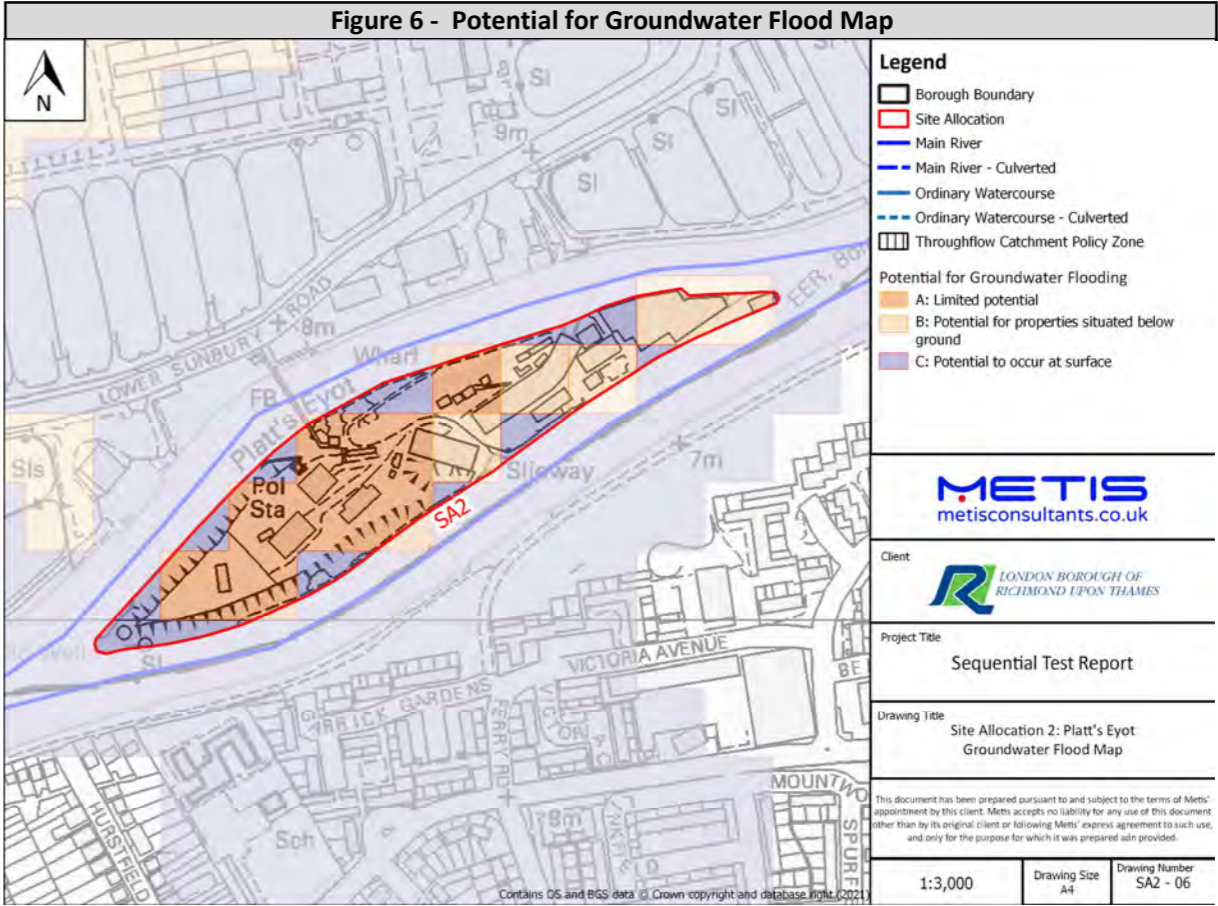
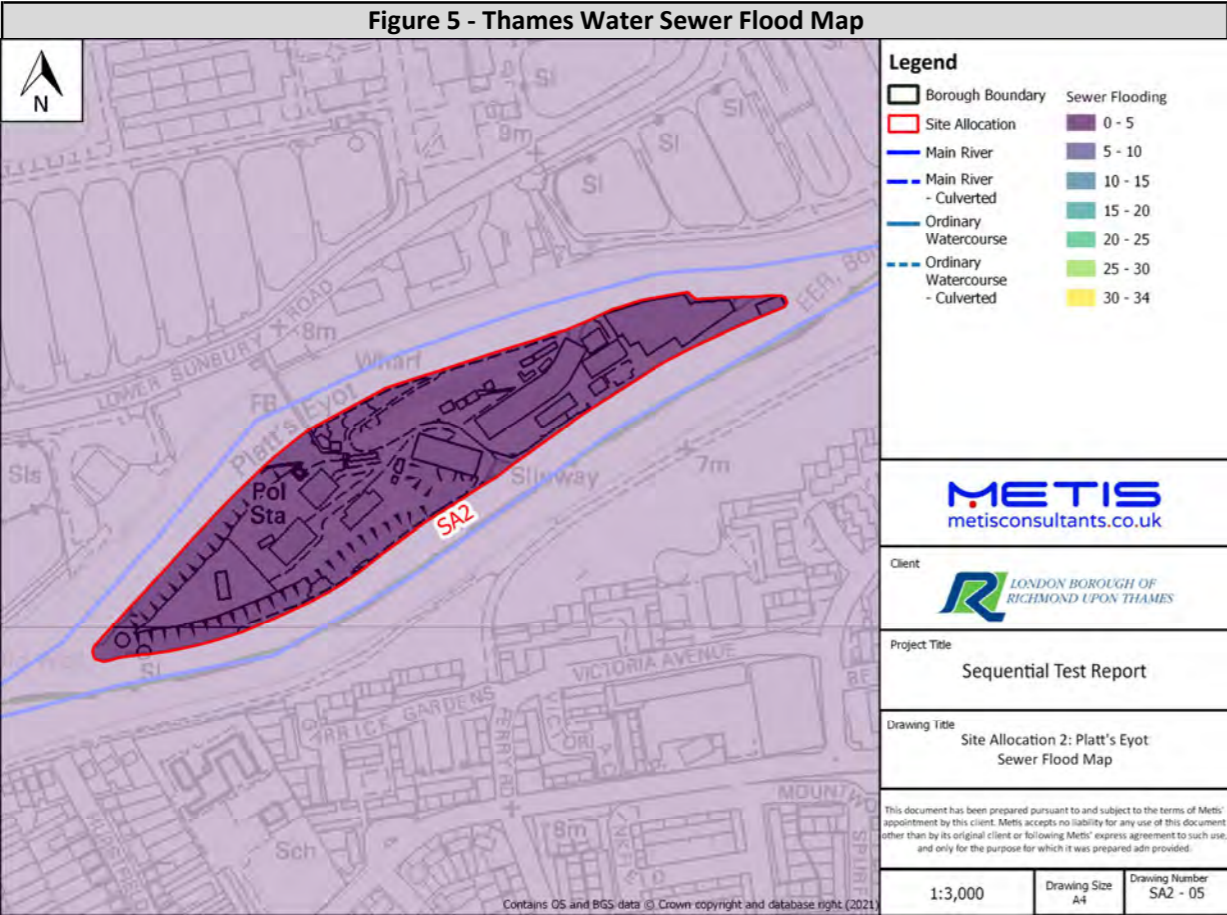
E. Will development require a flood risk permit/watercourse consent?

- Yes - all edges of the site are within 8m of the River Thames. See Report section 5.4 for further requirements.

F. Can the site pass the Exceptions Test?

- No - Less Vulnerable development should not be permitted at this site.
- Water compatible developments do not require the Exception test.





SITE ASSESSMENT - St. Mary's University, Strawberry Hill

Address: Waldegrave Road, Twickenham, TW1 4SX	Area: 12.1 Ha
	Site Reference: SA10

Current Use	Proposed Use
University	Education, Sport and Student Accomodation

Current Vulnerability Classification	Proposed Vulnerability Classification
More Vulnerable	More Vulnerable

Current Risk Summary							
Fluvial / Tidal			Groundwater			Sewer Flooding	
FZ1	98.7	% of Site	A**	11.9	% of Site	No. Incidents	7
FZ2	1.3	% of Site	B	88.1	% of Site	Dry Islands and Islands	
FZ3a	0.6	% of Site	C	0	% of Site	Dry Island?	N
FZ3b	0	% of Site	**BGS classification (refer Fig 6)			Island?	N
Surface Water			Policy Zone?		Residual Risk		
3.33%*	0	% of Site	Artificial		Article 4 Zone?		N
1% AEP	1	% of Site	Reservoir	Y	At risk?	N/A	% of site
0.1% AEP	4	% of Site	Canal	N	At risk?	Town or Local Centres	
*Annual Exceedance Probability (AEP)			Other	N	At risk?	Within buffer?	Y

FLUVIAL / TIDAL

Risk Assessment (Defended)				
Parameter	FZ3b	FZ3a	*FZ3a+CC	Units
Speed of inundation	N/A	N/A	N/A	Hrs
Min. Depth	N/A	N/A	N/A	m
Max. Depth	N/A	N/A	N/A	m
Max. Velocity	N/A	N/A	N/A	m/s
Max Flood Level	N/A	N/A	N/A	m AOD
Max Ground Level	N/A	N/A	N/A	m AOD
Min Ground Level	N/A	N/A	N/A	m AOD
Max Flood Hazard	N/A	N/A	N/A	N/A
Duration of Flood	N/A	N/A	N/A	Hrs

* The +35% Climate Change Allowance event (central case) is reviewed

Risk Assessment (Thames Tidal Defence Breach Model)			
Parameter	2005	2100	Units
Min. Depth	N/A	0.04	m
Max. Depth	N/A	1.73	m
Max. Velocity	N/A	0.2	m/s
Max. Hazard	N/A	N/A	N/A
Max. Ground Level	N/A	12.18	m AOD
Max Flood Level	N/A	6.6	m AOD

Description of flood mechanism
<ul style="list-style-type: none"> A small section of site (north-east) is at risk of flooding from the Thames estuary, which flows to the east of the site.

Figure 1 - Fluvial / Tidal Flood Depth Map

Site Access / Egress
Safe egress routes should be directed to the south or south-west where there is no predicted risk of tidal/fluviat flooding.

Figure 2 - Fluvial Flood Hazard Map

Mitigation / FRA Requirements
<ul style="list-style-type: none"> More Vulnerable developments such as the education facility and student accomodation should be directed away from the north and west of the site to areas of lower flood risk. Less vulnerable developments such as the sports field may be permitted in the higher risk areas. Site user should be signed up to the EA's Flood Warning Services.

SURFACE WATER

Risk Assessment				
Parameter	3.33% AEP	1% AEP	*0.1% AEP	Units
Min. Depth	N/A	0.15-0.30	0.15-0.30	m
Max. Depth	N/A	0.3-0.60	0.60-0.90	m
Max. Velocity	N/A	1.00-2.00	> 2.00	m/s
Max. Hazard	N/A	0.50-0.75	0.50-0.75	N/A

*The 0.1% annual probability extent represents the potential climate change adjusted impact of current risk

Description of Flood Mechanism
<ul style="list-style-type: none"> The site is currently at low risk of surface water flooding. Strawberry Vale road to west of the site is predicted to be at risk of surface water flooding. Climate change is predicted to increase the predicted flood extent, depth and velocity.

Figure 3 - RoFSW Flood Depth Map

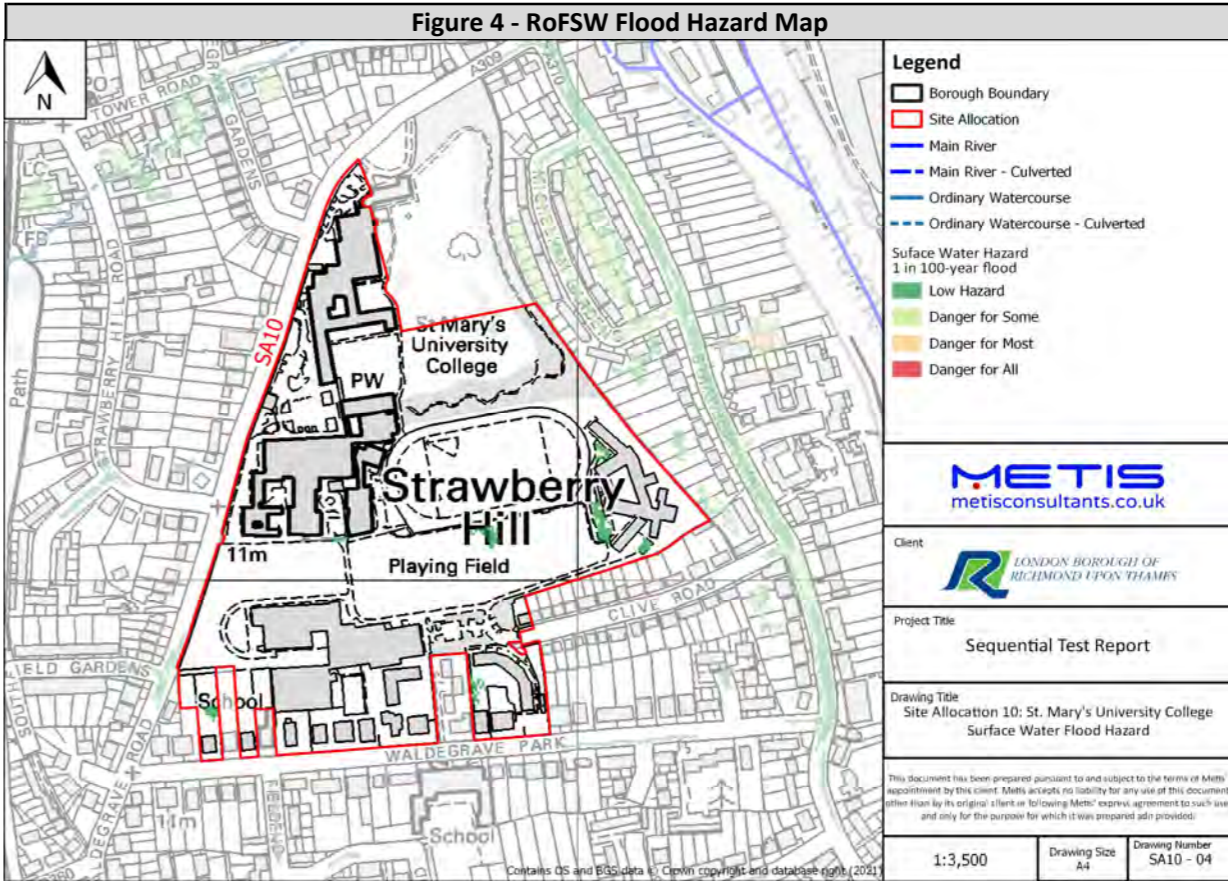
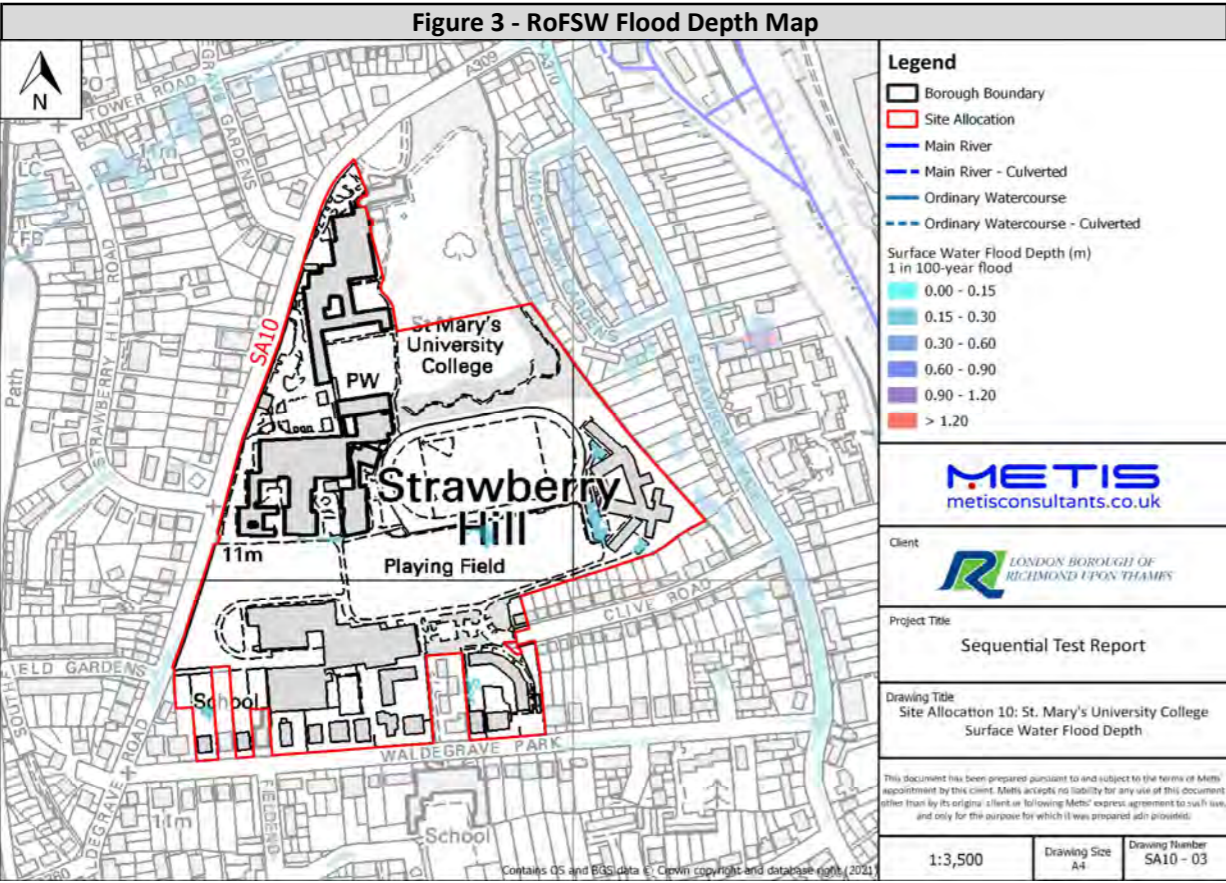
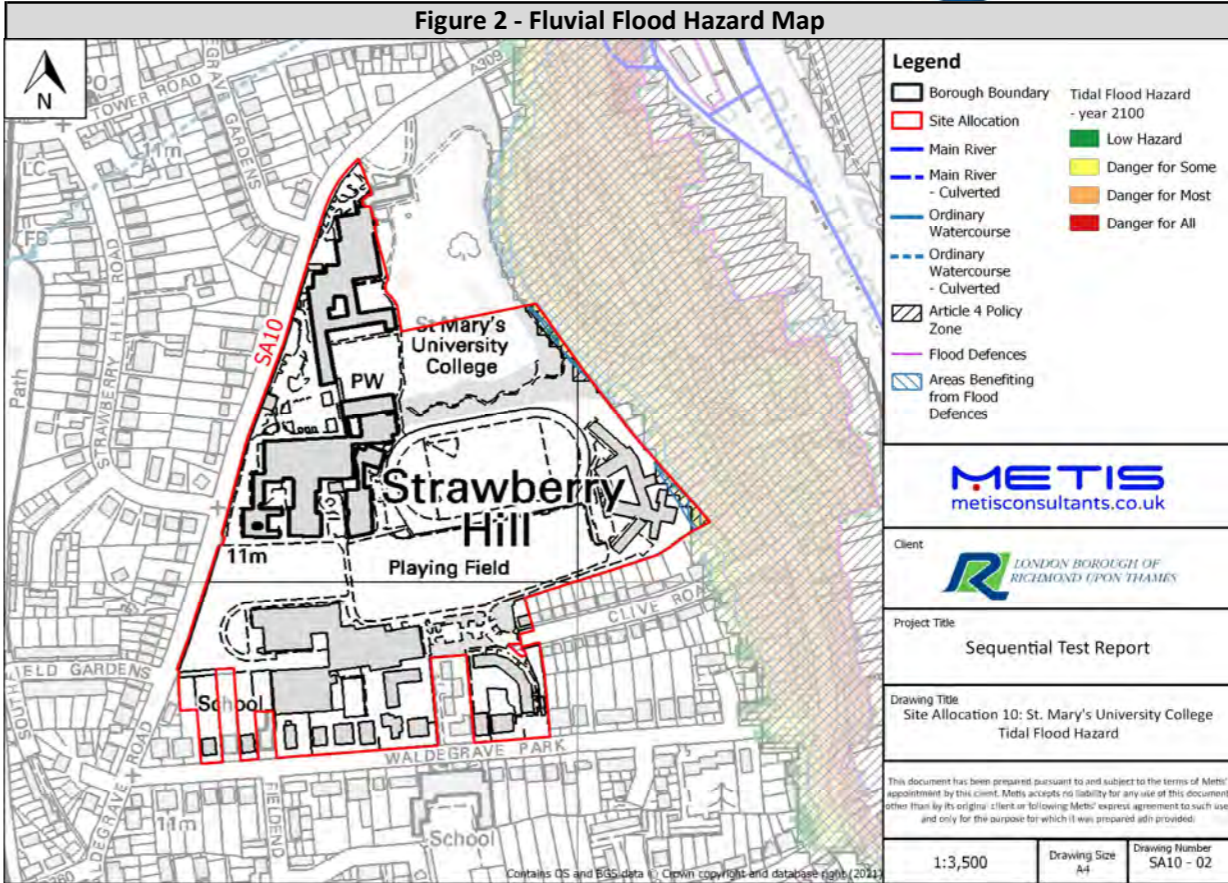
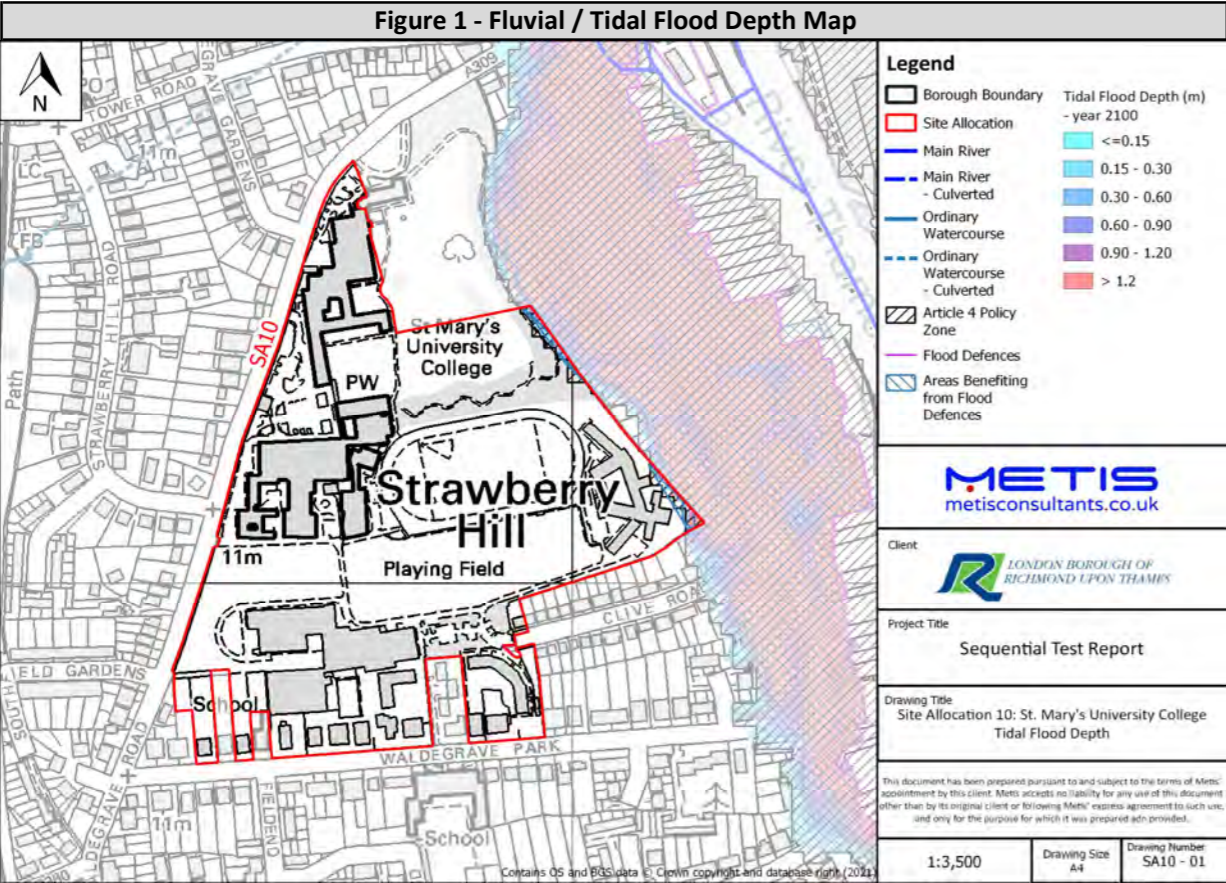
Site Access / Egress
Safe egress routes should be directed away from Strawberry Vale road to areas in the south or south west which have lower risk of flooding.

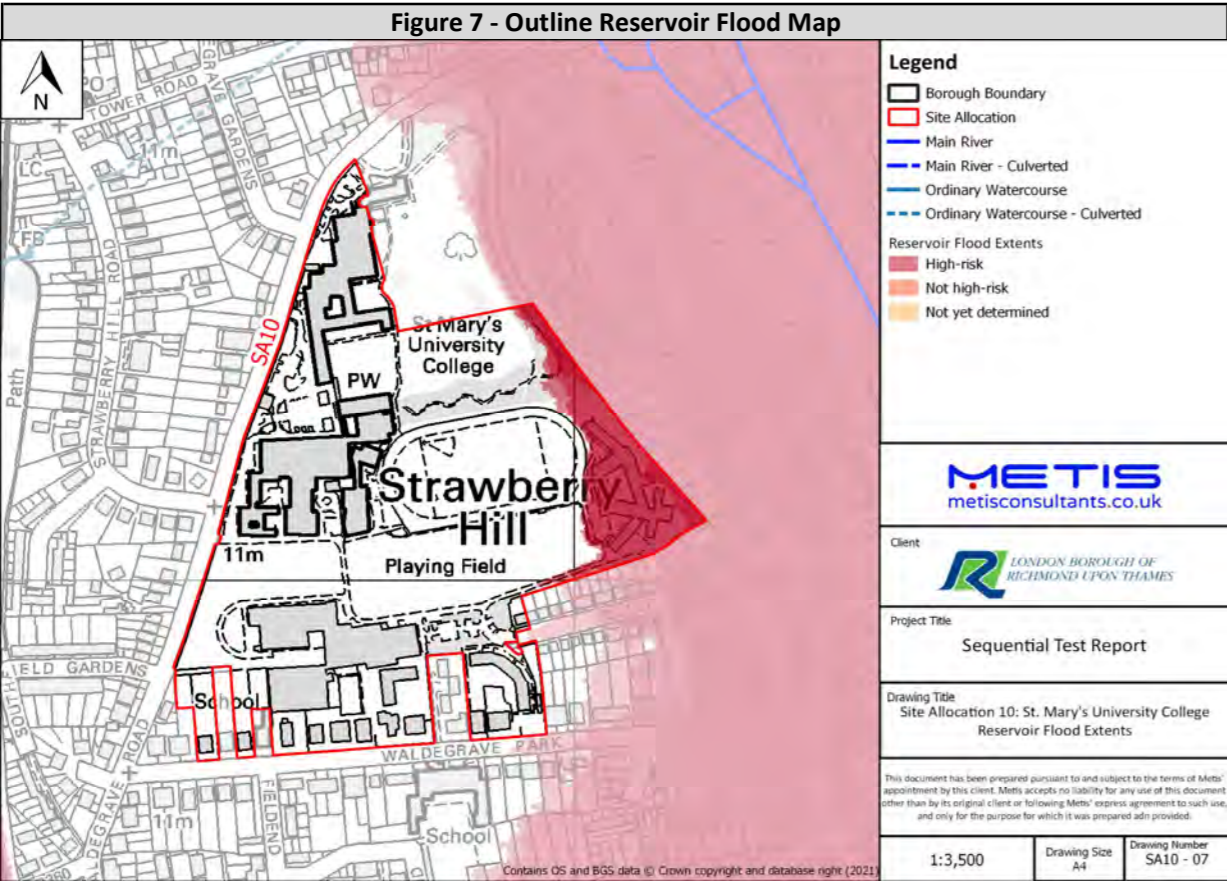
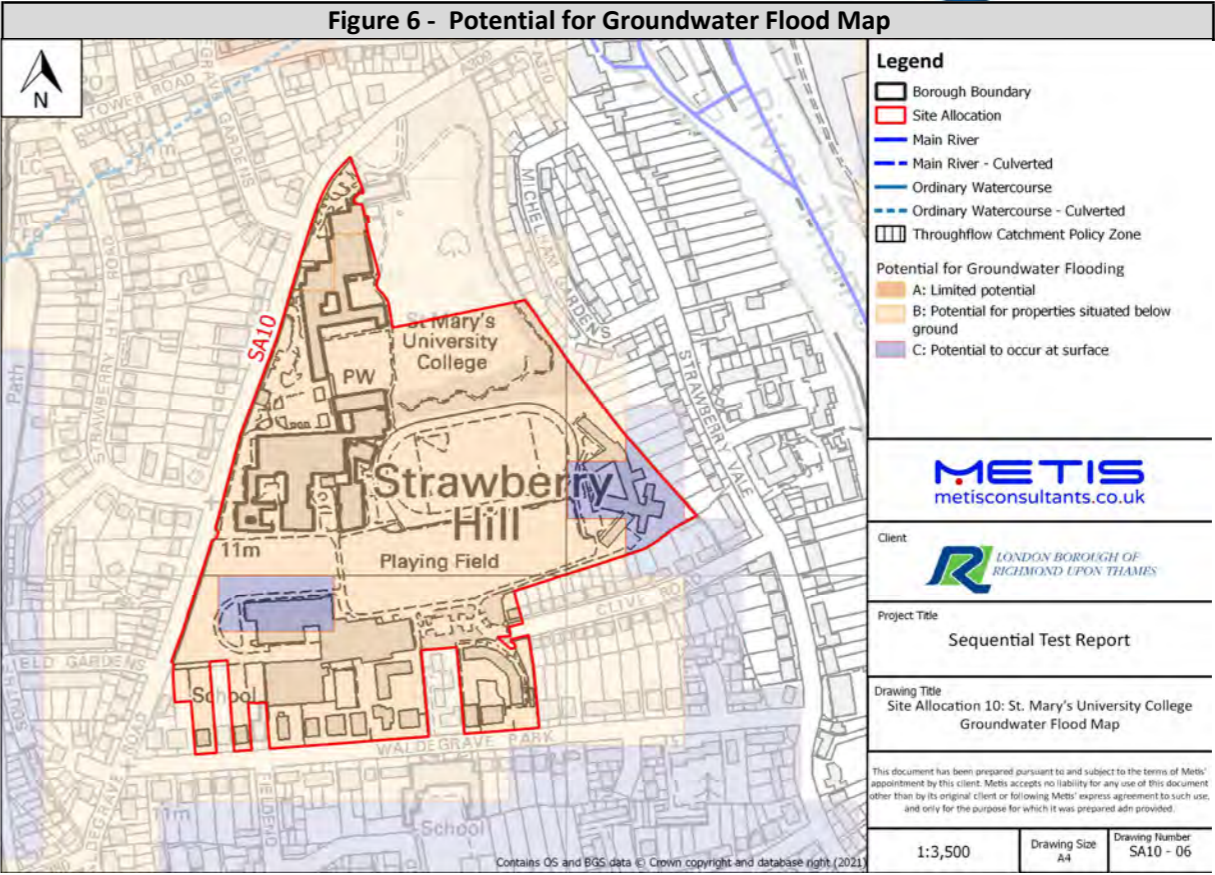
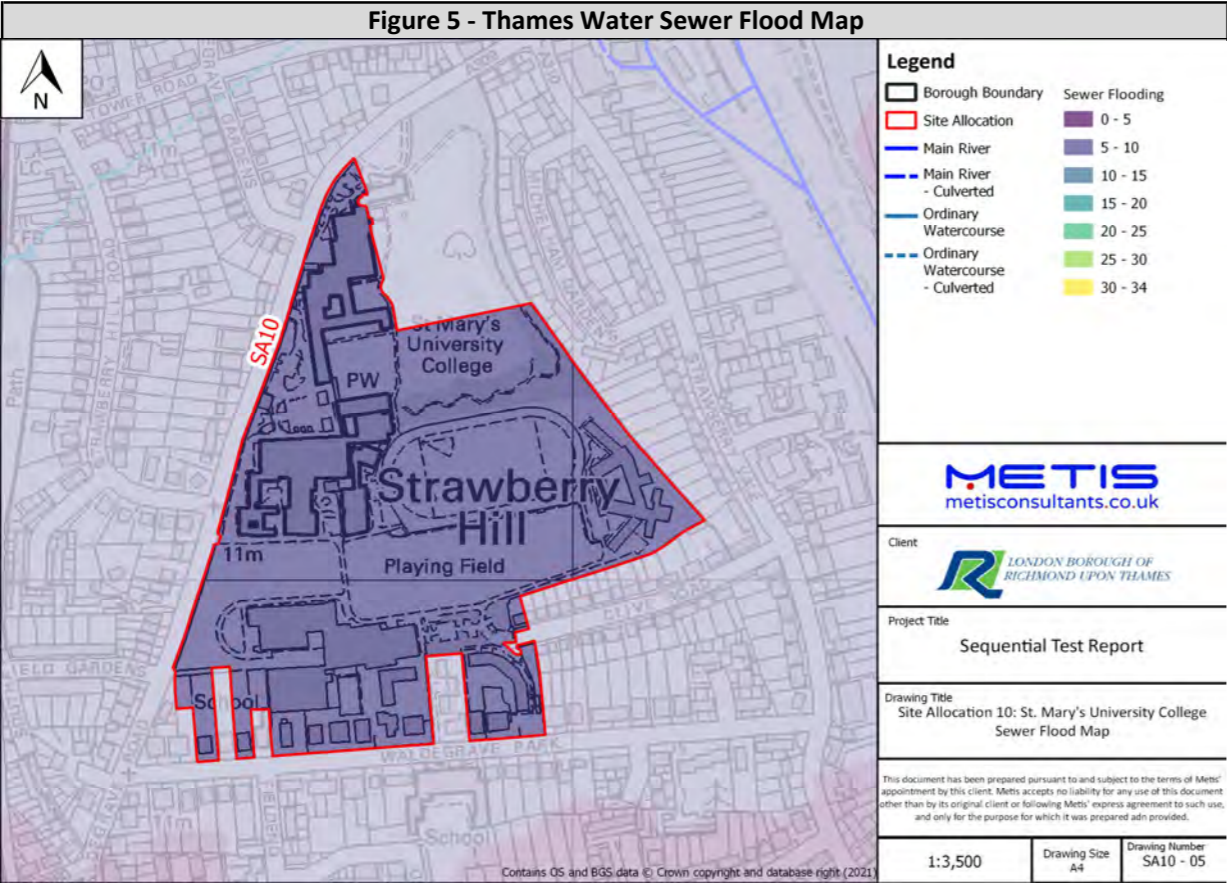
Figure 4 - RoFSW Flood Hazard Map

Mitigation - Surface Water Drainage
<ul style="list-style-type: none"> SuDS must be included and comply with the criteria set out in Local Plan Policy LP 8(B). Developments should apply the Sustainable Drainage Hierarchy set out in Policy SI13 of the London Plan. The actions in the London Sustainable Drainage Action Plan (LSDAP) should also be taken. Ground investigations are required to confirm whether infiltration based SuDS are suitable.

SITE ASSESSMENT - St. Mary's University, Strawberry Hill

SEWER	GROUNDWATER	ARTIFICIAL
Risk Assessment	Risk Assessment	Risk Assessment
The site is located within a postcode which has 7 previous reports of sewer flooding.	<ul style="list-style-type: none"> A large proportion of this site falls in an area which is classified as at risk of flooding from groundwater for subsurface structures. A small area in the North corner and in south-east section area classified as having potential for groundwater flooding at the surface. The site is underlain by the Kempton Park Gravel superficial deposit geology and the London Clay bedrock. The site is not located within a throughflow catchment area. 	<ul style="list-style-type: none"> A small proportion in the western side of the site is at risk of flood from the Queen Elizabeth II reservoir.
Figure 5 - Thames Water Sewer Flood Map	Figure 6 - Potential for Groundwater Flood Map	Figure 7 - Outline Reservoir Flood Map
Mitigation Requirements	Mitigation Requirements	Mitigation Requirements
<ul style="list-style-type: none"> Must consult with relevant Water and Sewerage company to confirm if the development site has historically flooded. Where historic flooding has occurred, the applicant must show how they will effectively manage this risk for the lifetime of the development. 	<ul style="list-style-type: none"> Applicants must ensure that the development does not impact the flow profile or increase the groundwater flood risk to neighbouring properties. If a basement is proposed, a basement screening assessment is required. 	<ul style="list-style-type: none"> Identify and assess the sources of risk. Implement appropriate and proportionate risk management measures.
PLANNING CONSIDERATIONS		
Safety of Development		
<p>A. Can the development be future proofed for climate change considerations?</p> <ul style="list-style-type: none"> Yes - More vulnerable development should be directed away from the north-eastern boundary of the site to areas of low/no tidal flood risk. Appropriate flood resistance or resilience measures should be developed for the predicted flood depths. <p>B. Can the development be designed safe throughout its lifetime without increasing flood risk elsewhere?</p> <ul style="list-style-type: none"> Yes - The development must use surface water drainage techniques to manage surface water runoff as close to the source as possible in line with Local Plan Policy LP 8(B). Green drainage infrastructure should be prioritised to provide wider ecological/biodiversity benefits as per London Plan Policy SI 13. <p>C. What is the cumulative impact of the development land use change and will flood risk increase?</p> <ul style="list-style-type: none"> The land use vulnerability classification is not changing. A large proportion of the site is covered in green area. Building over this area will increase the impermeable surface area and therefore the risk of flooding. <p>D. How can the development reduce risk overall?</p> <ul style="list-style-type: none"> By directing development away from the north-east side of the site. Include SuDS to manage surface water runoff and reduce run-off rates to comply with Local Plan Policy LP 8(B). <p>E. Will development require a flood risk permit/watercourse consent?</p> <ul style="list-style-type: none"> No - The site is not within 8m of a Main River, 5m of an Ordinary Watercourse or 16m from the Thames tidal defences. <p>F. Can the site pass the Exceptions Test?</p> <ul style="list-style-type: none"> Yes - See question B and C. 		





SITE ASSESSMENT - Richmond upon Thames College

Address: Egerton Road, Twickenham, TW2 7SJ	Area: 8.7 Ha
	Site Reference: SA11

Current Use	Proposed Use
College and Secondary School	Education, Sport and Student Accommodation

Current Vulnerability Classification	Proposed Vulnerability Classification
More Vulnerable	More Vulnerable

Current Risk Summary							
Fluvial / Tidal			Groundwater			Sewer Flooding	
FZ1	85.2	% of Site	A**	0	% of Site	No. Incidents	1
FZ2	14.8	% of Site	B	0	% of Site	Dry Islands and Islands	
FZ3a	0	% of Site	C	100	% of Site	Dry Island?	N
FZ3b	0	% of Site	**BGS classification (refer Fig 6)			Island?	N
Surface Water			Policy Zone?		N	Residual Risk	
3.33%*	0	% of Site	Artificial			Article 4 Zone?	N
1% AEP	0.9	% of Site	Reservoir	Y	At risk?	N/A	% of site
0.1% AEP	7.2	% of Site	Canal	N	At risk?	Town or Local Centres	
*Annual Exceedance Probability (AEP)			Other	N	At risk?	Within buffer?	Y

FLUVIAL / TIDAL

Risk Assessment (Defended)				
Parameter	FZ3b	FZ3a	*FZ3a+CC	Units
Speed of inundation	N/A	N/A	10.25	Hrs
Min. Depth	N/A	N/A	0.00	m
Max. Depth	N/A	N/A	0.40	m
Max. Velocity	N/A	N/A	0.44	m/s
Max Flood Level	N/A	N/A	8.25	m AOD
Max Ground Level	N/A	N/A	10.49	m AOD
Min Ground Level	N/A	N/A	7.85	m AOD
Max Flood Hazard	N/A	N/A	1.25-2.50	N/A
Duration of Flood	N/A	N/A	44+	Hrs

* The +35% Climate Change Allowance event (central case) is reviewed

Risk Assessment (Thames Tidal Defence Breach Model)			
Parameter	2005	2100	Units
Min. Depth	N/A	N/A	m
Max. Depth	N/A	N/A	m
Max. Velocity	N/A	N/A	m/s
Max. Hazard	N/A	N/A	N/A
Max Ground level	N/A	N/A	m AOD
Max Flood Level	N/A	N/A	m AOD

Description of flood mechanism
<ul style="list-style-type: none"> The south section of this site is at risk of flooding from the River Crane, which flows adjacent to the site border. Flooding originates from the River Crane at the south- western corner of the site and inundates the lower section of the site. The flooding extent covers most of the lower section, up until Cranford Way. The Northern section of the site is not predicted to be risk of fluvial flooding.

Figure 1 - Fluvial / Tidal Flood Depth Map

Site Access / Egress
Safe Access/Egress routes should be directed towards the Northern section. There is a bridge over Cranford Way that connects the two sections of the site.

Figure 2 - Fluvial Flood Hazard Map

Mitigation / FRA Requirements
<ul style="list-style-type: none"> More vulnerable developments such as the student accommodation and education facilities should be restricted to the Northern section of the site. Less vulnerable developments such as sports grounds may be permitted in the higher risk area. See Report section 5.4 for Main River requirements. Develop Flood Warning and Emergency Plans for the site. Site users should be signed up to the EA'S Flood Warning Service.

SURFACE WATER

Risk Assessment				
Parameter	3.33% AEP	1% AEP	*0.1% AEP	Units
Min. Depth	N/A	0.00-0.15	0.00-0.15	m
Max. Depth	N/A	0.15-0.30	0.30-0.60	m
Max. Velocity	N/A	0.25-0.50	0.50-1.00	m/s
Max. Hazard	N/A	0.75-1.25	0.75-1.25	N/A

*The 0.1% annual probability extent represents the potential climate change adjusted impact of current risk

Description of Flood Mechanism
<ul style="list-style-type: none"> The site is currently at low risk of surface water flooding. Climate Change is predicted increase the flood extent, depth and velocity. In the 0.1% AEP, surface water ponds on the playing field in the north section of the site. The site is within a critical drainage area (Twickenham)

Figure 3 - RoFSW Flood Depth Map

Site Access / Egress
Safe egress routes should be directed away playing field where flood risk is predicted. Safe egress routes are available to the west, north and east of the site.

Figure 4 - RoFSW Flood Hazard Map

Mitigation - Surface Water Drainage
<ul style="list-style-type: none"> SuDS must be included and comply with the criteria set out in Local Plan Policy LP 8(B). Developments should apply the Sustainable Drainage Hierarchy set out in Policy SI13 of the London Plan. The actions in the London Sustainable Drainage Action Plan (LSDAP) should also be taken.

SITE ASSESSMENT - Richmond upon Thames College

SEWER	GROUNDWATER	ARTIFICIAL
Risk Assessment	Risk Assessment	Risk Assessment
<p>This site is located with a postcode which has 1 previous report of sewer flooding.</p>	<ul style="list-style-type: none"> The entire site is located on an area classified to have a potential of groundwater flooding at the surface The site underlain by Kempton Park Gravel superficial deposits and the London Clay bedrock. The site is not within a throughflow catchment area. 	<ul style="list-style-type: none"> The south-eastern side of this site is at risk of flooding from the Queen Elizabeth II and Staines North Reservoir. The Reservoir flooding extent model predicts that this area of the site is at 'high risk' if either of the Reservoirs are breached on a wet day (rivers at capacity).
<p>Figure 5 - Thames Water Sewer Flood Map</p>	<p>Figure 6 - Potential for Groundwater Flood Map</p>	<p>Figure 7 - Outline Reservoir Flood Map</p>
Mitigation Requirements	Mitigation Requirements	Mitigation Requirements
<p>No mitigation required.</p>	<ul style="list-style-type: none"> Applicants must ensure that the development does not impact the flow profile or increase the groundwater flood risk to neighbouring properties. If a basement is proposed, a basement screening assessment is required. 	<ul style="list-style-type: none"> Identify and assess the sources of risk - including from other local reservoirs that may not be mapped. Implement appropriate and proportionate risk management measures.

PLANNING CONSIDERATIONS

Safety of Development

A. Can the development be future proofed for climate change considerations?

- Yes- By restricting more vulnerable developments to the northern section of the site.
- See Report section 5.4 Main River requirements.

B. Can the development be designed safe throughout its lifetime without increasing flood risk elsewhere?

- Yes - by restricting more vulnerable developments away from Flood Zone 2.
- The development must use surface water drainage techniques to manage surface water runoff as close to the source as possible in line with Local Plan Policy LP 8(B). Green drainage infrastructure should be prioritised to provide wider ecological/biodiversity benefits as per London Plan Policy SI 13.

C. What is the cumulative impact of the development land use change and will flood risk increase?

- The Land use vulnerability classification for the site is not changing.
- The site has a large proportion of green areas throughout. Building on this will increase the amount of impermeable surfaces and increase the risk of flooding.
- Any changes near the southern border of the site may affect the flow path of the River Crane, increasing the risk of flooding.

D. How can the development reduce risk overall?

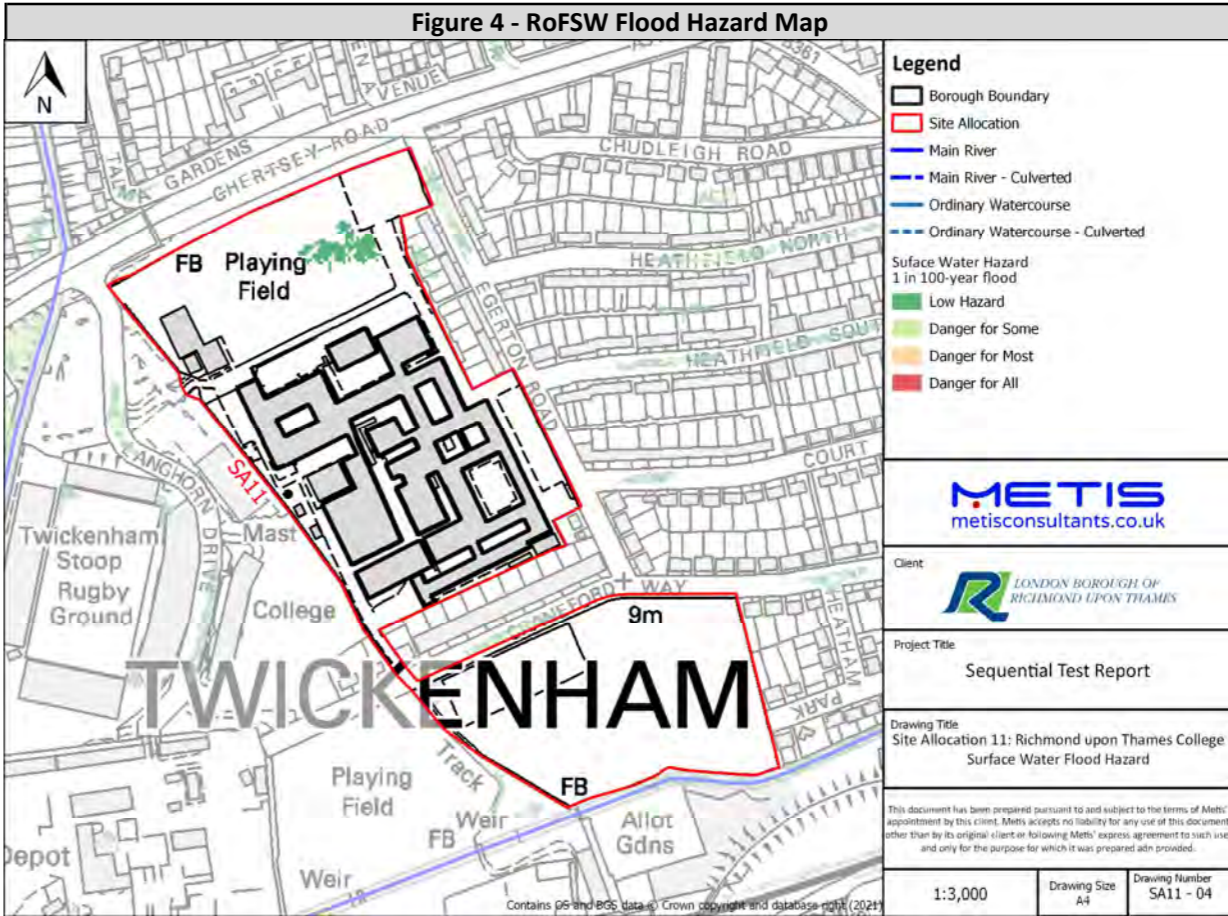
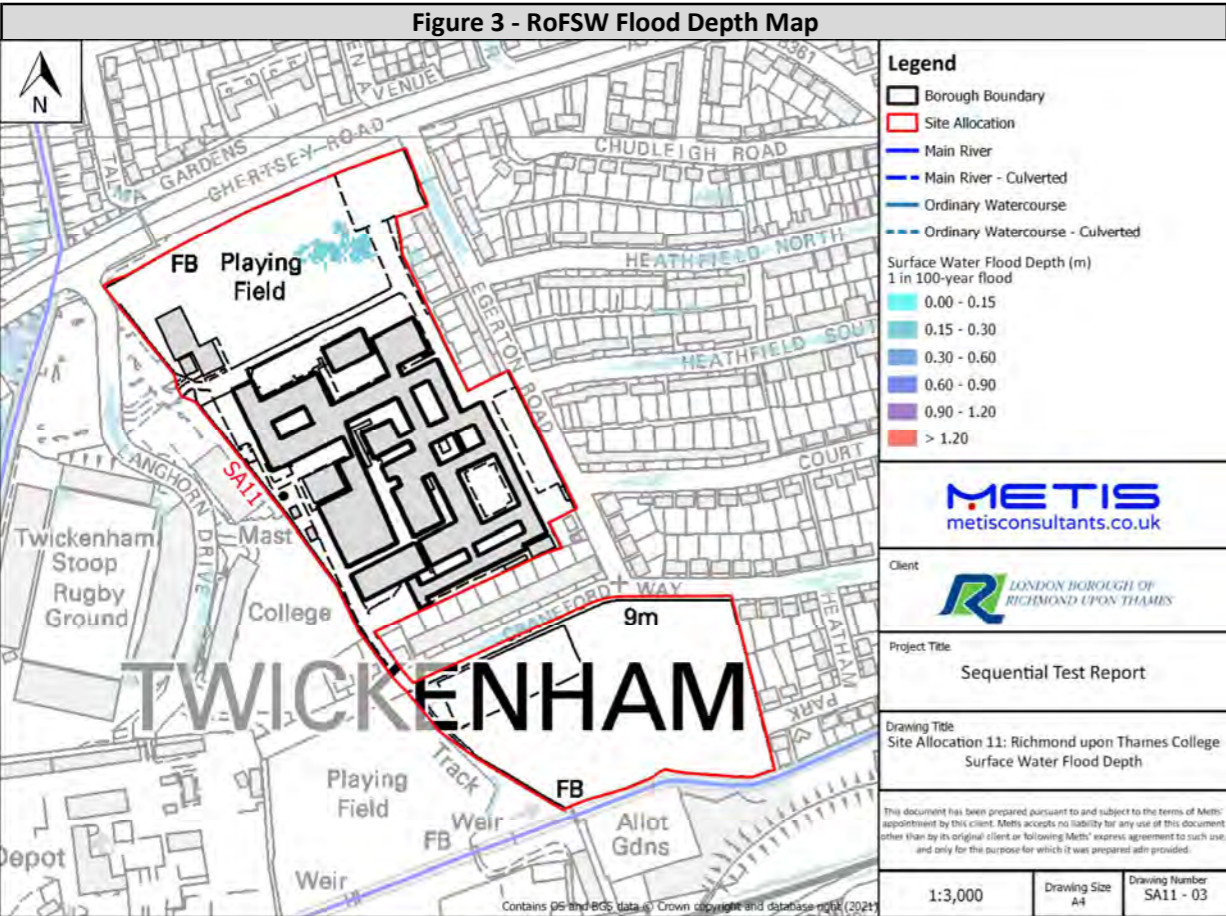
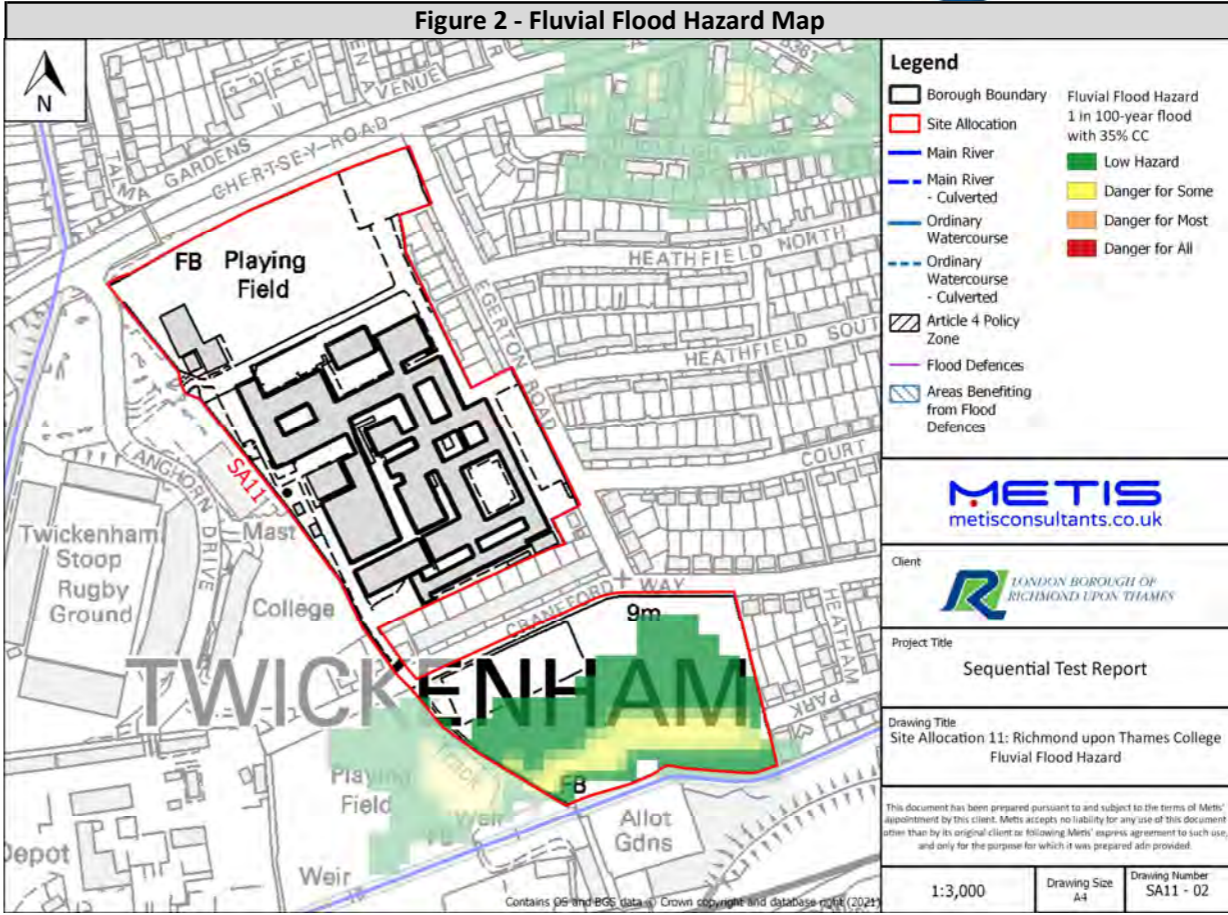
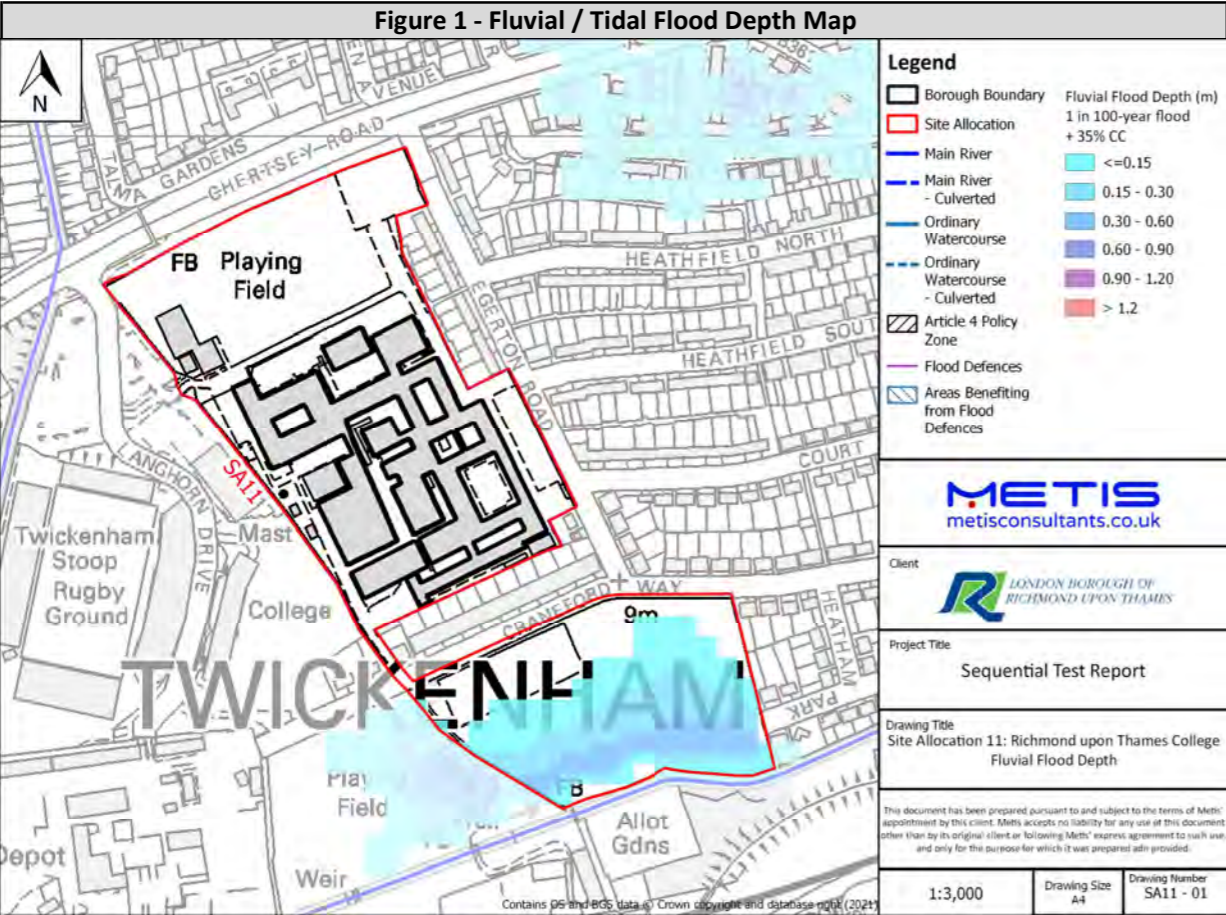
- By restricting development away from the south section of the site.
- Including SuDS to manage surface water run-off to comply with Local Plan Policy LP 8(B).
- By restricting all development to outside the 8m Buffer of the Main River.

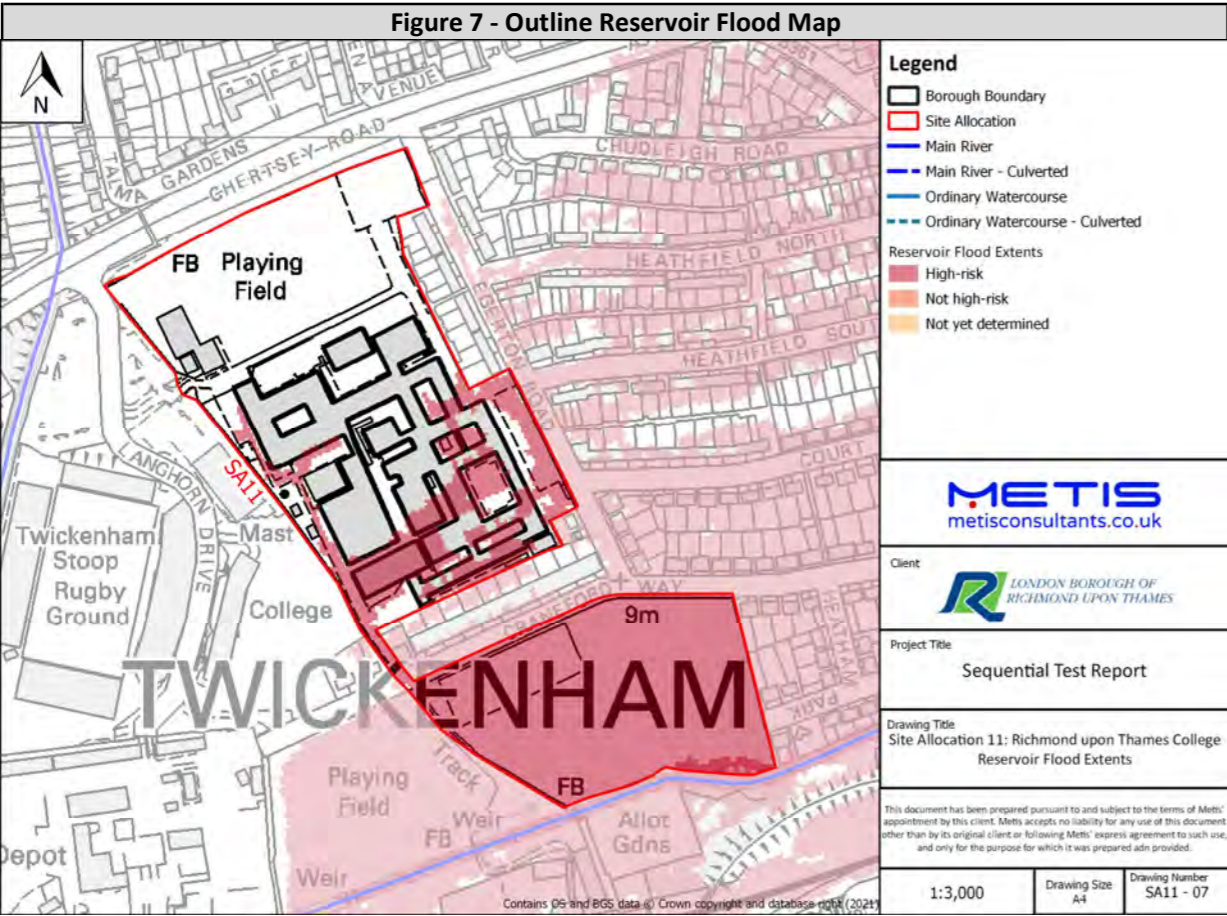
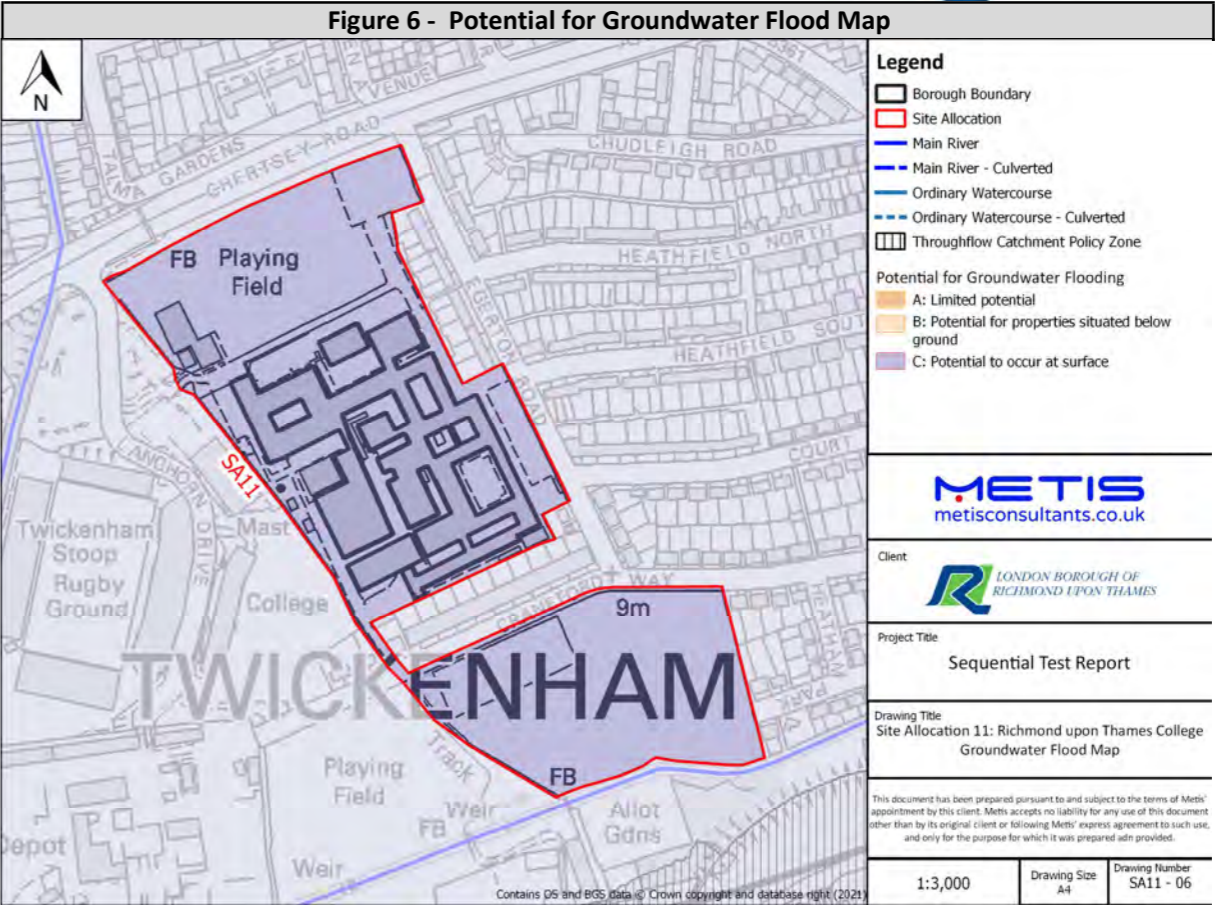
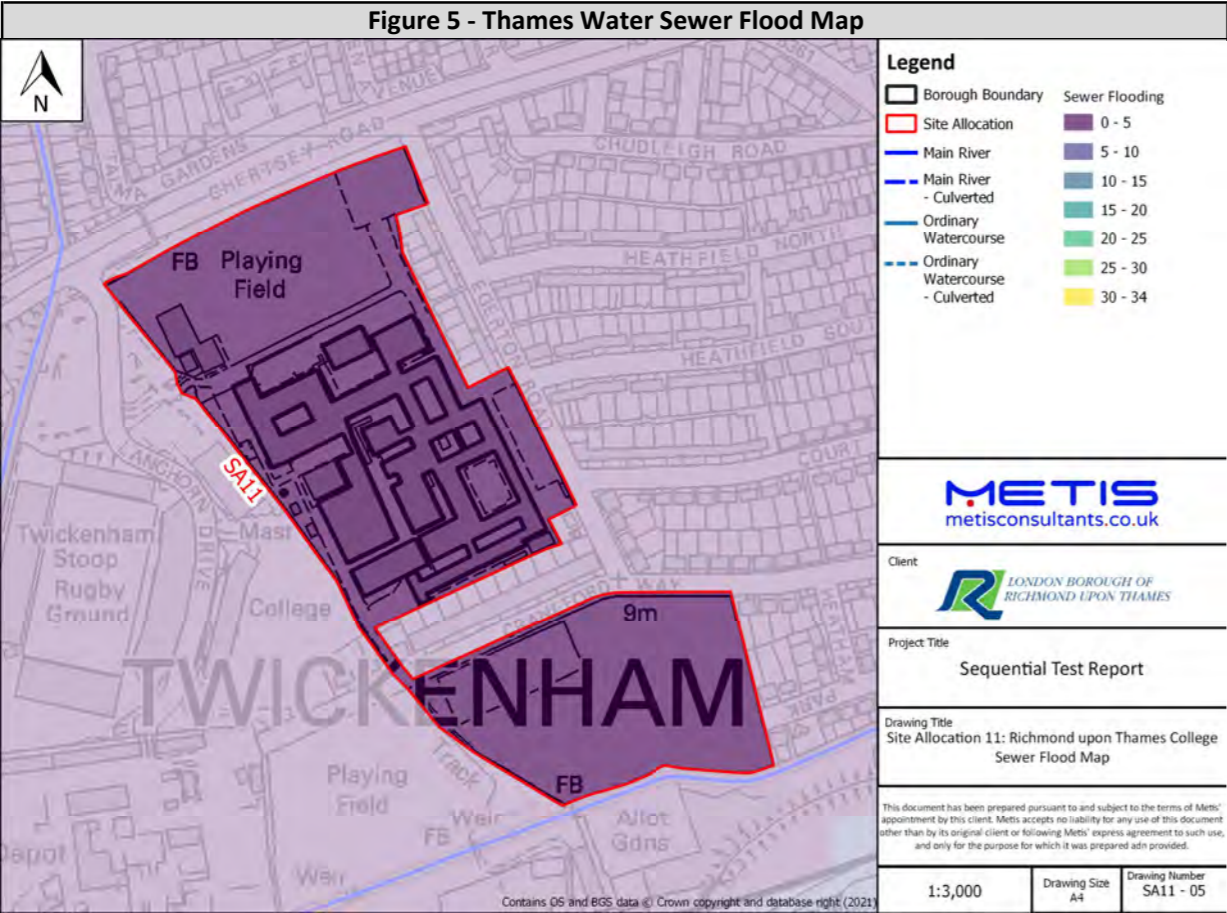
E. Will development require a flood risk permit/watercourse consent?

- Yes - The southern edge of the site is within 8m of the River Crane - See Report 5.4. for Main River requirements.

F. Can the site pass the Exception Test?

- Yes - See B and C.





SITE ASSESSMENT - Twickenham Stadium Rugby Ground

Address: 200 Whitton Rd, Twickenham TW2 7BA	Area: 12.62 Ha
	Site Reference: SA13

Current Use	Proposed Use
Sports Stadium	Sport Stadium with additional features such as indoor leisure, hotel or business uses, as well as hospitality and conference facilities.

Current Vulnerability Classification	Proposed Vulnerability Classification
Less Vulnerable	More Vulnerable

Current Risk Summary							
Fluvial / Tidal			Groundwater			Sewer Flooding	
FZ1	12.6	% of Site	A**	0.0	% of Site	No. Incidents	1
FZ2	87.6	% of Site	B	0.0	% of Site	Dry Islands and Islands	
FZ3a	0.0	% of Site	C	82.7	% of Site	Dry Island?	N
FZ3b	0.0	% of Site	**BGS classification (refer Fig 6)			Island?	N
Surface Water			Policy Zone?		N	Residual Risk	
3.33%*	8.1	% of Site	Artificial			Article 4 Zone?	N
1% AEP	35.0	% of Site	Reservoir	N	At risk?	N/A	% of site
0.1% AEP	79.0	% of Site	Canal	Y	At risk?	Town or Local Centres	
*Annual Exceedance Probability (AEP)			Other	N	At risk?	Within buffer?	Y

FLUVIAL / TIDAL

Risk Assessment (Defended)				
Parameter	FZ3b	FZ3a	*FZ3a+CC	Units
Speed of inundation	N/A	N/A	9.50	Hrs
Min. Depth	N/A	N/A	0.00	m
Max. Depth	N/A	N/A	0.58	m
Max. Velocity	N/A	N/A	0.95	m/s
Max Flood Level	N/A	N/A	11.59	m AOD
Max Ground Level	N/A	N/A	10.99	m AOD
Min Ground Level	N/A	N/A	8.51	m AOD
Max Flood Hazard	N/A	N/A	> 2.00	N/A
Duration of Flood	N/A	N/A	44+	Hrs

* The +35% Climate Change Allowance event (central case) is reviewed

Risk Assessment (Thames Tidal Defence Breach Model)			
Parameter	2005	2100	Units
Min. Depth	N/A	N/A	m
Max. Depth	N/A	N/A	m
Max. Velocity	N/A	N/A	m/s
Max. Hazard	N/A	N/A	N/A
Max. Ground Level	N/A	N/A	m AOD
Max Flood Level	N/A	N/A	m AOD

Description of flood mechanism
<ul style="list-style-type: none"> The site is not currently at risk of fluvial flood but it is in the climate change scenario, which covers most of the site apart from a small area in the south-western region. Flooding is predicted to originate from the adjacent Main Rivers which flows along the western and eastern boundary. The flood depths and hazard are highest in the North region of the site.

Figure 1 - Fluvial / Tidal Flood Depth Map

Site Access / Egress
Safe access / egress routes are available towards the south-east of the site, where flooding is not predicted.

Figure 2 - Fluvial Flood Hazard Map

Mitigation / FRA Requirements
<ul style="list-style-type: none"> To mitigate against predicted flooding in the 1% AEP + climate change event, more vulnerable developments (such as the hotel) should be restricted to areas of lower flood risk and directed away from the north and north east of the site. Lower vulnerability developments may go in the higher risk area. See Report section 5.4 or Main River requirements. Develop a Flood Emergency and Evacuation Plan for the site. Site users should be signed up to the EA's Flood Warning Service.

SURFACE WATER

Risk Assessment				
Parameter	3.33% AEP	1% AEP	*0.1% AEP	Units
Min. Depth	0-0.15	0-0.15	0-0.15	m
Max. Depth	0.9-1.20	>1.20	>1.20	m
Max. Velocity	1.00-2.00	0.5-1.00	1.00-2.00	m/s
Max. Hazard	0.75-1.25	1.25-2.00	1.25-2.00	N/A

*The 0.1% annual probability extent represents the potential climate change adjusted impact of current risk

Description of Flood Mechanism
<ul style="list-style-type: none"> Surface water ponds in the northern section of the site. Some water also collects along the south-western side of the Stadium. Climate Change is predicted to increase the flood extent and depth. The site is located within a Critical Drainage Area (Twickenham).

Figure 3 - RoFSW Flood Depth Map

Site Access / Egress
Safe access / egress routes should be directed towards Whitton Road (South of the site), where the risk of flooding is lower.

Figure 4 - RoFSW Flood Hazard Map

Mitigation - Surface Water Drainage
<ul style="list-style-type: none"> SuDS must be included and comply with the criteria set out in Local Plan Policy LP 8(B). Developments should apply the Sustainable Drainage Hierarchy set out in Policy SI13 of the London Plan. The actions in the London Sustainable Drainage Action Plan (LSDAP) should also be taken. Ground investigations are required to confirm whether infiltration based SuDS are suitable.

SITE ASSESSMENT - Twickenham Stadium Rugby Ground

SEWER	GROUNDWATER	ARTIFICIAL
Risk Assessment	Risk Assessment	Risk Assessment
<ul style="list-style-type: none"> The site is served by separate surface and foul sewer networks. The site falls within a postcode area where there is 1 reported flood incident from sewer flooding. 	<ul style="list-style-type: none"> The majority of the site falls within an area which is classified as having potential risk of groundwater flooding at the surface. A small section at the north of the site is not deemed at risk of groundwater flooding. The site is not located within a Throughflow Catchment area. 	<p>The site is not at risk from reservoir flooding.</p>
<p>Figure 5 - Thames Water Sewer Flood Map</p>	<p>Figure 6 - Potential for Groundwater Flood Map</p>	<p>Figure 7 - Outline Reservoir Flood Map</p>
Mitigation Requirements	Mitigation Requirements	Mitigation Requirements
<p>No mitigation measures required.</p>	<ul style="list-style-type: none"> Ensure that proposed subsurface developments do not increase the risk of groundwater related flood risk in the immediate area. Applicant should provide a screening assessment (as a minimum) to confirm low risk impacts or advise the level of impact and the associated mitigation action proposed. 	<p>No mitigation measures required.</p>

PLANNING CONSIDERATIONS

Safety of Development

A. Can the development be future proofed for climate change considerations?

- Yes - See Report section 5.2 for the finished floor levels.

B. Can the development be designed safe throughout its lifetime without increasing flood risk elsewhere?

- Yes - The development must use surface water drainage techniques to manage surface water runoff as close to the source as possible as per Local Plan Policy LP 8(B). Green drainage infrastructure should be prioritised to provide wider ecological/biodiversity benefits as per London Plan Policy SI 13.

C. What is the cumulative impact of the development land use change and will flood risk increase?

- The development land use is changing from the 'Less Vulnerable' to the 'More Vulnerable' classification. The site is proposed to be used for hospitality (including a hotel) uses.
- Currently there are a number of green areas throughout the site. Building over these will increase the impermeable surface area and therefore the risk of flooding.

D. How can the development reduce risk overall?

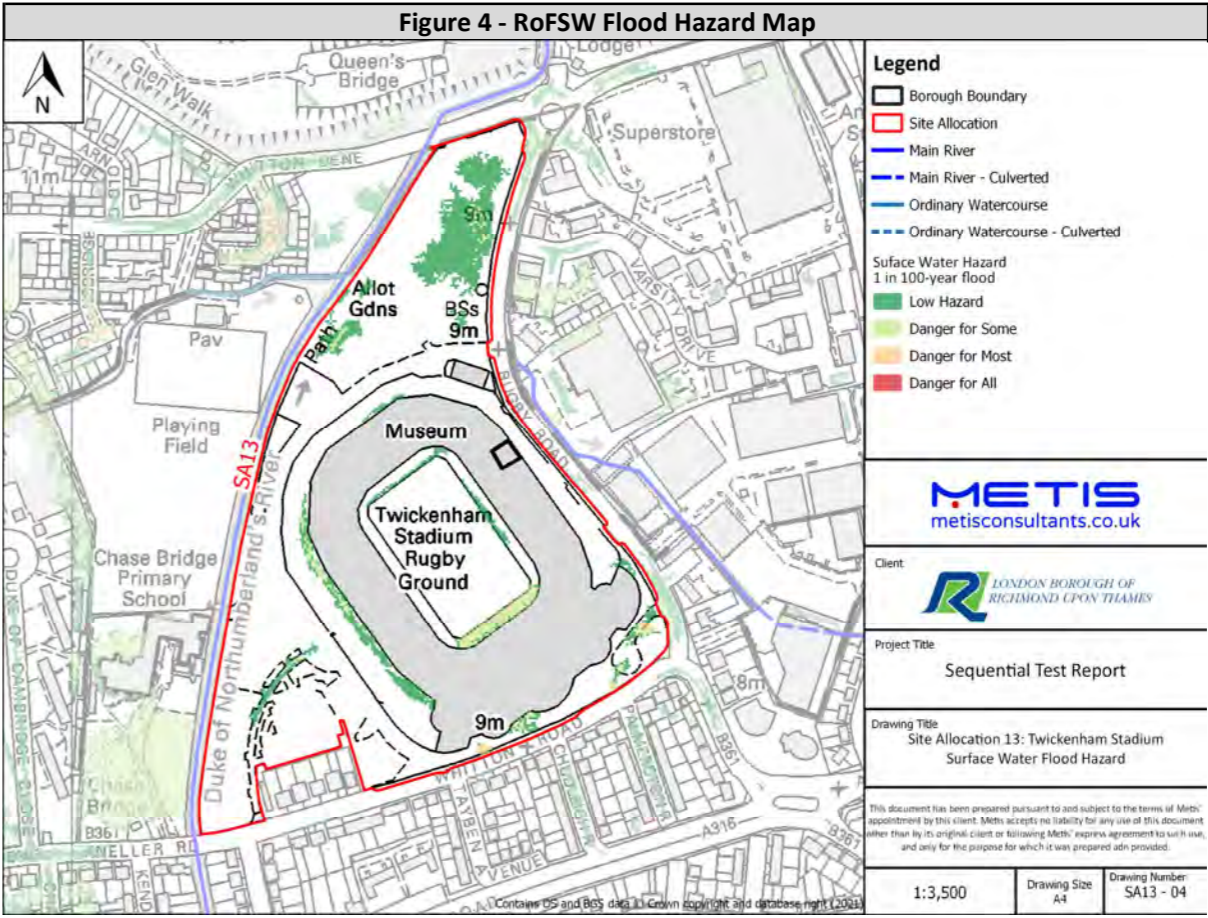
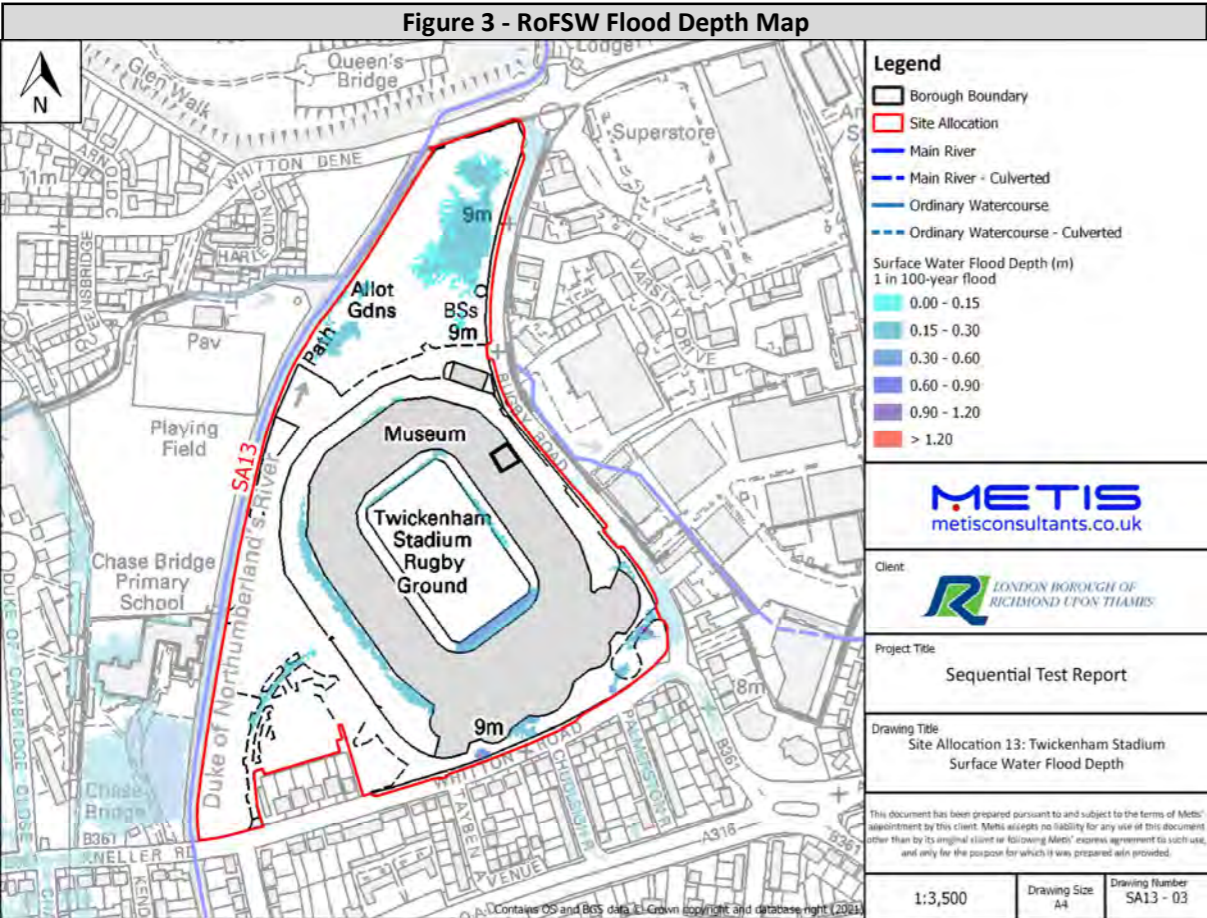
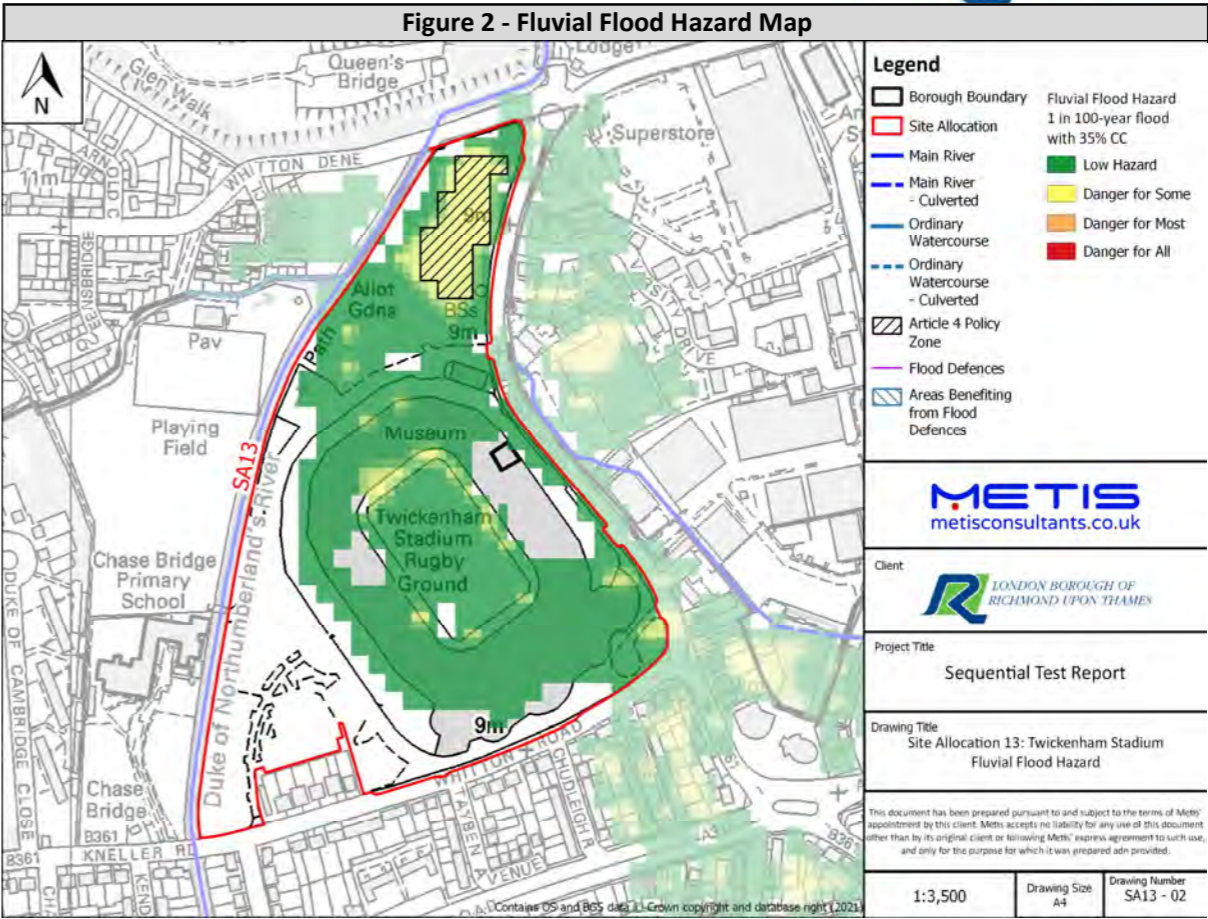
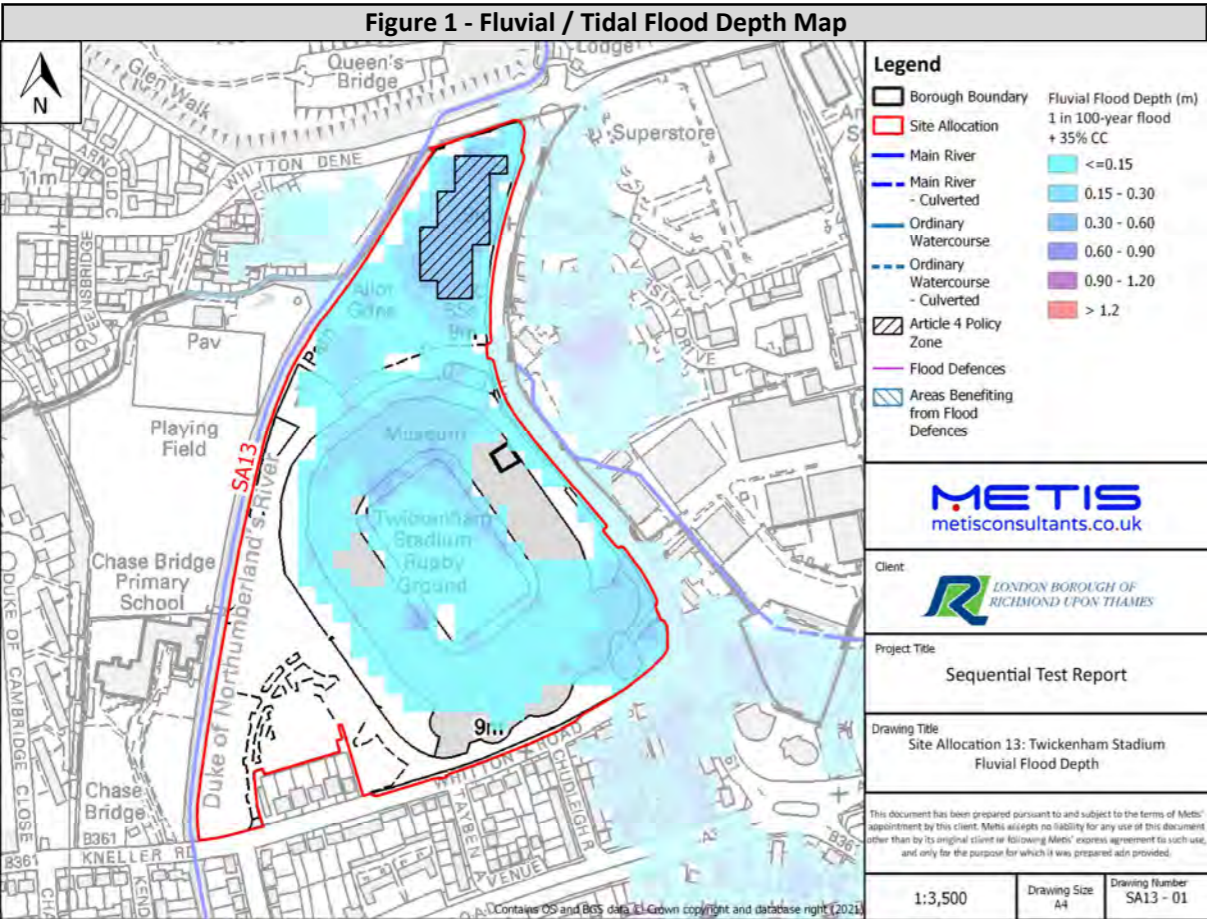
- By ensuring more vulnerable developments are restricted to lower flood risk areas.
- By restricting all developments to outside the 8m Main River buffer zone.
- Include SuDS to manage surface water runoff and reduce run-off rates to comply with Local Plan Policy LP 8(B).

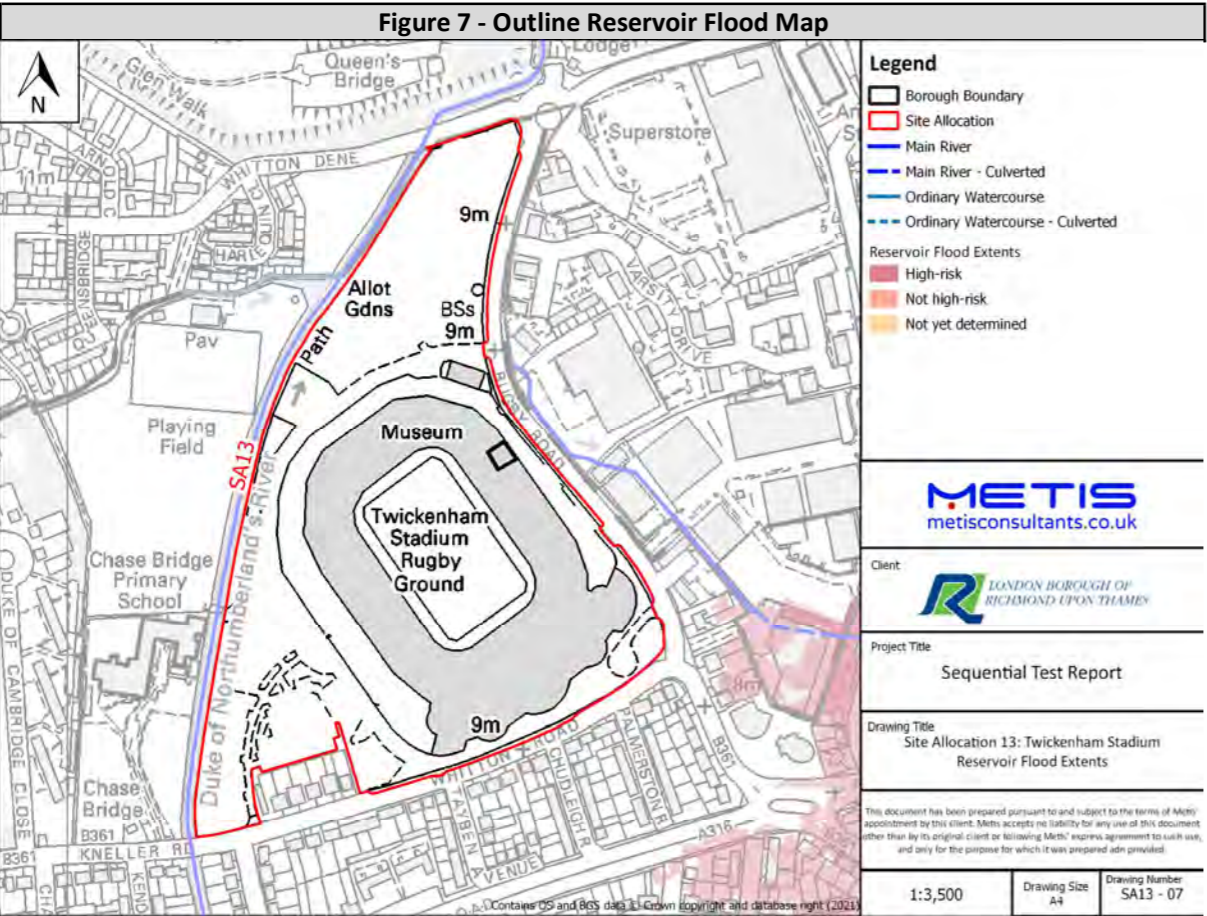
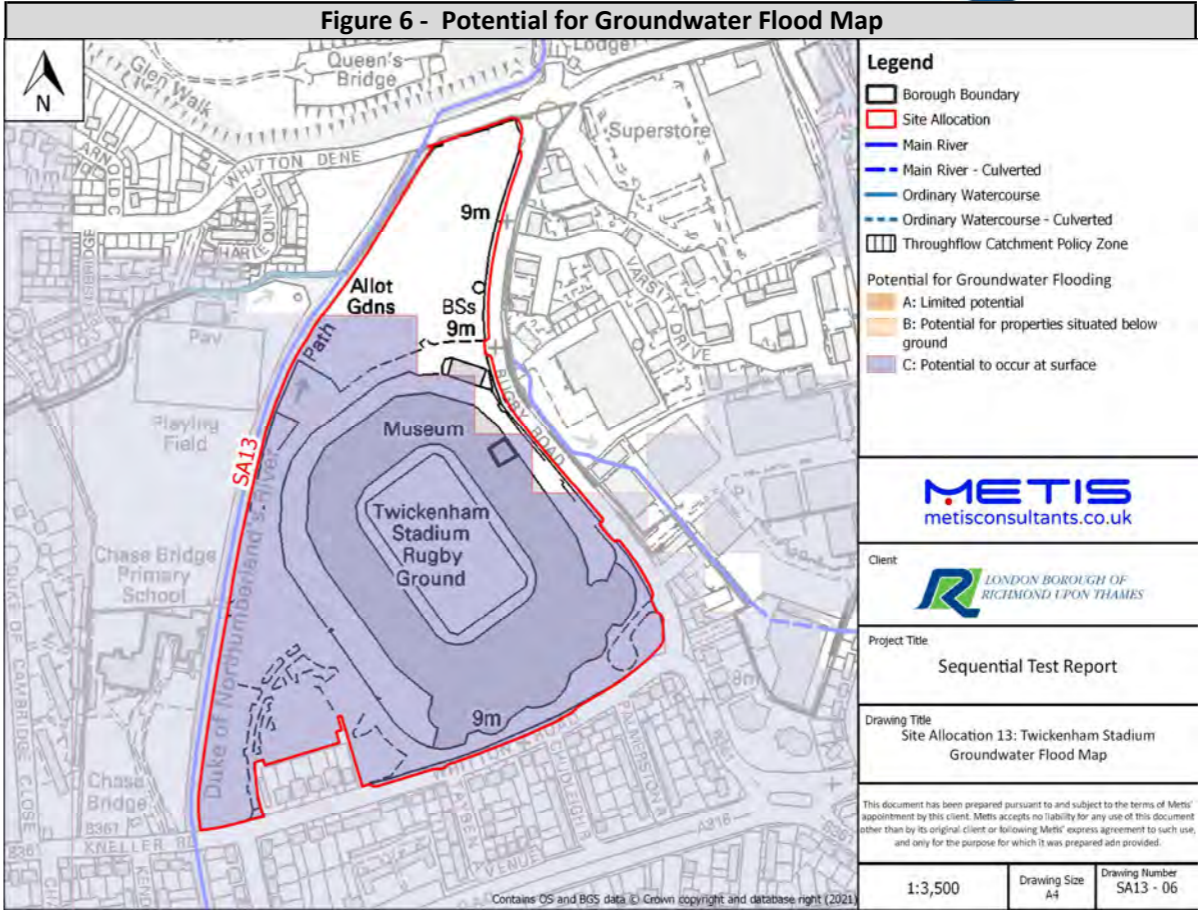
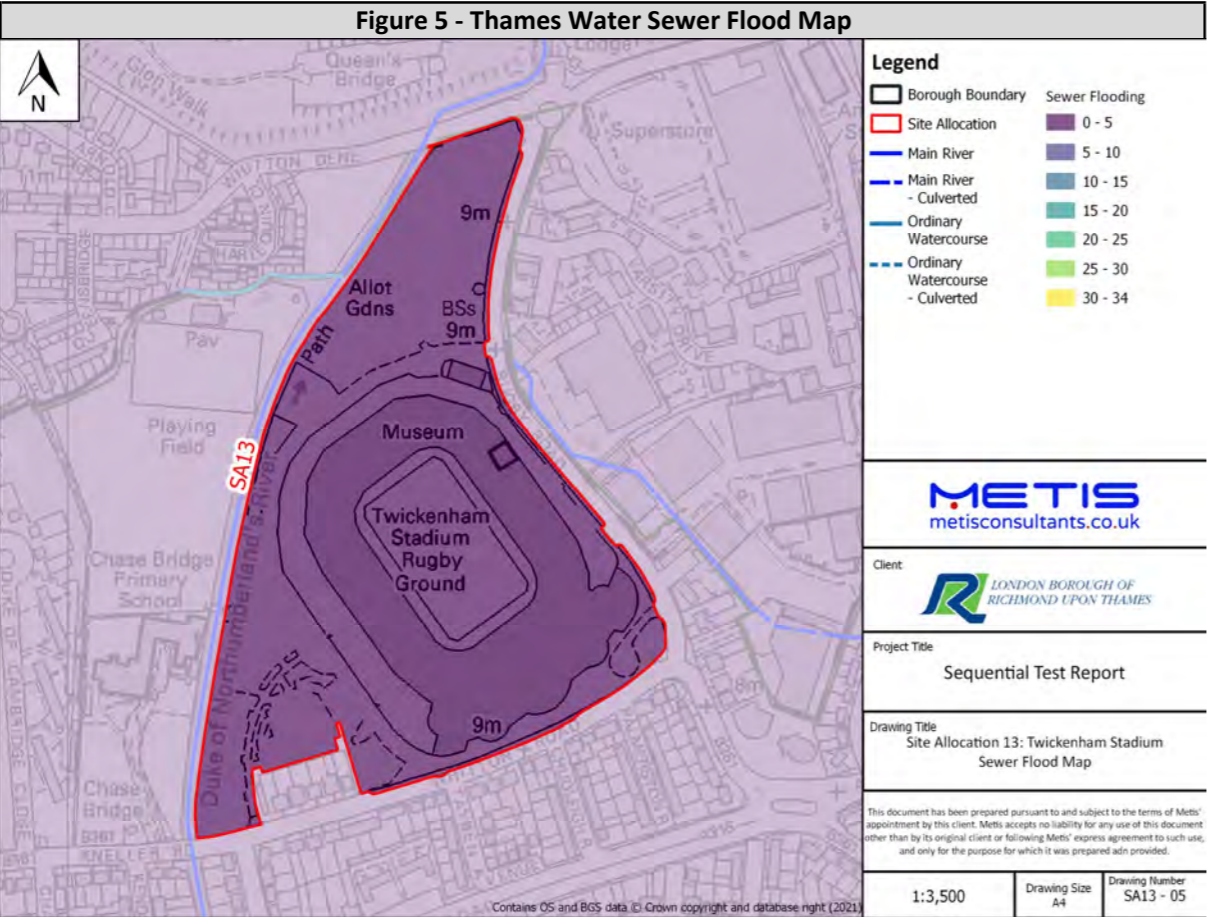
E. Will development require a flood risk permit/watercourse consent?

- Yes, the western boundary of the site is within 8m of the Duke of Northumberland river, which is a main river. See Report section 5.4 for further requirements.

F. Can the site pass the Exception Test?

- Not required - only required if a highly vulnerable development is proposed.





SITE ASSESSMENT - Mereway Day Centre

Address: Mereway Road, Twickenham, TW2 6RF	Area: 0.2 Ha
	Site Reference: SA14

Current Use	Proposed Use
Day Centre	Social and community infrastructure uses

Current Vulnerability Classification	Proposed Vulnerability Classification
Less Vulnerable	Less Vulnerable

Current Risk Summary							
Fluvial / Tidal			Groundwater			Sewer Flooding	
FZ1	20.6	% of Site	A**	0	% of Site	No. Incidents	3
FZ2	79.4	% of Site	B	0	% of Site	Dry Islands and Islands	
FZ3a	0	% of Site	C	100	% of Site	Dry Island?	N
FZ3b	0	% of Site	**BGS classification (refer Fig 6)			Island?	N
Surface Water			Policy Zone?		N	Residual Risk	
3.33%*	0.1	% of Site	Artificial			Article 4 Zone?	N
1% AEP	8.9	% of Site	Reservoir	N	At risk?	N/A	% of site
0.1% AEP	44.7	% of Site	Canal	N	At risk?	Town or Local Centres	
*Annual Exceedance Probability (AEP)			Other	N	At risk?	Within buffer?	Y

FLUVIAL / TIDAL

Risk Assessment (Defended)				
Parameter	FZ3b	FZ3a	*FZ3a+CC	Units
Speed of inundation	N/A	N/A	N/A	Hrs
Min. Depth	N/A	N/A	N/A	m
Max. Depth	N/A	N/A	N/A	m
Max. Velocity	N/A	N/A	N/A	m/s
Max Flood Level	N/A	N/A	N/A	m AOD
Max Ground Level	N/A	N/A	11.02	m AOD
Min Ground Level	N/A	N/A	9.54	m AOD
Max Flood Hazard	N/A	N/A	N/A	N/A
Duration of Flood	N/A	N/A	N/A	Hrs

* The +70% Climate Change Allowance event (upper end allowance extreme case) is reviewed

Risk Assessment (Thames Tidal Defence Breach Model)			
Parameter	2005	2100	Units
Min. Depth	N/A	N/A	m
Max. Depth	N/A	N/A	m
Max. Velocity	N/A	N/A	m/s
Max. Hazard	N/A	N/A	N/A
Max. Ground Level	N/A	N/A	m AOD
Max Flood Level	N/A	N/A	m AOD

Description of flood mechanism
<ul style="list-style-type: none"> The site is not currently at risk of fluvial flooding but it is in the 0.1% AEP climate change scenario. In this scenario, the site is at risk of flooding from the River Crane which flows directly adjacent to the north border of the site. The flood extent in the 0.1% AEP scenario is 79.4%. A small section in the north-eastern part of the site is not predicted to be at risk of flooding. No depth, hazard or velocity data was available for this scenario at this site.

[Figure 1 - Fluvial / Tidal Flood Depth Map](#)

Site Access / Egress
Site egress routes should be directed towards the southern or eastern section of the site, where no flood risk is predicted.

[Figure 2 - Fluvial Flood Hazard Map](#)

Mitigation / FRA Requirements
<ul style="list-style-type: none"> More information on flood depth, hazard, velocity should be requested from the EA. See Report section 5.4 for Main River requirements. Develop a Flood Emergency and Evacuation Plan for the site. Site users should be signed up to the EA's Flood Warning Service.

SURFACE WATER

Risk Assessment				
Parameter	3.33% AEP	1% AEP	*0.1% AEP	Units
Min. Depth	0.00-0.15	0.00-0.15	0.00-0.15	m
Max. Depth	0.15-0.30	0.30-0.60	>1.20	m
Max. Velocity	0.5-1.00	1.00-2.00	>2.00	m/s
Max. Hazard	0.50-0.75	1.25-2.00	>2.00	N/A

*The 0.1% annual probability extent represents the potential climate change adjusted impact of current risk

Description of Flood Mechanism
<ul style="list-style-type: none"> Surface water flooding is predicted to occur along the north boundary of the site. Climate change is predicted to increase the flood extent, depth, velocity and hazard. The flood extent in the 0.1% AEP covers the entire ground area of the surrounding the existing building.

[Figure 3 - RoFSW Flood Depth Map](#)

Site Access / Egress
Safe egress routes should be direct towards south east corner of the site, where no surface water flooding is predicted.

[Figure 4 - RoFSW Flood Hazard Map](#)

Mitigation - Surface Water Drainage
<ul style="list-style-type: none"> SuDS must be included and comply with the criteria set out in Local Plan Policy LP 8(B). Developments should apply the Sustainable Drainage Hierarchy set out in Policy SI13 of the London Plan. The actions in the London Sustainable Drainage Action Plan (LSDAP) should also be taken. Ground investigations are required to confirm whether infiltration based SuDS are suitable.

SITE ASSESSMENT - Mereway Day Centre

SEWER	GROUNDWATER	ARTIFICIAL
Risk Assessment	Risk Assessment	Risk Assessment
This site is located with a postcode which has 3 previous reports of sewer flooding.	<ul style="list-style-type: none"> This site is located in an area that is classified as having a potential for groundwater to occur at the surface. The site is not located within a throughflow catchment area. The site is underlain by Kenpton Park Gravel superficial deposits. 	This site is not at risk of flooding from artificial sources.
Figure 5 - Thames Water Sewer Flood Map	Figure 6 - Potential for Groundwater Flood Map	Figure 7 - Outline Reservoir Flood Map
Mitigation Requirements	Mitigation Requirements	Mitigation Requirements
<ul style="list-style-type: none"> Must consult with the relevant Water and Sewerage Company to confirm if the development site has historically flooded. Where historic flood has occurred, the applicant must show how they will effectively manage this risk for the lifetime of the development. 	Applicants must ensure that the development does not impact the flow profile or increase the groundwater flood risk to neighbouring properties.	No mitigation required.

PLANNING CONSIDERATIONS

Safety of Development

A. Can the development be future proofed for climate change considerations?

- Yes - restrict all development to outside the 8m buffer zone of the Main River.
- Restrict development away from Flood Zone 3b towards the south-east of the site.

B. Can the development be designed safe throughout its lifetime without increasing flood risk elsewhere?

- Yes - The development must use surface water drainage techniques to manage surface water runoff as close to the source as possible as per Local Plan Policy LP 8(B). Green drainage infrastructure should be prioritised to provide wider ecological/biodiversity benefits as per London Plan Policy SI 13.
- For any development in Flood Zone 3b - See report section 5.8. for compensatory flood storage requirements.
- Ensure the development does not impact the groundwater flow path.

C. What is the cumulative impact of the development land use change and will flood risk increase?

- The land use vulnerability classification is not changing. The site is currently a brownfield site with a mixture of impermeable and permeable surfaces. Building over green areas will increase the risk of flooding from surface water.

D. How can the development reduce risk overall?

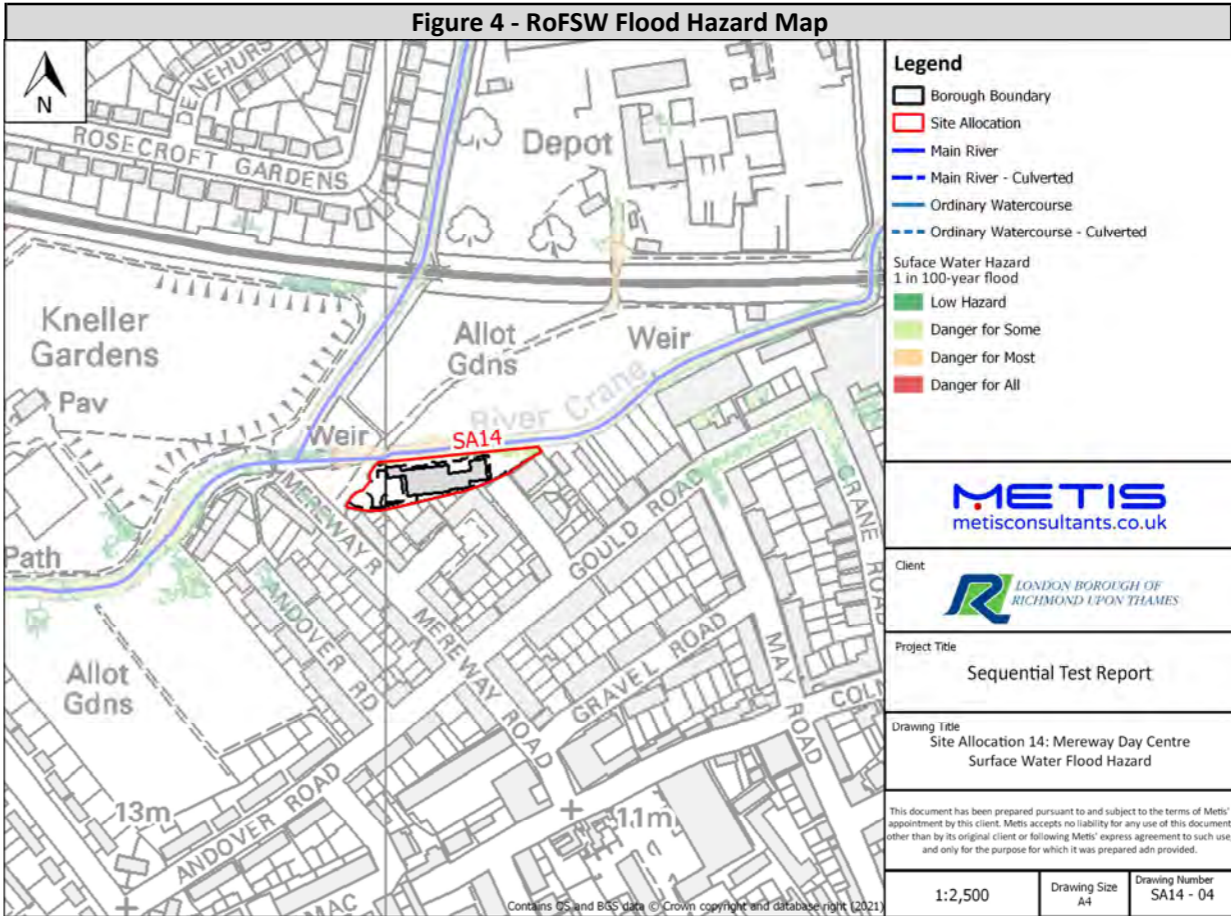
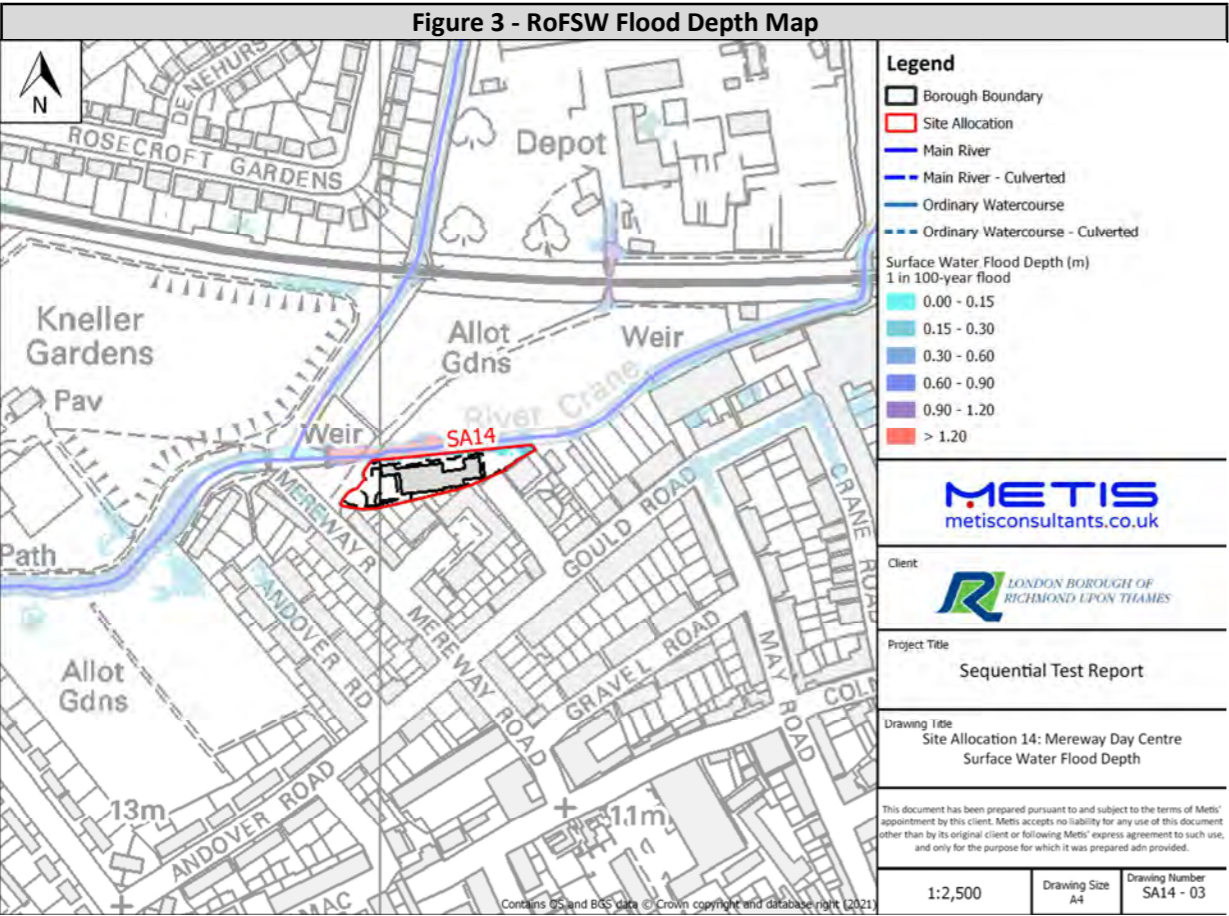
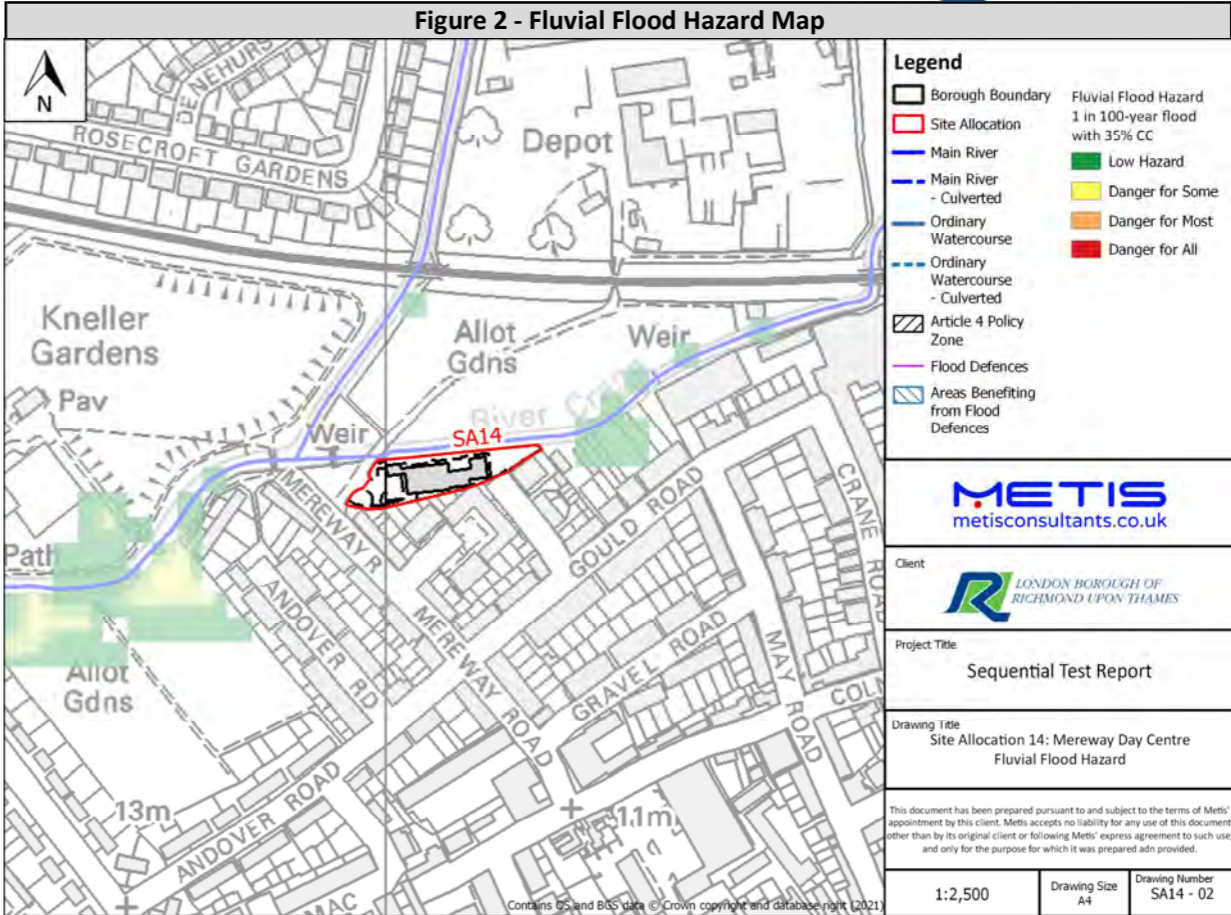
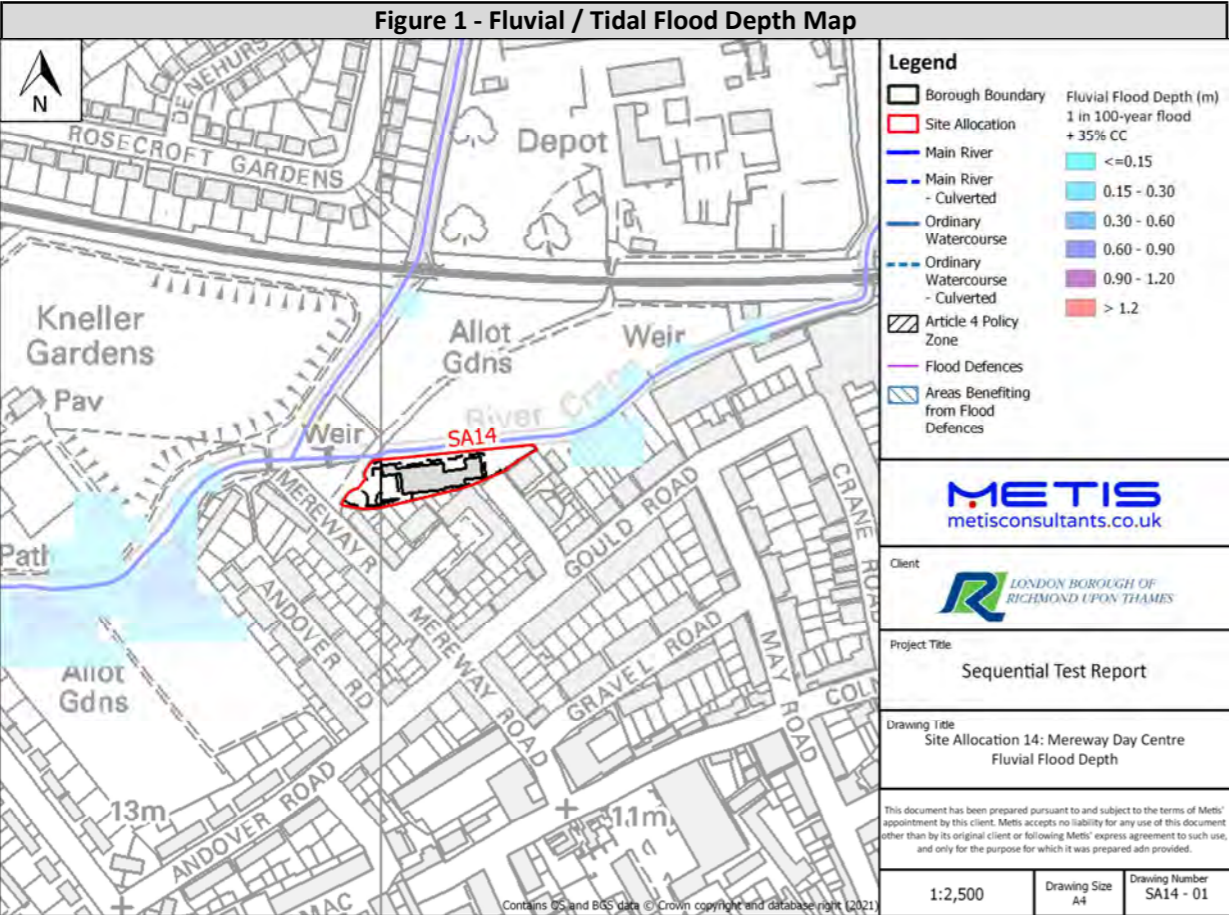
- By ensuring developments are restricted away from Flood Zone 3b to lower flood risk areas.
- By restricting all developments to outside the 8m Main River buffer zone.
- Providing flood plain compensation and run-off storage for new developments.
- Include SuDS to manage surface water runoff and reduce run-off rates to comply with Local Plan Policy LP 8(B).

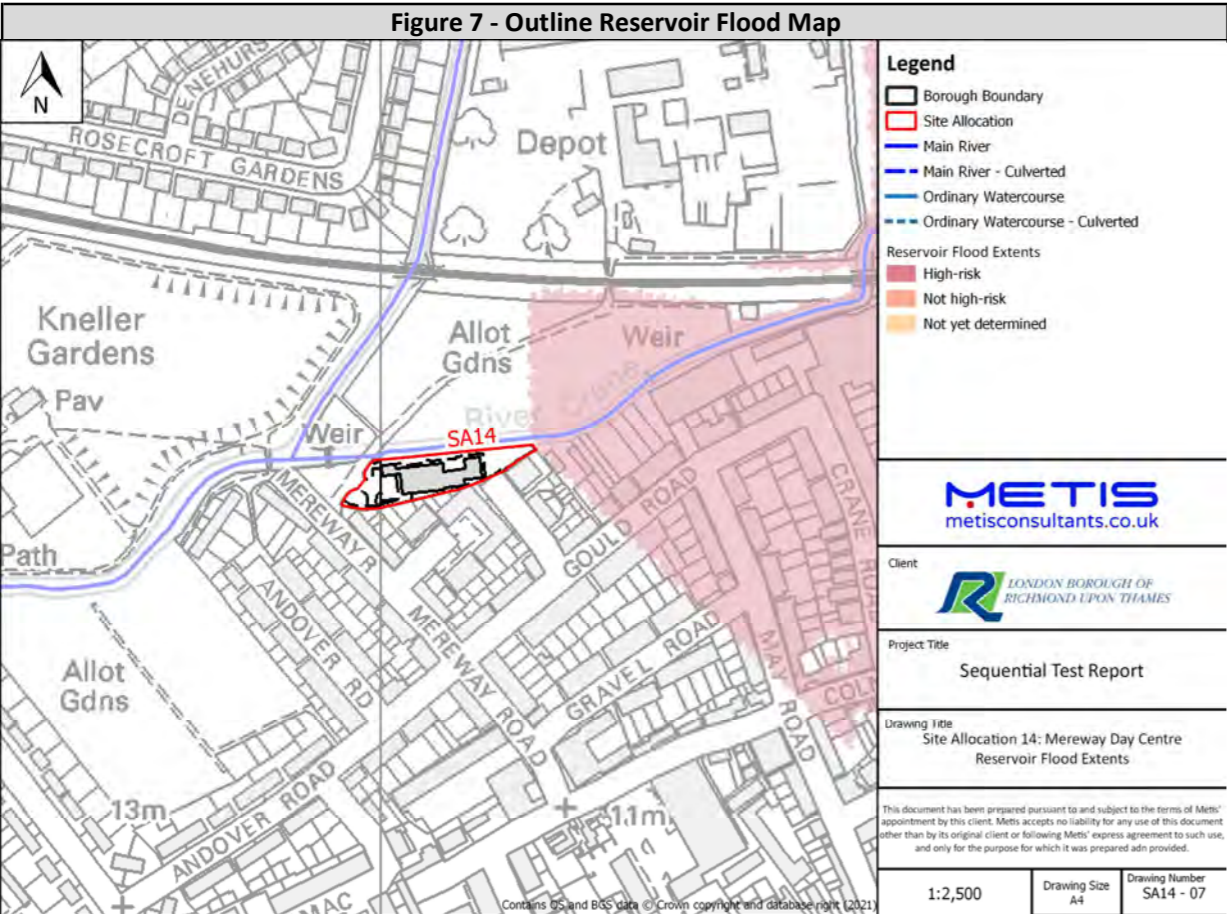
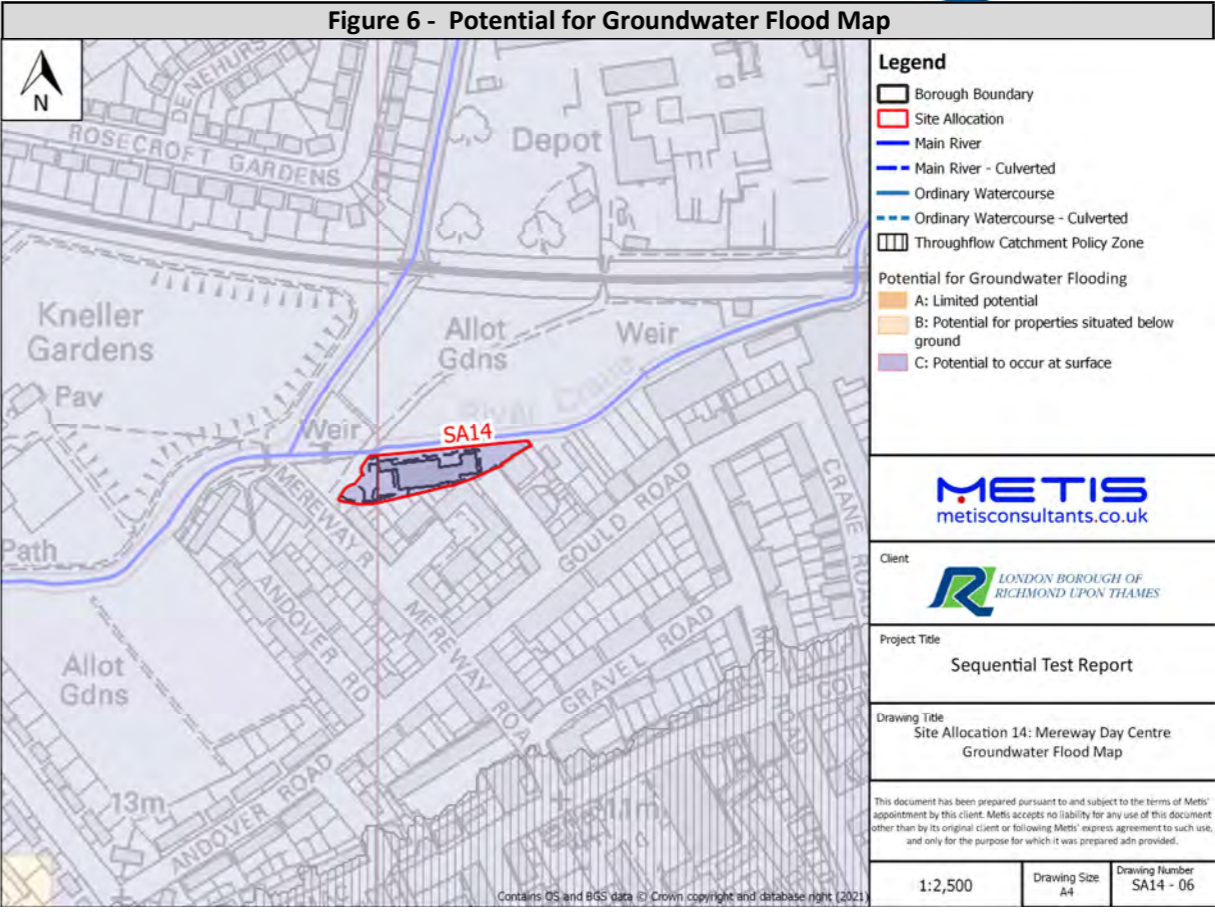
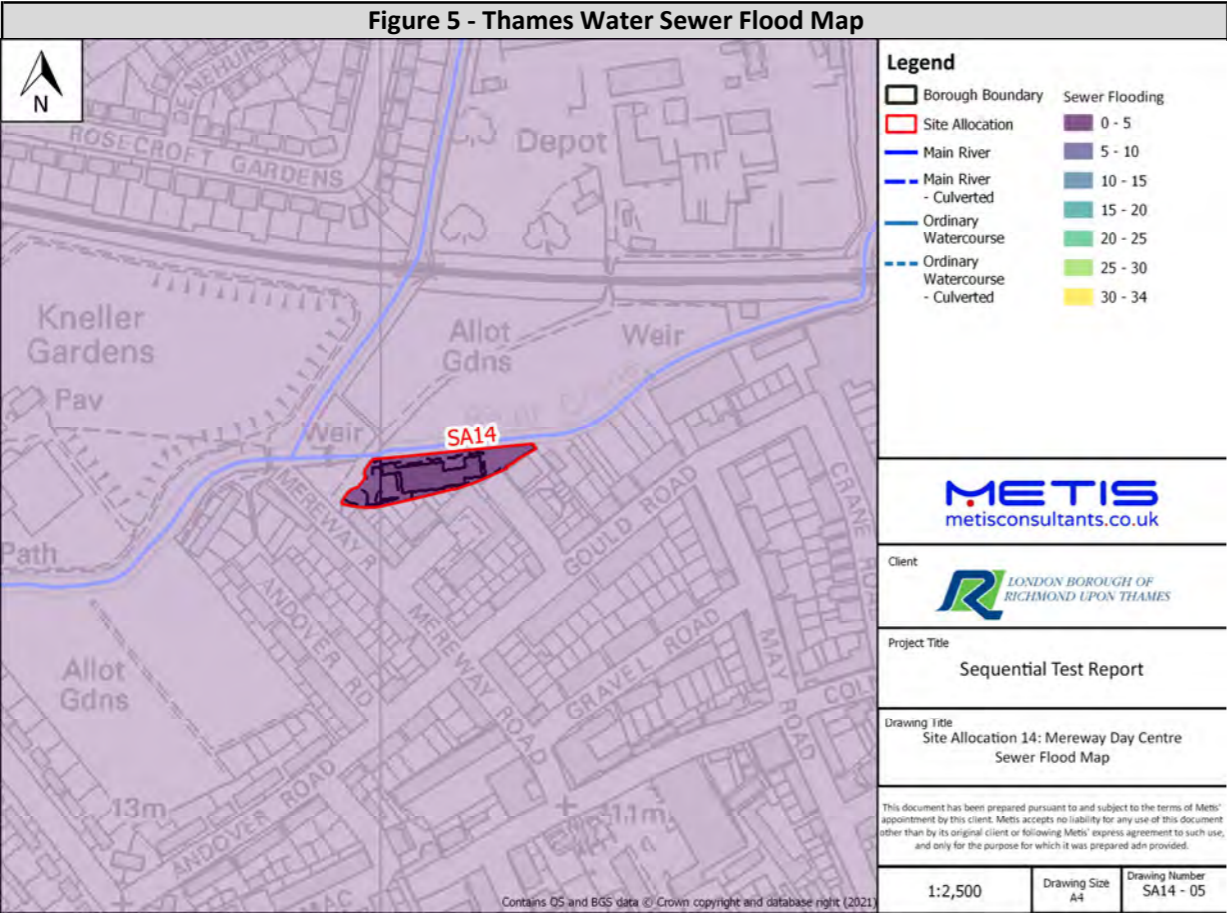
E. Will development require a flood risk permit/watercourse consent?

- Yes, the northern boundary of the site is within 8m of the River Crane, which is a main river. See Report section 5.4 for further requirements.

F. Can the site pass the Exception Test?

- Not required - only required if more vulnerable development is proposed.





SITE ASSESSMENT - Twickenham Riverside

Address:	The Embankment, TW1 3LE	Area:	1.06 Ha
		Site Reference:	SA18

Current Use	Proposed Use
Retail, Office, Food and Drink and Public Open Space	Leisure/Community use, Residential, Open space

Current Vulnerability Classification	Proposed Vulnerability Classification
Less Vulnerable	More Vulnerable

Current Risk Summary							
Fluvial / Tidal			Groundwater			Sewer Flooding	
FZ1	90	% of Site	A**	0	% of Site	No. Incidents	1
FZ2	10	% of Site	B	0	% of Site	Dry Islands and Islands	
FZ3a	0.6	% of Site	C	0	% of Site	Dry Island?	N
FZ3b	8.6	% of Site	**BGS classification (refer Fig 6)			Island?	N
Surface Water			Policy Zone?		Y	Residual Risk	
3.33%*	0	% of Site	Artificial			Article 4 Zone?	Y
1% AEP	0.1	% of Site	Reservoir	Y	At risk?	16.1	% of site
0.1% AEP	1.1	% of Site	Canal	N	At risk?	Town or Local Centres	
*Annual Exceedance Probability (AEP)			Other	N	At risk?	Within buffer?	Y

FLUVIAL / TIDAL

Risk Assessment (Defended)				
Parameter	FZ3b	FZ3a	*FZ3a+CC	Units
Speed of inundation	N/A	N/A	N/A	Hrs
Min. Depth	N/A	N/A	N/A	m
Max. Depth	N/A	N/A	N/A	m
Max. Velocity	N/A	N/A	N/A	m/s
Max Flood Level	N/A	N/A	N/A	m AOD
Max Ground Level	N/A	N/A	N/A	m AOD
Min Ground Level	N/A	N/A	N/A	m AOD
Max Flood Hazard	N/A	N/A	N/A	N/A
Duration of Flood	N/A	N/A	N/A	Hrs

* The +35% Climate Change Allowance event (central case) is reviewed

Risk Assessment (Thames Tidal Defence Breach Model)			
Parameter	2005	2100	Units
Min. Depth	N/A	0	m
Max. Depth	N/A	1.5	m
Max. Velocity	N/A	2.47	m/s
Max. Hazard	N/A	>2.00	N/A
Max. Ground Level	N/A	9.34	m AOD
Max Flood Level	N/A	6.42	m AOD

Description of flood mechanism
<ul style="list-style-type: none"> The site is at risk of flooding from the Thames estuary, which flows along the south-eastern border of the site. Flooding is predicted to occur at the two south-eastern corners of the site, with a small section in the middle also inundated. The predicted fluvial flood extent for the 1% AEP + Climate Change event is 22.6%. The small section in the south-east of the site is protected by tidal flood defences. Only extent data was available for the River Thames, more data should be requested from the EA (depth, velocity etc)

[Figure 1 - Fluvial / Tidal Flood Depth Map](#)

Site Access / Egress
Safe egress routes should be directed towards King Street which is on the north-west side of site. No fluvial/tidal flooding is predicted in this area.

[Figure 2 - Fluvial Flood Hazard Map](#)

Mitigation / FRA Requirements
<ul style="list-style-type: none"> Development should be directed away from the south-eastern border of the site to areas of no/low flood risk. For developments within Flood Zone 2/3, finished floor levels must be set above the modelled Thames tidal breach flood level for the year 2100. As a minimum, any sleeping accommodation must be located above this breach level. Future defence raisings are required in line with the TE2100 Plan crest levels guidance. They must consider the lifetime of the development and the status of current flood defence crest levels in the site-specific FRA. Refer to section 5.5 in the report for Thames tidal requirements. Any basement dwelling within the Article 4 policy zone must comply with the requirements set out in the Local Plan. Develop Flood Warning and Emergency Plans for the site. Include appropriate flood resistance or resilience measures to address predicted flood depths. Site users should be signed up to EA's Flood Warning Service.

SURFACE WATER

Risk Assessment				
Parameter	3.33% AEP	1% AEP	*0.1% AEP	Units
Min. Depth	N/A	0.00-0.15	0.00-0.15	m
Max. Depth	N/A	0.15-0.30	0.30 -0.60	m
Max. Velocity	N/A	0.00-0.25	0.50-1.00	m/s
Max. Hazard	N/A	0.75-1.25	1.25 -2.00	N/A

*The 0.1% annual probability extent represents the potential climate change adjusted impact of current risk

Description of Flood Mechanism
<ul style="list-style-type: none"> There is low risk of surface water flooding. The roads adjacent to the site are, with surface water flowing along King street. Climate change is predicted to increase the flood extent with wharf lane and water lane also inundated in the 0.1% AEP event. The site is located within a CDA (Strawberry Hill)

[Figure 3 - RoFSW Flood Depth Map](#)

Site Access / Egress
Safe egress routes should be directed towards the North corner of the site. No surface water flooding is predicted for this area.

[Figure 4 - RoFSW Flood Hazard Map](#)

Mitigation - Surface Water Drainage
<ul style="list-style-type: none"> SuDS must be included and comply with the criteria set out in the Local Plan Policy LP 8(B) Developments should apply the Sustainable Drainage Hierarchy set out in Policy SI13 of the London Plan. The actions in the London Sustainable Drainage Action Plan (LSDAP) should also be taken. Ground investigations are required to confirm whether infiltration based SuDS are suitable.

SITE ASSESSMENT - Twickenham Riverside

SEWER	GROUNDWATER	ARTIFICIAL
Risk Assessment	Risk Assessment	Risk Assessment
<p>This site is located with a postcode which has 1 previous reports of sewer flooding.</p>	<ul style="list-style-type: none"> This site is located in an area that is classified as having no potential for groundwater flooding. However, the site is within a throughflow catchment area. The site is underlain by Langely silt member and London clay bedrock. 	<ul style="list-style-type: none"> This site is at risk of flooding from the Queen Elizabeth II, Staines North and Walton-Bessborough reservoirs. The reservoir extent map predicts that if any of these reservoirs breach on a wet day (rivers at capacity), the site will be at high-risk of flooding.
<p>Figure 5 - Thames Water Sewer Flood Map</p>	<p>Figure 6 - Potential for Groundwater Flood Map</p>	<p>Figure 7 - Outline Reservoir Flood Map</p>
Mitigation Requirements	Mitigation Requirements	Mitigation Requirements
<p>No mitigation required.</p>	<ul style="list-style-type: none"> A screening assessment is required to ensure that the development does not increase the risk of throughflow related flood risk in the immediate area. If a basement is proposed, a Basement Impact Assessment is required. 	<ul style="list-style-type: none"> Identify all the reservoirs which may impact flood risk at the site and assess their risks. Implement appropriate and proportionate risk management measures.

PLANNING CONSIDERATIONS

Safety of Development

A. Can the development be future proofed for climate change considerations?

- Yes - Finished floor levels must be set above the Thames tidal breach flood level for the year 2100.
- Appropriate flood resistance or resilience measures should be developed for the predicted flood depths.

B. Can the development be designed safe throughout its lifetime without increasing flood risk elsewhere?

- Yes - By directed development away from the south-eastern section of the site, where fluvial/tidal flood risk is higher.
- The development must use surface water drainage techniques to manage surface water runoff as close to the source as possible in line with Local Plan Policy LP 8(B). Green drainage infrastructure should be prioritised to provide wider ecological/biodiversity benefits as per London Plan Policy SI 13.
- By planning and maintaining flood defences raisings in line with the TE2100 Plan crest levels guidance.
- By ensuring the development does not impact the flow profile of groundwater throughflow.
- By restricting development outside the 16m buffer of the Thames tidal defences.

C. What is the cumulative impact of the development land use change and will flood risk increase?

- The development land use is changing from the 'Less Vulnerable' to the 'More Vulnerable' classification, as residential uses have been proposed.
- The site is covered mainly by impermeable surfaces with green areas throughout. Building on these permeable surface will increase the risk of flooding.

D. How can the development reduce risk overall?

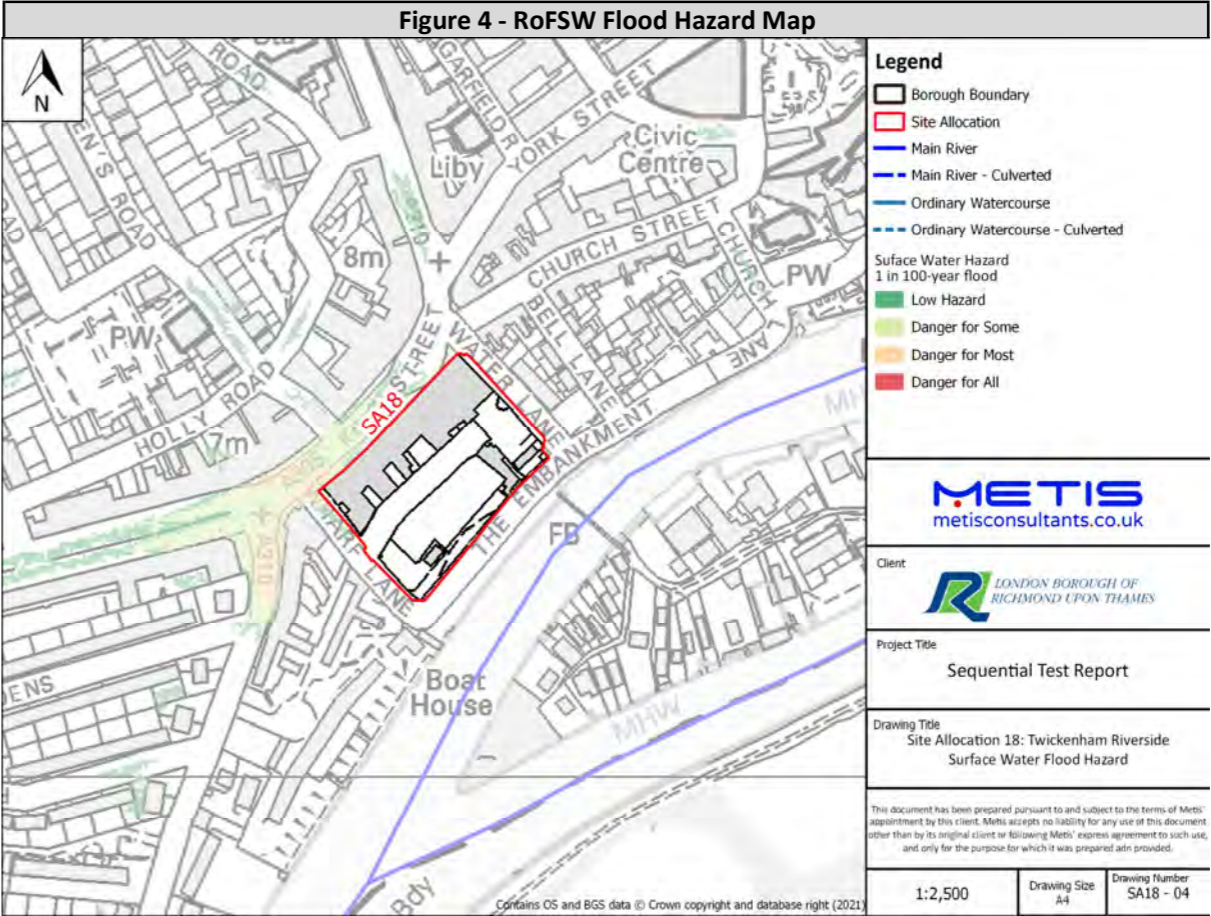
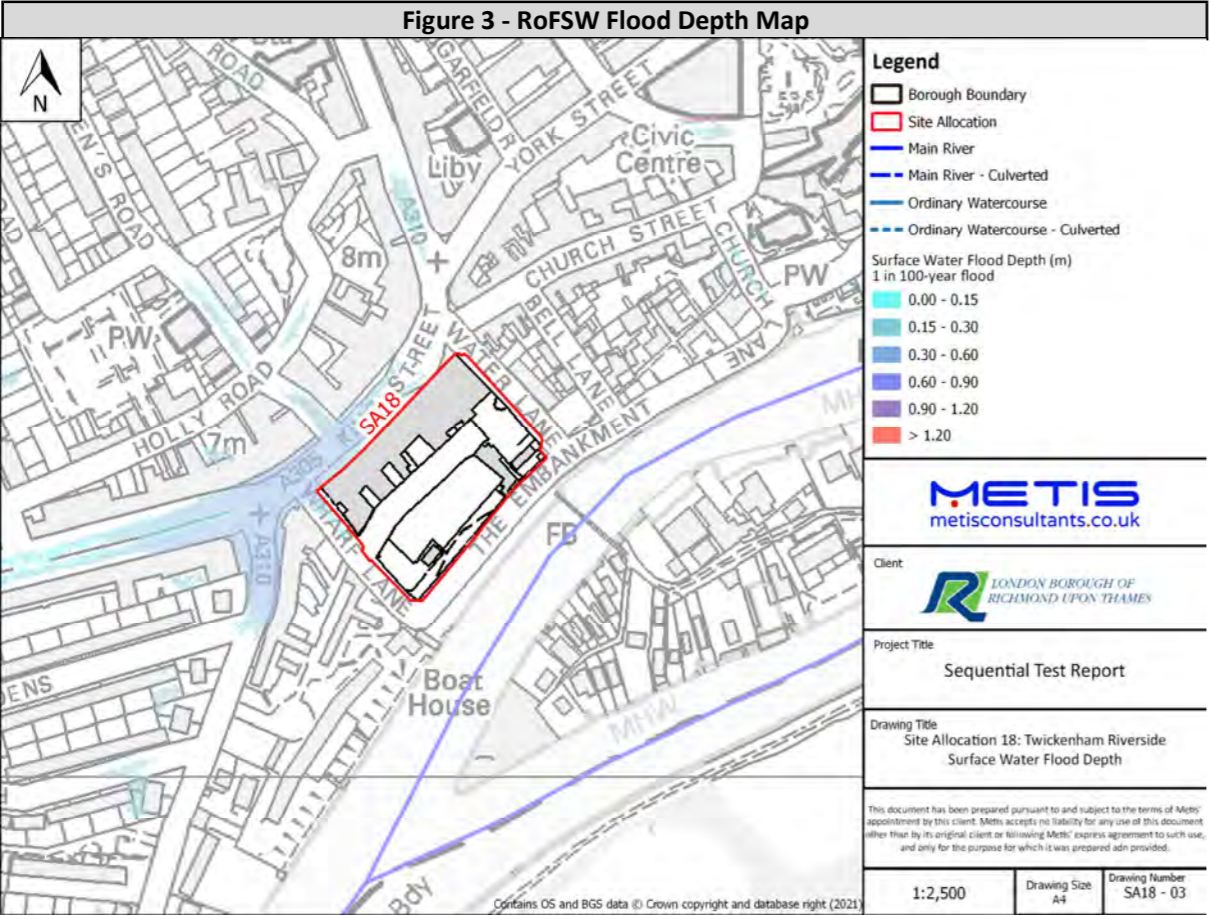
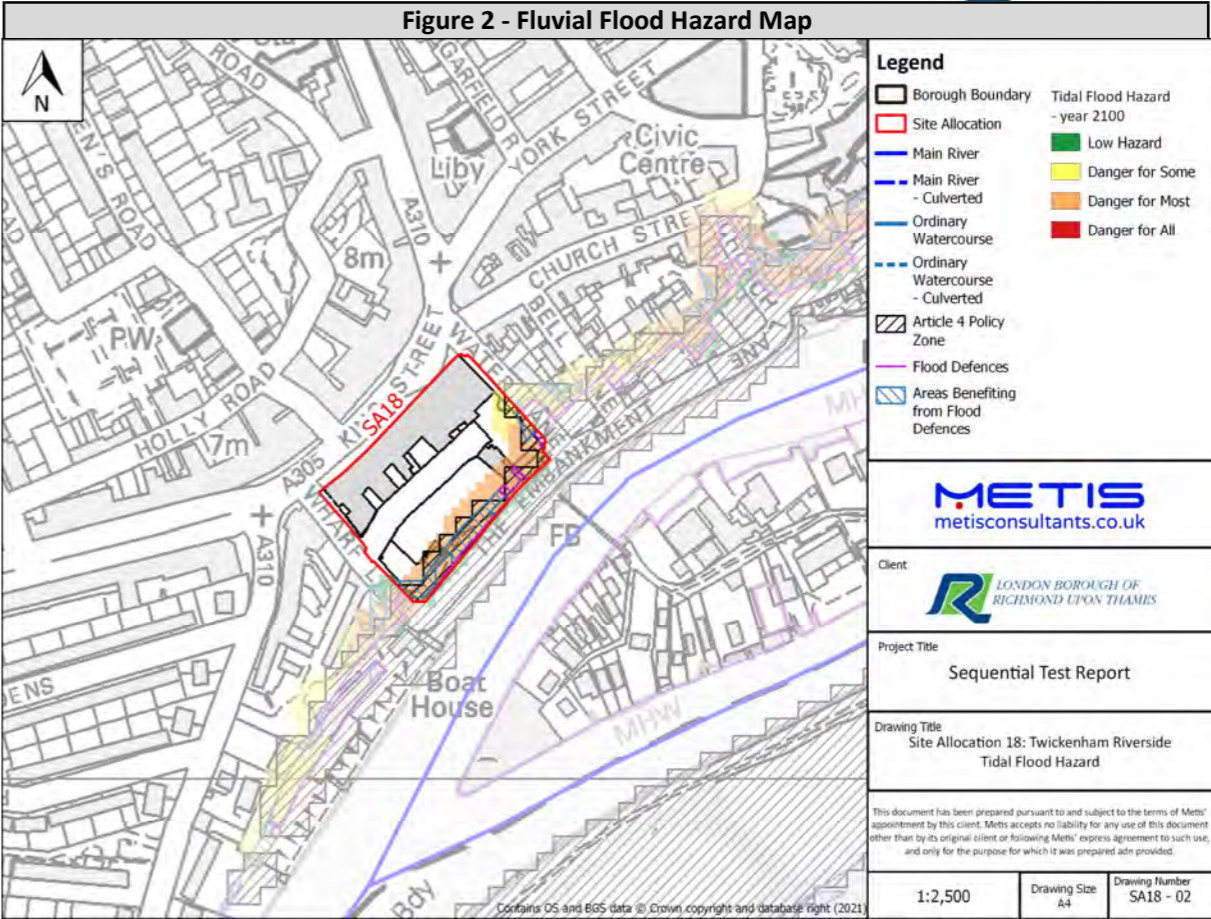
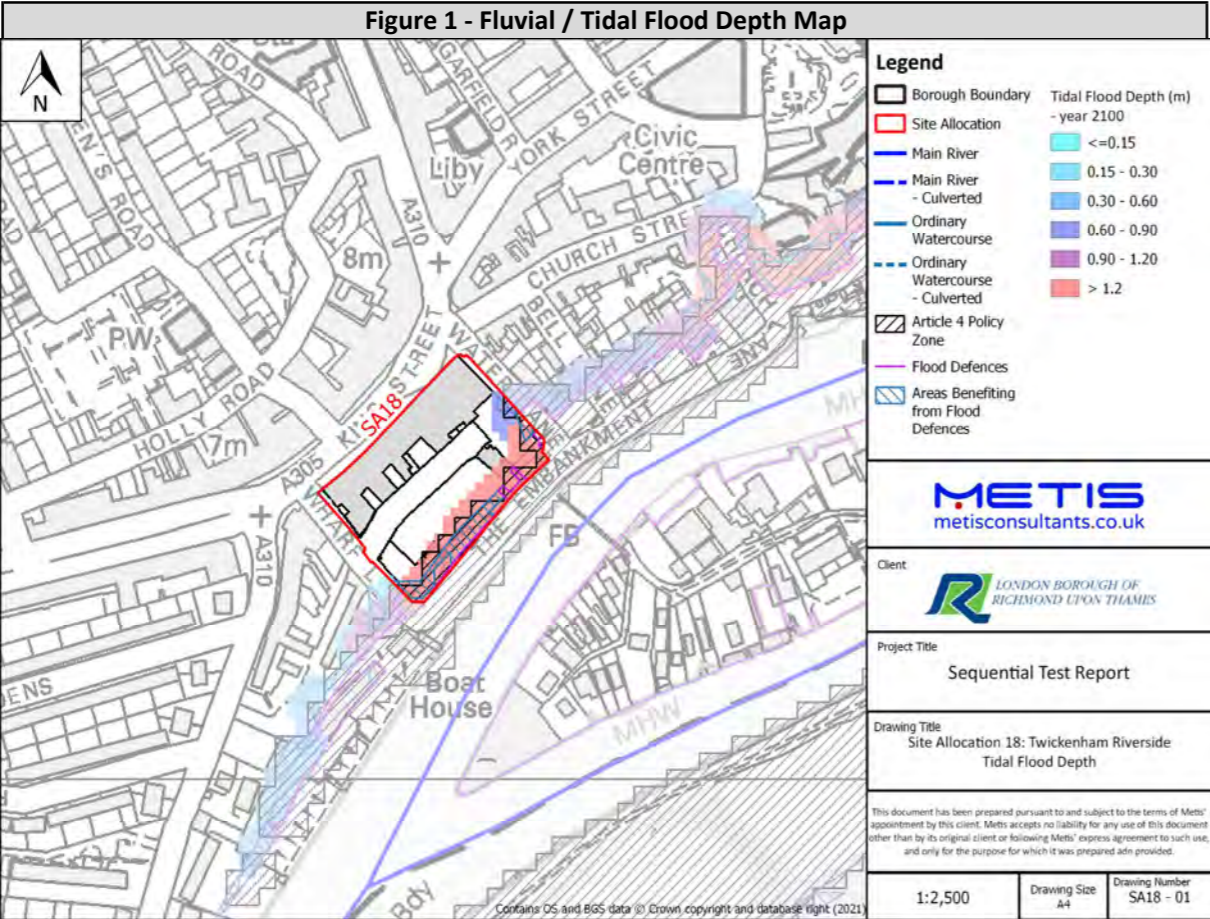
- By restricting more vulnerable developments to above tidal breach crest level for the year 2100.
- By restricting all development to outside the 16m Tidal defence buffer zone.
- By providing flood plain compensation and run-off storage.

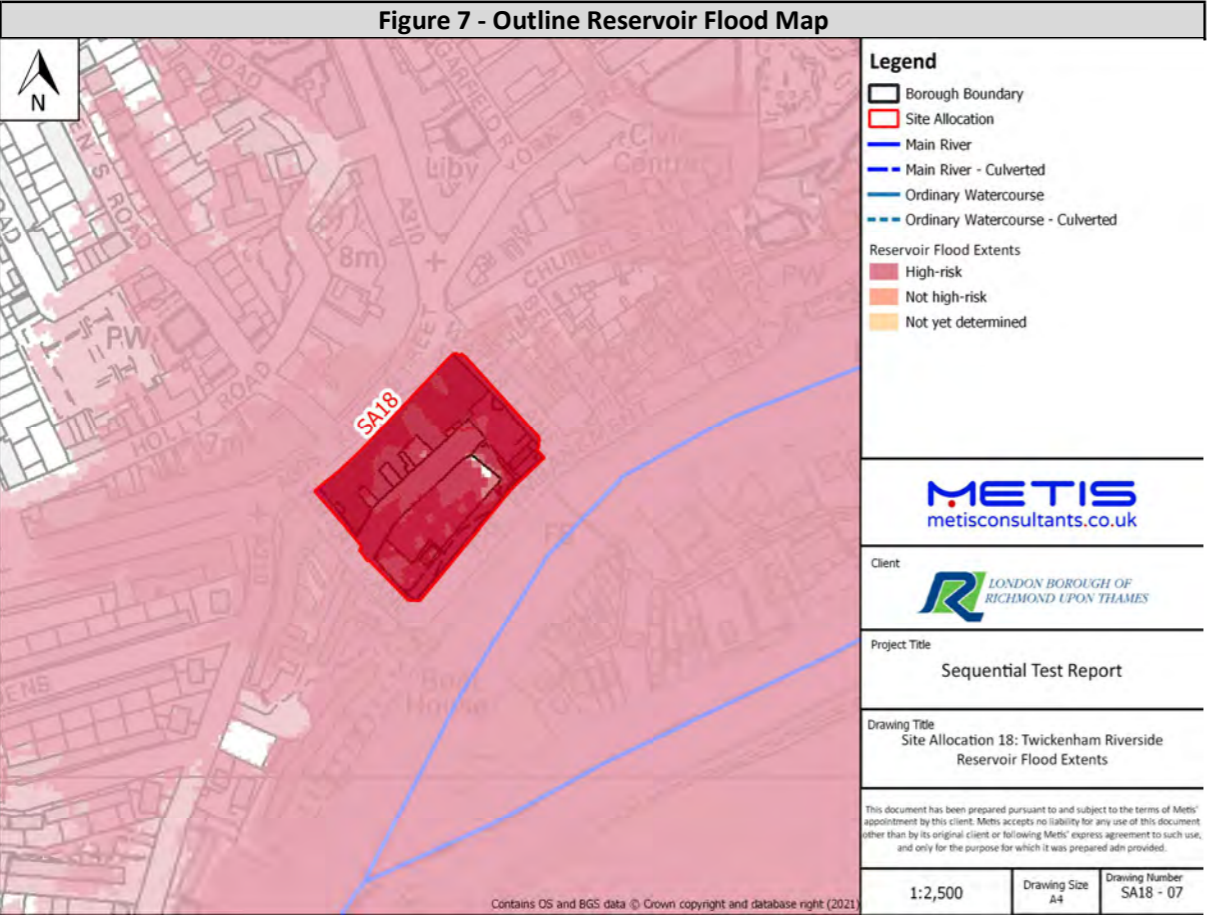
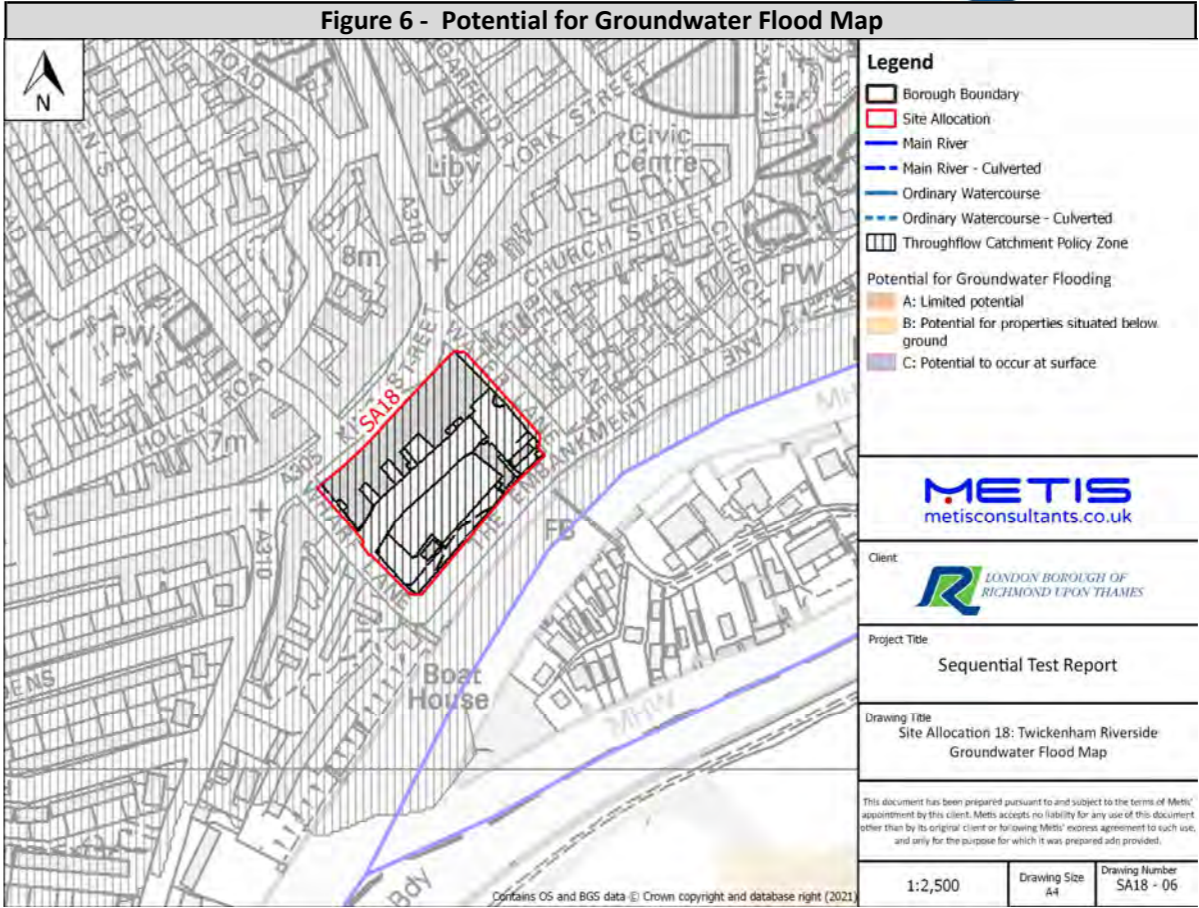
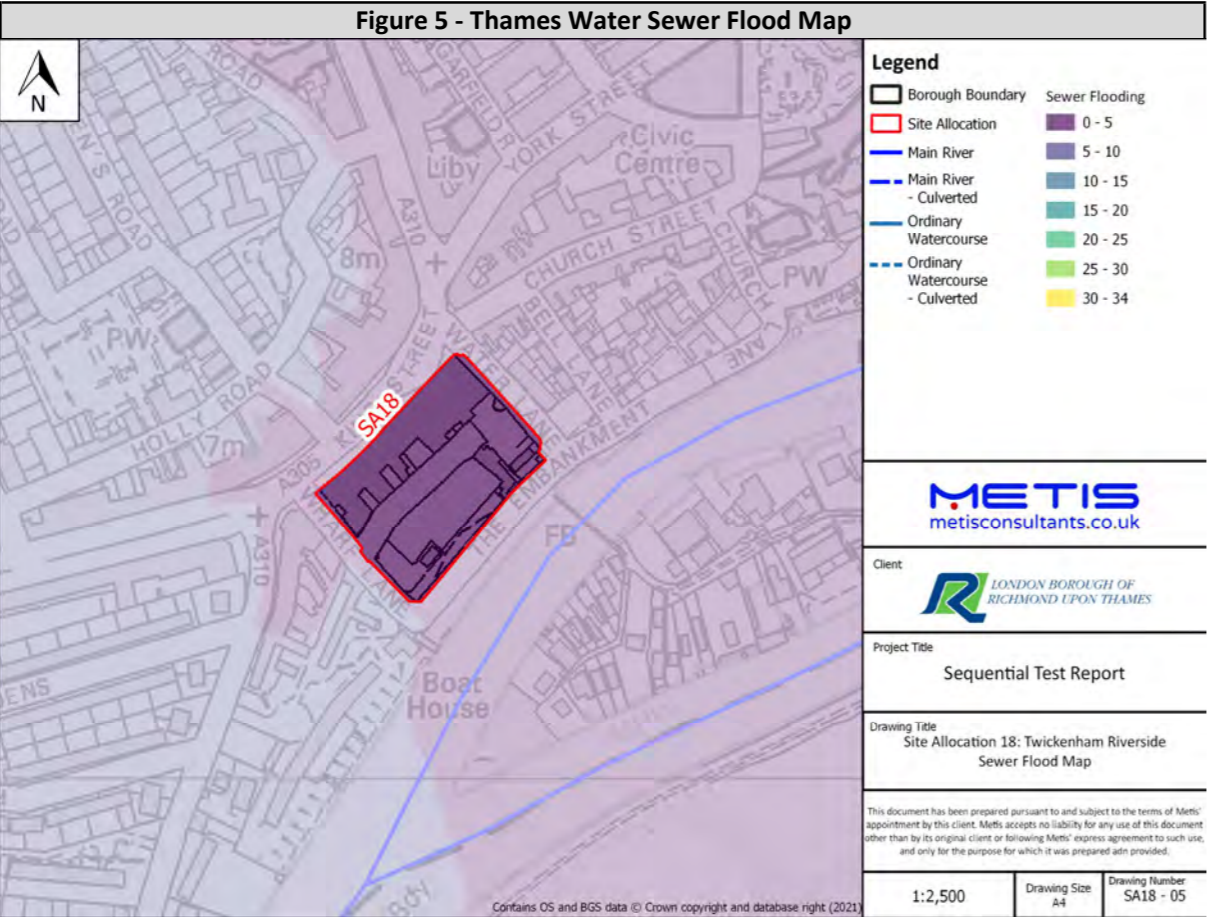
E. Will development require a flood risk permit/watercourse consent?

- Yes - The the south-eastern section of the site is within 16m of tidal flood defence. See Report section 5.5 for further requirements.

F. Can the site pass the Exception Test?

- Yes - See B and C.





SITE ASSESSMENT - Kew Retail Park

Address: Bessant Drive, Kew, TW9 4AD	Area: 3.9 Ha
	Site Reference: SA30

Current Use	Proposed Use
Retail	Residential-led redevelopment with commercial uses

Current Vulnerability Classification	Proposed Vulnerability Classification
Less Vulnerable	More Vulnerable

Current Risk Summary							
Fluvial / Tidal			Groundwater			Sewer Flooding	
FZ1	0	% of Site	A**	0	% of Site	No. Incidents	0
FZ2	0	% of Site	B	0	% of Site	Dry Islands and Islands	
FZ3a	100	% of Site	C	48.2	% of Site	Dry Island?	N
FZ3b	0	% of Site	**BGS classification (refer Fig 6)			Island?	N
Surface Water			Policy Zone?		N	Residual Risk	
3.33%*	0	% of Site	Artificial			Article 4 Zone?	Y
1% AEP	1.7	% of Site	Reservoir	Y	At risk?	N/A	% of site
0.1% AEP	27.7	% of Site	Canal	N	At risk?	Town or Local Centres	
*Annual Exceedance Probability (AEP)			Other	N	At risk?	Within buffer?	Y

FLUVIAL / TIDAL

Risk Assessment (Defended)				
Parameter	FZ3b	FZ3a	*FZ3a+CC	Units
Speed of inundation	N/A	N/A	N/A	Hrs
Min. Depth	N/A	N/A	N/A	m
Max. Depth	N/A	N/A	N/A	m
Max. Velocity	N/A	N/A	N/A	m/s
Max Flood Level	N/A	N/A	N/A	m AOD
Max Ground Level	N/A	N/A	N/A	m AOD
Min Ground Level	N/A	N/A	N/A	m AOD
Max Flood Hazard	N/A	N/A	N/A	N/A
Duration of Flood	N/A	N/A	N/A	Hrs

Description of flood mechanism

- The site is at risk of flooding from the Thames estuary, which flows adjacent to the north-eastern boundary of the site.
- The site is protected by Thames tidal flood defences.
- The site is entirely within the Thames tidal breach zone (modelled for 2100)
- In this worst case scenario, the entire site would be inundated with max depths of 4.23m.

Site Access / Egress

- As 100% of the sites is predicted to be at risk of flooding, safe egress routes cannot be achieved.
- Safe refuge areas should be provided on site.

Mitigation / FRA Requirements

- Refer to report section 5.3 for finished floor levels.
- Future defence raisings are required in line with the TE2100 Plan crest levels guidance. Must consider the lifetime of the development and the status of current flood defence crest levels in the site-specific FRA.
- If new basements are proposed they must submit a site specific FRA in line with Article 4 direction on basement development. Self-contained residential basements and bedrooms at basement level will not be permitted.
- Refer to section 5.5 in the report for Thames tidal requirements.
- Develop Flood Warning and Emergency Plans for the site.
- Include appropriate flood resistance or resilience measures to address predicted flood depths.
- Site users should be signed up to EA's Flood Warning Service.

Figure 1 - Fluvial / Tidal Flood Depth Map

Figure 2 - Fluvial Flood Hazard Map

Risk Assessment (Thames Tidal Defence Breach Model)			
Parameter	2005	2100	Units
Min. Depth	N/A	1.01	m
Max. Depth	N/A	4.23	m
Max. Velocity	N/A	1.6	m/s
Max. Hazard	N/A	> 2.00	N/A
Max Ground level	N/A	5.32	m AOD
Max Flood Level	N/A	6.03	m AOD

SURFACE WATER

Risk Assessment				
Parameter	3.33% AEP	1% AEP	*0.1% AEP	Units
Min. Depth	N/A	0.00-0.15	0.00-0.15	m
Max. Depth	N/A	0.15-0.30	0.30-0.60	m
Max. Velocity	N/A	0.00-0.25	0.5-1.00	m/s
Max. Hazard	N/A	0.5-0.75	0.75-1.25	N/A

*The 0.1% annual probability extent represents the potential climate change adjusted impact of current risk

Description of Flood Mechanism

- A small section of this site is at risk of surface water, mainly along the entrance road on the south east of the site.
- Climate change is predicted to increase the maximum flood depth and extent.
- In the 0.1% AEP scenario, the car park is mostly inundated with water.

Figure 3 - RoFSW Flood Depth Map

Site Access / Egress

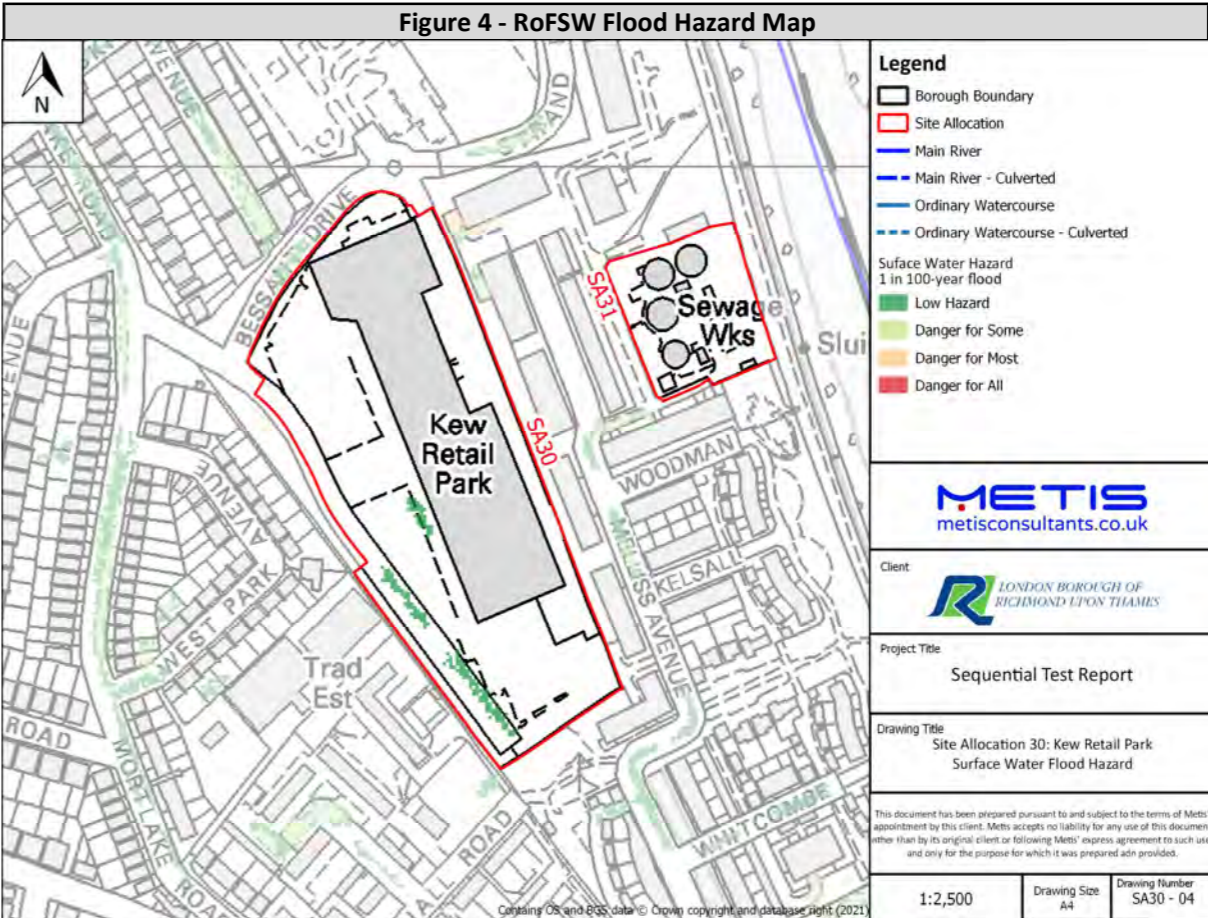
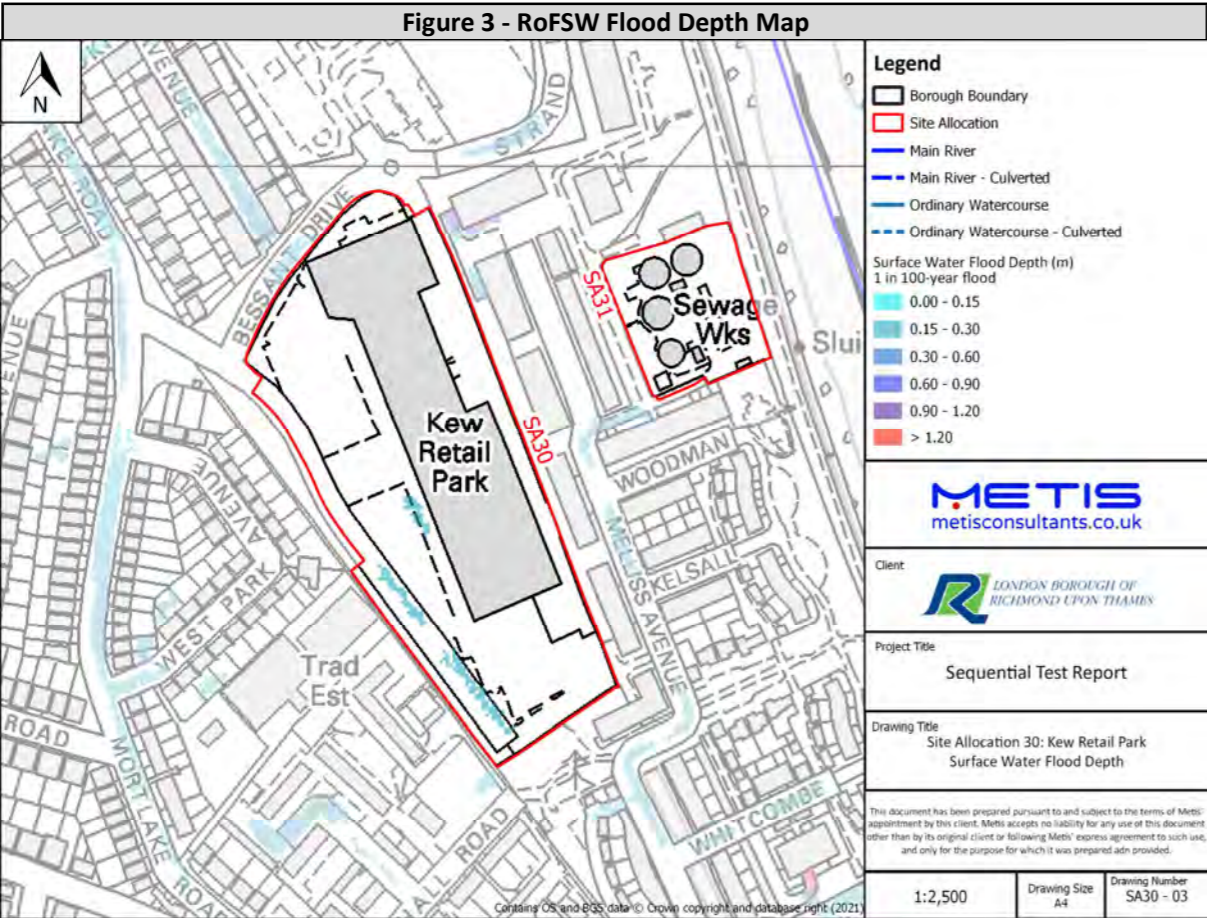
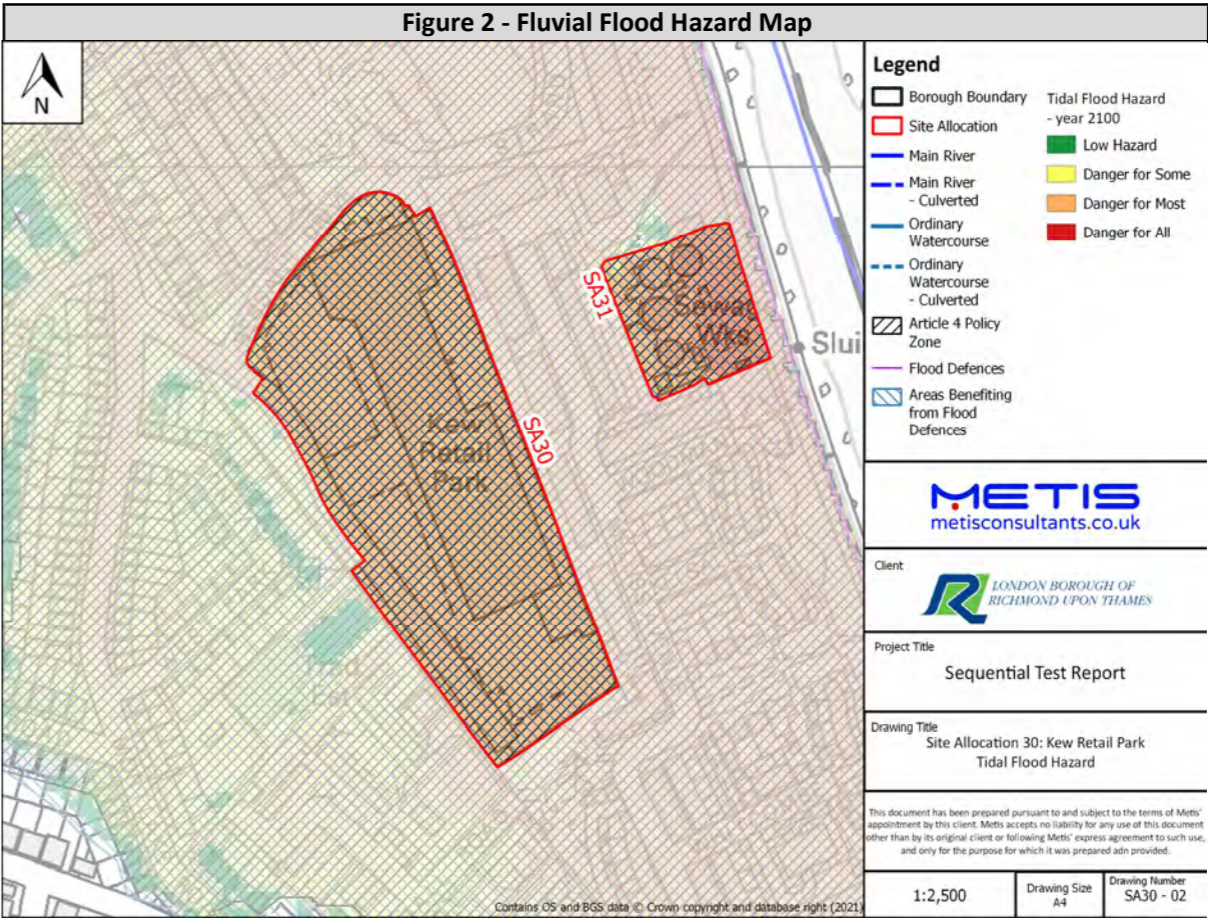
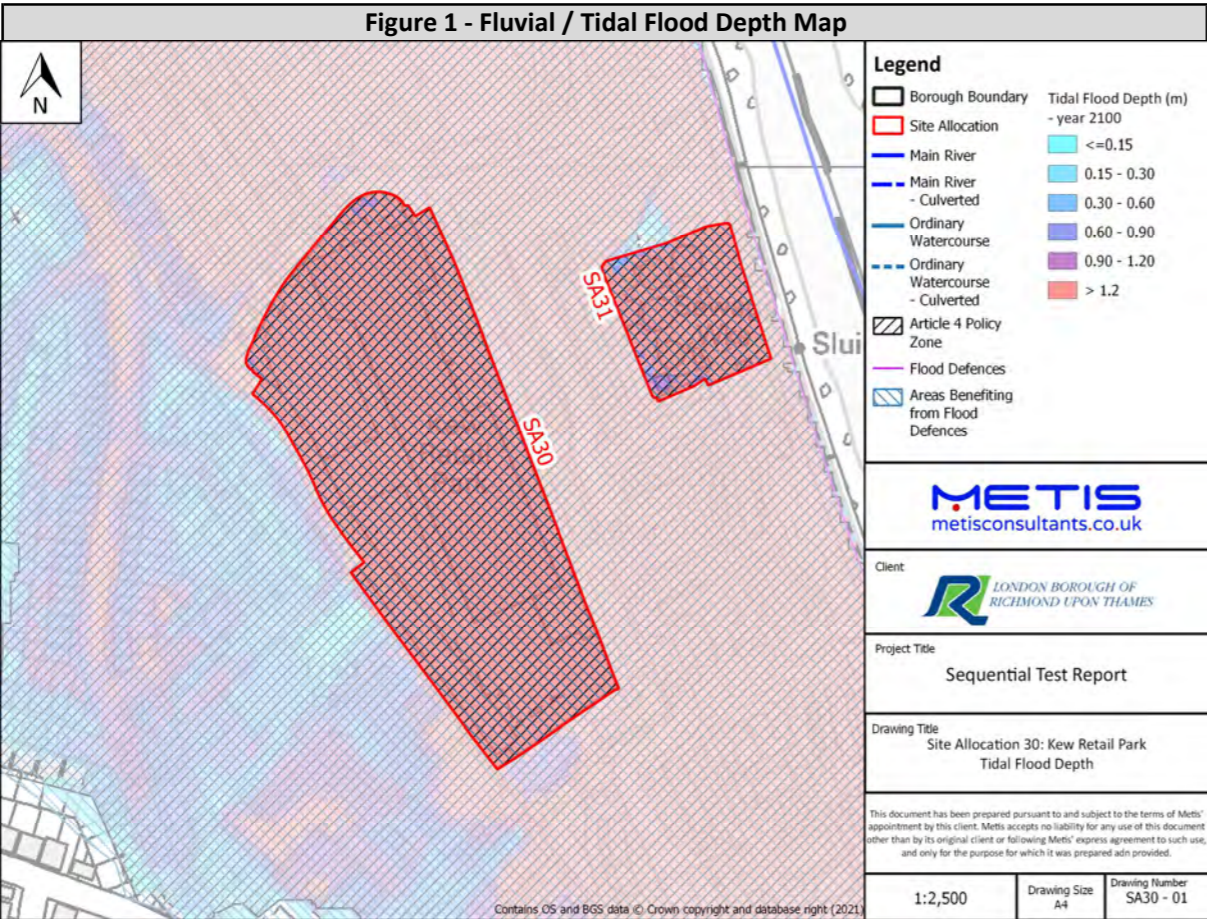
- Safe Egress routes should be directed towards the north-west of the site where the risk of flood is lower.

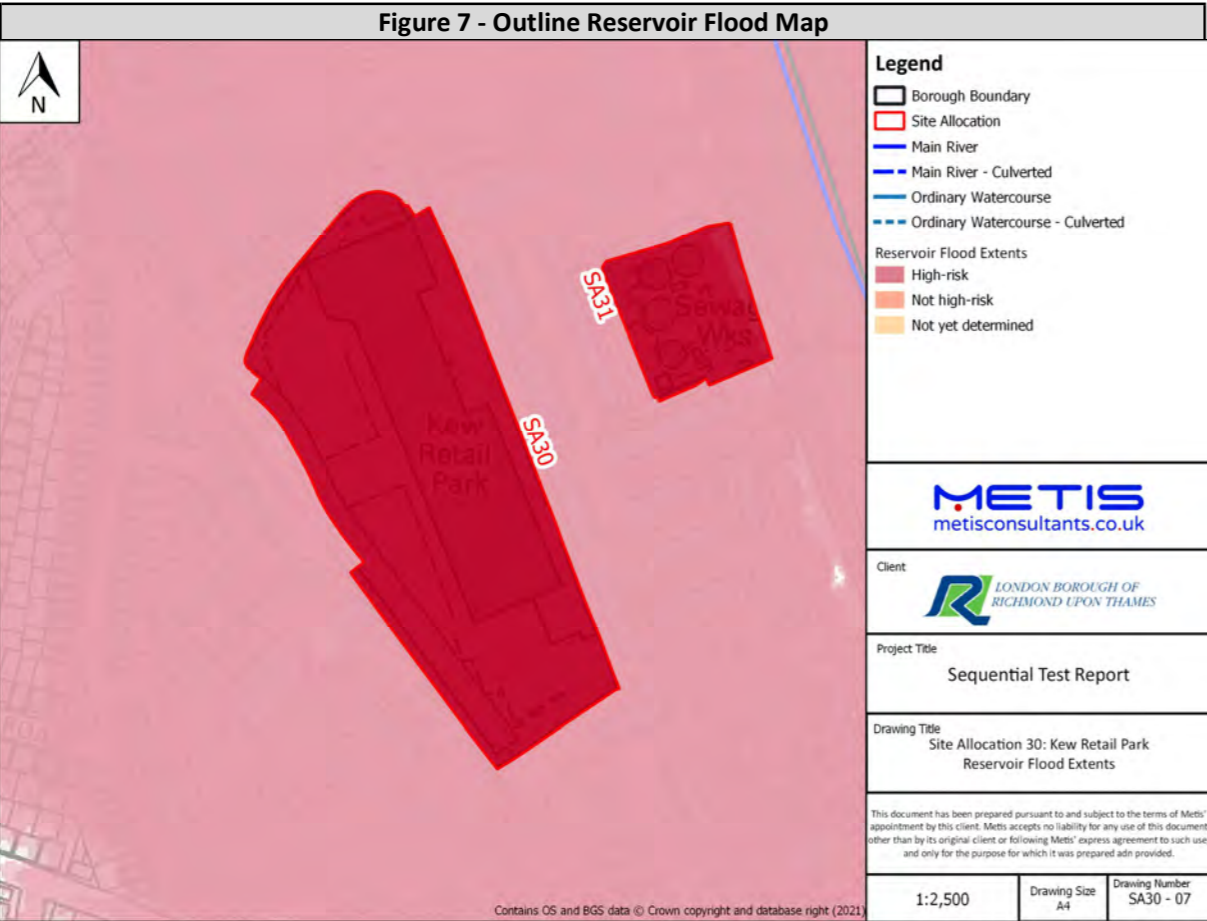
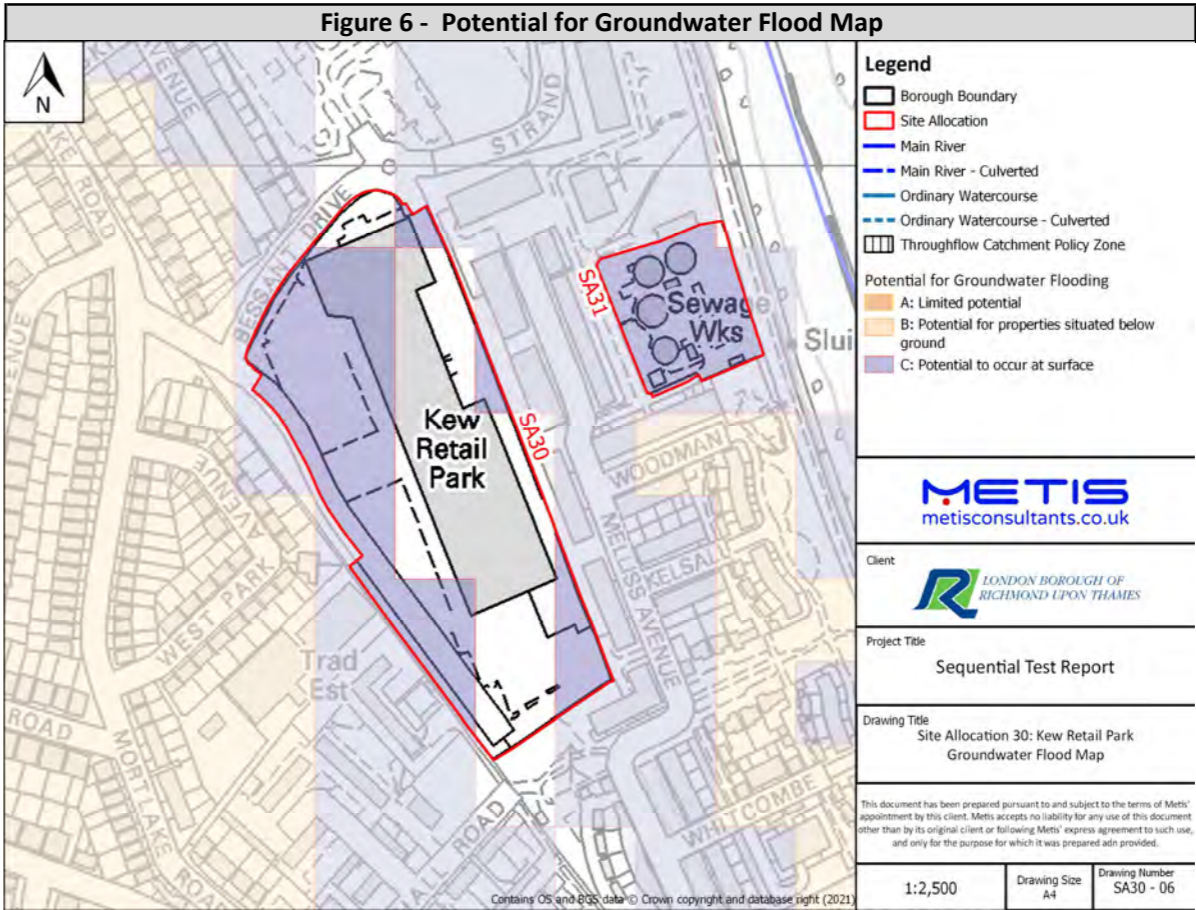
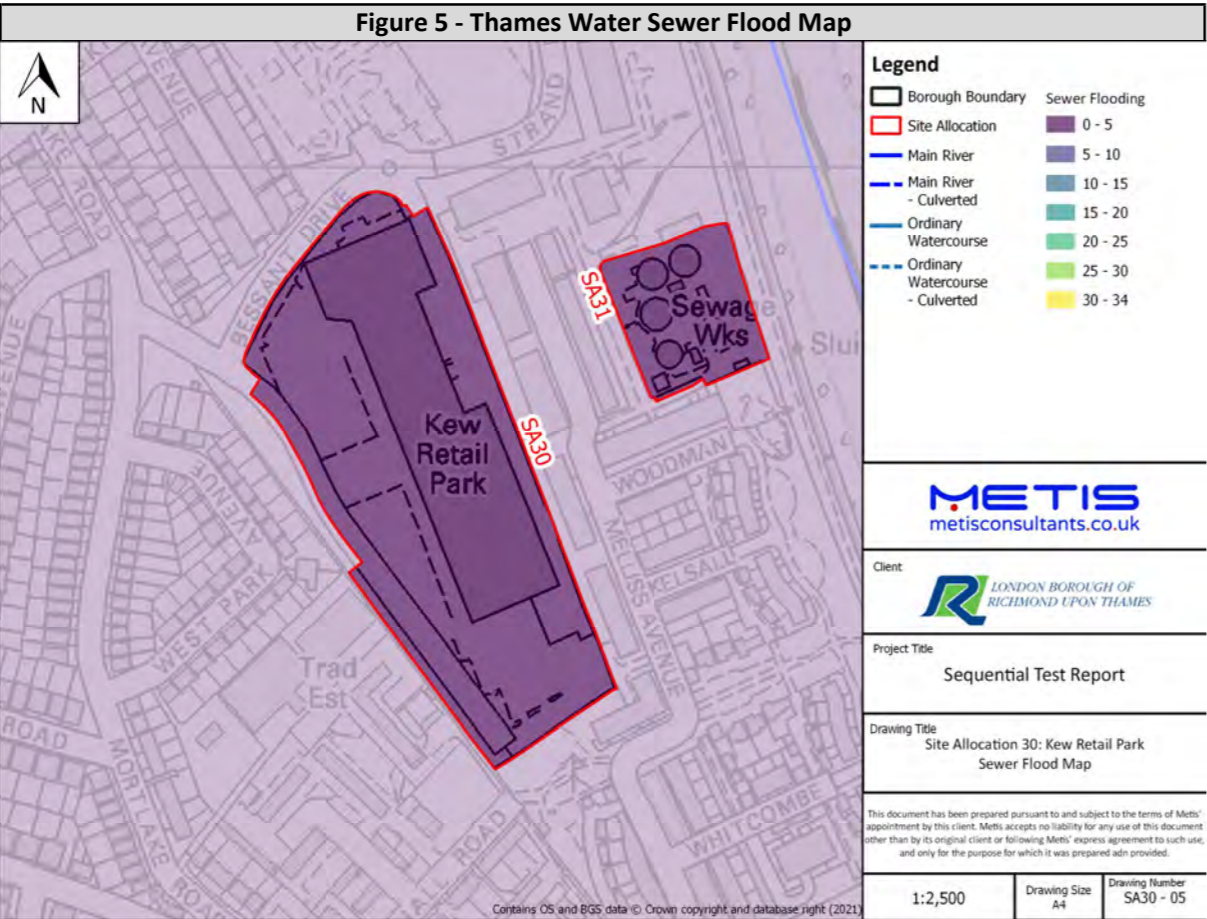
Figure 4 - RoFSW Flood Hazard Map

Mitigation - Surface Water Drainage

- SuDS must be included and comply with the criteria set out in Local Plan Policy LP 8(B).
- Developments should apply the Sustainable Drainage Hierarchy set out in Policy SI13 of the London Plan.
- The actions in the London Sustainable Drainage Action Plan (LSDAP) should also be taken.

SITE ASSESSMENT - Kew Retail Park		
SEWER	GROUNDWATER	ARTIFICIAL
Risk Assessment	Risk Assessment	Risk Assessment
<p>This site is located with a postcode which has no previous reports of sewer flooding.</p>	<ul style="list-style-type: none"> • A proportion of this site falls in an area which is classified as at risk of flooding from groundwater at the surface. • A centre of the site is not classified as at risk of flooding from groundwater. • The site is underlain by the Aluvium (north-west) and Kempton Park Gravel superficial deposit geology (south-east). • The site is not located within a throughflow catchment area 	<ul style="list-style-type: none"> • This site is at risk of flooding from the Pen Pond Lower Lake and the Queen Elizabeth II, Staines north and Walton-Bessborough reservoirs. • The Reservoir flooding extent predicts that the entire site is at 'high risk' if any of these reservoirs are breached.
<p>Figure 5 - Thames Water Sewer Flood Map</p>	<p>Figure 6 - Potential for Groundwater Flood Map</p>	<p>Figure 7 - Outline Reservoir Flood Map</p>
Mitigation Requirements	Mitigation Requirements	Mitigation Requirements
<p>No mitigation required.</p>	<ul style="list-style-type: none"> • Applicants must ensure that the development does not impact the flow profile or increase the groundwater flood risk to neighbouring properties. • If a basement is proposed, a basement screening assessment is required. 	<ul style="list-style-type: none"> • Identify and assess the sources of risk including from smaller reservoirs that are not included in this model. • Implement appropriate and proportionate risk management measures.
PLANNING CONSIDERATIONS		
Safety of Development		
<p>A. Can the development be future proofed for climate change considerations?</p> <ul style="list-style-type: none"> • Yes - Finished floor levels must be set above the Thames tidal breach flood level for the year 2100. • Appropriate flood resistance or resilience measures should be developed for the predicted flood depths. <p>B. Can the development be designed safe throughout its lifetime without increasing flood risk elsewhere?</p> <ul style="list-style-type: none"> • Yes - The development must use surface water drainage techniques to manage surface water runoff as close to the source as possible as per Local Plan Policy LP 8(B). Green drainage infrastructure should be prioritised to provide wider ecological/biodiversity benefits as per London Plan Policy SI 13. • By planning and maintaining flood defences raisings in line with the TE2100 Plan crest levels guidance. <p>C. What is the cumulative impact of the development land use change and will flood risk increase?</p> <ul style="list-style-type: none"> • The development land use is changing from the 'Less Vulnerable' to the 'More Vulnerable' classification, as residential uses have been proposed. • Currently, the site is predominantly covered in impermeable surfaces with a small number of greenery patches throughout the car park. Increases to the impermeable area coverage and change in topography will increase surface water runoff and flood risk if not managed properly. <p>D. How can the development reduce risk overall?</p> <ul style="list-style-type: none"> • Increase the area of permeable surfaces on site. • Include SuDS to manage surface water run-off to comply with Local Plan Policy LP 8(B). • Restrict more vulnerable developments to above tidal breach crest level for the year 2100. <p>E. Will development require a flood risk permit/watercourse consent?</p> <ul style="list-style-type: none"> • No - The site is not within 8m of a Main River, 5m of an ordinary watercourse or within 16m of the Thames tidal defences. <p>F. Can the site pass the Exception Test?</p> <ul style="list-style-type: none"> • Yes - see question B and C. 		





SITE ASSESSMENT - Kew Biothane Plant

Address: Kew Biothane, Melliss Avenue, TW9
4BA

Area: 0.7 Ha
Site Reference: SA31

Current Use	Proposed Use
Biothane Plant – related to the Stag Brewery	Residential, Open Space

Current Vulnerability Classification	Proposed Vulnerability Classification
Highly Vulnerable	More Vulnerable

Current Risk Summary							
Fluvial / Tidal			Groundwater			Sewer Flooding	
FZ1	0	% of Site	A**	98.5	% of Site	No. Incidents	0
FZ2	100	% of Site	B	0	% of Site	Dry Islands and Islands	
FZ3a	100	% of Site	C	0	% of Site	Dry Island?	N
FZ3b	0	% of Site	**BGS classification (refer Fig 6)			Island?	N
Surface Water			Policy Zone?		N	Residual Risk	
3.33%*	0	% of Site	Artificial			Article 4 Zone?	Y
1% AEP	0	% of Site	Reservoir	Y	At risk?	100	% of site
0.1% AEP	3.46	% of Site	Canal	N	At risk?	Town or Local Centres	
*Annual Exceedance Probability (AEP)			Other	N	At risk?	Within buffer?	Y

FLUVIAL / TIDAL

Risk Assessment (Defended)				
Parameter	FZ3b	FZ3a	*FZ3a+CC	Units
Speed of inundation	N/A	N/A	N/A	Hrs
Min. Depth	N/A	N/A	N/A	m
Max. Depth	N/A	N/A	N/A	m
Max. Velocity	N/A	N/A	N/A	m/s
Max Flood Level	N/A	N/A	N/A	m AOD
Max Ground Level	N/A	N/A	N/A	m AOD
Min Ground Level	N/A	N/A	N/A	m AOD
Max Flood Hazard	N/A	N/A	N/A	N/A
Duration of Flood	N/A	N/A	N/A	Hrs

* The +35% Climate Change Allowance event (central case) is reviewed

Risk Assessment (Thames Tidal Defence Breach Model)			
Parameter	2005	2100	Units
Min. Depth	N/A	0.45	m
Max. Depth	N/A	2.39	m
Max. Velocity	N/A	1.71	m/s
Max. Hazard	N/A	>2.00	N/A
Max. Ground Level	N/A	6.74	m AOD
Max Flood Level	N/A	6.2	m AOD

Description of flood mechanism
<ul style="list-style-type: none">• The site is at risk of flooding from the Thames estuary, which flows adjacent to the north-eastern boundary of the site.• The site is protected by Thames tidal flood defences.• The site is entirely within the Thames tidal breach zone (modelled for 2100)• In this worst case scenario, the entire site would be inundated with max depths of 2.39 m.

[Figure 1 - Fluvial / Tidal Flood Depth Map](#)

Site Access / Egress
<ul style="list-style-type: none">• As 100% of the sites is predicted to be at risk of flooding, safe egress routes cannot be achieved.• Safe refuge areas should be provided on site.

[Figure 2 - Fluvial Flood Hazard Map](#)

Mitigation / FRA Requirements
<ul style="list-style-type: none">• See Report section 5.3 for finished floor levels.• Future defence raisings are required in line with the TE2100 Plan crest levels guidance.• Must consider the lifetime of the development and the status of current flood defence crest levels in the site-specific FRA.• If new basements are proposed they must submit a site specific FRA in line with Article 4 direction on basement development. Self-contained residential basements and bedrooms at basement level will not be permitted.• See Report section 5.3 for Thames tidal stipulations.• Develop Flood Warning and Emergency Plans for the site.• Include appropriate flood resistance or resilience measures to address predicted flood depths.• Site users should be signed up to EA's Flood Warning Service.

SURFACE WATER

Risk Assessment				
Parameter	3.33% AEP	1% AEP	*0.1% AEP	Units
Min. Depth	N/A	N/A	0.15-0.30	m
Max. Depth	N/A	N/A	0.15-0.30	m
Max. Velocity	N/A	N/A	0.20-0.50	m/s
Max. Hazard	N/A	N/A	0.75-1.25	N/A

*The 0.1% annual probability extent represents the potential climate change adjusted impact of current risk

Description of Flood Mechanism
<ul style="list-style-type: none">• The site is not currently at risk of surface water flooding.• However, climate change is predicted to increase this risk slightly.• In the 0.1% AEP scenario, it is predicted that surface water will pond in the centre on the site.

[Figure 3 - RoFSW Flood Depth Map](#)

Site Access / Egress
Safe egress routes should be routed away from the centre towards the north-east. In this area, there is no risk of flooding on site or on the adjacent road.

[Figure 4 - RoFSW Flood Hazard Map](#)

Mitigation - Surface Water Drainage
<ul style="list-style-type: none">• SuDS must be included and comply with the criteria set out in Local Plan Policy LP 8(B).• Developments should apply the Sustainable Drainage Hierarchy set out in Policy SI13 of the London Plan.• The actions in the London Sustainable Drainage Action Plan (LSDAP) should also be taken.• Ground investigations are required to confirm whether infiltration based SuDS are suitable.

SITE ASSESSMENT - Kew Biothane Plant

SEWER	GROUNDWATER	ARTIFICIAL
Risk Assessment	Risk Assessment	Risk Assessment
<p>This site is located with a postcode which has no previous reports of sewer flooding.</p> <p>Figure 5 - Thames Water Sewer Flood Map</p>	<ul style="list-style-type: none"> The site is located in an area which is classified as having a potential for groundwater flooding at the surface. A small area (1.5%) in the the north west corner has no groundwater related flood risk. The site is underlain by made ground artificial deposits and the London Clay bedrock. The site is not located within a throughflow catchment area. <p>Figure 6 - Potential for Groundwater Flood Map</p>	<ul style="list-style-type: none"> This site is at risk of flooding from the Pen Pond Lower Lake and the Queen Elizabeth II, Staines north and Walton-Bessborough reservoirs. The Reservoir flooding extent predicts that the entire site is at 'high risk' if any of these reservoirs are breached. <p>Figure 7 - Outline Reservoir Flood Map</p>
Mitigation Requirements	Mitigation Requirements	Mitigation Requirements
<p>No mitigation required.</p>	<ul style="list-style-type: none"> Applicants must should ensure that the development does not impact the flow profile or increase the groundwater flood risk to neighbouring properties. If a basement is proposed, a basement screening assessment is required. 	<ul style="list-style-type: none"> Identify and assess the sources of risk - including smaller reservoir which are not mapped. Propose appropriate and proportionate risk management measures.

PLANNING CONSIDERATIONS

Safety of Development

A. Can the development be future proofed for climate change considerations?

- Yes - Finished floor levels must be set above the Thames tidal breach flood level for the year 2100.
- See report section 5.8. for compensatory flood storage requirements.
- Appropriate flood resistance or resilience measures should be developed for the predicted flood depths.

B. Can the development be designed safe throughout its lifetime without increasing flood risk elsewhere?

- Yes - The development must use surface water drainage techniques to manage surface water runoff as close to the source as possible as per Local Plan Policy LP 8(B). Green drainage infrastructure should be prioritised to provide wider ecological/biodiveristy benefits as per London Plan Policy SI 13.
- By planning and maintaining flood defences raisings in line with the TE2100 Plan crest levels guidance.

C. What is the cumulative impact of the development land use change and will flood risk increase?

- The Land use is changing from the 'Highly Vulnerable' to the 'More Vulnerable' classification, as residential uses have been proposed.
- The site is currently a brownfield site which has green areas throughout. Building over these will increase the impermeable surface area and therefore the risk of flooding.

D. How can the development reduce risk overall?

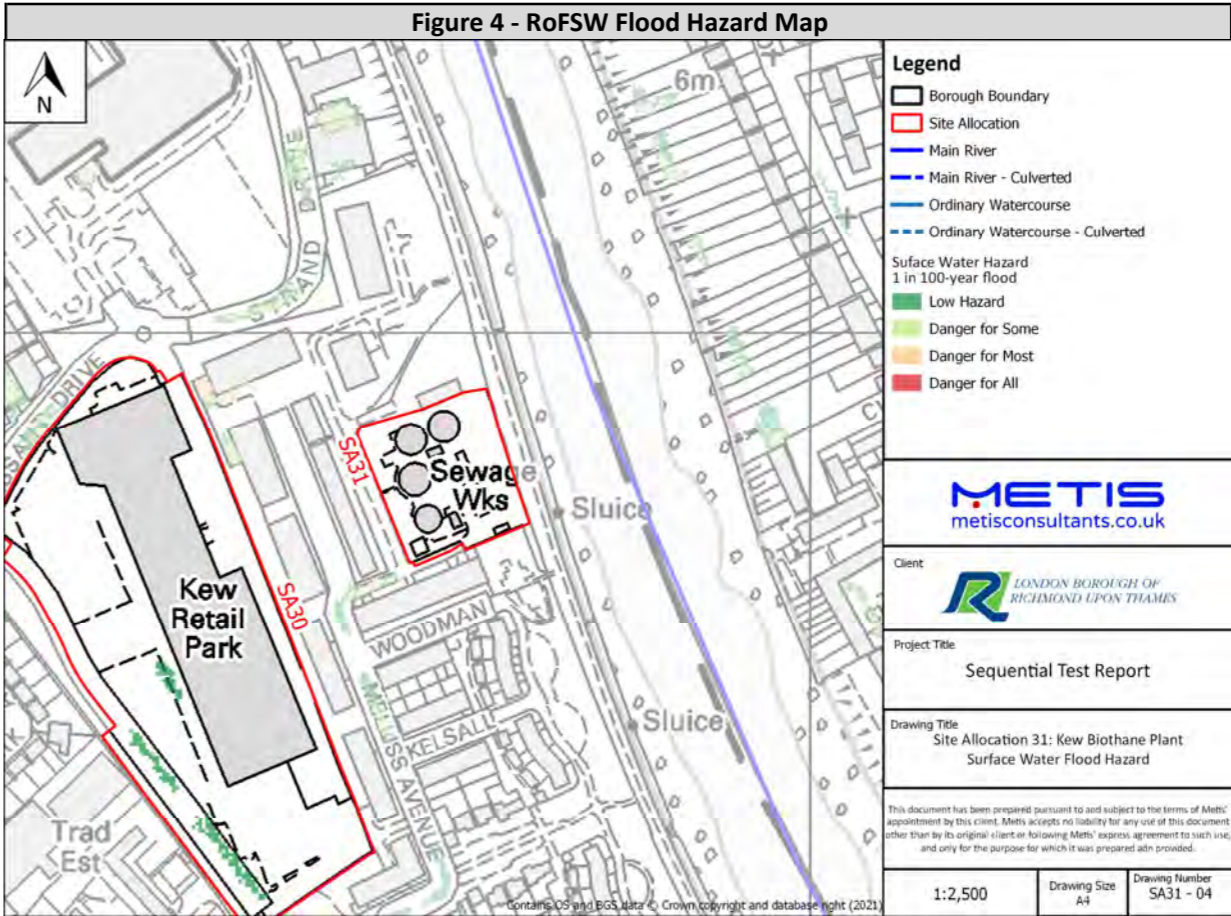
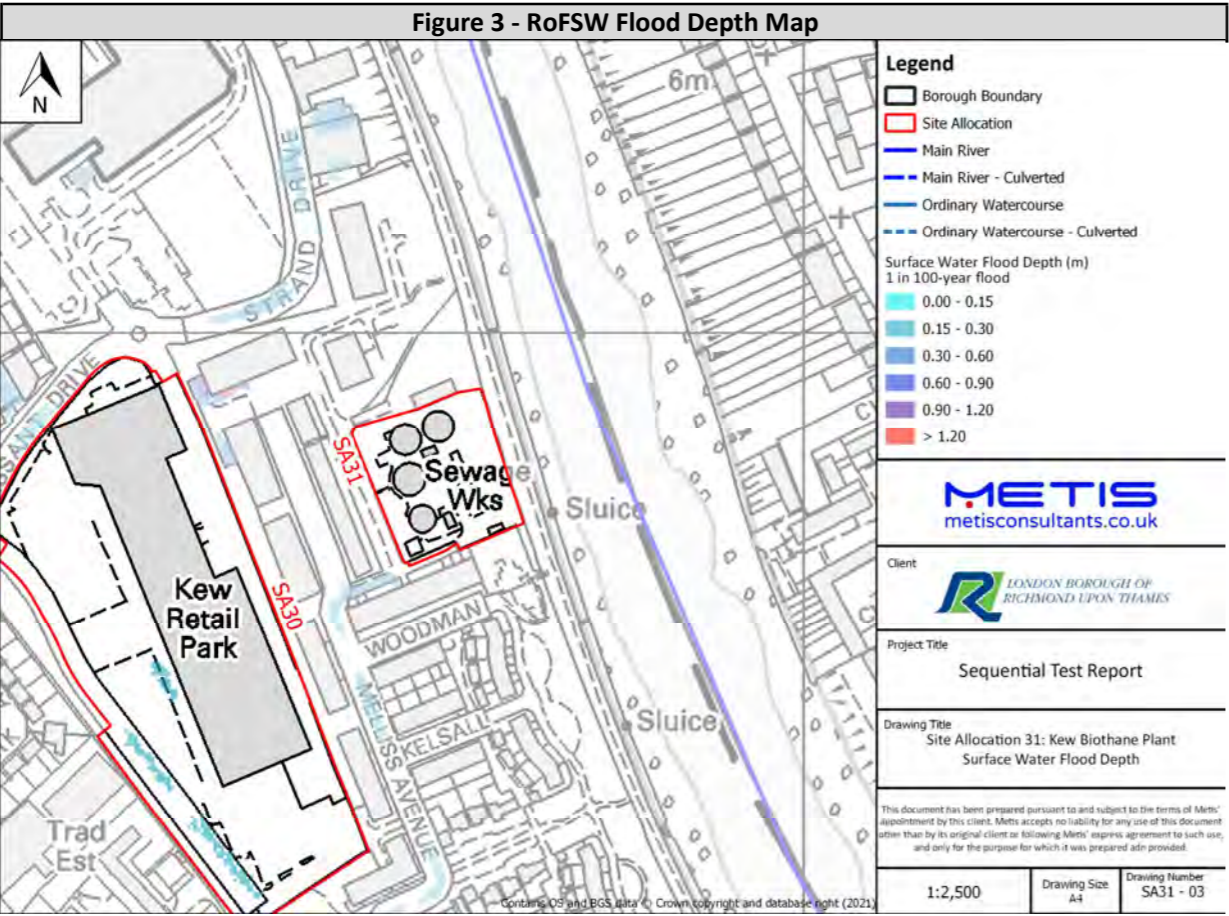
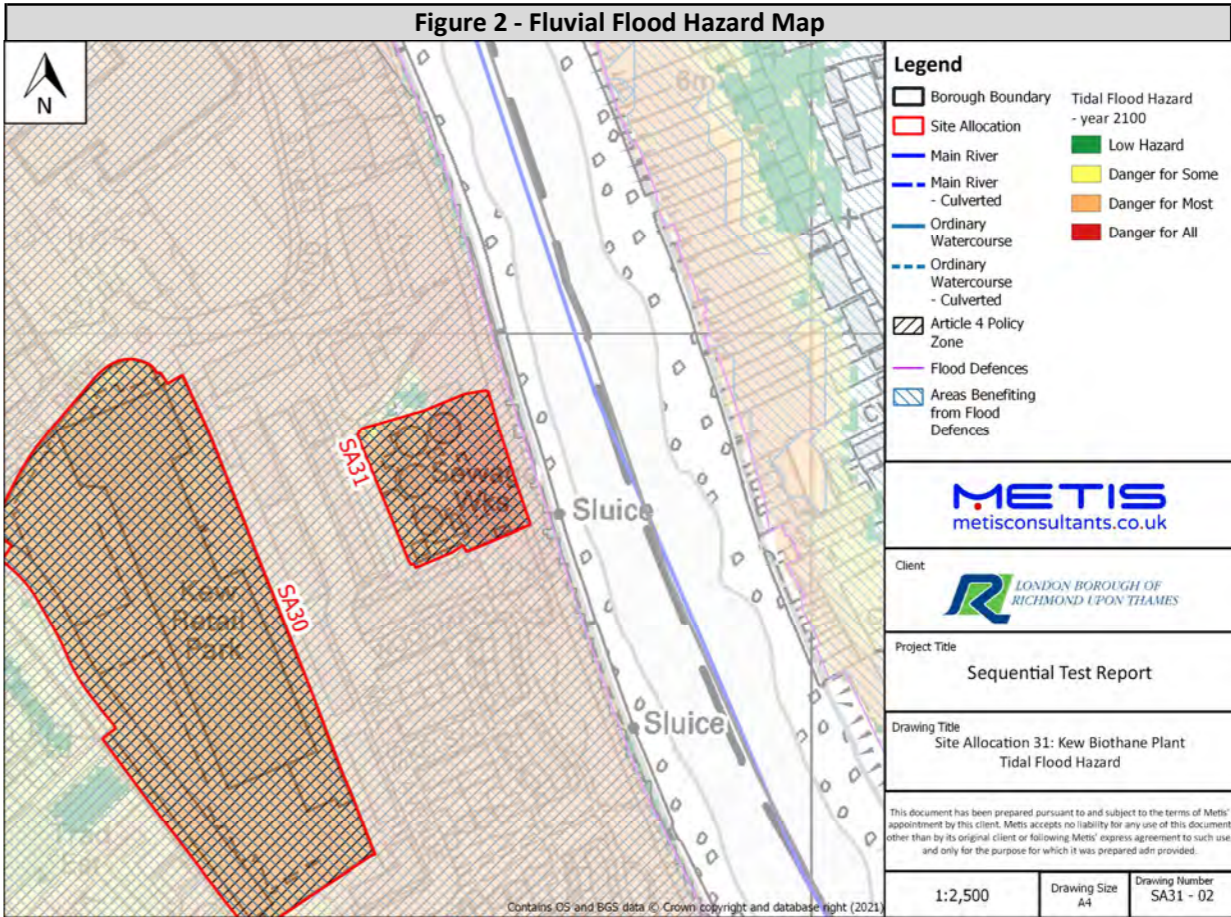
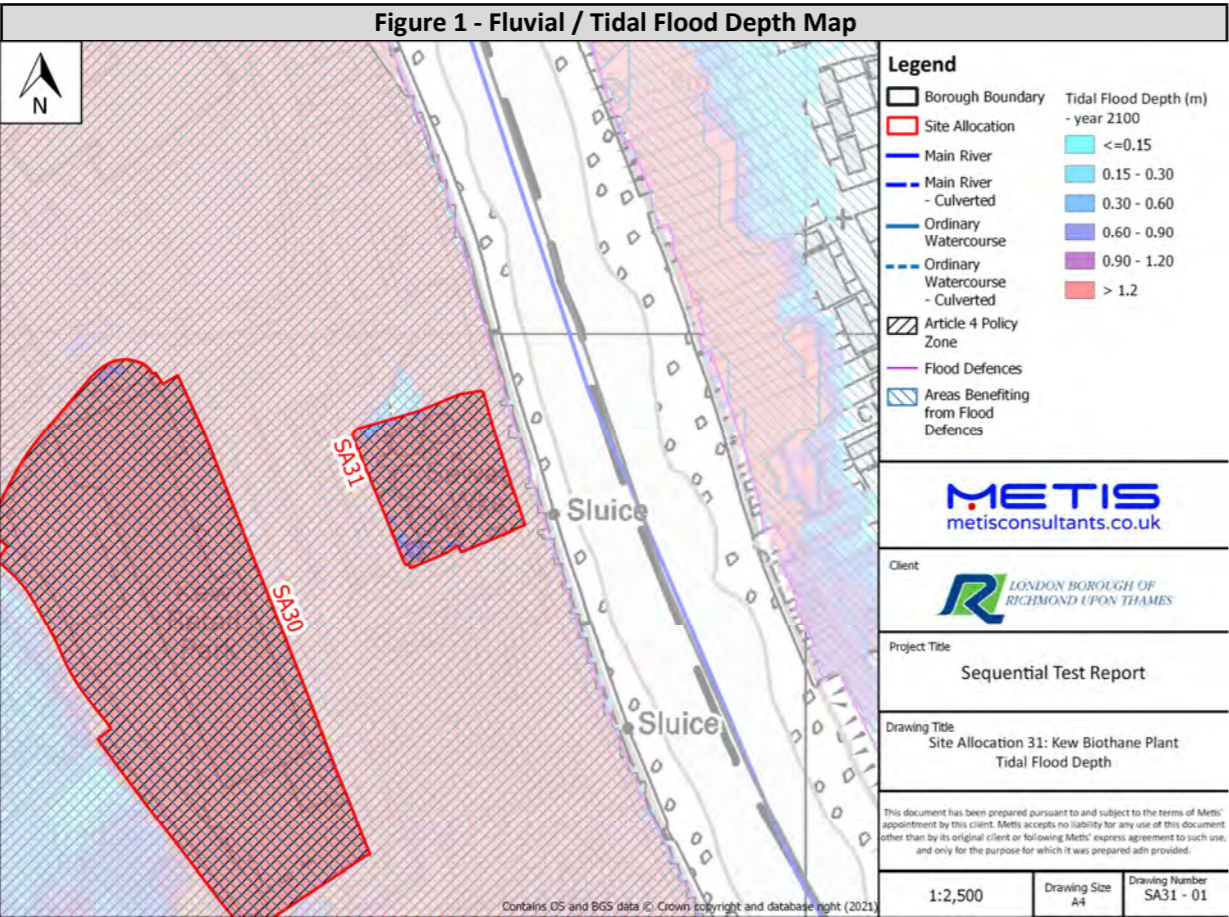
- By ensuring more vulnerable developments are restricted to lower flood risk areas.
- By restricting all developments to outside the 16m Thames tidal defence buffer zone.
- Providing flood plain compensation and run-off storage for new developments.
- Include SuDS to manage surface water and reduce run-off rates to comply with Local Plan Policy LP 8(B).
- By restricting floor level to above the tidal breach crest level for the year 2100.

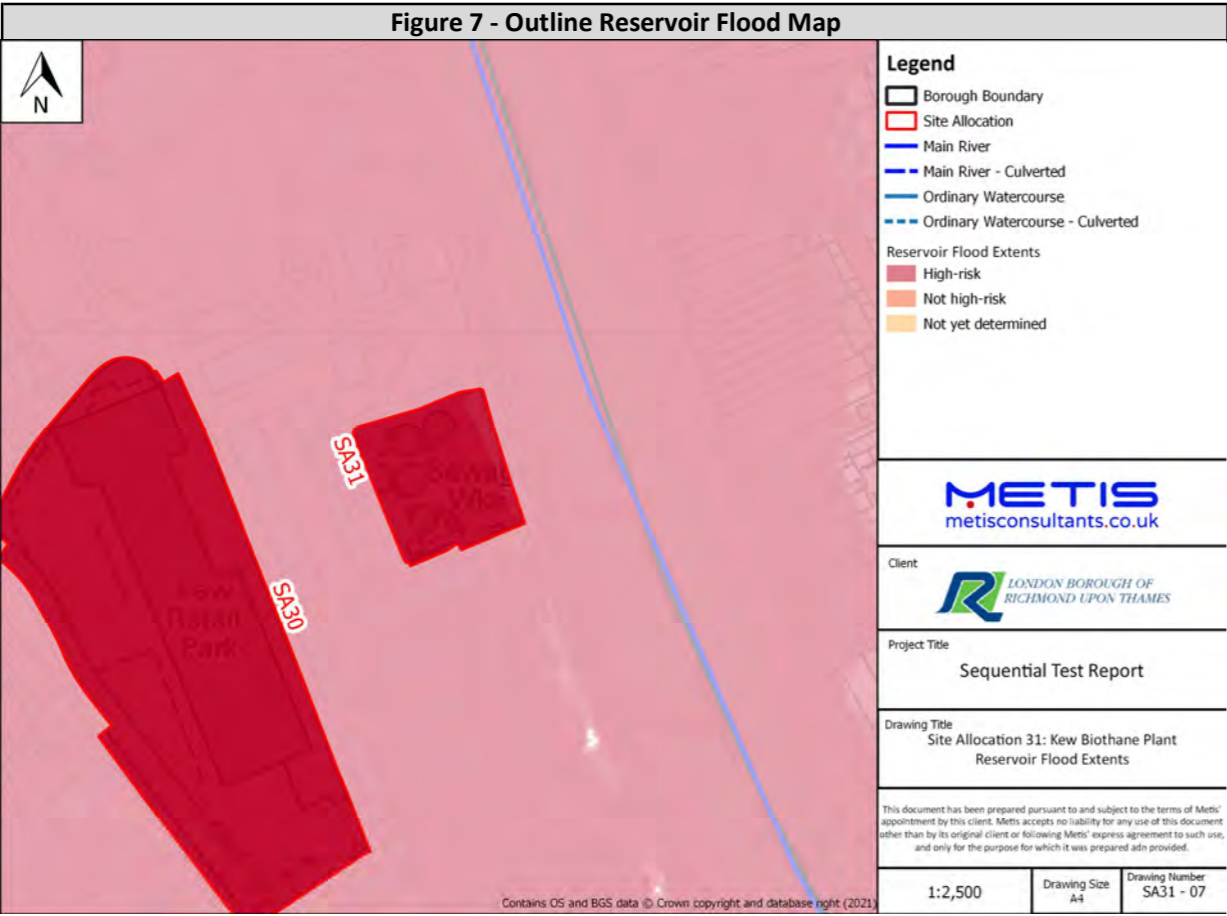
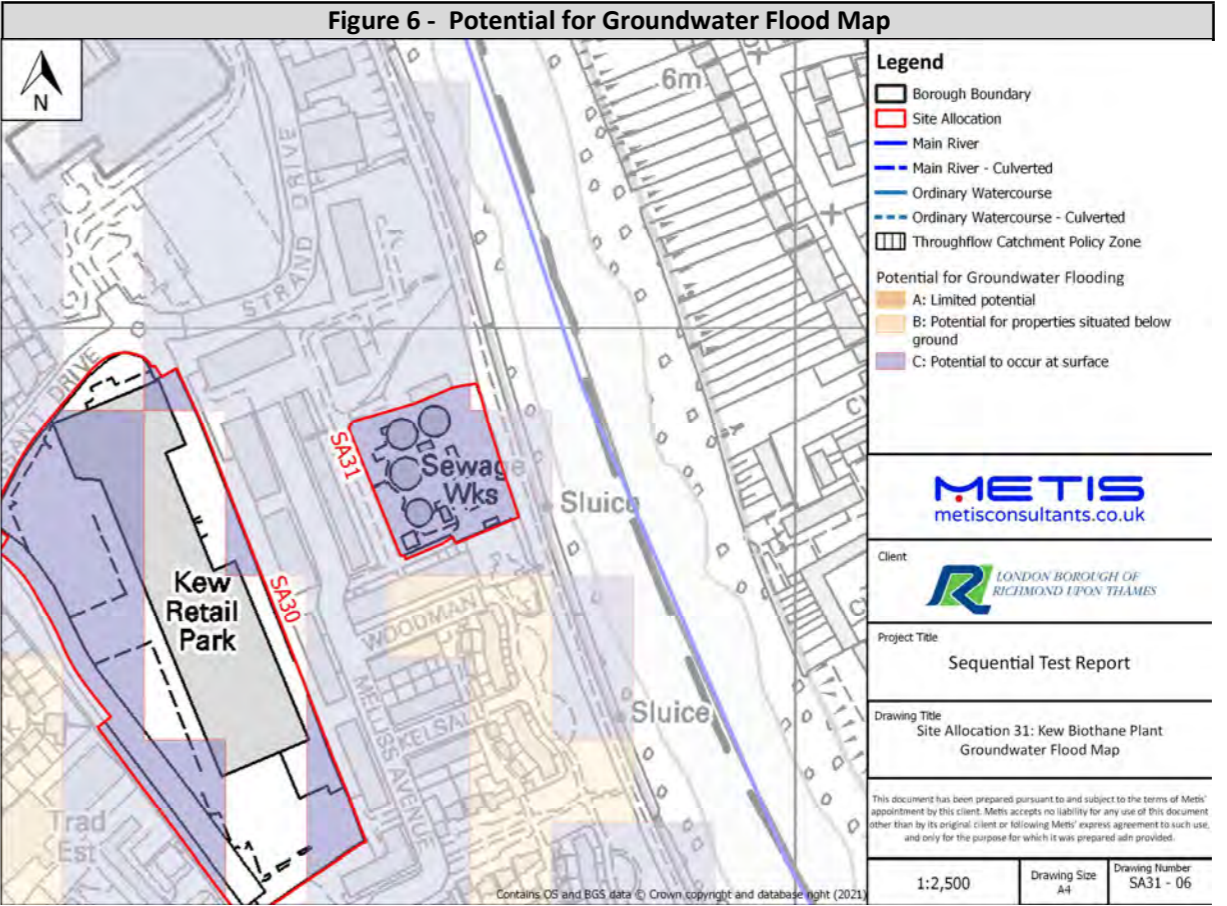
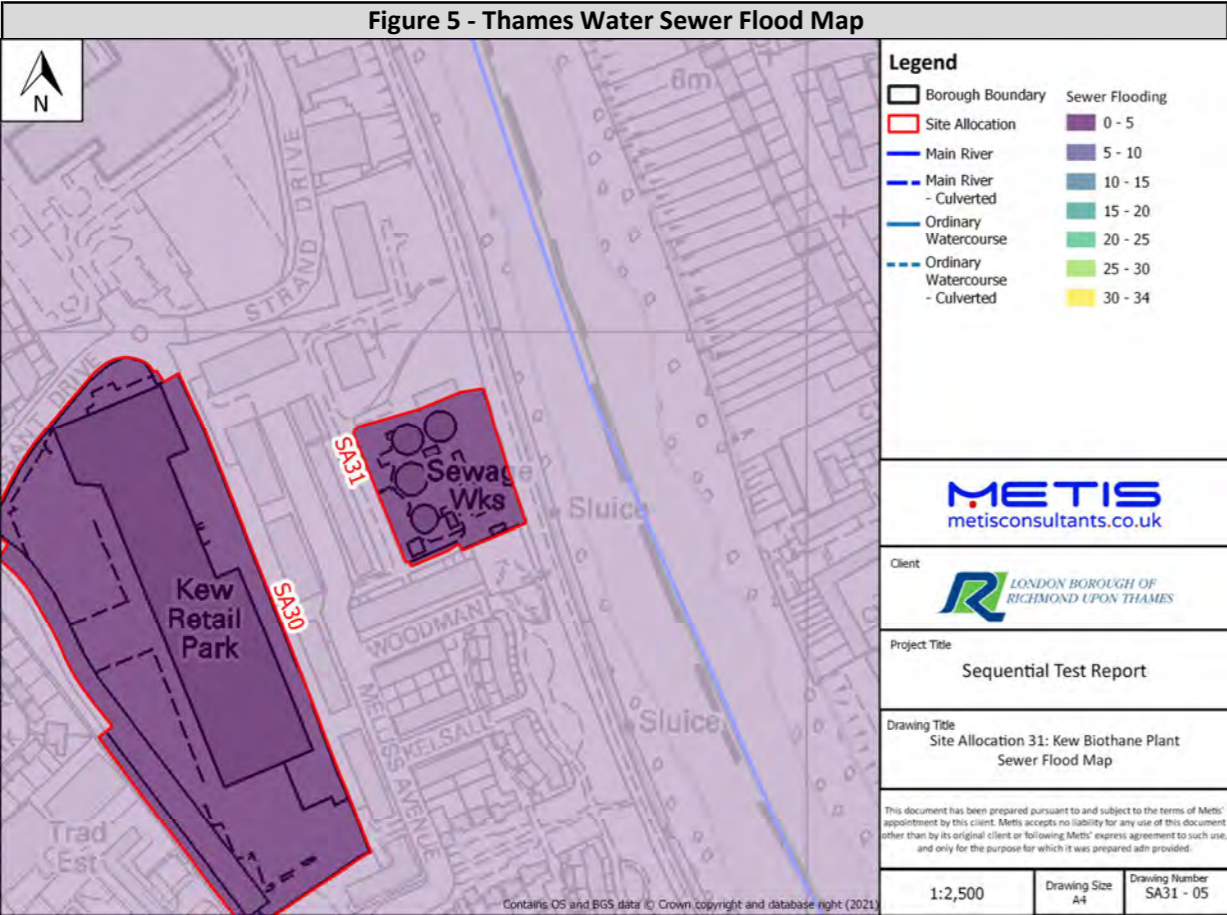
E. Will development require a flood risk permit/watercourse consent?

- Yes - the site is within 16m of the Thames tidal defence. See Report section 5.5 for further requirements.

F. Can the site pass the Exception Test?

- Yes - see question B and C above.





SITE ASSESSMENT - Stag's Brewery

Address: Lower Richmond Road, Mortlake,
SW14 7ET

Area: 8.77 Ha
Site Reference: SA34

Current Use	Proposed Use
Brewery	Education, residential, employment, commercial, retail health facilities, community and social, sport and leisure

Current Vulnerability Classification	Proposed Vulnerability Classification
Less Vulnerable	More Vulnerable

Current Risk Summary							
Fluvial / Tidal			Groundwater			Sewer Flooding	
FZ1	0	% of Site	A**	0	% of Site	No. Incidents	2
FZ2	100	% of Site	B	28.8	% of Site	Dry Islands and Islands	
FZ3a	69.8	% of Site	C	71.2	% of Site	Dry Island?	N
FZ3b	1.2	% of Site	**BGS classification (refer Fig 6)			Island?	N
Surface Water			Policy Zone?		Y	Residual Risk	
3.33%*	0.7	% of Site	Artificial			Article 4 Zone?	Y
1% AEP	7	% of Site	Reservoir	Y	At risk?	86.8	% of site
0.1% AEP	24.9	% of Site	Canal	N	At risk?	Town or Local Centres	
*Annual Exceedance Probability (AEP)			Other	N	At risk?	Within buffer?	Y

FLUVIAL / TIDAL

Risk Assessment (Defended)				
Parameter	FZ3b	FZ3a	*FZ3a+CC	Units
Speed of inundation	N/A	N/A	N/A	Hrs
Min. Depth	N/A	N/A	N/A	m
Max. Depth	N/A	N/A	N/A	m
Max. Velocity	N/A	N/A	N/A	m/s
Max Flood Level	N/A	N/A	N/A	m AOD
Max Ground Level	N/A	N/A	N/A	m AOD
Min Ground Level	N/A	N/A	N/A	m AOD
Max Flood Hazard	N/A	N/A	N/A	N/A
Duration of Flood	N/A	N/A	N/A	Hrs

* The +35% Climate Change Allowance event (central case) is reviewed

Risk Assessment (Thames Tidal Defence Model)			
Parameter	2005	2100	Units
Min. Depth	N/A	0	m
Max. Depth	N/A	2.39	m
Max. Velocity	N/A	2.03	m/s
Max. Hazard	N/A	>2.00	N/A
Max Ground level	N/A	3.83	m AOD
Max Flood Level	N/A	6.04	m AOD

Description of flood mechanism
<ul style="list-style-type: none">The site is at risk of flooding from the Thames Estuary which flows alongside the north-east border of the site.The site is also at risk of flooding from an culvert ordinary watercourse that flows through the western corner of the site.The highest flood depths and hazard are predicted to be in the north-east corner of the site.High flood depths are also predicted in the south-west corner.Lower flood risk is predicted for the north-west section of the site.The entire site is protected by Thames tidal flood defences.

[Figure 1 - Fluvial / Tidal Flood Depth Map](#)

Site Access / Egress
<ul style="list-style-type: none">Safe Egress routes should be directed towards the north-west corner, leading on to Clifford Avenue.No fluvial flood risk is predicted for this area.Safe refuge site should also be designated on site.

Mitigation / FRA Requirements
<ul style="list-style-type: none">More vulnerable developments such as residential and education facilities should not be permitted in FZ3b.All development should be directed away from the north-east and south of the site to areas of lower flood risk.See Report section 5.3 for finished floor levels requirements.Future defence raisings are required in line with the TE2100 Plan crest levels guidance. They must consider the lifetime of the development and the status of current flood defence crest levels in the site-specific FRA.If new basements are proposed they must submit a site specific FRA in line with Article 4 direction on basement development. Self-contained residential basements and bedrooms at basement level will not be permitted.See section 5.5 of the report for Thames tidal requirements.See section 5.6 of the report for Ordinary watercourse requirements.Develop Flood Warning and Emergency Plans for the site.Include appropriate flood resistance or resilience measures to address predicted flood depths.Site users should be signed up to EA's Flood Warning Service.

SURFACE WATER

Risk Assessment				
Parameter	3.33% AEP	1% AEP	*0.1% AEP	Units
Min. Depth	0.00-0.15	0.00-0.15	0.00-0.15	m
Max. Depth	0.60-0.90	0.90-1.20	>1.20	m
Max. Velocity	0.00-0.25	0.5-1.00	>2.00	m/s
Max. Hazard	0.50-0.75	>2.00	>2.00	N/A

*The 0.1% annual probability extent represents the potential climate change adjusted impact of current risk

Description of Flood Mechanism
<ul style="list-style-type: none">Surface water is predicted to pool at the south-west corner of the site.The flood extent, depth and velocity are predicted to increase with climate change.A large proportion of the site, north of the sports grounds are not predicted to be at risk from surface water.The site is located in a critical drainage area

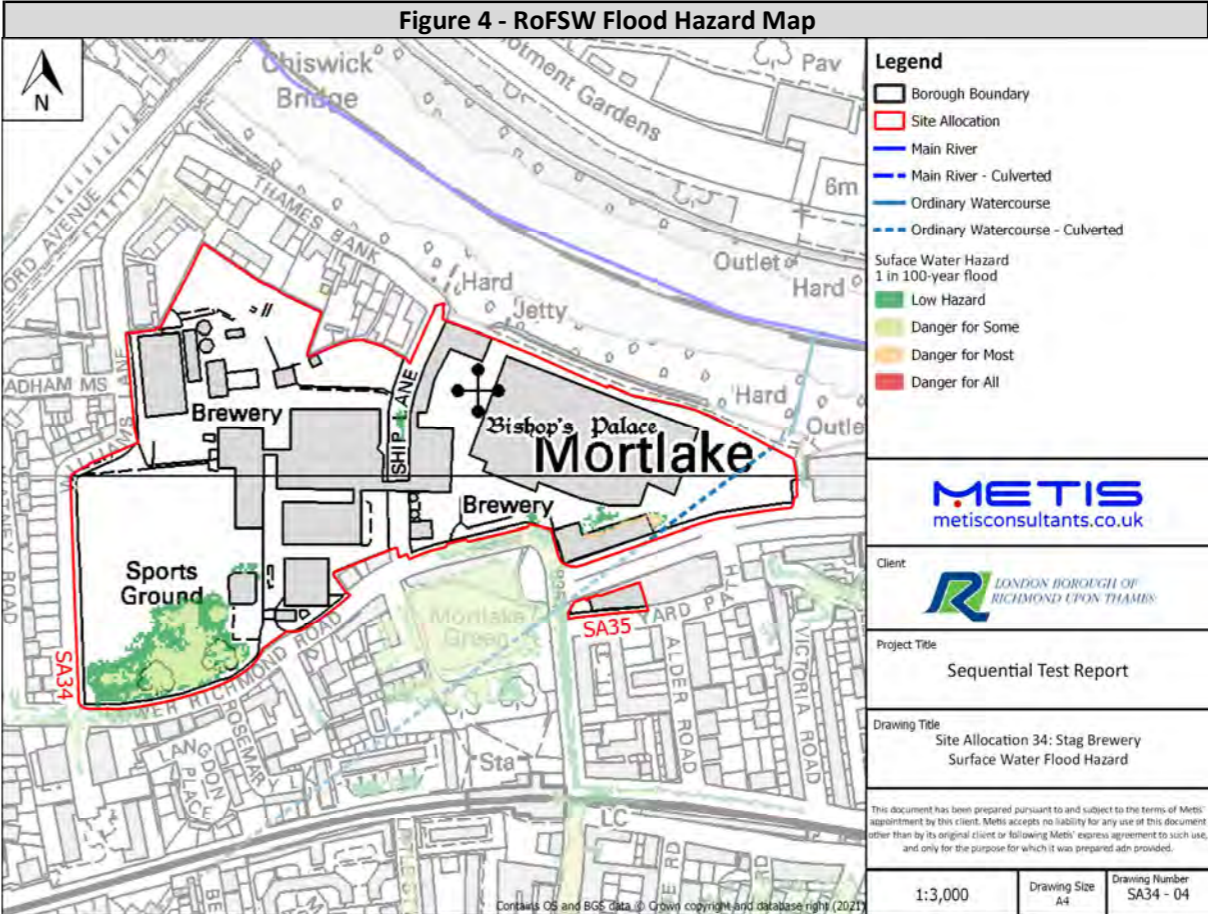
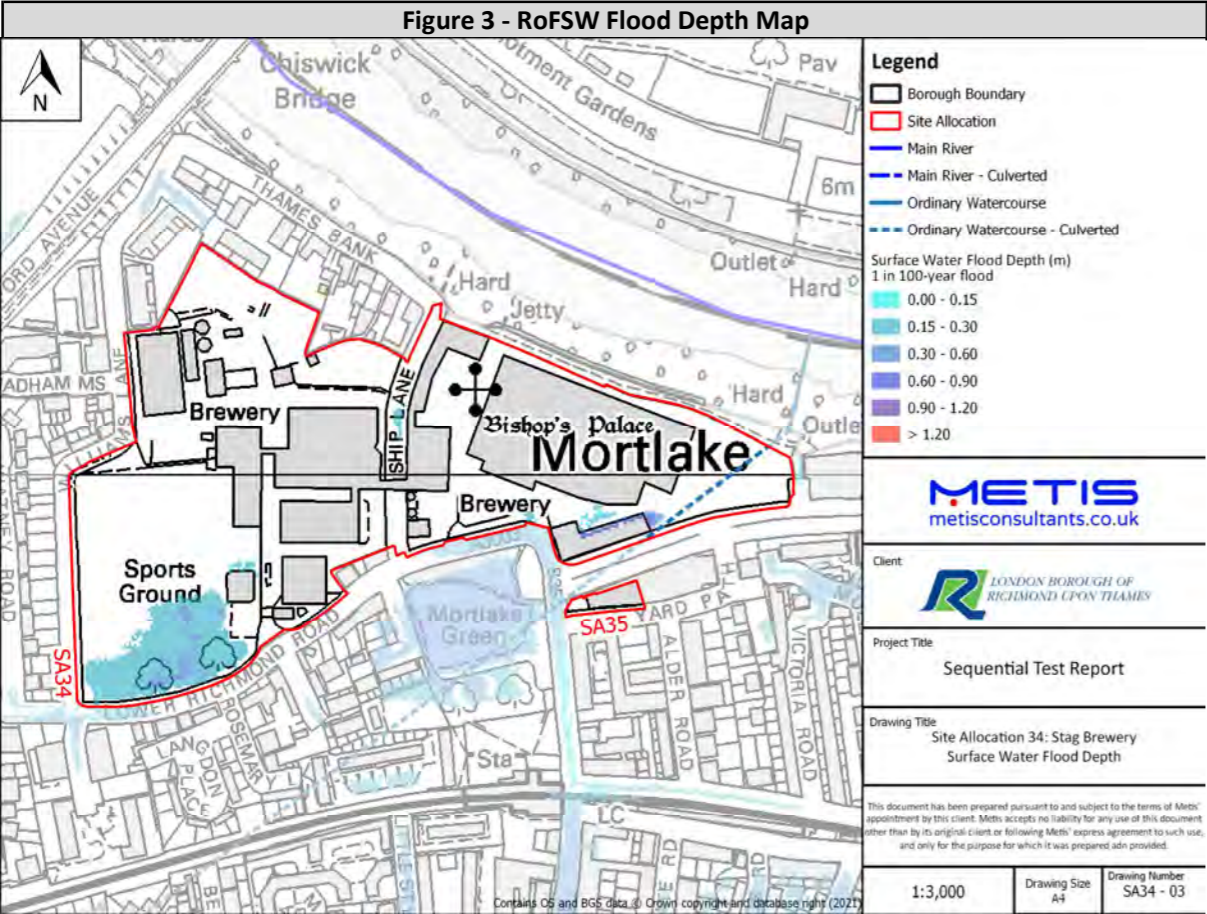
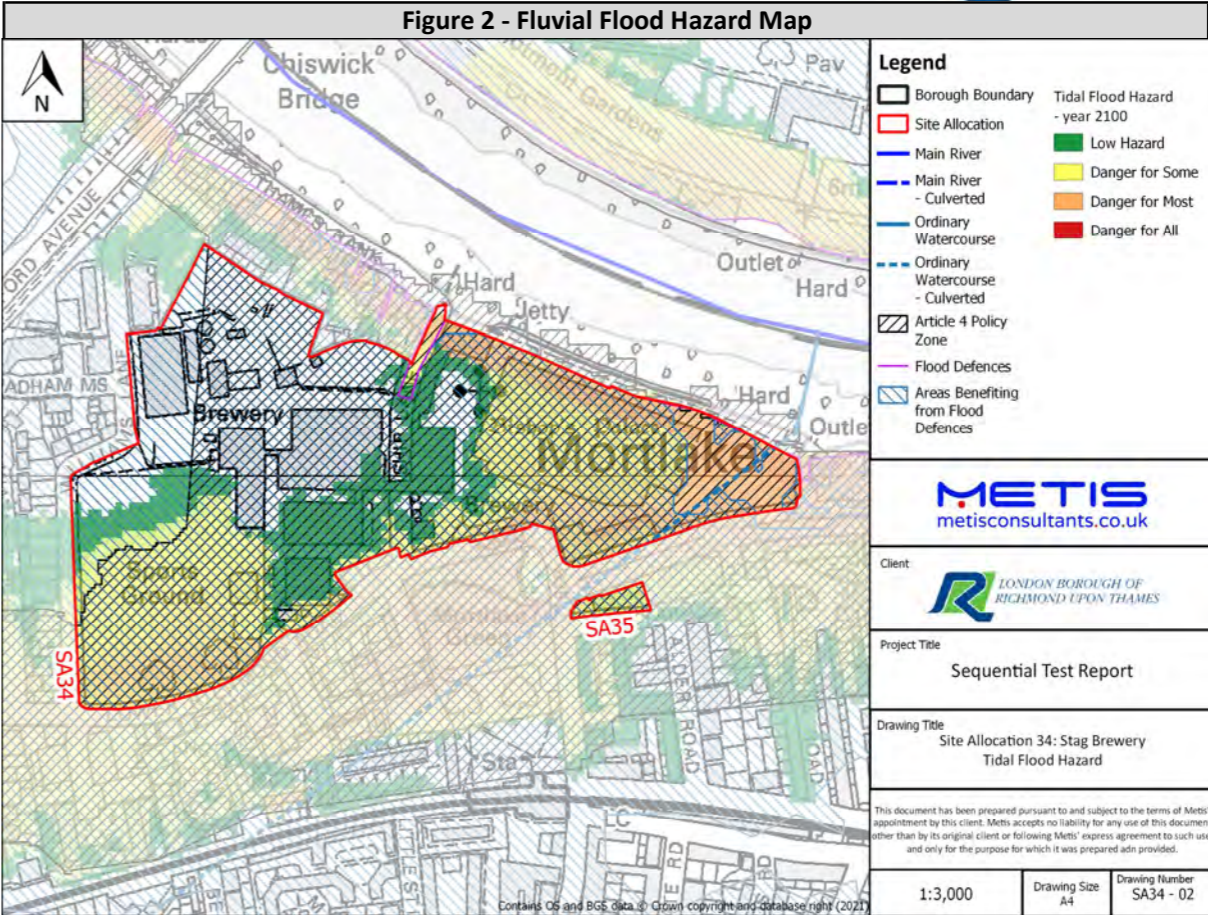
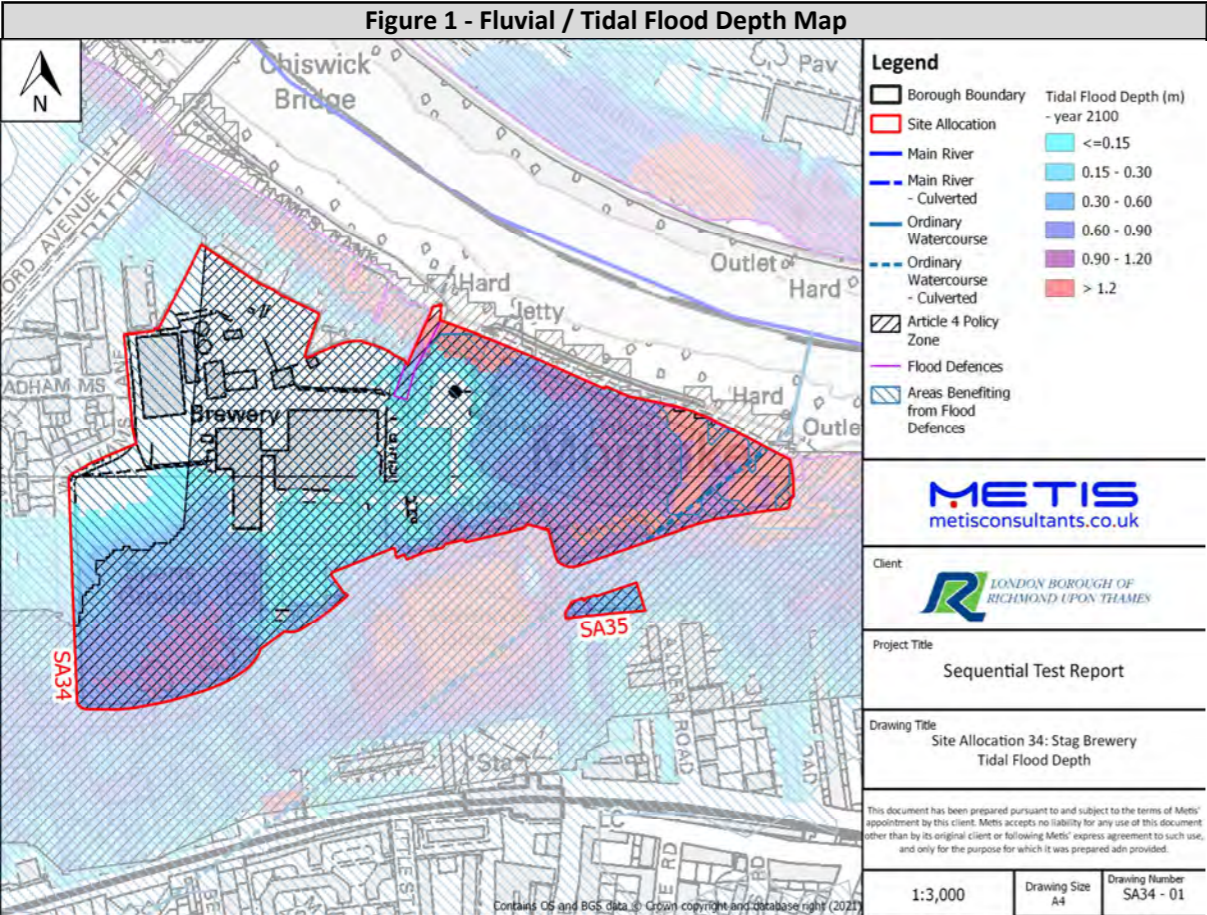
[Figure 3 - RoFSW Flood Depth Map](#)

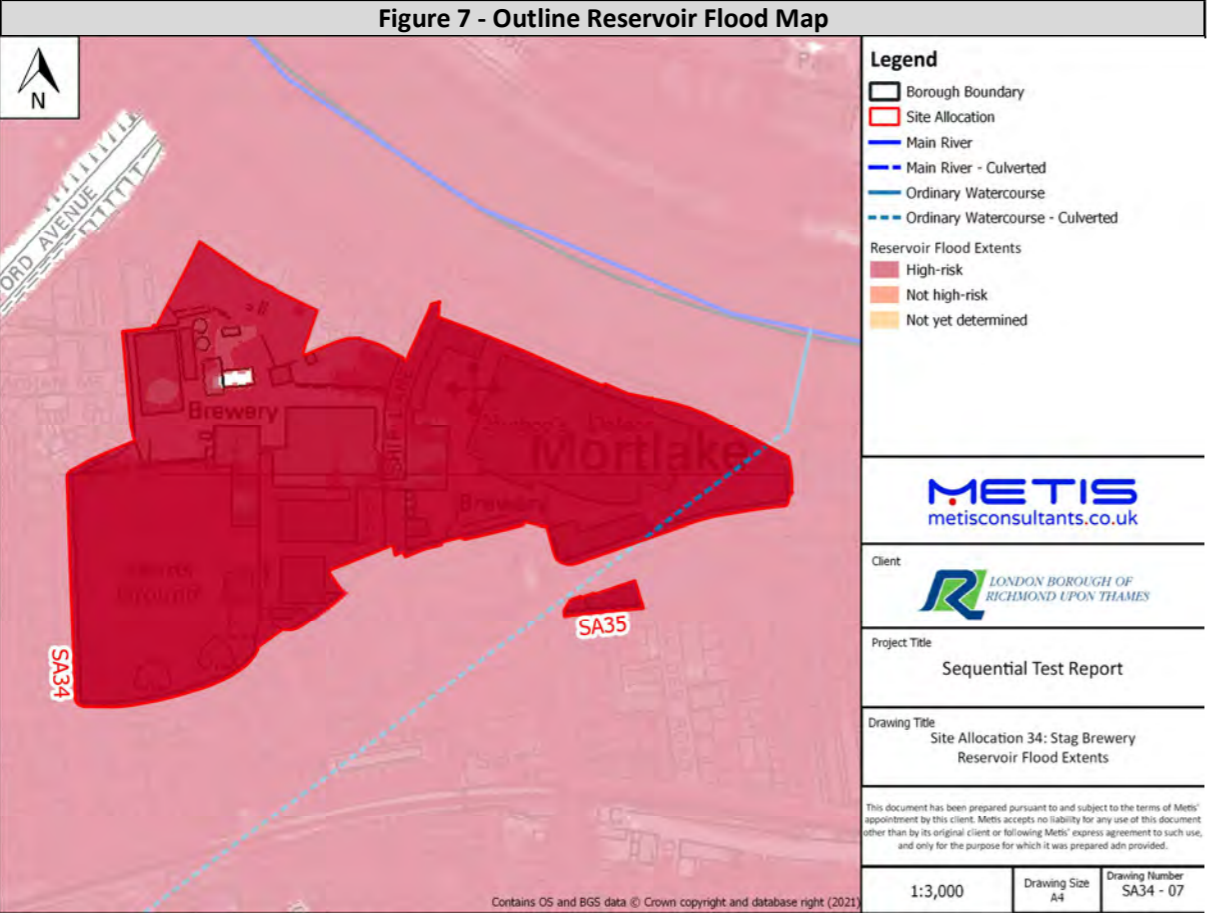
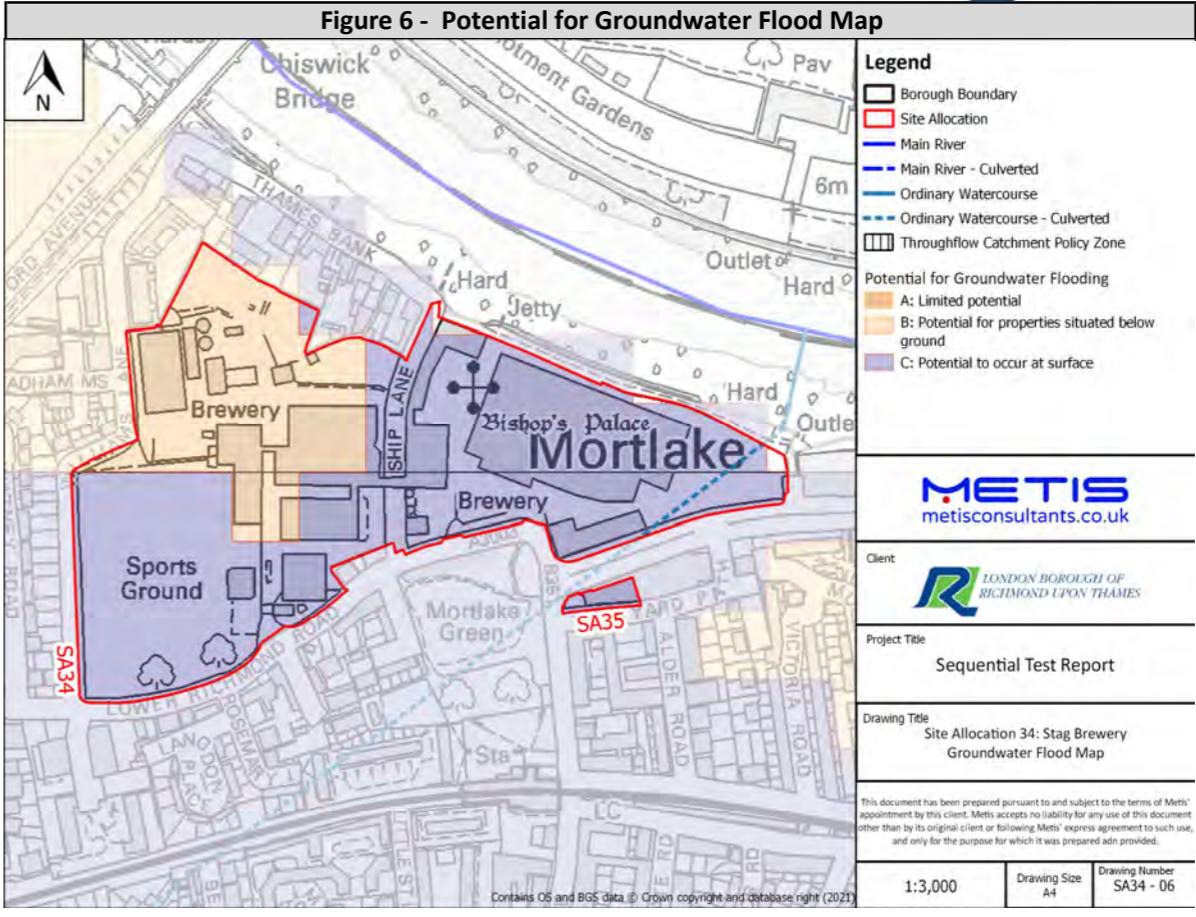
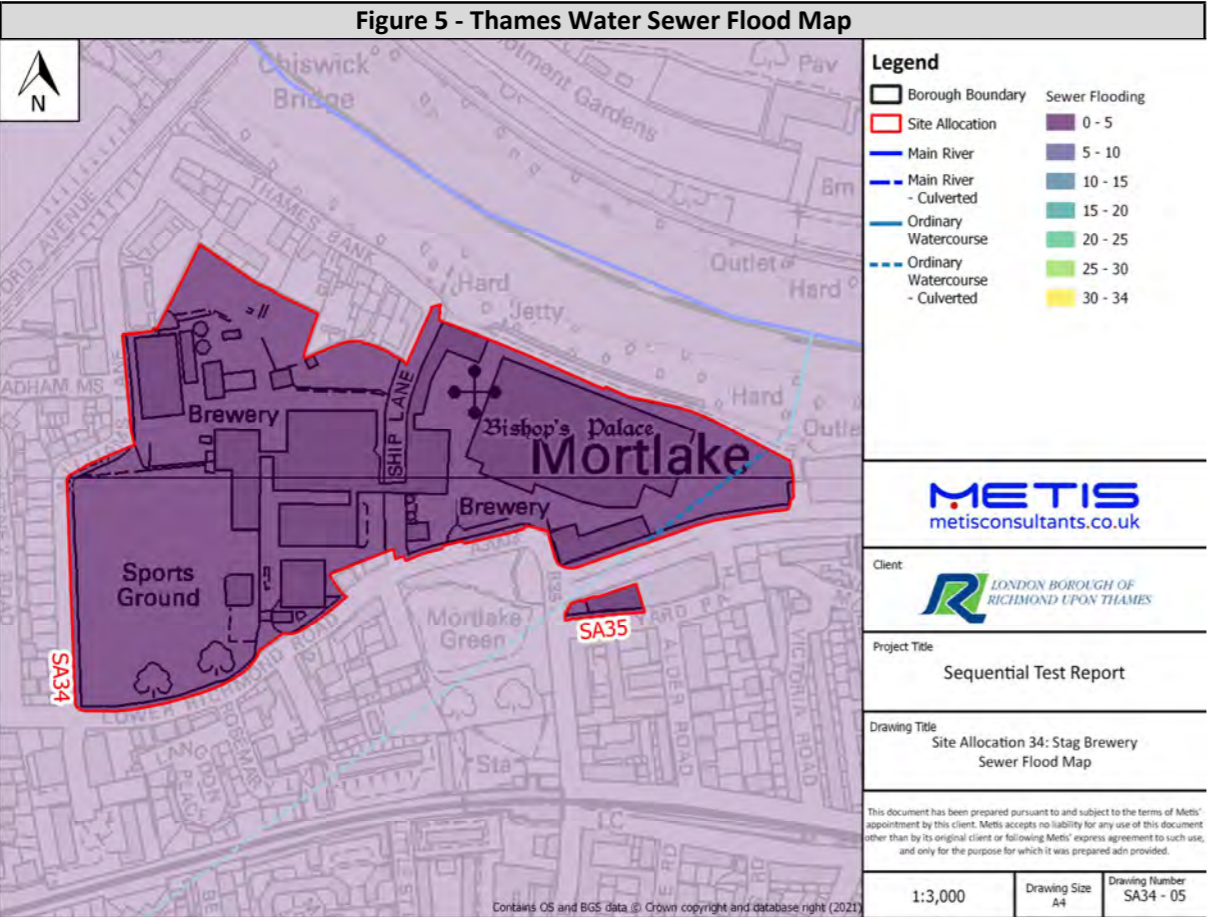
Site Access / Egress
Safe egress routes should be direct to the north of the site where there is no risk of surface water flooding.

[Figure 4 - RoFSW Flood Hazard Map](#)

Mitigation - Surface Water Drainage
<ul style="list-style-type: none">SuDS must be included and comply with the criteria set out in Local Plan Policy LP 8(B).Developments should apply the Sustainable Drainage Hierarchy set out in Policy SI13 of the London Plan.The actions in the London Sustainable Drainage Action Plan (LSDAP) should also be taken.Ground investigations are required to confirm whether infiltration based SuDS are suitable.

SITE ASSESSMENT - Stag's Brewery			
SEWER		GROUNDWATER	ARTIFICIAL
Risk Assessment		Risk Assessment	Risk Assessment
<p>This site is located with a postcode which has 2 previous reports of sewer flooding.</p>		<ul style="list-style-type: none"> • A large proportion of the site is classified as having a potential for groundwater flooding at the surface. • The rest of the site has a potential for groundwater flooding for properties below ground level. • The site is underlain by the Kempton Park gravel superficial deposits and the London Clay bedrock. • The site is not located in a throughflow catchment area. 	<ul style="list-style-type: none"> • This site is at risk of flooding from the Pen Pond Lower lake and Queen Elizabeth II, Staines North and Walton- Bessborough reservoirs. • The Reservoir flood extent model predicts that the site is at high risk of flooding if any of these reservoirs breach on a wet day (rivers at capacity).
<p>Figure 5 - Thames Water Sewer Flood Map</p>		<p>Figure 6 - Potential for Groundwater Flood Map</p>	<p>Figure 7 - Outline Reservoir Flood Map</p>
Mitigation Requirements		Mitigation Requirements	Mitigation Requirements
<ul style="list-style-type: none"> • Must consult with the relevant Water and Sewerage Company to confirm if the development site has historically flooded. • Where historic flooding has occurred, the applicant must show how they will effectively manage this risk for the lifetime of the development. 		<ul style="list-style-type: none"> • Applicants must ensure that the development does not impact the flow profile or increase the groundwater flood risk to neighbouring properties. • If a basement is proposed, a basement screening assessment is required. 	<ul style="list-style-type: none"> • Assess the risk from each reservoir. • Implement appropriate and proportionate risk management measures.
PLANNING CONSIDERATIONS			
Safety of Development			
<p>A. Can the development be future proofed for climate change considerations?</p> <ul style="list-style-type: none"> • Yes - Finished floor levels must be set above the Thames tidal breach flood level for the year 2100. • Appropriate flood resistance or resilience measures should be developed for the predicted flood depths. • See report section 5.8. for compensatory flood storage requirements. <p>B. Can the development be designed safe throughout its lifetime without increasing flood risk elsewhere?</p> <ul style="list-style-type: none"> • Yes - The development must use surface water drainage techniques to manage surface water runoff as close to the source as possible as per Local Plan Policy LP 8(B). Green drainage infrastructure should be prioritised to provide wider ecological/biodiversity benefits as per London Plan Policy SI 13. • By planning and maintaining flood defences raisings in line with the TE2100 Plan crest levels guidance. <p>C. What is the cumulative impact of the development land use change and will flood risk increase?</p> <ul style="list-style-type: none"> • The land use vulnerability classification for this site is changing from the Less Vulnerable to More Vulnerable category, as residential and educational uses are proposed. • The site is currently a brownfield site, largely covered with impermeable surface with a number of green areas throughout. Increasing the impermeable area coverage or altering the topography of the site will increase the risk of flooding. <p>D. How can the development reduce risk overall?</p> <ul style="list-style-type: none"> • By directing development to lower flood risk areas in the north-west section. • By restricting all developments to outside the 16m Thames tidal defence buffer zone and 5m of the culverted ordinary watercourse. • Providing flood plain compensation and run-off storage. • Include SuDS to manage surface water and reduce run-off rates to comply with Local Plan Policy LP 8(B). • By restricting floor level to above the tidal breach crest level for the year 2100. <p>E. Will development require a flood risk permit/watercourse consent?</p> <ul style="list-style-type: none"> • Yes - Part of the site is within the 16m buffer zone of the Thames tidal defences and within 5m of an ordinary watercourse. See Report section 5.5 and 5.6 for further requirements. <p>F. Can the site pass the Exception Test?</p> <ul style="list-style-type: none"> • No proposed development is permitted in Flood Zone 3b. • The exception test is required for more vulnerable developments in FZ3a - can be passed, see B and C. 			





SITE ASSESSMENT - Mortlake and Barnes Delivery Office

Address: 2-12 Mortlake High Street, London,
SW14 8JB

Area: 0.1 Ha
Site Reference: SA35

Current Use	Proposed Use
Post Office Sorting and Delivery Office	Employment, commerical, retail

Current Vulnerability Classification	Proposed Vulnerability Classification
Less Vulnerable	Less Vulnerable

Current Risk Summary							
Fluvial / Tidal			Groundwater			Sewer Flooding	
FZ1	0	% of Site	A**	0	% of Site	No. Incidents	1
FZ2	100	% of Site	B	0	% of Site	Dry Islands and Islands	
FZ3a	100	% of Site	C	100	% of Site	Dry Island?	N
FZ3b	0	% of Site	**BGS classification (refer Fig 6)			Island?	N
Surface Water			Policy Zone?		Y	Residual Risk	
3.33%*	0	% of Site	Artificial			Article 4 Zone?	Y
1% AEP	0	% of Site	Reservoir	Y	At risk?	100	% of site
0.1% AEP	0	% of Site	Canal	N	At risk?	Town or Local Centres	
*Annual Exceedance Probability (AEP)			Other	N	At risk?	Within buffer?	Y

FLUVIAL / TIDAL

Risk Assessment (Defended)				
Parameter	FZ3b	FZ3a	*FZ3a+CC	Units
Speed of inundation	N/A	N/A	N/A	Hrs
Min. Depth	N/A	N/A	N/A	m
Max. Depth	N/A	N/A	N/A	m
Max. Velocity	N/A	N/A	N/A	m/s
Max Flood Level	N/A	N/A	N/A	m AOD
Max Ground Level	N/A	N/A	N/A	m AOD
Min Ground Level	N/A	N/A	N/A	m AOD
Max Flood Hazard	N/A	N/A	N/A	N/A
Duration of Flood	N/A	N/A	N/A	Hrs

* The +35% Climate Change Allowance event (central case) is reviewed

Risk Assessment (Thames Tidal Defence Breach Model)			
Parameter	2005	2100	Units
Min. Depth	N/A	0.39	m
Max. Depth	N/A	0.94	m
Max. Velocity	N/A	0.4	m/s
Max. Hazard	N/A	1.67	N/A
Max Ground level	N/A	5.81	m AOD
Max Flood Level	N/A	6.75	m AOD

Description of flood mechanism
<ul style="list-style-type: none">The site is at risk of flooding from the Thames Estuary and a culverted watercourse which flows to the west of the site.The predicted flood extent covers the entire site.The highest flood depths are predicted in the the western section of the side.The entire site is protected by the Thames tidal defences.

Figure 1 - Fluvial / Tidal Flood Depth Map

Site Access / Egress
<ul style="list-style-type: none">Safe egress cannot be achieved as the entire site is at risk of flooding.Safe refuge area should be provided on site.

Figure 2 - Fluvial Flood Hazard Map

Mitigation / FRA Requirements
<ul style="list-style-type: none">Developments should be directed away from the western side of site to areas of lower flood risk.See Report section 5.3 for finished floor levels requirements.Future defence raisings are required in line with the TE2100 Plan crest levels guidance. They must consider the lifetime of the development and the status of current flood defence crest levels in the site-specific FRA.If new basements are proposed they must submit a site specific FRA in line with Article 4 direction on basement development. Self-contained residential basements and bedrooms at basement level will not be permitted.See section 5.6 of the report for ordinary watercourse requirements.Develop Flood Warning and Emergency Plans for the site.Include appropriate flood resistance or resilience measures to address predicted flood depths.Site users should be signed up to EA's Flood Warning Service.

SURFACE WATER

Risk Assessment				
Parameter	3.33% AEP	1% AEP	*0.1% AEP	Units
Min. Depth	N/A	N/A	N/A	m
Max. Depth	N/A	N/A	N/A	m
Max. Velocity	N/A	N/A	N/A	m/s
Max. Hazard	N/A	N/A	N/A	N/A

*The 0.1% annual probability extent represents the potential climate change adjusted impact of current risk

Description of Flood Mechanism
N/A

Figure 3 - RoFSW Flood Depth Map

Site Access / Egress
N/A

Figure 4 - RoFSW Flood Hazard Map

Mitigation - Surface Water Drainage
N/A

SITE ASSESSMENT - Mortlake and Barnes Delivery Office

SEWER	GROUNDWATER	ARTIFICIAL
Risk Assessment	Risk Assessment	Risk Assessment
<p>This site is located with a postcode which has 1 previous report of sewer flooding.</p>	<ul style="list-style-type: none"> The entire site is classified as having a potential for groundwater flooding at the surface. The site is underlain by the Kempton Park gravel superficial deposits and the London Clay bedrock. The site is not located in a throughflow catchment area. 	<ul style="list-style-type: none"> This site is at risk of flooding from the Pen Pond Lower lake and Queen Elizabeth II, Staines North and Walton- Bessborough reservoirs. The Reservoir flood extent model predicts that the site is at high risk of flooding if any of these reservoirs breach on a wet day (rivers at capacity).
<p>Figure 5 - Thames Water Sewer Flood Map</p>	<p>Figure 6 - Potential for Groundwater Flood Map</p>	<p>Figure 7 - Outline Reservoir Flood Map</p>
Mitigation Requirements	Mitigation Requirements	Mitigation Requirements
<p>No mitigation required.</p>	<ul style="list-style-type: none"> Applicants must ensure that the development does not impact the flow profile or increase the groundwater flood risk to neighbouring properties. If a basement is proposed, a basement screening assessment is required. 	<ul style="list-style-type: none"> Assess the risk from each reservoir. Implement appropriate and proportionate risk management measures.

PLANNING CONSIDERATIONS

Safety of Development

A. Can the development be future proofed for climate change considerations?

- Yes - Finished floor levels must be set above the Thames tidal breach flood level for the year 2100.
- Appropriate flood resistance or resilience measures should be developed for the predicted flood depths.
- See report section 5.8. for compensatory flood storage requirements.

B. Can the development be designed safe throughout its lifetime without increasing flood risk elsewhere?

- Yes - The development must use surface water drainage techniques to manage surface water runoff as close to the source as per Local Plan Policy LP 8(B). Green drainage infrastructure should be prioritised to provide wider ecological/biodiversity benefits as per London Plan Policy SI 13.
- By planning and maintaining flood defences raisings in line with the TE2100 Plan crest levels guidance.

C. What is the cumulative impact of the development land use change and will flood risk increase?

- The land use vulnerability classification for this site is not changing.
- The site is currently a brownfield site with one continuous building. It is unlikely that the risk of flooding will be increased.

D. How can the development reduce risk overall?

- By directing development to lower flood risk areas
- By restricting all developments to outside the 5m buffer zone of the culverted ordinary watercourse.
- Providing flood plain compensation and run-off storage.
- Include SuDS to manage surface water and reduce run-off rates to comply with Local Plan Policy LP 8(B).
- By restricting floor levels to above the tidal breach crest level for the year 2100.

E. Will development require a flood risk permit/watercourse consent?

- Yes - The western edge of this site is within the 5m buffer of an ordinary watercourse - See Report section 5.6. for further requirements.

F. Can the site pass the Exception Test?

- Not required for Less Vulnerable developments in Flood Zone 3a.

