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Flood risk, water and environment

Flood Risk Assessment AEG3080_TW10_Ham_01

Site Address: Thames Young Mariners Base
Riverside Drive
Ham
Richmond
TW10 7RX

UK Experts in Flood Modelling, Flood Risk
Assessments, and Surface Water Drainage Strategies

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Document Issue Record

Project: Flood Risk Assessment

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Reference: AEG3080_TW10_Ham_01

Site Location: Thames Young Mariners Base, Riverside Drive, Ham, Richmond, TW10 7RX

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1. Introduction

- 1.1. Aegaea were commissioned by Surrey County Council to undertake a Flood Risk Assessment (FRA) to facilitate a planning application for the proposed development. This FRA has been prepared in accordance with the requirements set out in the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance.
- 1.2. This FRA is intended to support a full planning application and as such the level of detail included is commensurate and subject to the nature of the proposals.

Site Overview

- 1.3. The site of the proposed development is Thames Young Mariners Base, Riverside Drive, Ham, Richmond, TW10 7RX (Figure 1).

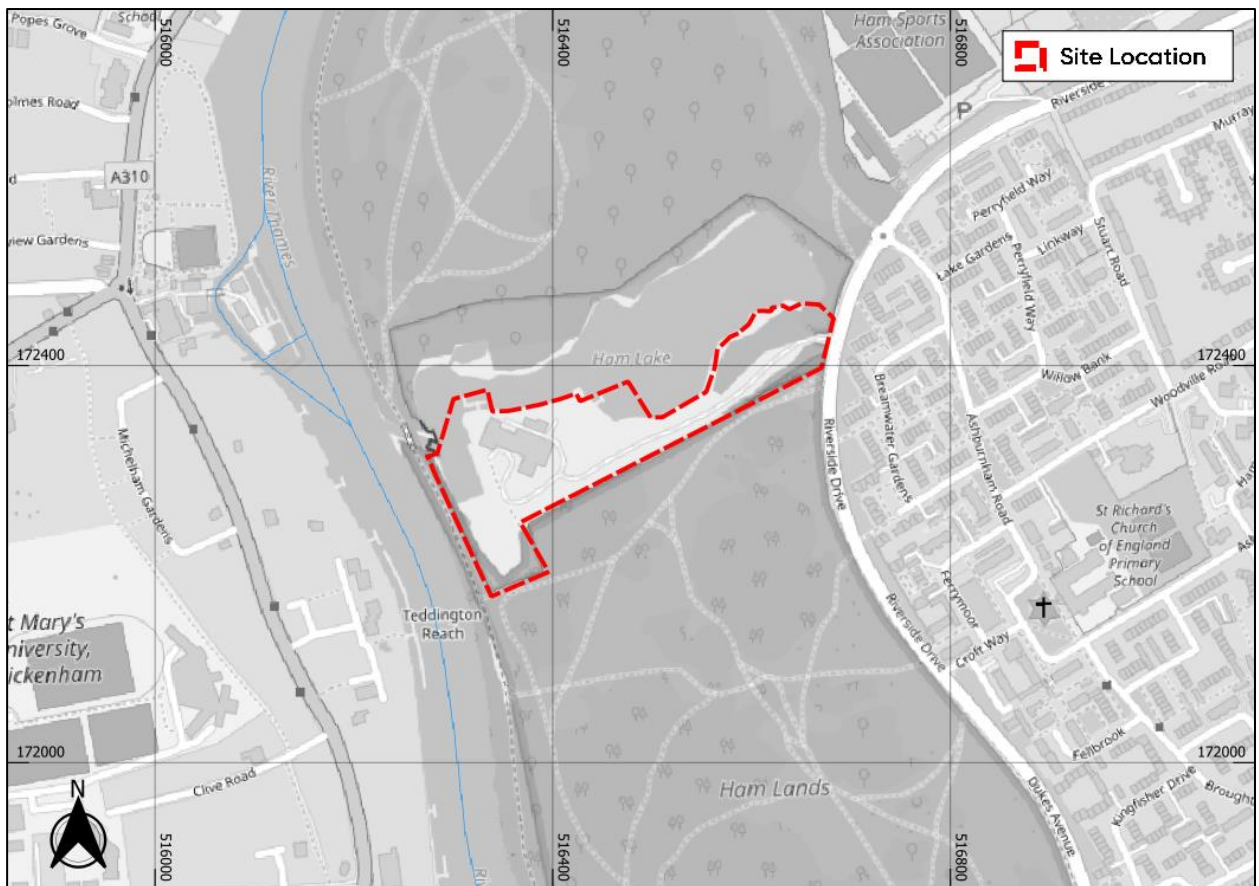


Figure 1: Site Location (Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © <https://www.openstreetmap.org> and contributors)

- 1.4. It is understood that the proposed development is for the demolition of existing buildings and construction of replacement buildings with associated residential accommodation, changing block, replacement staff accommodation and outdoor activity equipment including high ropes, climbing wall, coasteering course, supporting pontoons with associated hard and soft landscaping and parking.
- 1.5. The buildings on site will be referred to as set out in Figure 2 throughout this report.



Figure 2: Site Location (Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © <https://www.openstreetmap.org> and contributors)

- 1.6. Review of the topographic survey (Appendix B) shows that land levels fall across the site in a northerly direction towards the lake. There is a hill in the centre of the site which reaches a maximum of 8.81m AOD. The lowest point is 4.42m AOD to the north of the Existing Main Building. Land levels rise to the east towards the access road to levels to between 7.7m and 7.9m AOD.

- 1.7. Environment Agency Light Detection and Ranging (LiDAR) data Digital Terrain Model has been used to review the topography of the site in relation to the surrounding area (Figure 3).

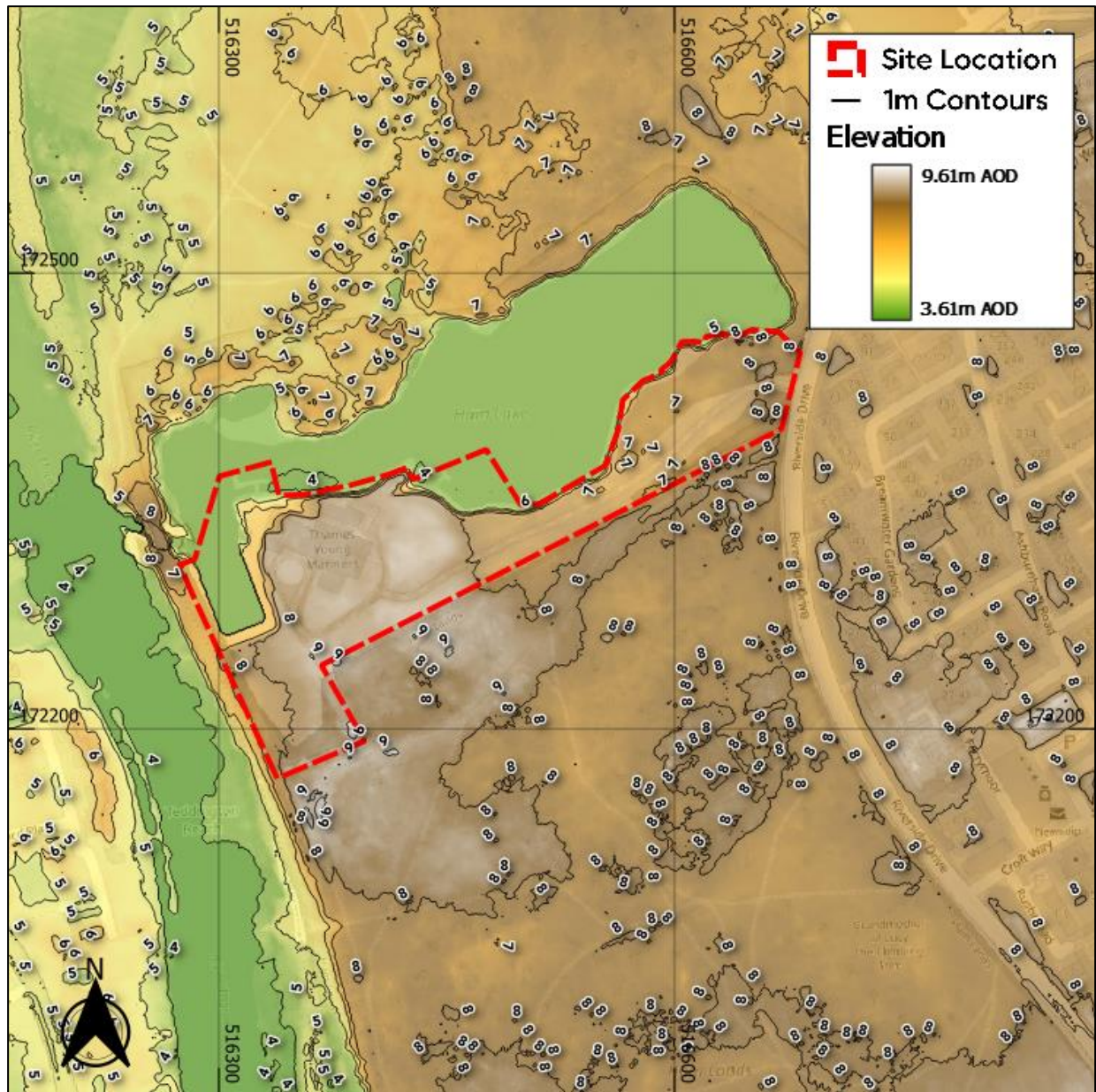


Figure 3: Site Topography(Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © <https://www.openstreetmap.org> and contributors. Contains public sector information licensed under the Open Government Licence v3.0)

- 1.8. Richmond Council is the Local Planning Authority (LPA) for the site and also the designated Lead Local Flood Authority (LLFA). The site sits within the Environment Agency's Kent South London and East Sussex region.

Planning Policy and Guidance

1.9. UK government planning guidance states¹ that an FRA is required for developments which are:

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

1.10. The site is located within Flood Zone 3. According to NPPF Footnote 59 an FRA is required.

1.11. The objective of this FRA is to demonstrate that the proposals are acceptable in terms of flood risk. This report summarises the findings of the study and specifically addresses the following issues in the context of the current legislative regime:

- Fluvial flood risk
- Surface water flood risk
- Risk of flooding from other sources

¹<https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications#when-you-need-an-assessment>

2. Planning Policy

- 2.1. Inappropriate development in a flood risk area could pose significant risk in terms of personal safety and damage to property for the occupiers of the development or for people elsewhere. The approach taken in the assessment of flood risk at the planning stage is set out in national, regional, and local planning policy and associated guidance. This section summarises the key policies and guidance relevant to the proposed development.

National Planning Policy Framework (NPPF)

- 2.2. The National Planning Policy Framework² (NPPF) (DLUHC, 2023) which includes UK Government policy on development and flood risk states:

165. Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.

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

- a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;*
- b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;*
- c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;*

²<https://www.gov.uk/guidance/national-planning-policy-framework>, last updated Dec 2023

- d) any residual risk can be safely managed; and
- e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

174. Applications for some minor development and changes of use should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 55.

2.3. Footnote 59 of the NPPF states:

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

2.4. Flood Zones in England are defined as follows:

Table 1: Flood Zone Definitions

Flood Zone	Definition
Zone 1 Low Probability	Land having less than 1 in 1,000 annual probability of river or sea flooding (all land outside Zones 2 and 3).
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 a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
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.
Zone 3b The Functional Floodplain	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise:

land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or

land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).

Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

- 2.5. An FRA should be appropriate to the scale, nature, and location of the development. It should identify and assess the risk from all sources of flooding to and from the development and demonstrate how any flood risks will be managed over the lifetime of the development.

The London Plan

- 2.6. The London Plan prepared by the Greater London Authority in 2021 sets out the policies for development in the region.
- 2.7. Policy SI 12 Flood risk management outlines the requirements for new development within the region. It states:

- A. Current and expected flood risk from all sources (as defined in paragraph 9.2.12) across London should be managed in a sustainable and cost-effective way in collaboration with the Environment Agency, the Lead Local Flood Authorities, developers and infrastructure providers.

- B. Development Plans should use the Mayor's Regional Flood Risk Appraisal and their Strategic Flood Risk Assessment as well as Local Flood Risk Management Strategies, where necessary, to identify areas where particular and cumulative flood risk issues exist and develop actions and policy approaches aimed at reducing these risks. Boroughs should cooperate and jointly address cross-boundary flood risk issues including with authorities outside London.

- C. Development proposals should ensure that flood risk is minimised and mitigated, and that residual risk is addressed. This should include, where possible, making space for water and aiming for development to be set back from the banks of watercourses.

- D. Developments Plans and development proposals should contribute to the delivery of the measures set out in Thames Estuary 2100 Plan. The Mayor will work with the Environment Agency and relevant local planning authorities, including authorities outside London, to safeguard an appropriate location for a new Thames Barrier.
- E. Development proposals for utility services should be designed to remain operational under flood conditions and buildings should be designed for quick recovery following a flood.
- F. Development proposals adjacent to flood defences will be required to protect the integrity of flood defences and allow access for future maintenance and upgrading. Unless exceptional circumstances are demonstrated for not doing so, development proposals should be set back from flood defences to allow for any foreseeable future maintenance and upgrades in a sustainable and cost-effective way.
- G. Natural flood management methods should be employed in development proposals due to their multiple benefits including increasing flood storage and creating recreational areas and habitat.

2.8. Policy SI 13 Sustainable drainage outlines the requirements for new development within the region. It states:

- A. Lead Local Flood Authorities should identify - through their Local Flood Risk Management Strategies and Surface Water Management Plans - areas where there are particular surface water management issues and aim to reduce these risks. Increases in surface water run-off outside these areas also need to be identified and addressed.
- B. Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:
 1. rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
 2. rainwater infiltration to ground at or close to source

3. rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
 4. rainwater discharge direct to a watercourse (unless not appropriate)
 5. controlled rainwater discharge to a surface water sewer or drain
 6. controlled rainwater discharge to a combined sewer.
- C. Development proposals for impermeable surfacing should normally be resisted unless they can be shown to be unavoidable, including on small surfaces such as front gardens and driveways.
 - D. Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improved water quality, and enhanced biodiversity, urban greening, amenity and recreation.

Local Plan

- 2.9. The Local Plan prepared by the Local Planning Authority, Richmond Council, sets out the policies for development in the local area.
- 2.10. Policy LP 21.1 Flood Risk and Sustainable Drainage outlines the requirements for new development within the area. It states:

All developments should avoid, or minimise, contributing to all sources of flooding, including fluvial, tidal, surface water, groundwater and flooding from sewers, taking account of climate change and without increasing flood risk elsewhere. Development will be guided to areas of lower risk by applying the 'Sequential Test' as set out in national policy guidance, and where necessary, the 'Exception Test' will be applied. Unacceptable developments and land uses will be refused in line with national policy and guidance, the Council's Strategic Flood Risk Assessment (SFRA) and as outlined in the table below.

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

2.11. Policy LP 21.3 Flood Risk and Sustainable Drainage outlines the requirements for new development within the area. It states:

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

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

2.12. Policy LP 21.4 Flood Risk and Sustainable Drainage outlines the requirements for new development within the area. It states:

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

- Retain the effectiveness, stability and integrity of flood defences, river banks and other formal and informal flood defence infrastructure.*
- Ensure the proposal does not prevent essential maintenance and upgrading to be carried out in the future. - Set back developments from river banks and existing flood defence infrastructure where possible (16 metres for the tidal Thames and 8 metres for other rivers).*
- Take into account the requirements of the Thames Estuary 2100 Plan and the River Thames Scheme, and demonstrate how the current and future requirements for flood defences have been incorporated into the development.*
- The removal of formal or informal flood defences is not acceptable unless this is part of an agreed flood risk management strategy by the Environment Agency.*

Sequential and Exception Tests

2.13. The Sequential and Exception Tests are applied in specific cases defined by UK Government policy. Their purpose is to drive development to areas of low flood risk and to support developments which improve flood risk for developments in areas at risk of flooding.

Sequential Test

- 2.14. The Sequential Test is deemed to be passed as the application is for the development of the extant use and replacement of improved facilities and more flood resilient buildings.

Exception Test

- 2.15. The Exception Test is applied to sites based on the Flood Zone and the nature of the development. As the proposed development consists of an extension it would be classed as 'More Vulnerable' in line with government development use classes.
- 2.16. The Flood Risk Vulnerability Classification table³ provided below in Table 2 shows which vulnerabilities are appropriate in each Flood Zone.
- 2.17. The proposed development is located within Flood Zones 1, 2 and 3 and the proposed development is classified as 'Less Vulnerable' and 'More Vulnerable'.

Table 2: Flood risk vulnerability and flood zone 'incompatibility'

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required	x	Exception Test required	✓	✓
Zone 3b	Exception Test required	x	x	x	✓

- 2.18. For the Exception Test to be passed, the proposed development must meet the following criteria:

³<https://www.gov.uk/guidance/flood-risk-and-coastal-change#table2>

- A. It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh the flood risk, as informed by a Strategic Flood Risk Assessment;
 - B. A Flood Risk Assessment demonstrates that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.
- 2.19. Part A of the Exception Test is outside the scope of this FRA. The planning application submitted by the client is required to be accompanied by an FRA which shows that the development can meet the requirements of the Part B of the Exception Test, with an overall reduction of flood risk to the site and surrounding area.

Summary

- 2.20. This flood risk assessment has been prepared with due consideration to the above local and national policy.

3. Consultation and Review

Consultation

- 3.1. The Environment Agency has provided Product 4 data for the site (Appendix C). The EA has also previously provided the modelled flood data from the Lower Thames Model (Hammersmith Domain) (2019) and Thames Upriver Breach Modelling Study (2017).

Documents and Online Mapping

- 3.2. Local Governments and Lead Local Flood Authorities provide documents which contain data and policies on flood risk and new development in their areas. These documents are introduced and briefly summarised below. For the purposes of this FRA, these documents have been reviewed for relevant information and any relevant data is discussed within the appropriate sub heading of this report.
- 3.3. The following sources of information have been reviewed for this assessment:
- Flood Map for Planning on the Environment Agency website <https://flood-map-for-planning.service.gov.uk/>
 - Long Term Flood Risk Information on the Environment Agency website <https://www.gov.uk/check-long-term-flood-risk>
 - National Planning Policy Framework (NPPF) (Department for Levelling Up, Housing and Communities, 2023)
 - Planning Practice Guidance - Flood Risk and Coastal Change (Department for Levelling Up, Housing and Communities, 2022)
 - Geoindex Onshore (British Geological Survey, 2023)
 - The London Plan (Greater London Authority, 2021) and Local Plan (Richmond Council, 2018)
 - Preliminary Flood Risk Assessment (Richmond Council, 2011)
 - Level 1 Strategic Flood Risk Assessment (Richmond Council, 2021)

Preliminary Flood Risk Assessment (PFRA)

- 3.4. The PFRA, published in 2011, is a high-level appraisal of flood risk across Lead Local Flood Authority Richmond Council. The flood risk from all sources, including fluvial, surface water,

groundwater, and surcharged sewers is evaluated. It is the basis upon which the Local Flood Risk Management Strategy is produced.

- 3.5. The PFRA summarises historical flood incidents in Richmond Council. The site is not recorded as having been affected by any flood event.

Strategic Flood Risk Assessment (SFRA)

- 3.6. The SFRA, published in 2021, provides the evidence base for the Local Planning Authority Richmond Council Local Plan and guidance for consideration when determining planning applications. The SFRA seeks to place new development into areas of lower flood risk taking into account current flood risk, future flood risk, and the effect a proposed development would have on the risk of flooding.
- 3.7. The SFRA mapping provided by Richmond Council has been used throughout production of this report as a source of information, particularly pertaining to historical flood incidents.

Local Flood Risk Management Strategy (LFRMS)

- 3.8. The Local Flood Risk Management Strategy sets out roles and responsibilities for flood risk management, assesses the risk of flooding in the area, where funding can be found to manage flood risk, and the policies, objectives, and actions of the Lead Local Flood Authority.
- 3.9. The Richmond Council LFRMS is used within this report to identify any flood management infrastructure and historical incidences of flooding.

4. Sources of Flood Risk

Fluvial / Tidal

- 4.1. Tidal flooding occurs when a high tide and high winds combine to elevate sea levels. An area behind coastal flood defences can still flood if waves overtop the defences or break through them. Tidal flooding can also occur a long way from the coast by raising river levels. Water may overtop the river bank or river defences when tide levels are high.
- 4.2. Flooding from watercourses arises when flows exceed the capacity of the channel, or where a restrictive structure is encountered, resulting in water overtopping the banks into the floodplain.
- 4.3. The River Thames (Main River) is located 20m to the west of the site as well as being 550m north of the site. There are no other watercourses in the vicinity of the site or within the redline application boundary.

Historical Fluvial Flooding

- 4.4. There is no record of historical fluvial flooding on or near the site. No historical flooding has been recorded at the site.

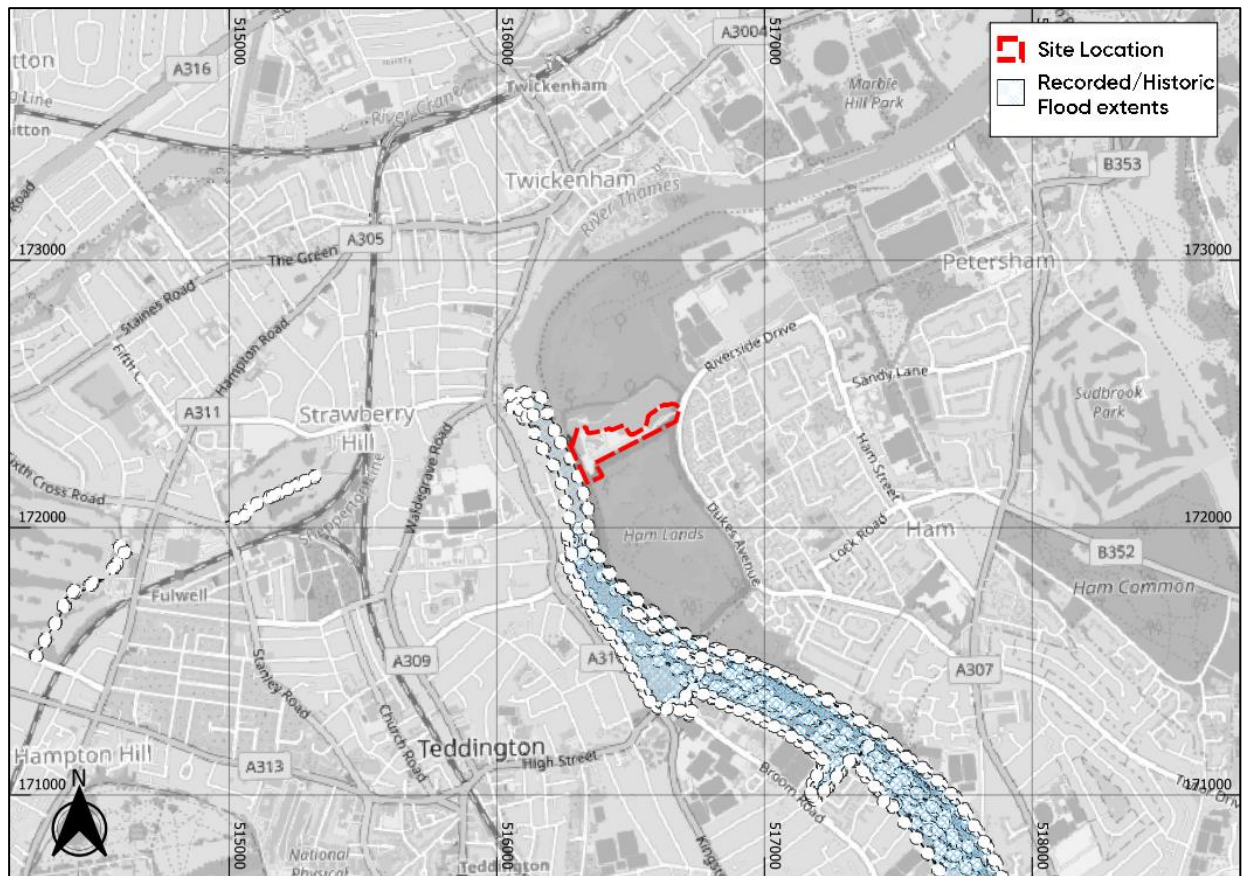


Figure 4: EA Historic Flood Mapping (Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © <https://www.openstreetmap.org> and contributors. Contains public sector information licensed under the Open Government Licence v3.0)

Flood Map for Planning

- 4.5. The EA's Flood Map for Planning shows the site is mostly located in Flood Zone 1 which is defined as having less than a 0.1% Annual Exceedance Probability (AEP) of flooding in any year. There is a section of the site along the northern boundary which is shown to be in Flood Zones 2 and 3. Flood Zone 2 is defined as having between a 0.1% and 1% AEP of flooding in any year. Flood Zone 3 is defined as having greater than a 1% AEP of flooding in any year.
- 4.6. Interrogation of the Flood Map for Planning dataset states that the risk is from fluvial and tidal sources. This is due to the site being located near to the tidal limit of the River Thames (Teddington Lock) and thus during an extreme flood could experience risk from fluvial and tidal flooding.

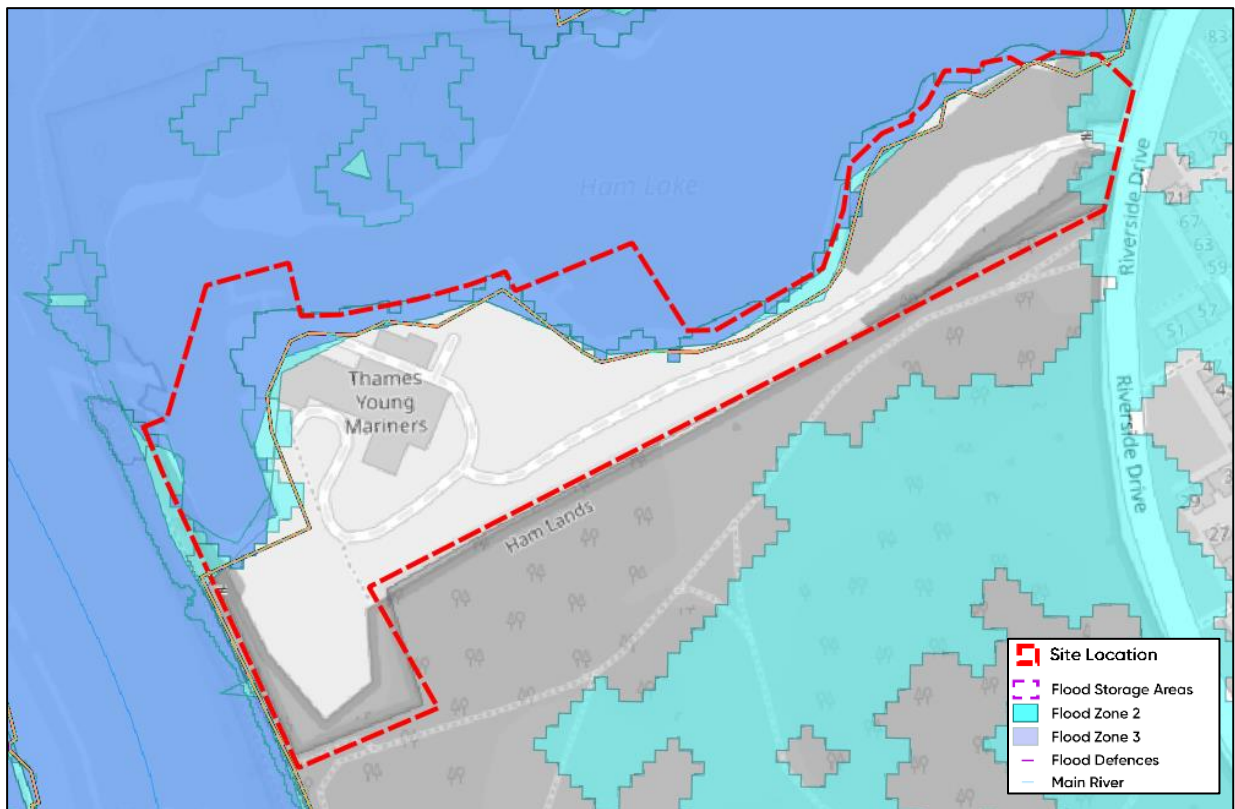


Figure 5: EA Flood Map for Planning (Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © <https://www.openstreetmap.org> and contributors. Contains public sector information licensed under the Open Government Licence v3.0)

- 4.7. It is necessary to determine whether the site is located within Flood Zone 3a or 3b. Review of the Richmond Interactive SFRA confirms that the site is partially located in Flood Zone 3b. However, further inspection of the mapping shows that the area of Flood Zone 3b is confined to the lake to the north of the site and that the area of development is not affected.

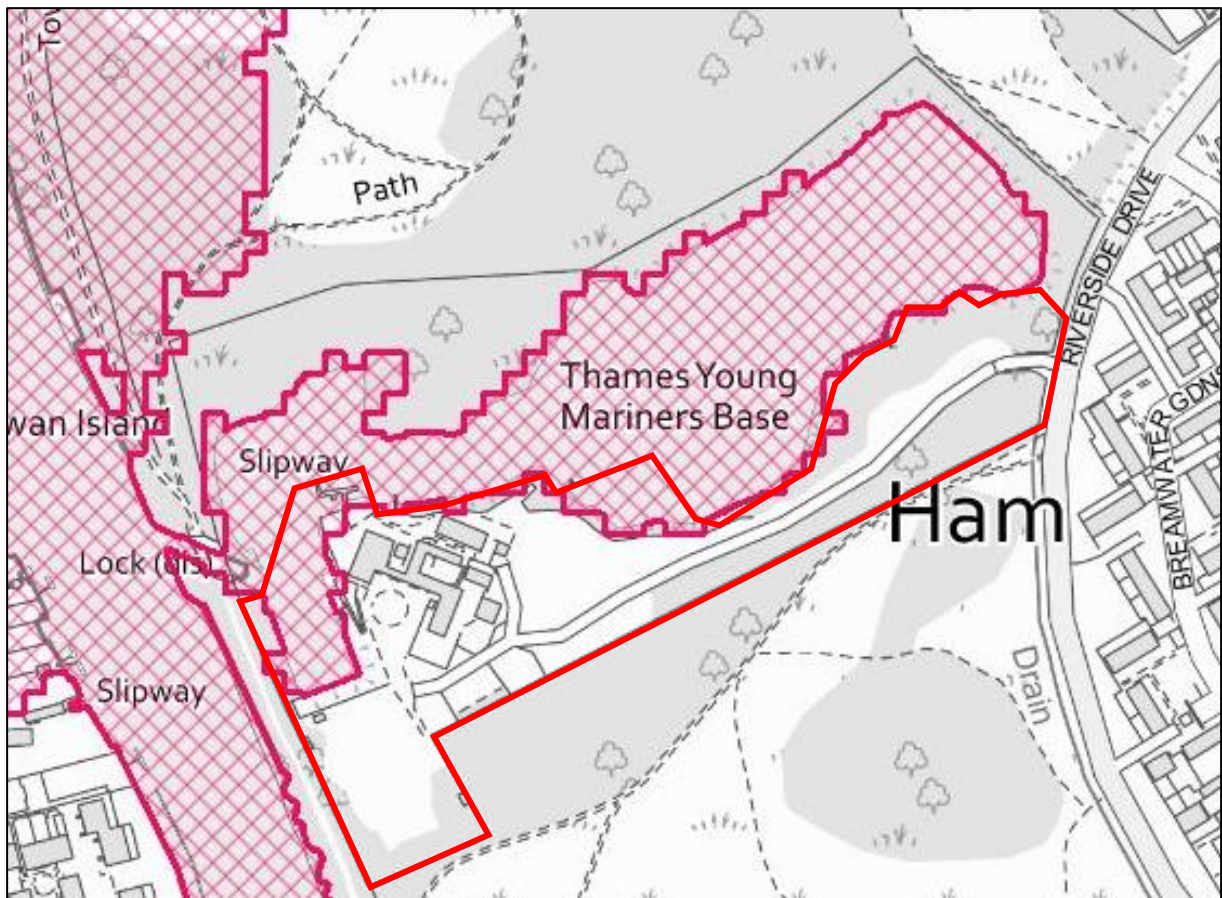


Figure 6: Richmond Interactive SFRA mapping (Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © <https://www.openstreetmap.org> and contributors. Contains public sector information licensed under the Open Government Licence v3.0)

Flood Defences

- 4.8. The location of the site in proximity to the River Thames means the site benefits from the Thames Tidal flood defences. The Thames Estuary 2100 programme (TE2100) aims to provide a 1 in 1000 year Standard of Protection along the River Thames to the year 2100.
- 4.9. As shown in Figure 5, there is defences present within the development site. Interrogation of the EA's 'AIMS' dataset identifies that the defences comprise an embankment designed to provide a flood risk management function for tidal flooding. It has a design Standard of Protection of 1 in 1000 years. The database states that the upstream crest level is 6.27m AOD and the downstream crest level is 6.10m AOD. Review of the topographic survey does not show an independent embankment with these crest levels, but instead, that the defence line follows the topography of the elevated land levels through the site.

- 4.10. The EA has requested that as part of the Thames Estuary 2100 programme (TE2100), the defences are raised to 6.90m AOD. The existing defences are located through the Existing Main Building. The proposed scheme will include a replacement building in this location. However, as part of the proposals land levels are not intended to be lowered, and therefore, there will still be elevated land levels at 6.90m AOD to provide protection from tidal flooding in the future.
- 4.11. The EA AIMS defence line and the 6.90m AOD contour has been marked on the plan in Figure 7 for reference.

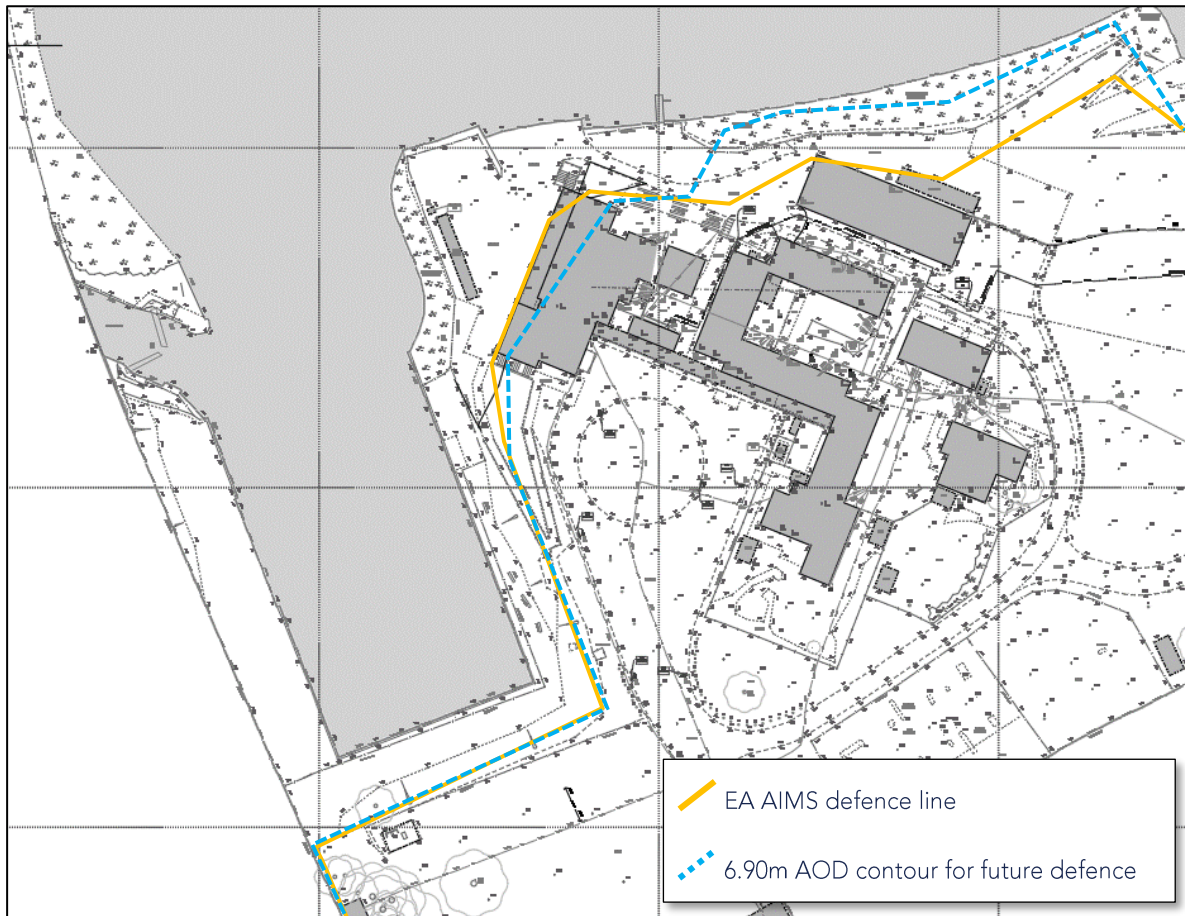


Figure 7: Existing site plan indicating the EA AIMS defence line and the 6.90m AOD contour for future defence levels.

Climate Change

- 4.12. The site is located within the London Management Catchment Peak River Flow Allowances. As the development is proposing overnight accommodation it is viewed to be of a more vulnerable use and as such the central 2080's epoch should be applied. This equates to a flow allowance of 17%.

- 4.13. The site is located in an area of the River Thames where the influences are both fluvial and tidal. Aegaea have reviewed the outputs from the Thames Upriver Breach Modelling Study as well as the Lower Thames Modelling Study (Hammersmith domain).

Lower Thames Model (2019) Data

- 4.14. Aegaea holds a copy of the Lower Thames Model (2019) data on file and has used this data in order to analyse the flood risk to the proposed site. The model includes several return period events in addition to scenarios including various climate change allowances.
- 4.15. The EA's Lower Thames Model (2019) does not include an event with a climate change allowance of 17%. The maximum modelled flood level for the 1 in 100 year event including a 15% climate change event is 6.29m AOD. The maximum modelled flood level for the 1 in 100 year event including a 25% climate change event is 6.59m AOD. Applying a linear interpolation between these flood levels to establish the 17% climate change allowance, the resulting flood level is 6.35m AOD.
- 4.16. Comparison of the EA's modelled flood extents for the 1 in 100 year event with 15% and 25% climate change scenarios shows the extents do not affect the site, and therefore these have not been reproduced in this report. A more accurate assessment has been undertaken by comparing the calculated flood level with the land levels across the site shown in the topographic survey (Figure 8).

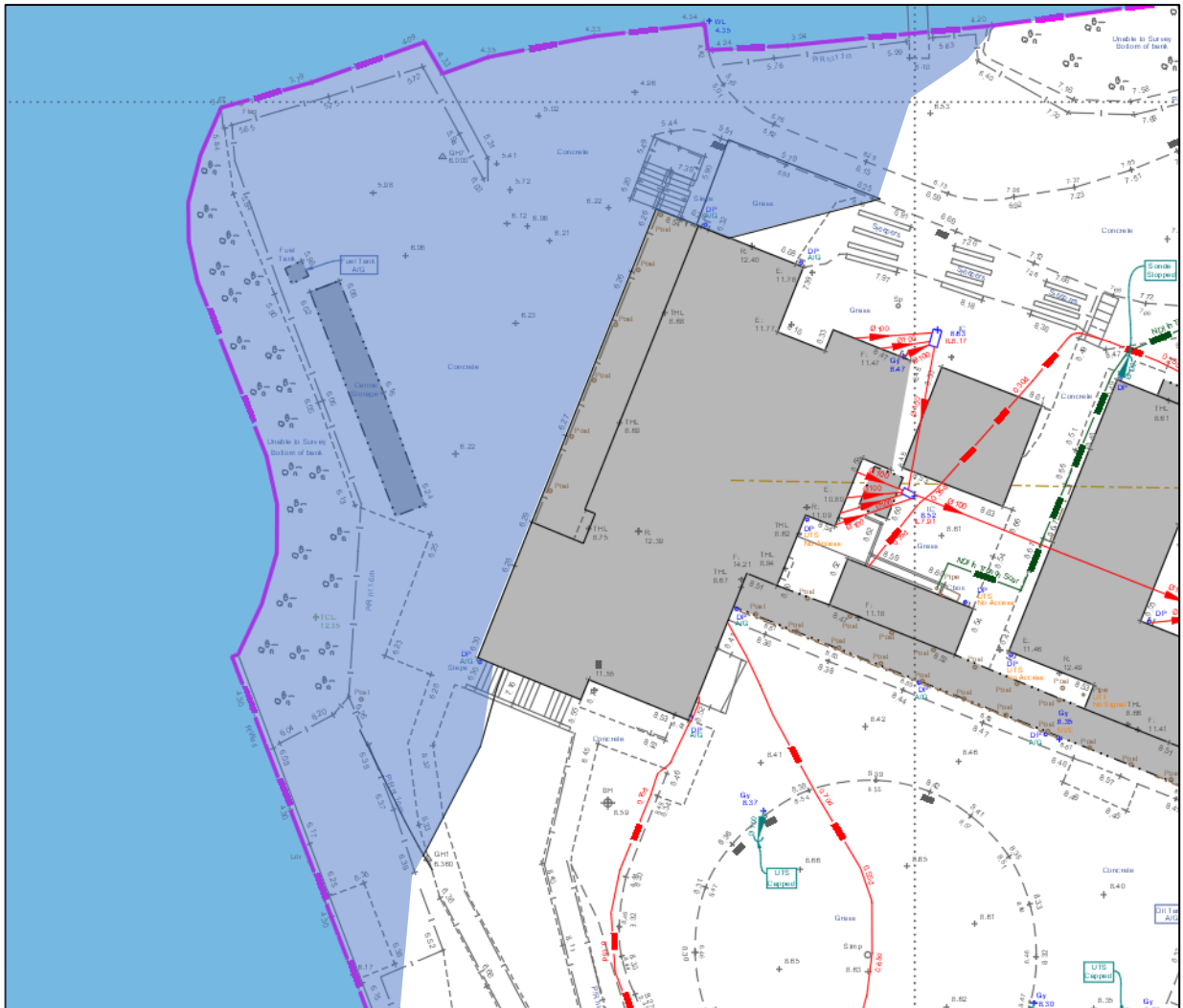


Figure 8: Existing site plan indicating the extent of flooding within the site based on the calculated flood level for the 1 in 100 year event including a 17% climate change allowance.

- 4.17. From Figure 8 it can be seen that only the north-western part of the site is affected during the 1 in 100 year event including a 17% allowance for climate change. At the edge of the Existing Main Building, the depth varies from 0.09m to 0.13m. The main concrete area and canoe storage to the north-west of the Existing Main Building is only affected up to a depth of 0.3m. The depth increases towards the banks of the Lake up to 1.97m at the lowest point. Other than at the banks of the lake, the remainder of the site, remains unaffected, including Buildings Two, Three, Four and Five, and the access road to/from the site.

Thames Tidal Upstream Breach Model (2017)

- 4.18. For developments such as this, which benefit from the tidal flood defences along the River Thames, the NPPF requires the **residual risk** of flooding, resulting from a failure or 'breach' of the defences being considered.
- 4.19. The results of the EA's Thames Upriver Breach Modelling study (2017) are shown in **Error! Reference source not found..** This figure shows that a small area of the site could be affected by a breach in the linear flood defences on the River Thames, in the 2100 epoch. The flood extent is isolated from the Lake/River as the results are simply flooding on the landward side of the defences – the defence line is shown in Figure 5.

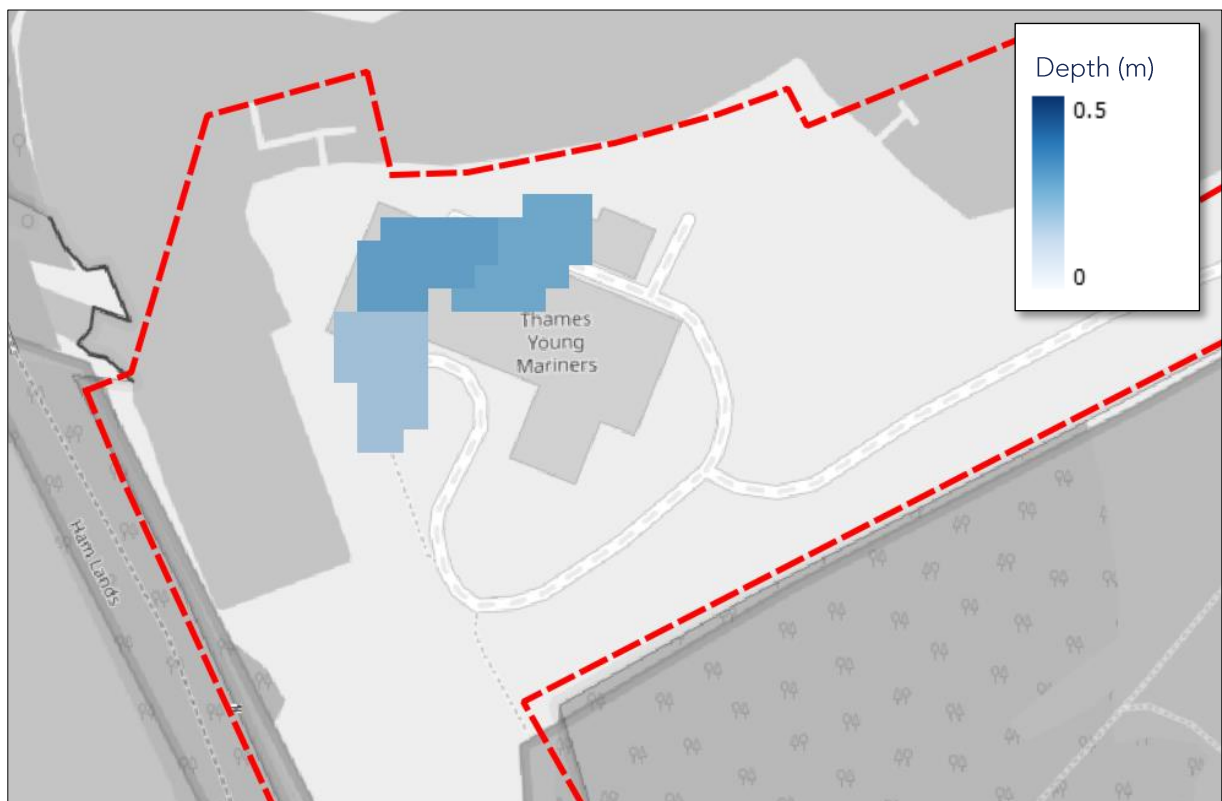


Figure 9: Maximum modelled depth of flooding from a failure of the River Thames Defences in 2100. Site boundary indicated by red dashed line. (Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © <https://www.openstreetmap.org> and contributors. Contains public sector information licensed under the Open Government Licence v3.0)

- 4.20. The maximum modelled flood level on site for this residual risk scenario is 6.45m AOD.
- 4.21. Based on the EA's modelled data, the depth of flooding in this location varies between 0.16m and 0.27m.

4.22. Safe dry access/egress would still be possible to/from the site under this scenario.

Canals

4.23. The Canal and River Trust (CRT) generally maintains canal levels using reservoirs, feeders, and boreholes and manages water levels by transferring it within the canal system.

4.24. No canals have been recorded within a 1km radius of the site.

4.25. The risk of flooding to this site from canals is considered to be low.

Pluvial

4.26. Pluvial flooding can occur during prolonged or intense storm events when the infiltration potential of soils, or the capacity of drainage infrastructure is overwhelmed leading to the accumulation of surface water and the generation of overland flow routes.

4.27. Annual surface water flood risk is labelled by the EA as:

- 'High Risk'; >3.3% AEP (annual probability greater than 1 in 30).
- 'Medium Risk'; 1.1% to 3.3% AEP (annual probability between 1 in 100 and 1 in 30).
- 'Low Risk'; 0.1% to 1% AEP (annual probability between 1 in 1000 and 1 in 100).
- 'Very Low Risk'; <0.1% AEP (annual probability less than 1 in 1000).

4.28. Examination of the EA's Flood Risk from Surface Water mapping shows the site is at 'Very Low' risk of flooding in surface water flood events (Figure 10). The site is shown to not be affected by surface water flooding.

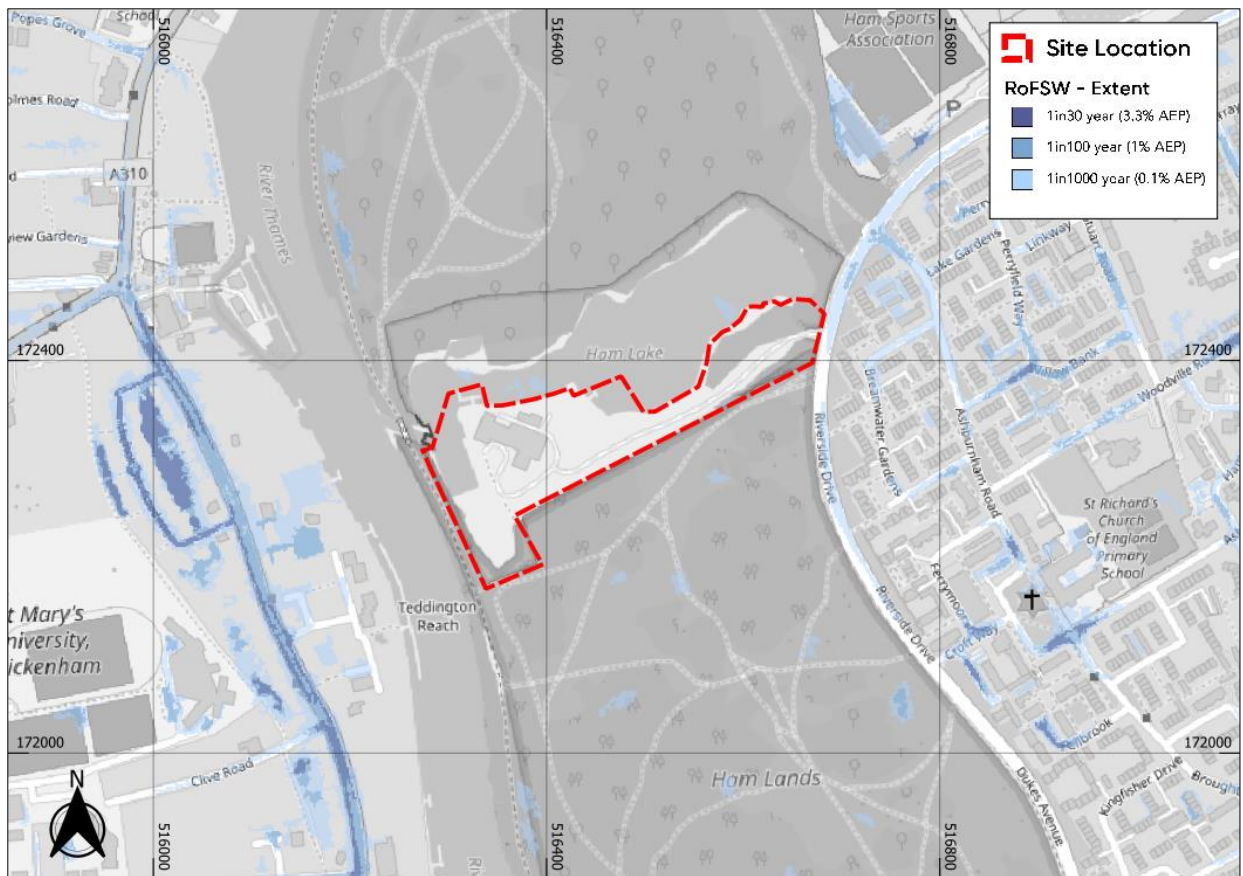


Figure 10: EA Surface Water Flood Risk Mapping (Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © <https://www.openstreetmap.org> and contributors. Contains public sector information licensed under the Open Government Licence v3.0)

- 4.29. The SFRA provides mapping of historical surface water flood incident records kept by the local authority. No historical surface water incidents have been recorded in the vicinity of the site.

Reservoirs

- 4.30. Flooding can occur from large waterbodies or reservoirs if they are impounded above the surrounding ground levels or are used to retain floodwater. Although unlikely, reservoirs and large waterbodies could overtop or breach leading to rapid inundation of the downstream floodplain.
- 4.31. According to the EA's Flood Risk from Reservoirs mapping the site is at risk of flooding in the event of a breach at multiple reservoirs (Figure 11). The worst reservoir failure model is a 'wet day' scenario meaning that it would have to happen at the same time as other flooding for there to be enough water to reach the site.

- 4.32. If a reservoir failure were to occur when the river levels are normal the risk of flooding from reservoir is mostly contained within the water bodies in proximity of the site. The extant buildings are not affected. With focus to the proposed layout the most northern building could be partially affected by this event. If a reservoir failure were to occur when the rivers are in flood the site and existing buildings are shown to be affected. The proposed buildings would be affected by the wet day event too.

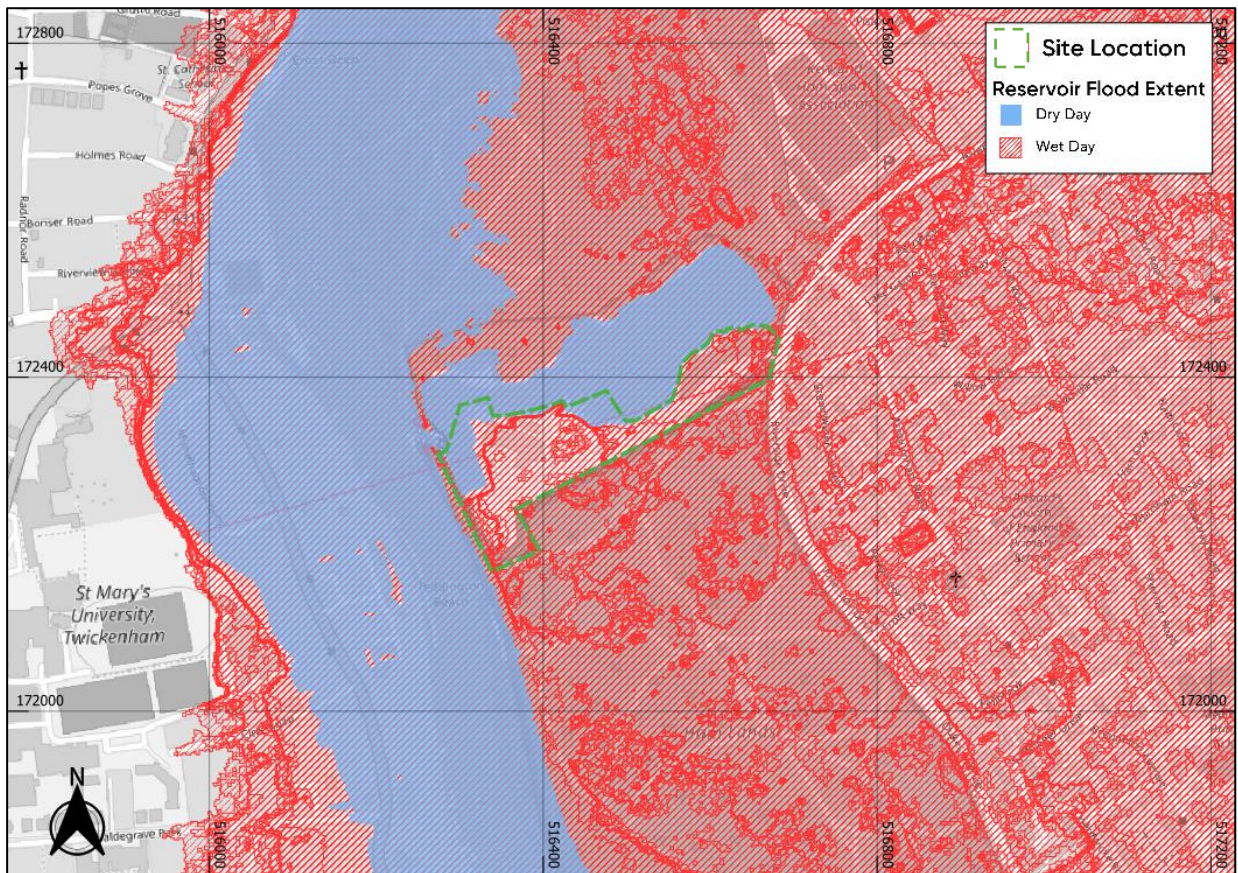


Figure 11: EA Reservoir Flood Risk Mapping (Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). ©<https://www.openstreetmap.org> and contributors. Contains public sector information licensed under the Open Government Licence v3.0)

- 4.33. All large reservoirs must be inspected and supervised by reservoir panel engineers as detailed by the Reservoirs Act 1975 in England and Wales. The EA are responsible to ensure that reservoirs are inspected regularly, and essential safety work carried out. As reservoirs are highly managed the maximum flood extent provided in the EA Risk of Flooding from Reservoirs mapping is considered a worst-case scenario. As reservoir flooding is unlikely and the modelled flood depths are based on the worst-case scenario, flooding from this source may be considered

as a relatively low risk. Although to be precautionary flood resilient design and building practices could be implemented to further reduce risk.

Groundwater

- 4.34. Groundwater flooding occurs in areas where underlying geology is permeable and water can rise within the strata sufficiently to breach the surface.
- 4.35. The British Geological Survey's (BGS) mapping shows superficial deposits of Kempton Park Gravel Member - Sand and Gravel underlying the site. The bedrock underlying the site is London Clay Formation - Clay and Silt.
- 4.36. Historical BGS boreholes located 242m East confirm that the site (Ref: TQ17SE6/M) recorded the geology to be of clay, ballast, sandy loam and London Clay.
- 4.37. The SFRA presents the EA's Areas Susceptible to Groundwater Flooding mapping (Figure 12), which assesses the future risk of groundwater flooding. This mapping consists of 1km grid squares and shows the proportion of each which is at risk of groundwater flooding. The site is within a 1km cell which is 50% and 74.9% at susceptibility of groundwater flooding.
- 4.38. Given the proximity of the site to the lake, which will act to maintain lower groundwater levels, the risk of above ground flooding to the development from groundwater is considered to be low.

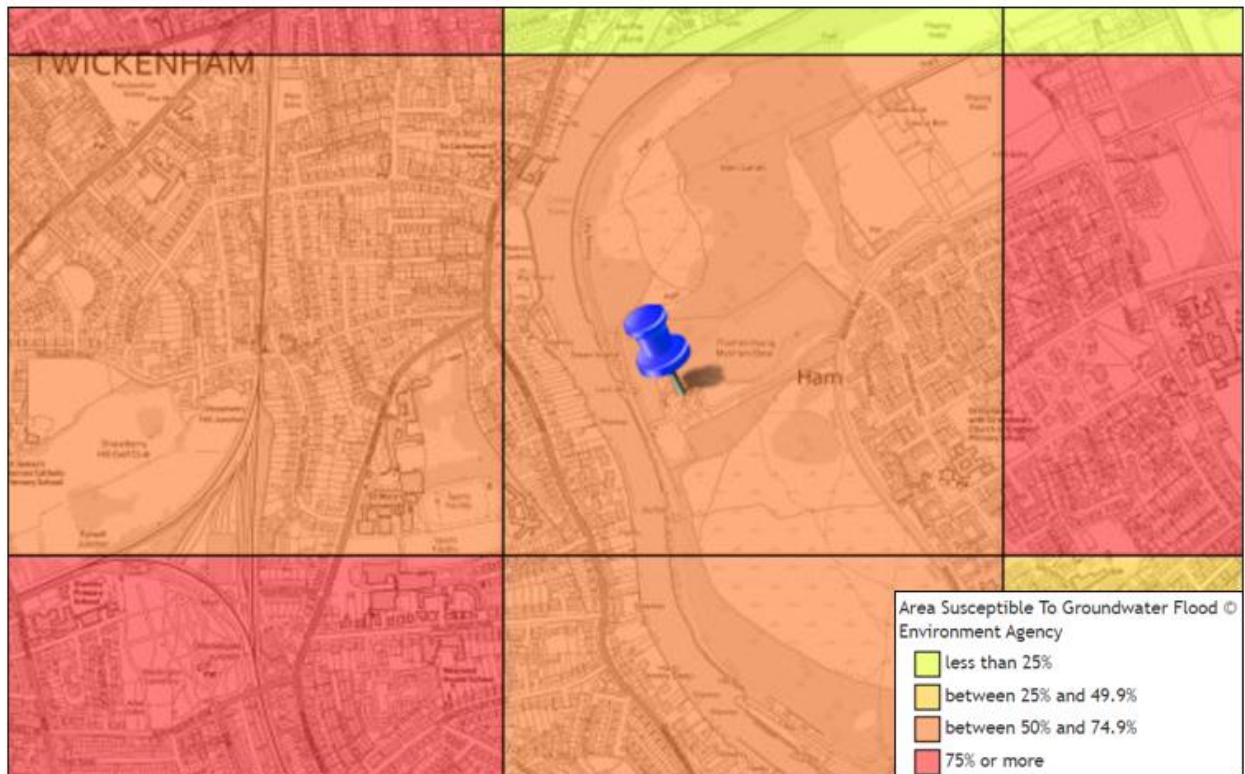


Figure 12: EA Reservoir Flood Risk Mapping (Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). ©<https://www.openstreetmap.org> and contributors. Contains public sector information licensed under the Open Government Licence v3.0)

Sewers

- 4.39. Foul or surface water sewers can be a cause of flooding if the drainage network becomes overwhelmed, either by blockage or due to local development beyond the designed capabilities of the drainage system.
- 4.40. The SFRA provides mapping of historical sewer flood incident records kept by the local authority (Figure 13). No incidents have been recorded in the vicinity of the site. The site is located in an area where Thames Water have had less than 10 incidents reported.
- 4.41. Local policy documentation does not identify the site as being in a Critical Drainage Area.
- 4.42. The development is therefore considered to be at low risk of flooding from sewers.

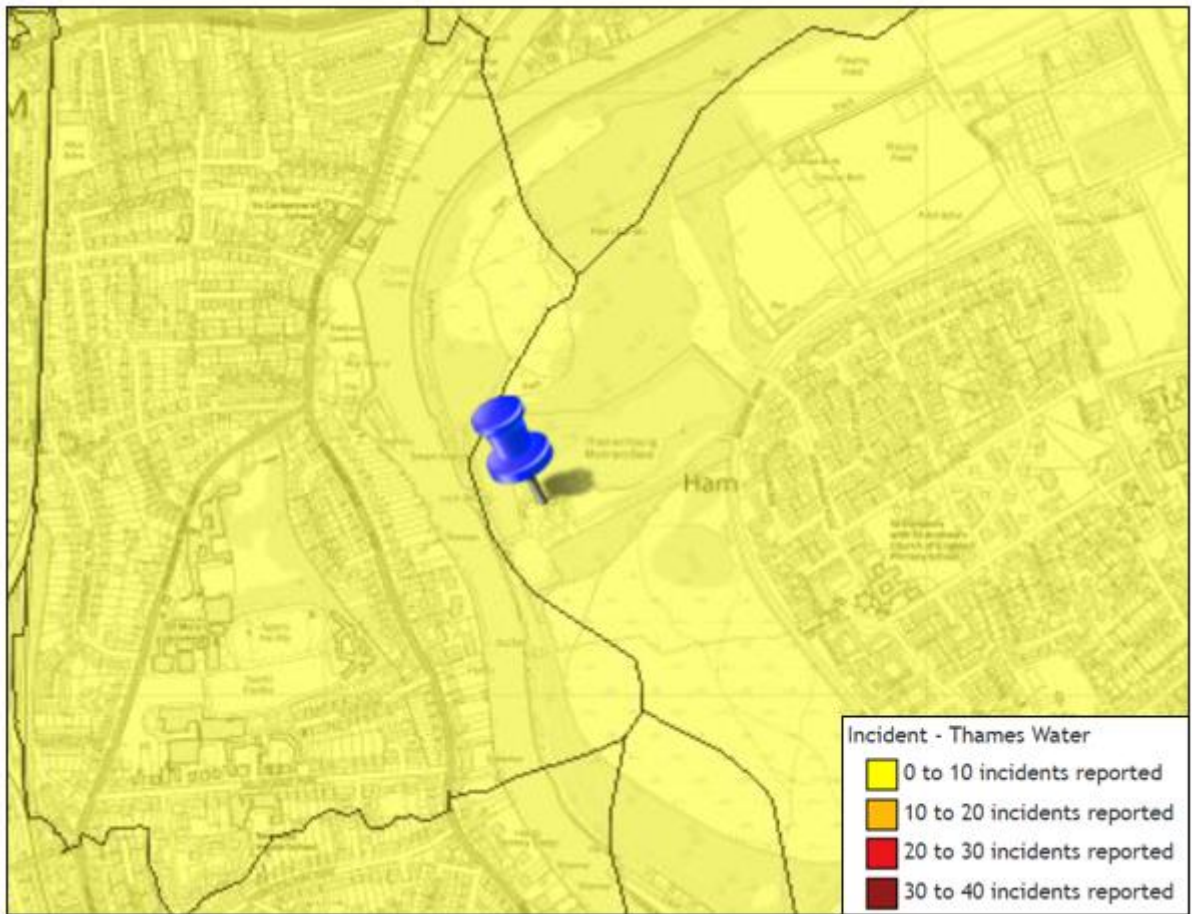


Figure 13: EA Reservoir Flood Risk Mapping (Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). ©<https://www.openstreetmap.org> and contributors. Contains public sector information licensed under the Open Government Licence v3.0)

5. Flood Risk Mitigation

Finished Floor Levels

- 5.1. It has been identified that part of the development could be flooded from the River Thames under the 1 in 100 year event including a 17% allowance for climate change, to a level of 6.35m AOD. In the event of a failure of the Thames Tidal Defences, there is also a residual risk of flooding to the lower part of the site to a level of 6.45m AOD.
- 5.2. Review of the scheme proposals (Appendix A) shows that the lowest finished floor level of the development is at basement level within the main building. The basement level is proposed to be used for changing rooms, WCs, showers and a drying store. The finished floor level is situated above the flood level for both the actual and residual risk scenarios at a level of 6.52m AOD. As such internal flooding is not predicted.
- 5.3. The finished floor level of the remainder of the buildings, and the first floor of the proposed Main Building are elevated above the this, and therefore will also remain dry during both the actual and residual risk scenarios.

Flood Resistance and Resilience.

- 5.4. Whilst internal flooding is not predicted within the basement level of the Main Building, due to elevated floor levels, the frontage of the building will be affected by flooding. Therefore, it is advised that flood resistant and resilient construction techniques are adopted in line with the guidance 'Improving the Flood Performance of New Buildings – Flood Resilient Construction'.

Surface Water Runoff

- 5.5. A surface water management strategy has been developed for the site under separate covers with the objective to ensure the development does not increase flood risk elsewhere as a result of surface water runoff.

Displacement of Floodwater

- 5.6. The existing layout of the site has been compared to the proposed layout, which is overlain with the predicted extent of flooding under the 1 in 100 year event including a 17% climate change allowance in Figure 14.

- 5.7. From Figure 14 it can be seen that the proposed development will increase the built footprint within the design flood extents. The northern and western corner of the main building will introduce a total of 22m² within the design flood extents.

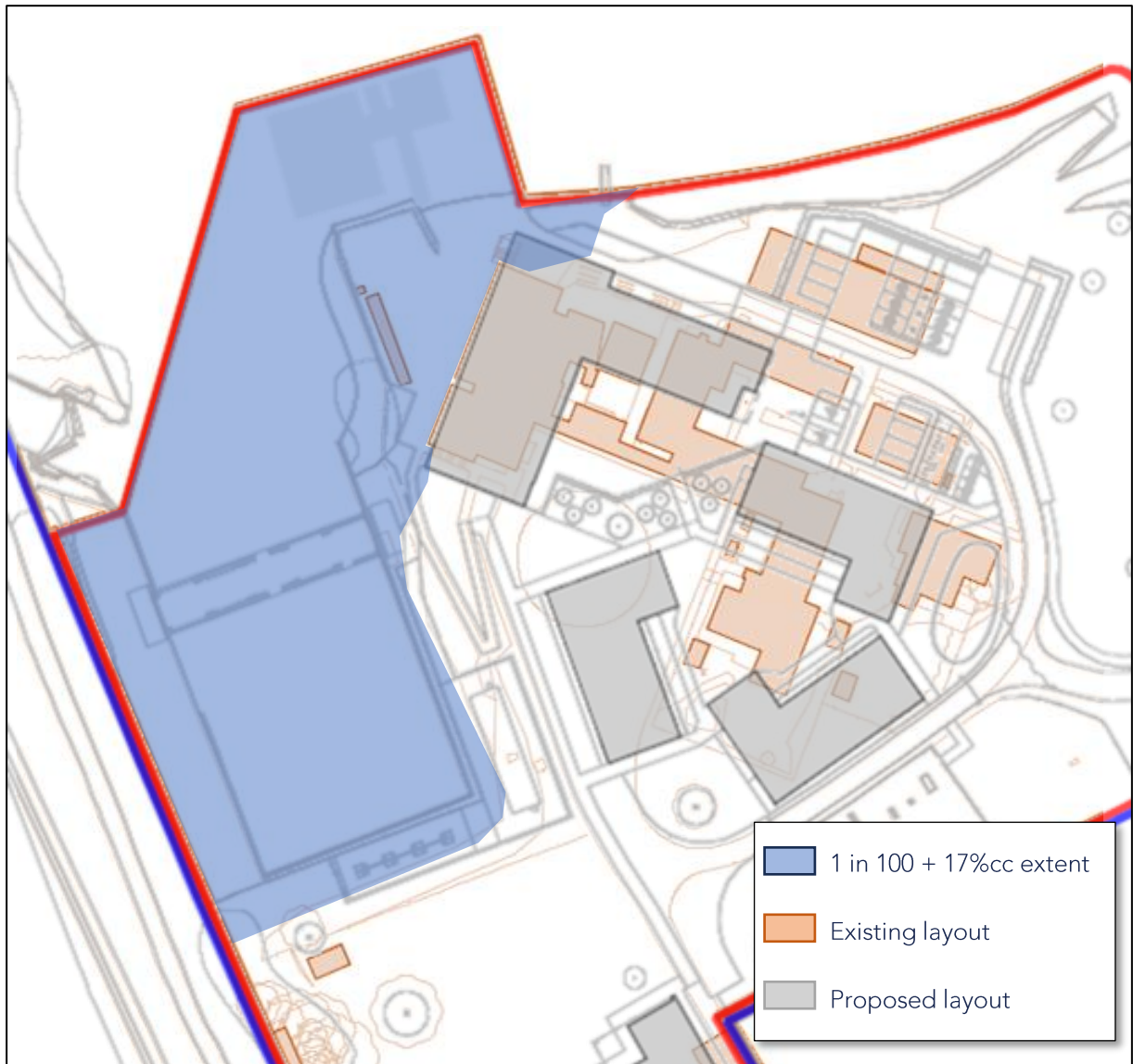


Figure 14: Existing and proposed site layout overlain with the maximum predicted flood extent for the 1 in 100 year event including a 17% allowance for climate change.

- 5.8. To offset the impact of the development, the building has been designed to accommodate the volume of water displaced within an unused void space in the basement floor layout. An area of 38.7m² is provided which is designed to be floodable as compensation for the impact of the building (Figure 15).

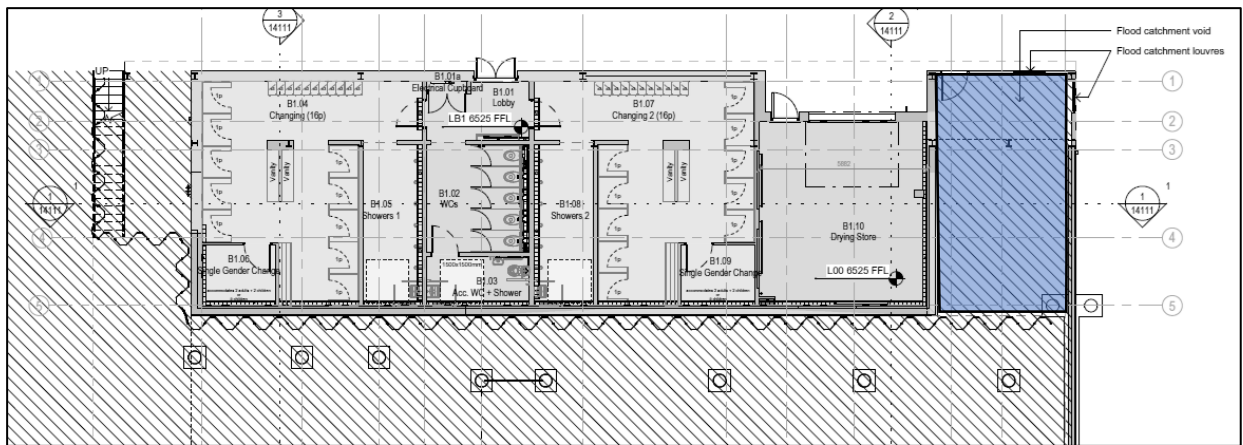


Figure 15: Basement level floor plan for main building showing the area of the unused void space designated to flood.

5.9. The floodable void space within the basement level, will include void openings within the walls of the building to permit the free flow of water as follows;

- A 1m wide opening per 5m length of external wall;
- Vertical steel louvres at 0.1m spacing across the opening to prevent unwanted access and storage;
- Base of the void at ground level, with void opening extending to 300mm above the flood level;
- Access point for maintenance and clearing on a bi-yearly basis (following autumn and spring) and following any flood events as set out in a maintenance plan (to be conditioned).

5.10. As indicated on the drawing, the layout includes void openings on the north-eastern and north-western façade of the building.

5.11. The above provision of void space with adequate openings will ensure the development does not increase flood risk elsewhere.

Safe Access/Egress

5.12. Dry access/egress will be possible to/from the development. It is only the changing rooms/shower/WCs which have flooding at the access point. The depth of flooding in these locations is predicted to be less than 250mm for the actual risk event (1 in 100 year +17%cc) and therefore safe access can be achieved as this presents a 'low hazard' based on the ZUK0 rating.

- 5.13. Under the breach event, flooding could reach up to 0.27m to the front of the changing rooms/shower/WCs which is just above the limit for safe access with a 'moderate hazard' based on ZUK0 ratings.
- 5.14. The site is in the Environment Agency (EA) 'Tidal Thames from Richmond Bridge to Teddington Weir' flood warning service area. This service allows site owners to register an address along with contact details so that, in the event of a flood being forecast, they are sent an alert. As a further precaution and risk reduction, the owner of the site should sign up.
- 5.15. Flood warnings/alerts can be enforced at any time of the day or night. Signing up for this service provides site owners some notice before a flood event. The amount of time afforded before a flood occurs depends on the site-specific location (e.g. proximity to the source of flooding, topography of the surrounding area) and the flood mechanism (e.g. bank over topping versus a breach event). Flood alerts and warnings provide site managers with time to take necessary action, e.g. communication of the risk of flooding to occupants/employees etc, evacuation of occupants offsite or to a safe level, removal of valuable items out of reach of flooding and the mounting of site-specific flood defences.

6. Conclusions

- 6.1. This FRA has been undertaken with reference to the requirements of NPPF and Planning Practice Guidance with respect to the development at Thames Young Mariners Base, Riverside Drive, Ham, Richmond, TW10 7RX. It has been written to support a planning application and prepared with due consideration to the nature of the proposed development to provide the appropriate level of detail.
- 6.2. An assessment of the risk of flooding from all sources has been undertaken and is summarised in the table below:

Source of Flooding	Flood Risk Summary
Fluvial/ Tidal	<p>The majority of the site is located in Flood Zone 1, part of the site along the boundary of the Lake is in Flood Zone 2 and 3. The site benefits from the Thames Tidal defences with a standard of protection of 1 in 1000 years. The EA's AIMS dataset identifies a flood management embankment which runs through the existing site, across the main building. The EA requires the height of the defence to be raised to 6.90m AOD in line with the TE2100 plan. It has been shown how this can be achieved with the land levels across the site.</p> <p>The risk of flooding from the River Thames has been assessed including an allowance for climate change. The area to the north of the Main Building is shown to flood to 6.35m AOD under the 1 in 100 year event including a 17% allowance for climate change (as interpolated from the EA's modelled flood data for the 15% and 25% climate change scenarios). During this event, the depth of flooding is less than 250mm and thus has a 'low hazard' and so safe access/egress is possible within the affected area, with dry access/egress possible for the remainder of the site.</p> <p>The site is also shown to be partly flooded to a level of 6.45m AOD in the event of a failure of the Thames Tidal Defences in the year 2100. This residual risk results in a flooding of the area near to the main building to a depth between 0.16m and 0.27m, meaning access/egress may not be possible at the peak of this event.</p>
Pluvial Reservoirs Groundwater Sewers Canals	The site is considered to be at low risk from other sources.

6.3. In terms of mitigation;

6.3.1. The lowest finished floor level within the scheme is set to 6.52m AOD, meaning internal flooding is not predicted during either the actual or residual risk event.

6.3.2. Flood Resistance and Resilience is recommended to be employed in the basement level due to the external flooding predicted. Such measures should be in accordance with 'Improving the Flood Performance of New Buildings - Flood Resilient Construction'.

6.3.3. A surface water drainage strategy has been prepared by others to manage surface water runoff from the development.

6.3.4. To ensure the development does not displace floodwater as a result of 22m² of the proposed building being located in the predicted flood extent, an area of 38.7m² at basement level has been designed to flood. This includes the provision of void openings in accordance with the guidelines set out in Section 5.

6.3.5. Whilst safe access is possible from the entire site, even during the actual risk flood event, occupants/staff are recommended to sign up to the EA's Flood Warning Service to advise when access might be limited to the basement level during the residual risk event.

6.4. The FRA supports the planning application and demonstrates that there is an acceptable level of flood risk to the site if the mitigation strategies recommended are implemented in the scheme. The development does not increase flood risk off site or to the wider area.

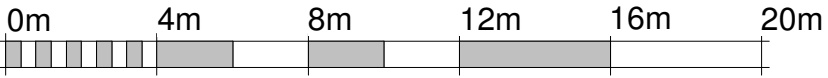
6.5. This Flood Risk Assessment should be submitted as part of the planning application to satisfy Part B of the Exception Test and the requirements of the NPPF.

Appendix A - Development Proposals

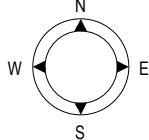


By Department Legend

- Ancillary Store/Services
- Bedroom
- Changing
- Circulation
- Exterior Circulation
- Kitchen
- Learning
- Living Area / Kitchen
- Main Hall
- Office / Meeting
- Plant
- Sanitary
- Social
- Staff Facilities
- Utilities



SCALE 1:200 @ A1



NO DIMENSIONS TO BE SCALED FROM THIS DRAWING

CDM - RESIDUAL HAZARDS The following are considered to be significant risks relevant to this drawing, which could not be fully mitigated or removed through design:

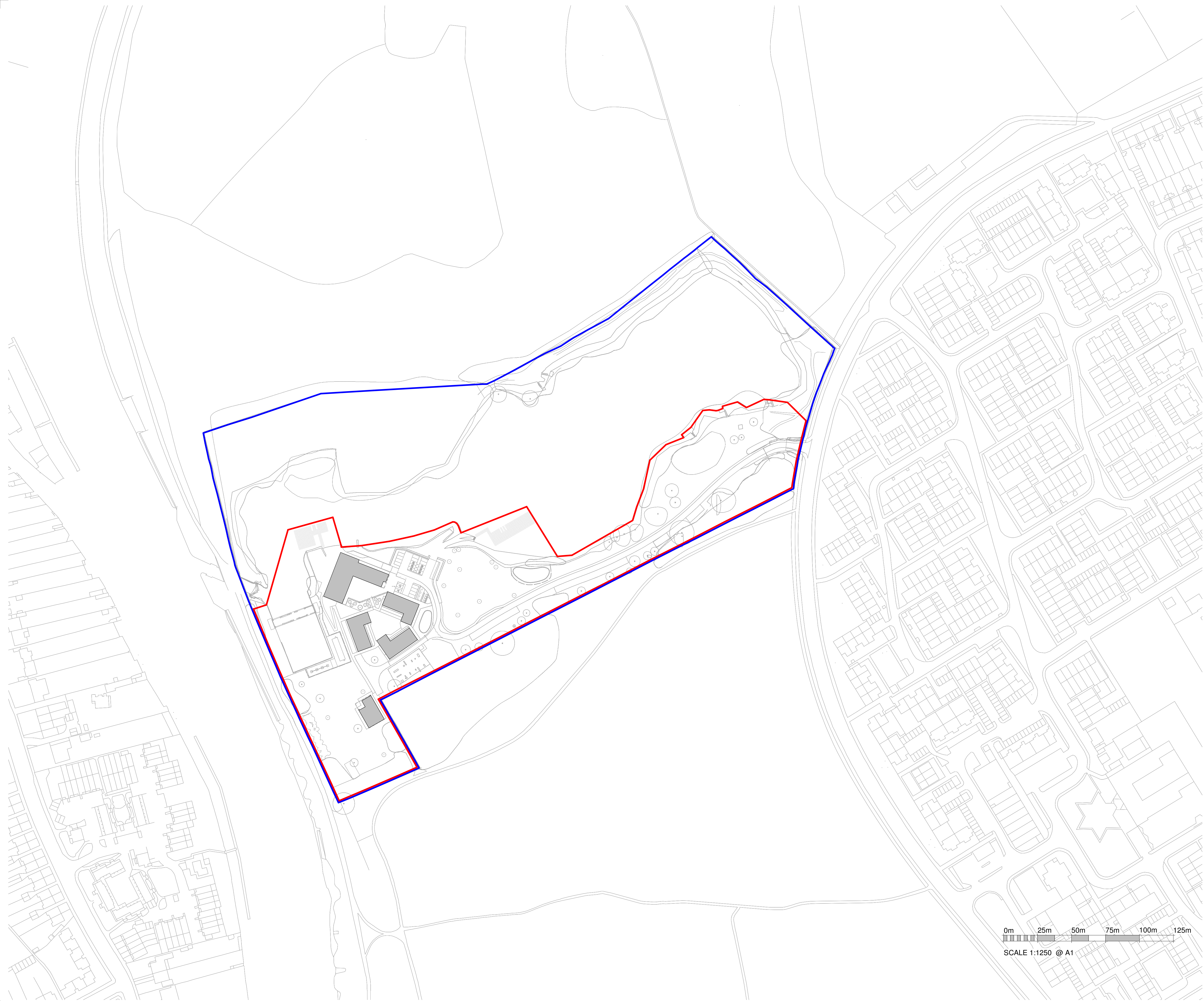
Ancillary Existing Structures/Services Areas Schedule		
Room Number	Room Name	Area
Ancillary Store/Services		
A1.02	Fuel Tank	0.89 m ²
A1.03	Canoe Storage	22.49 m ²
A1.04	Room	4.00 m ²
A1.05	Room	9.77 m ²
A1.06	Storage Container	29.62 m ²
A1.07	Oil Tank	1.52 m ²
A1.08	Room	2.75 m ²
A1.09	Oil Tank	2.49 m ²
A1.10	Shed	3.26 m ²
A1.11	Shed	7.62 m ²
A1.12	Shed	8.35 m ²
A1.13	Shed	6.77 m ²
A1.14	Shed	6.76 m ²
A1.15	Room	12.97 m ²
A1.16	BBQ	15.61 m ²
A1.17	Power Station	18.55 m ²
A1.18	Room	99.75 m ²
A1.19	Room	92.92 m ²
A1.20	Room	14.85 m ²
A1.21	Archery Range	75.45 m ²
		440.79 m ²
Exterior Circulation		
A1.01	Exterior Circulation	73.58 m ²
		73.58 m ²
Grand total: 21		514.37 m ²

P02	Issued as Stage 3 Complete	23.11.22	AJ	CG
P01	Issued for Planning submission	03.10.22	AJ	CG
Revision		Date	Dn	Chk

This document references the following files:-

Client				
Surrey County Council				
Project				
Surrey Outdoor Learning & Development Centre Thames Young Mariners				
Drawing Title				
Site Plan - 00 Existing Buildings				
Suitability Status				
A3-Authorised & Accepted as Stage 3 Complete				
Job No.	Scale	Size	Rev	
211263	1 : 500	@ A1	P02	
Drawing Number				
PR-200 - PEV - ZZ - ZZ - DR - A - 11001				
Project Code	Originator	Zone	Level	Type
				Role
				Number

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NO DIMENSIONS TO BE SCALED FROM THIS DRAWING

CDM - RESIDUAL HAZARDS The following are considered to be significant risks relevant to this drawing, which could not be fully mitigated or removed through design:

00100 Key

1:1

- Site Ownership Boundary (8.86 Hectares)
- Proposed Development Boundary (3.75 Hectares)

P04	Issued as Stage 3 Complete	23.11.22	AJ	CG
P03	Issued for Stage 3 Fire Strategy Report	01.11.22	AJ	CG
P02	Issued for Planning submission Incorporating Comments Following Review	12.10.22	AJ	CG
P01	Issued for Planning submission	03.10.22	AJ	CG

Revision	Date	Dn	Chk
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This document references the following files:-

Client
Surrey County Council

Project
Surrey Outdoor Learning & Development Centre
Thames Young Mariners

Drawing Title
Proposed Site Block Plan

Suitability Status
A3-Authorised & Accepted as Stage 3 Complete

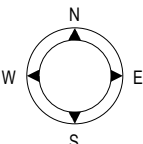
Job No.	Scale	Size	Rev
211263	As indicated	@ A1	P04

Drawing Number
PR-200 - PEV - ZZ - ZZ - DR - A - 00103

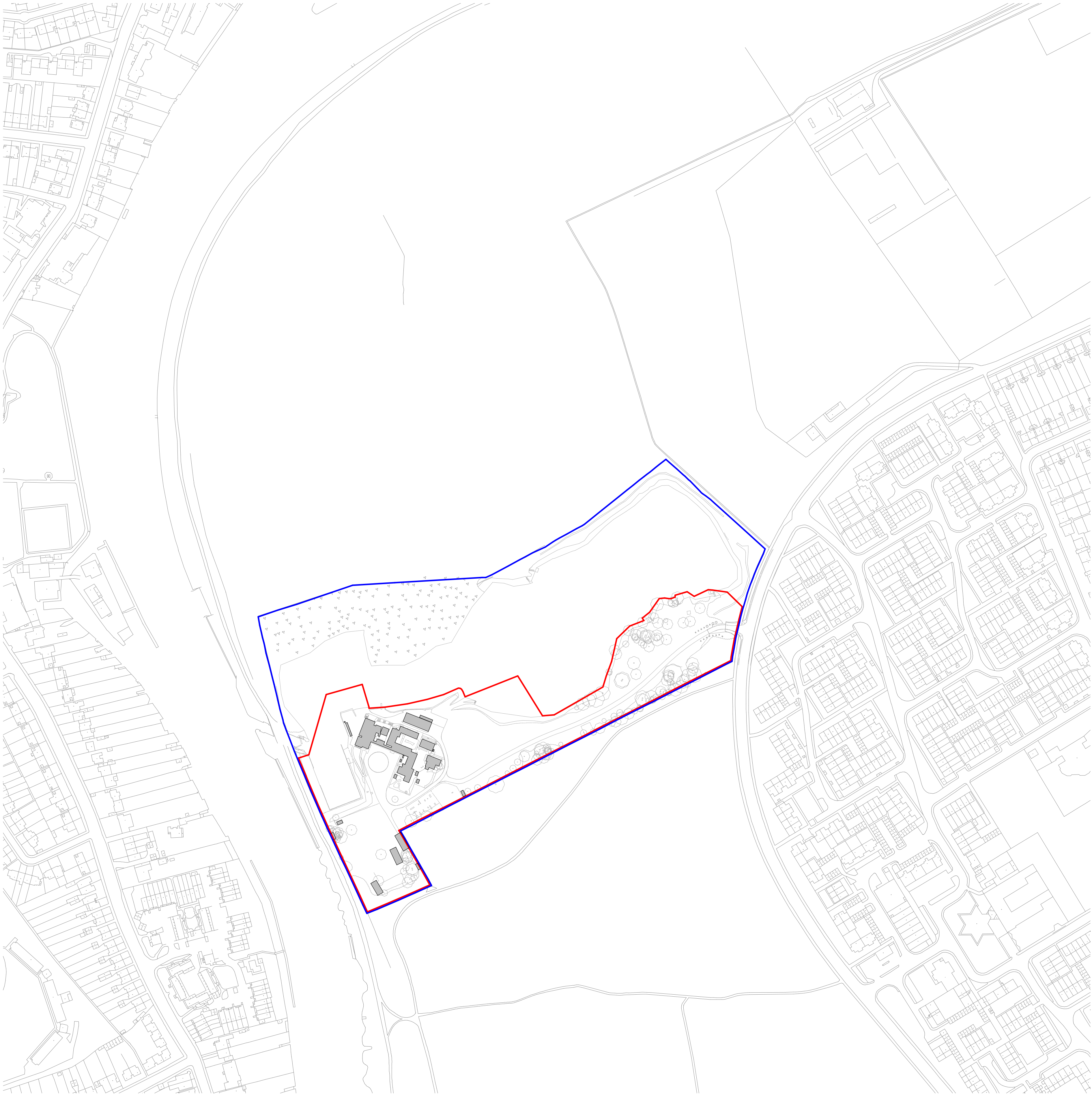
Project Code	Originator	Zone	Level	Type	Role	Number
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SCALE 1:1250 @ A1



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NO DIMENSIONS TO BE SCALED FROM THIS DRAWING

CDM - RESIDUAL HAZARDS The following are considered to be significant risks relevant to this drawing, which could not be fully mitigated or removed through design:

P02	Issued as Stage 3 Complete	23.11.22	AJ	CG
P01	Issued for Planning submission	03.10.22	AJ	CG
Revision		Date	Dm	Chk

This document references the following files:-

Client
Surrey County Council

Project
**Surrey Outdoor Learning & Development Centre
Thames Young Mariners**

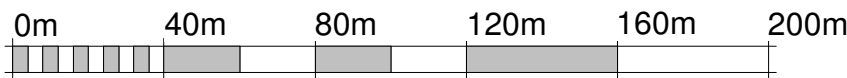
Drawing Title
Location Plan

Suitability Status
A3-Authorised & Accepted as Stage 3 Complete

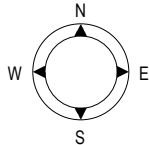
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211263	1 : 2000	@ A1	P02

Drawing Number
PR-200 - PEV - ZZ - ZZ - DR - A - 00101

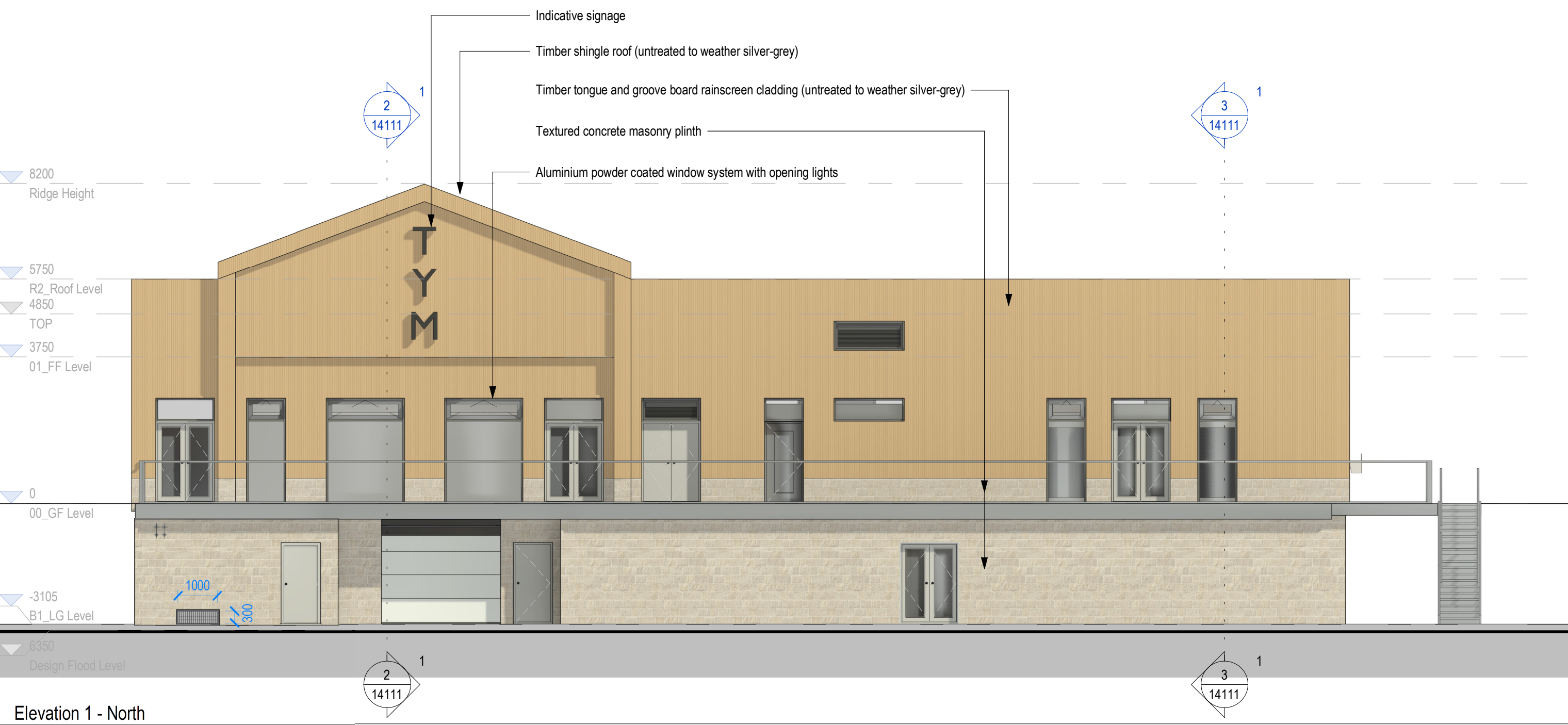
Project Code	Originator	Zone	Level	Type	Role	Number
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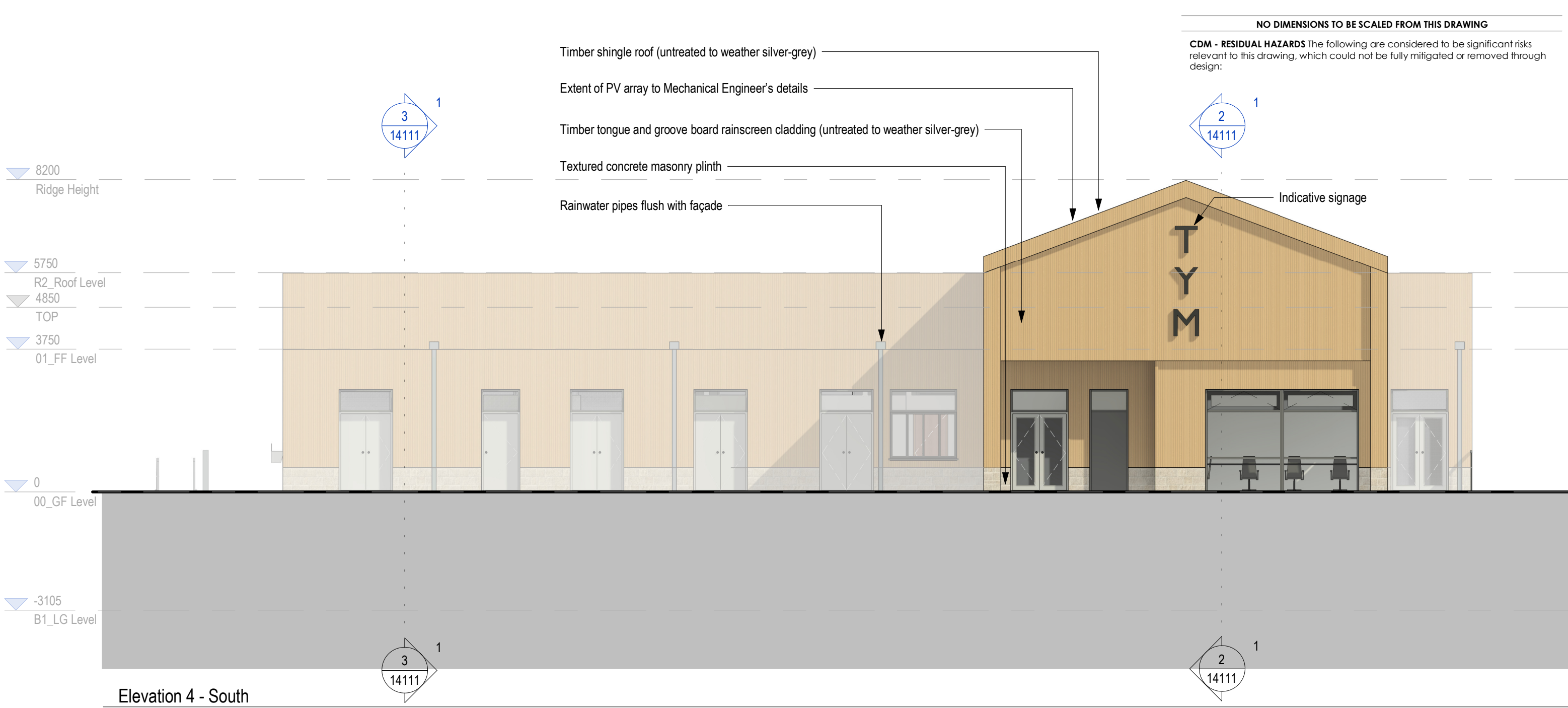
SCALE 1:2000 @ A1



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Elevation 1 - North
1 : 100



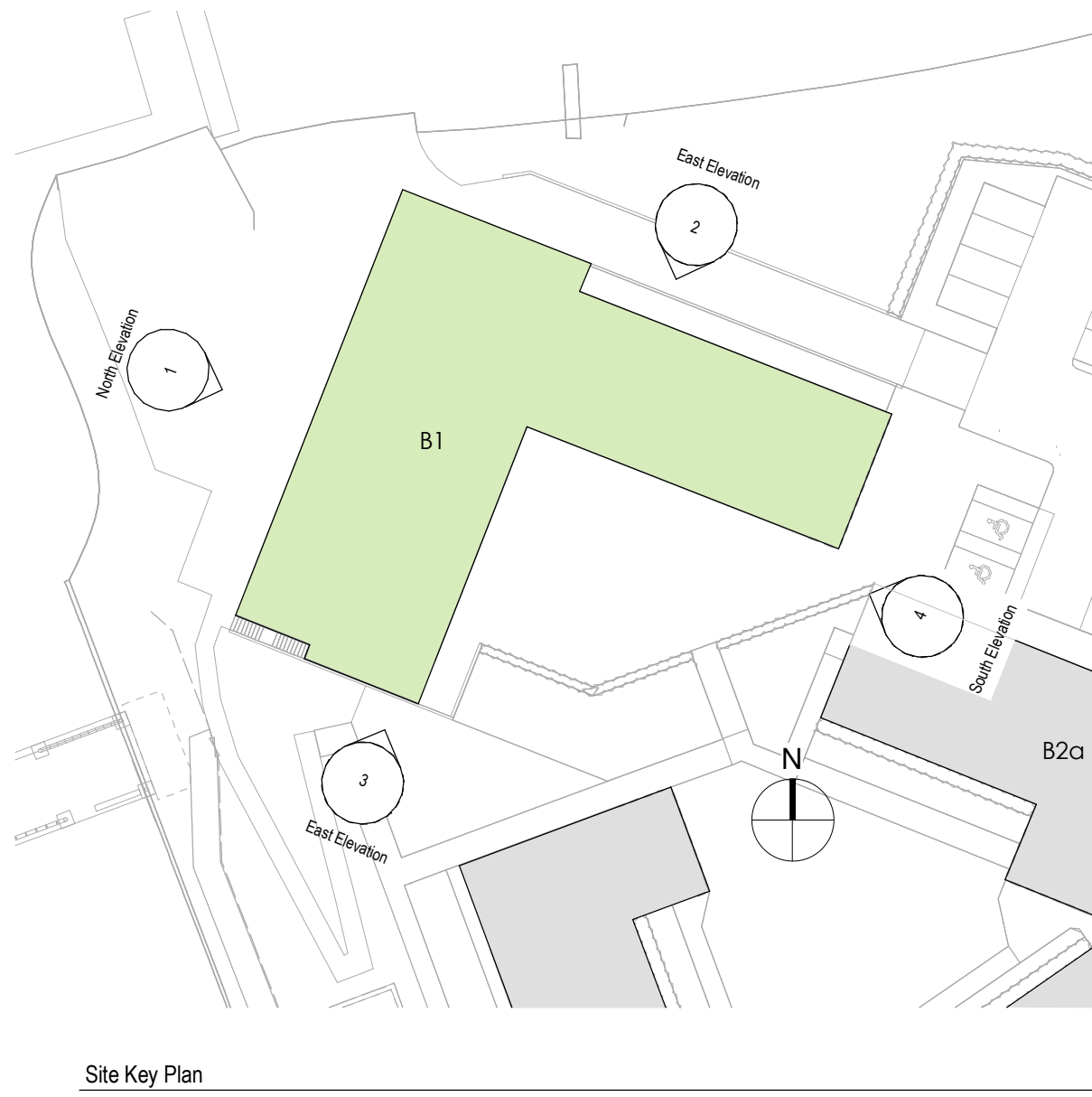
Elevation 4 - South
1 : 100



Elevation 2 - East
1 : 100



Elevation 3 - West
1 : 100



NO DIMENSIONS TO BE SCALED FROM THIS DRAWING

CDM - RESIDUAL HAZARDS The following are considered to be significant risks relevant to this drawing, which could not be fully mitigated or removed through design:

P06	Flood catchment louvres added to Level B1.	11.12.23	CG	CG
P05	Issued for Planning submission incorporating Comments Following Review	12.10.22	AJ	CG
P04	Issued for Planning submission	03.10.22	AJ	CG
P03	Roof form & fenestration revised generally. Issued for coordination	11.08.22	LH	CG
P02	VE Design Review	19.05.22	NB	LH
P01	Issue 01 - for Cost Plan	12.04.22	NB	CG
Revision		Date	Dn	Chk

This document references the following files:-

Client

Surrey County Council

Project

Surrey Outdoor Learning & Development Centre

Thames Young Mariners

Drawing Title

Proposed Elevations

B1 - Main Building

Suitability Status

S2-Suitable for information

Job No.

211263

Scale

As indicated

Size

@ A1

Rev.

P06

Drawing Number

PR-200 - PEV - XX - ZZ - DR - A - 13111

Project Code

Originator

Zone

Level

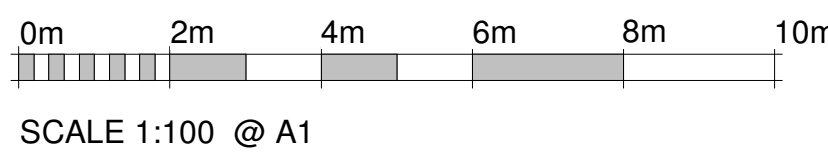
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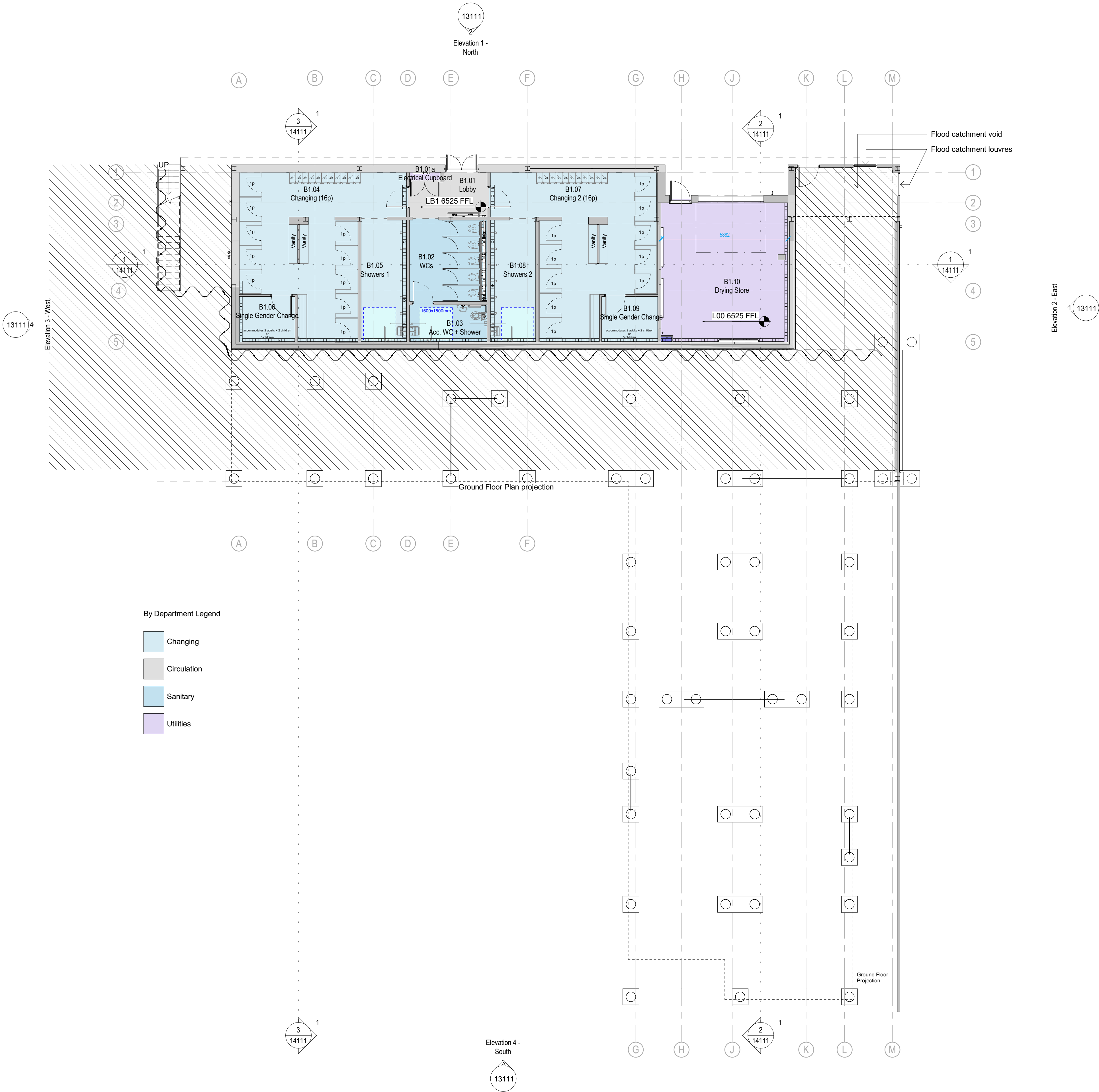
Role

Number

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CDM - RESIDUAL HAZARDS The following are considered to be significant risks relevant to this drawing, which could not be fully mitigated or removed through design:			
B1-Rooms Areas Schedule Excluding Occupancy Data			
Room Number	Room Name	Area	Comments
Changing			
B1.04	Changing (16p)	41.65 m²	
B1.05	Showers 1	11.99 m²	
B1.06	Single Gender Change	5.50 m²	
B1.07	Changing 2 (16p)	41.55 m²	
B1.08	Showers 2	11.91 m²	
B1.09	Single Gender Change	5.50 m²	
		118.10 m²	
Circulation			
B1.01	Lobby	6.76 m²	
		6.76 m²	
Sanitary			
B1.02	WCs	13.62 m²	
B1.03	Acc. WC + Shower	6.24 m²	
		19.86 m²	
Utilities			
B1.10a	Electrical Cupboard	0.42 m²	
B1.10	Drying Store	38.01 m²	
		38.43 m²	
Grand total: 11		183.14 m²	

L0-Total GIA

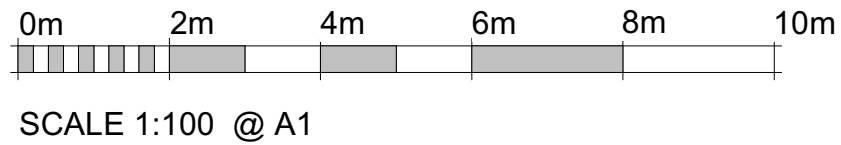
GIA

192.48 m²

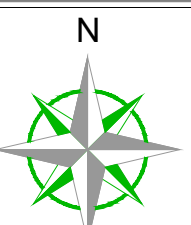


Revision			
Revision	Date	Dm	Chk
P13	19.12.23	CG	CG
P12	11.12.23	CG	CG
P11	20.10.23	CG	CG
P10	23.11.22	AJ	CG
P09	14.11.22	AJ	CG
P08	01.11.22	AJ	CG
P07	03.10.22	AJ	CG
P06	11.07.22	BP	LH
P05	01.07.22	NB	LH
P04	07.06.22	NB	LH
P03	19.05.22	NB	LH
P02	11.05.22	NB	LH
P01	12.04.22	NB	CG

This document references the following files:-			
Linked File Name			
PR-200-ATK-ZZ-ZZ-ES-S-00002_B2			
PR-200-ATK-ZZ-ZZ-M2-N-10000_B2 - Main Building_S4 - Suitable for Stage Approval_1			
Client			
Surrey County Council			
Project			
Surrey Outdoor Learning & Development Centre			
Thames Young Mariners			
Drawing Title			
Proposed GA Plan- B1			
General Arrangement Plan			
B1 - Main Building			
Suitability Status			
A3-Authorised & Accepted as Stage 3 Complete			
Job No.	Scale	Size	Rev
211263	As indicated	@ A1	P13
Drawing Number			
PR-200-PEV-ZZ-B1-DR-A-11211			
Project Code	Original	Zone	Level
	Type	Role	Number



Appendix B - Topographic Survey



NOTES:

1. All utility plans shall be the property of Greenhatch Group and shall not be used for any other purpose without the written consent of Greenhatch Group.

2. All utility plans shall be the property of Greenhatch Group and shall not be used for any other purpose without the written consent of Greenhatch Group.

3. All utility plans shall be the property of Greenhatch Group and shall not be used for any other purpose without the written consent of Greenhatch Group.

4. All utility plans shall be the property of Greenhatch Group and shall not be used for any other purpose without the written consent of Greenhatch Group.

5. All utility plans shall be the property of Greenhatch Group and shall not be used for any other purpose without the written consent of Greenhatch Group.

UTILITY LINETYPES			
Water	100	Water	100
Electricity	100	Electricity	100
Gas	100	Gas	100
Telecom	100	Telecom	100
Drainage	100	Drainage	100
Other	100	Other	100

UTILITY SURVEY INFORMATION			
Water	100	Water	100
Electricity	100	Electricity	100
Gas	100	Gas	100
Telecom	100	Telecom	100
Drainage	100	Drainage	100
Other	100	Other	100

LEGEND			
Water	100	Water	100
Electricity	100	Electricity	100
Gas	100	Gas	100
Telecom	100	Telecom	100
Drainage	100	Drainage	100
Other	100	Other	100

DISCLAIMER

Whilst every effort has been taken in the preparation of this drawing, the original landowner/owner/contractor shall remain responsible for the accuracy of the information provided. The use of this drawing for any purpose other than that for which it was prepared is at the user's risk. Greenhatch Group shall not be held responsible for any loss or damage arising from the use of this drawing.

Rev. Date Description Drawn Q. Ref.



Topographical Surveys

Site Engineering

Utility / CCTV Surveys

Measured Building Surveys

3D Laser Scanning

Revit & BIM Models

Rowan House

Duffield Road

Little Eaton

Derby

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CLIENT

Pick Everard

PROJECT

Thames Young Mariners,
Surrey Outdoor Learning Centre
Riverside Drive, TW10 7RX

TITLE

Utility
Survey

SCALE

A1@ 1: 1000

DATE

12.04.2022

DRAWN

JB

QUALITY REF

GH13557

Level datum

See note

Grid orientation

See note

Job number

43456

Drawing No.

43456_UG

Rev.

0

Comments

This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for the plan if supplied to any party other than the original client.
All dimensions should be checked on site prior to design and construction.
Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:

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Appendix C - Product 4

Product 4 (Detailed Flood Risk) for: Thames Young Mariners Base, Riverside Drive, Ham, Richmond, TW10 7RX

Requested by: Nick Darling-Drewett

Reference: KSL 325112 LMB

Date: 06 October 2023

Contents

- Flood Map for Planning (Rivers and Sea)
- Flood Map Extract
- Thames Estuary 2100 (TE2100)
- Thames Tidal Upriver Breach Inundation Modelling 2017
- Thames Tidal Upriver Breach Inundation Modelling Map
- Site Node Locations Map
- Defence Details
- Recorded Flood Events Data
- Recorded Flood Events Outlines Map
- Additional Information

The information provided is based on the best data available as of the date of this letter.

You may feel it is appropriate to contact our office at regular intervals, to check whether any amendments/ improvements to the data for this location have been made. Should you re-contact us after a period of time, please quote the above reference in order to help us deal with your query.

Please refer to the [Open Government Licence](#) which explains the permitted use of this information.

Flood Map for Planning (Rivers and Sea)

The Flood Map:

Our Flood Map shows the natural floodplain for areas at risk from river and tidal flooding. The floodplain is specifically mapped ignoring the presence and effect of defences (including any tidal barriers). Although flood defences reduce the risk of flooding they cannot completely remove that risk as they may be over topped or breached during a flood event.

The Flood Map indicates areas with a 1% (0.5% in tidal areas), Annual Exceedance Probability (AEP) - the probability of a flood of a particular magnitude, or greater, occurring in any given year, and a 0.1% AEP of flooding from rivers and/or the sea in any given year. In addition, the map also shows the location of some flood defences.

The Flood Map is intended to act as a guide to indicate the potential risk of flooding. When producing it we use the best data available to us at the time and also take into account historic flooding and local knowledge. The Flood Map is updated on a quarterly basis to account for any amendments required. These amendments are then displayed on the internet at <https://www.gov.uk/check-flood-risk>

At this Site:

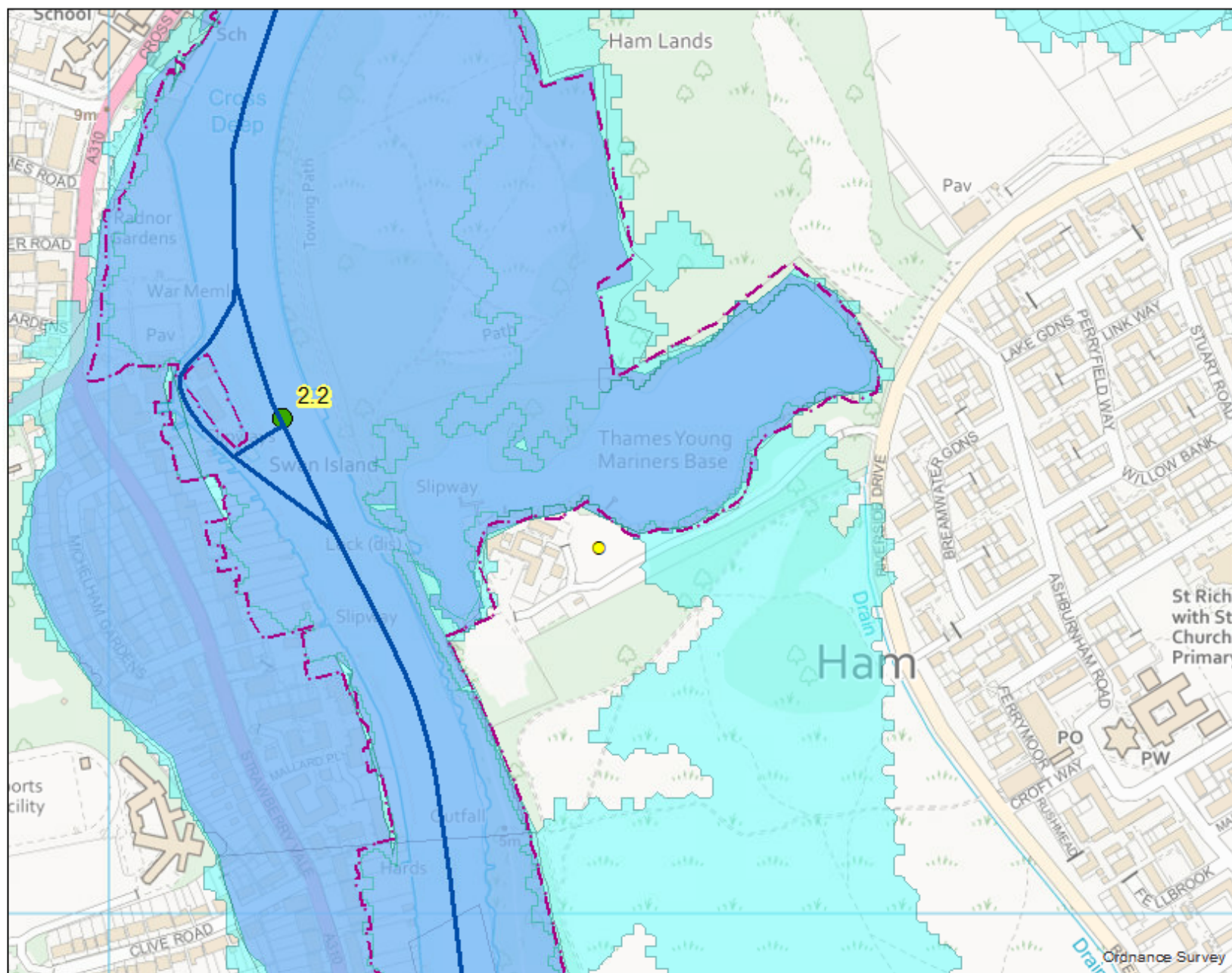
The Flood Map shows that this site lies within the outline of Flood Zone 3. This zone comprises land assessed as having a 0.5% (1 in 200) or greater annual probability of tidal flooding.

Enclosed is an extract of our Flood Map which shows this information for your area.

Method of production

The Flood Map at this location has been derived using detailed modelling of the tidal River Thames through the Thames Tidal Defences Study completed in 2006 by Halcrow Ltd.

Detailed FRA Map centred on TW10 7RX created 06 October 2023 [Ref: KSL 325112 LMB]



Scale 1: 5,000



Legend

- Site
- Main Rivers
- TE2100 Model Nodes
- - - Flood Map - Defences
- - - Flood Map - Water Storage Areas
- Flood Map - Flood Zone 3
- Flood Map - Flood Zone 2

Flood Map for Planning (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:

- from the sea with a 0.5% or greater chance of occurring each year
- or from a river with a 1% or greater chance of occurring each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 0.1% chance of occurring each year.

Thames Estuary 2100 (TE2100)

You have requested in-channel flood levels for the tidal river Thames. These have been taken from the Thames Estuary 2100 study completed by HR Wallingford in 2008. The modelled node closest to your site is **2.2**; the locations of nearby nodes are also shown on the enclosed map.

Details about the TE2100 plan

The Plan sets out how the Environment Agency and our partners can work together to manage tidal flood risk, from now until the end of the century. The Plan covers the Thames Estuary from Teddington in the west to the mouth of the estuary at Shoeburyness (north bank) and Sheerness (south bank) in the east. It is an adaptive plan for managing the estuary, including the tidal defence system, until 2100 so that current standards of flood protection are maintained or improved taking into account climate change effects e.g. sea level rise. The Plan has 3 phases of activity:

- Until 2035 – maintain and improve current defences, safeguard areas required for future improvements, and monitor climate change indicators.
- 2035-2050 – raise existing walls, defences & smaller barriers whilst reshaping the riverside environment.
- 2050-2100 – determine and implement an option for the future of the Thames Barrier, and adapt other defences as required to work alongside this to protect the estuary.

The Thames Estuary 2100 Plan can be found at: <https://www.gov.uk/government/publications/thamesestuary-2100-te2100>

Details about the TE2100 in-channel levels

The TE2100 in-channel levels take into account operation of the Thames Barrier when considering future levels. The Thames Barrier requires regular maintenance and with additional closures the opportunity for maintenance will be reduced. When this happens, river levels – for which the Barrier would normally shut for the 2008 epoch – will have to be allowed through to ensure that the barrier is not shut too often. For this reason, levels upriver of the barrier will increase and the tidal walls will need to be raised to match.

Why is there no return period for levels upriver of the barrier?

The levels upriver of the barrier are the highest levels permitted by the operation of the Thames Barrier. If levels and flows are forecast to be any higher, the Thames Barrier would shut, ensuring that the tide is blocked and the river maintained to a low level. For this reason the probability of any given water level upriver of the Barrier is controlled and therefore any associated return period becomes irrelevant. The Thames Barrier and associated defence system has a 1 in 1000 year standard which means it ensures that flood risk is managed up to an event that has a 0.1% annual probability. The probability of water levels upriver is ultimately controlled by the staff at the Thames Barrier.

Why are the levels in west London higher than the defence crest levels?

In west London there is a heavy influence from upriver flows (fluvial flows). The flood defences are built to manage tidal flood risk only. With very high fluvial flows, the river levels in west London could be above the 0.1% annual probability tidal level.

Why are the climate change/future west London levels lower than the 2008 levels?

The climate change levels are assessed to determine the future tidal defence levels. For this reason they only account for extreme tidal events and not extreme fluvial flow events. The 2008 levels include extreme flows from upriver (fluvial events) as well as extreme tidal events.

For further information about the Thames Barrier please visit our website at:

<https://www.gov.uk/the-thames-barrier>

Where to find the in-channel levels and defence crest level data from the 2008 TE2100 study

The TE2100 in-channel levels and defence crest levels documents can be downloaded from ShareFile at the following link:

<https://ea.sharefile.com/d-s5e564014724448219331e780c91c4ac2>

- Upriver of the Thames Barrier – is detailed within Table 6.1 (page 44) of the document titled '*Thames Estuary 2100, Improvements to Flood Risk Management System, Design Water Levels and Future Defence Crest Levels, May 2015*'.
- Downriver of the Thames Barrier is detailed within Table 7.1 (page 56) of the document titled '*Thames Estuary 2100, Improvements to Flood Risk Management System, Design Water Levels and Future Defence Crest Levels, May 2015*'. Defence raising for other barrier options can also be found in the document titled '*Thames Estuary 2100, Phase 3 Studies, Topic 1.5, Phase 3 Set 2 Estuary Wide Options Hydraulic modelling, December 2008*'

Thames Tidal Upriver Breach Inundation Modelling - 2017

The table below displays site-specific modelled flood levels at your site. These have been taken from the Thames Tidal Upriver Breach Inundation Modelling Study 2017 completed by Atkins Ltd. in May 2017.

We have developed a modelling approach where all upriver breach locations along the Thames are equitably modelled, to ensure a consistent approach across London. This modelling simulates 5679 continuous tidal breaches along the entire extent of the Thames from Teddington to the Thames Barrier. For hard and composite defences breaches are set at 20 m wide; for soft defences, breaches are 50 m wide. In both cases, the defence breach scour distance was assumed to extend into the floodplain by the same distance as the breach width.

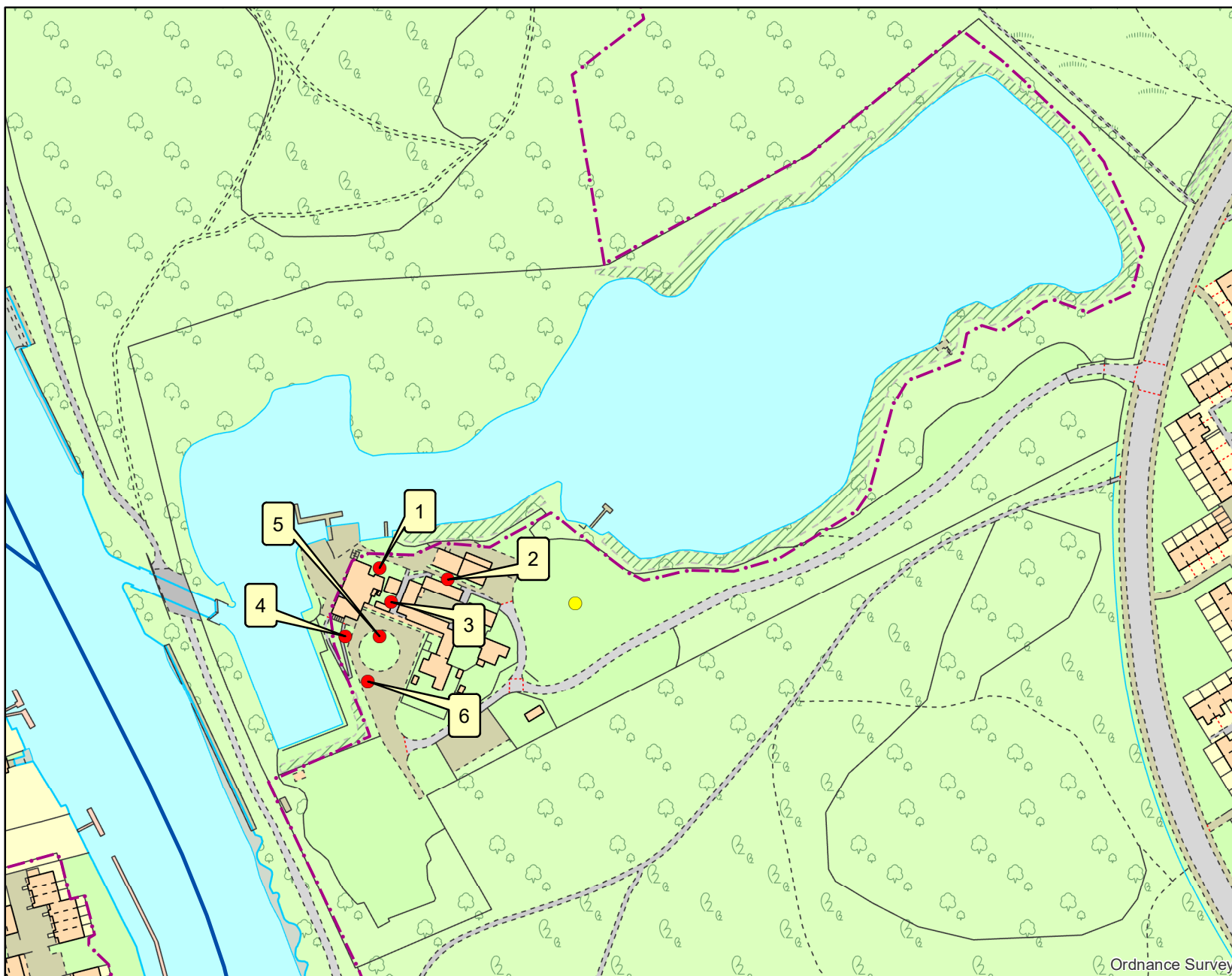
For breaches upriver of the Thames Barrier, there is no return period for modelled levels as the levels are controlled by barrier closures. The levels used are referred to as Maximum Likely Water Levels (MLWLs). Therefore 2014 and 2100 epochs were modelled on that basis.

This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within London.

Node	National Grid Reference		Modelled levels in mAODN for Max Likely Water Level	
	Easting	Northing	2014	2100
1	516347	172340	Nil Return	6.45
2	516377	172335	Nil Return	6.45
3	516352	172325	Nil Return	Nil Return
4	516332	172310	Nil Return	6.45
5	516347	172310	Nil Return	6.45

6	516342	172290	Nil Return	Nil Return
7	516347	172340	Nil Return	6.45
8	516377	172335	Nil Return	6.45
9	516352	172325	Nil Return	Nil Return
10	516332	172310	Nil Return	6.45

2D Node Map centred on TW10 7RX created 06 October 2023 [Ref: KSL 325112 LMB]



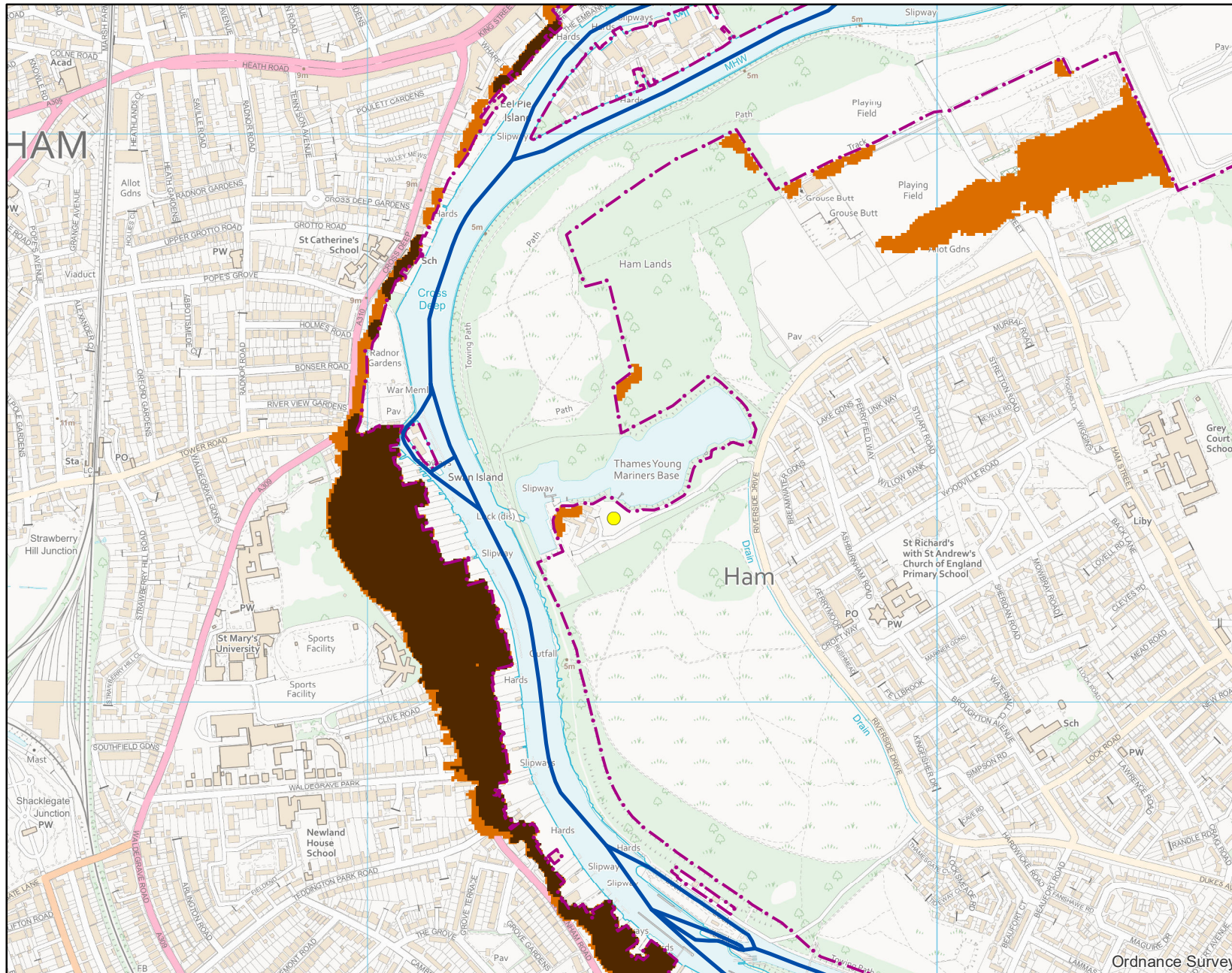
Scale 1: 2,500



Legend

- 2D_Nodes
- Site
- Main Rivers
- - - Flood Map - Defences

Modelled Breach Inundation Map centred on TW10 7RX created 06 October 2023 [Ref: KSL 325112 LMB]



Scale 1: 10,000



Legend

- Site
- Main Rivers
- - - Flood Map - Defences

Upriver MLWL Breach Inundation

Epoch

- 2014
- 2100

Thames Tidal Upriver Breach Inundation Modelling 2017

A modelled representation of all upriver tidal breach locations along the Thames from Teddington to the Thames Barrier, based on low floodplain topography. For hard and composite defences breaches are set at 20 m wide; for soft defences, breaches are 50 m wide. In both cases, the defence breach scour distance was assumed to extend into the floodplain by the same distance as the breach width. The modelling is based on the 2008 TE2100 in-channel levels, with an allowance for climate change for epoch 2100.

Defence Details

The design standard of protection of the flood defences in this area of the Thames is 0.1% AEP; they are designed to defend London up to a 1 in 1000 year **tidal** flood event. The defences are all raised, man-made and privately owned. It is the riparian owners' responsibility to ensure that they are maintained to a crest level of 6.90m AODN (the Statutory Flood Defence Level in this reach of the Thames). Information relating the TE2100 Plan and any future defence crest levels can be found on ShareFile at following link: <https://ea.sharefile.com/d-s5e564014724448219331e780c91c4ac2>

For more information on your rights and responsibilities as a riparian owner, please see our document 'Living on the edge' found on our website at: <https://www.gov.uk/government/publications/riverside-ownership-rights-and-responsibilities>

Areas Benefiting from Flood Defences

The Environment Agency has taken the decision to retire this dataset and remove it from the Flood Map for Planning portal. This is because we have determined that it no longer meets the customer needs and creates a false sense of security for users.

To understand the long-term risk of flooding to an area, you can use the [Check Your Long Term Flood Risk portal](#): this will provide an understanding of flood risk from rivers and sea, taking into account the presence and condition of defences, and other sources of flood risk such as from surface water and reservoirs.

Recorded Flood Events Data

We hold records of historic flood events from rivers and the sea. Information on the floods that may have affected the area local to your site is provided below and in the enclosed map (if relevant).

Flood Event Data

We do not hold records of historic flood events from rivers and/or the sea affecting the area local to this site. However, please be aware that this does not necessarily mean that flooding has not occurred here in the past, as our records are not comprehensive.

Due to the fact that our records are not comprehensive, we would advise that you make further enquiries locally with specific reference to flooding at this location. You should consider contacting the relevant Local Planning Authority and/or water/sewerage undertaker for the area.

We map flooding to land, not individual properties. Our historic flood event record outlines are an indication of the geographical extent of an observed flood event. Our historic flood event outlines do not give any indication of flood levels for individual properties. They also do not imply that any property within the outline has flooded internally.

Please be aware that flooding can come from different sources. Examples of these are:

- from rivers or the sea;
- surface water (i.e. rainwater flowing over or accumulating on the ground before it is able to enter rivers or the drainage system);
- overflowing or backing up of sewer or drainage systems which have been overwhelmed,
- groundwater rising up from underground aquifers

Currently the Environment Agency can only supply flood risk data relating to the chance of flooding from rivers or the sea. However you should be aware that in recent years, there has been an increase in flood damage caused by surface water flooding and drainage systems that have been overwhelmed.

Additional Information

Information Warning - OS background mapping

The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply to this background mapping. You are granted a non-exclusive, royalty free, revocable licence solely to view the Licensed Data for non-commercial purposes for the period during which the Environment Agency makes it available. You are not permitted to copy, sub-license, distribute, sell or otherwise make available the Licensed Data to third parties in any form. Third party rights to enforce the terms of this licence shall be reserved to OS.

Environment Agency planning guidance and pre application service

- Planning Practice Guidance_- provides information about planning considerations in areas at risk of flooding. <https://www.gov.uk/guidance/flood-risk-and-coastal-change>
- Planning applications: assessing flood risk - information about completing Flood Risk Assessments. <https://www.gov.uk/planning-applications-assessing-flood-risk>
- Site specific flood risk assessment: Checklist_- a checklist to help ensure you have considered all the relevant factors in your flood risk assessment. <http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/site-specific-flood-risk-assessment-checklist/>
- Climate change allowance guidance <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

We recommend that you discuss your proposals with the Local Planning Authority at the earliest opportunity. They will be able to advise you on a wide range of planning matters in addition to flood risk.

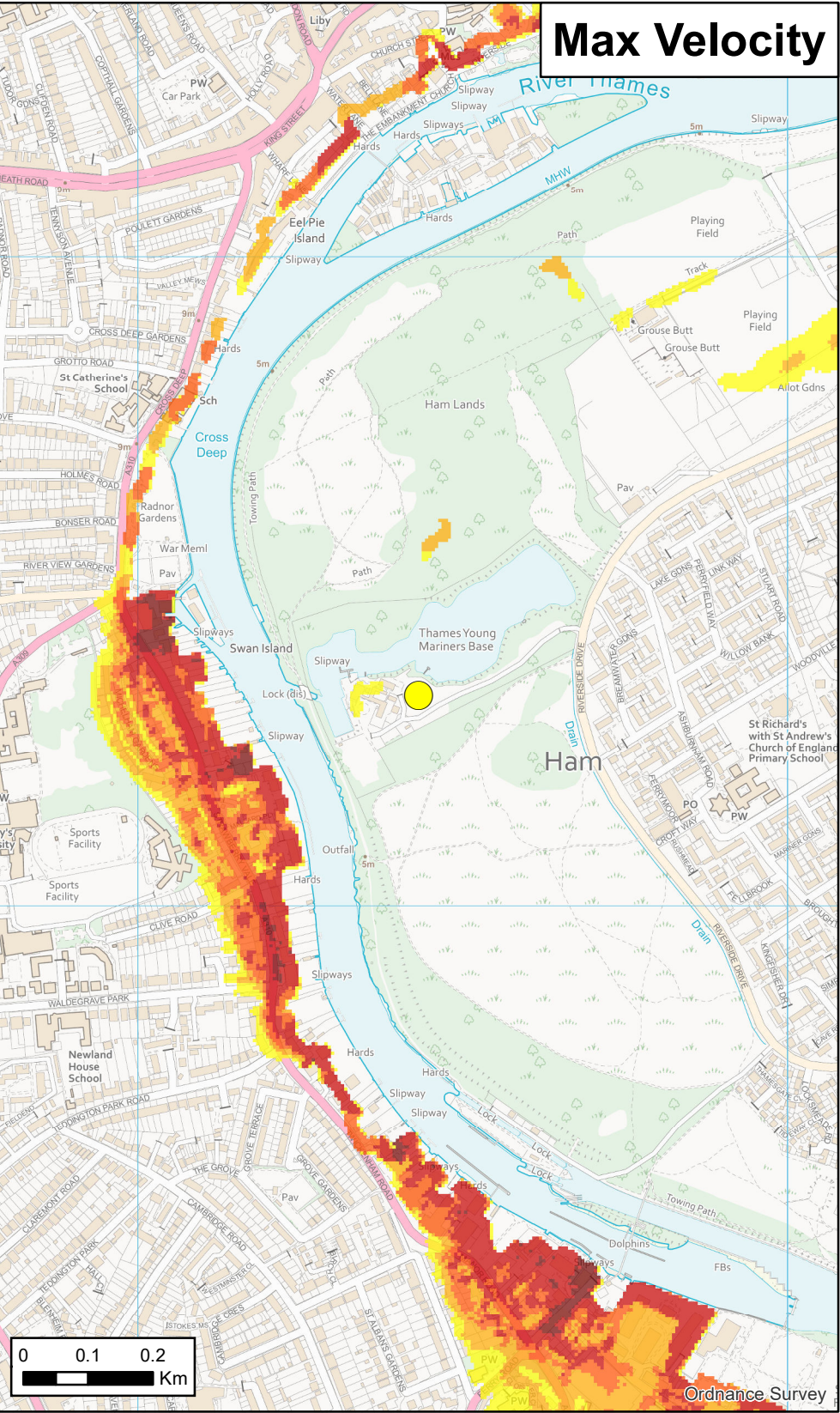
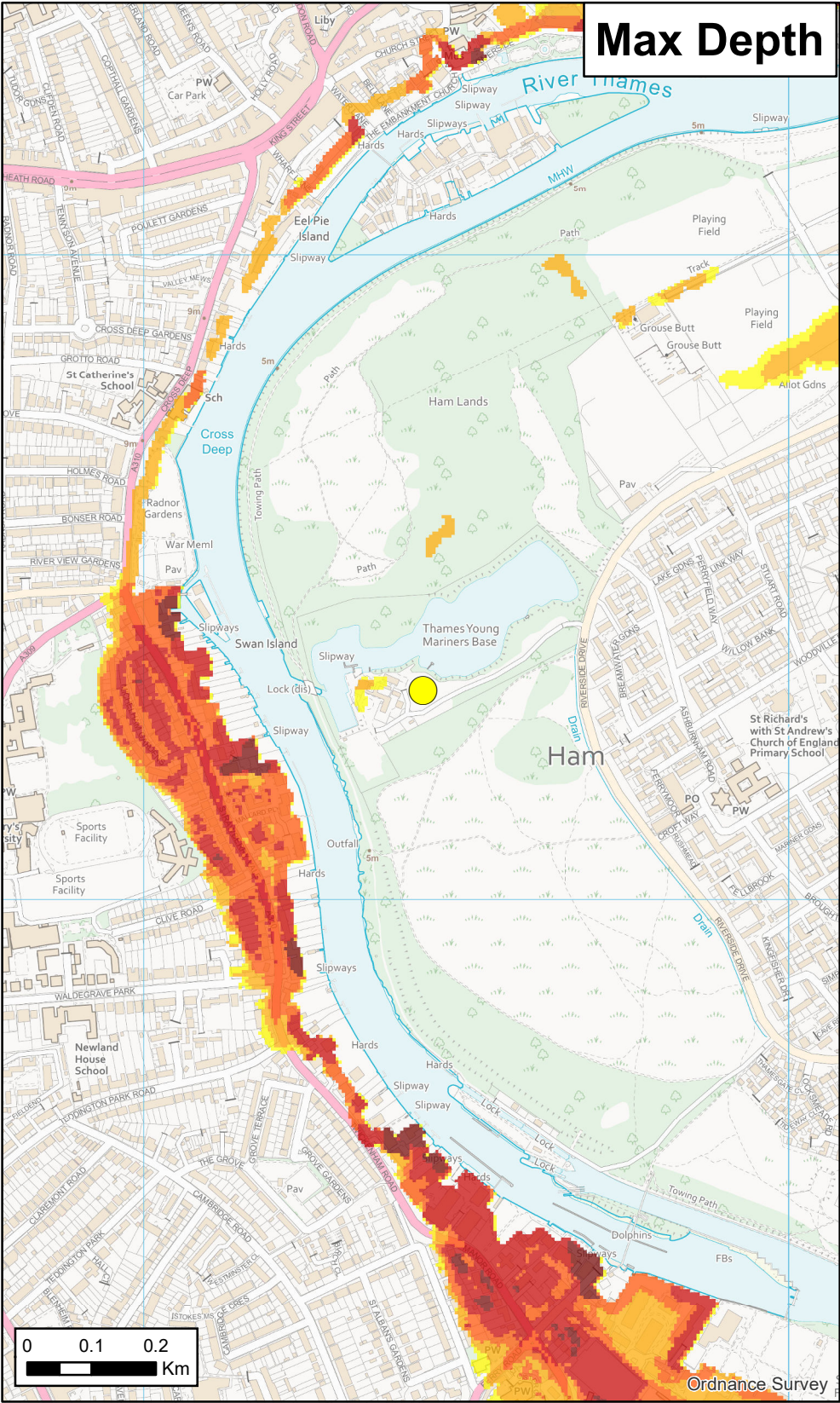
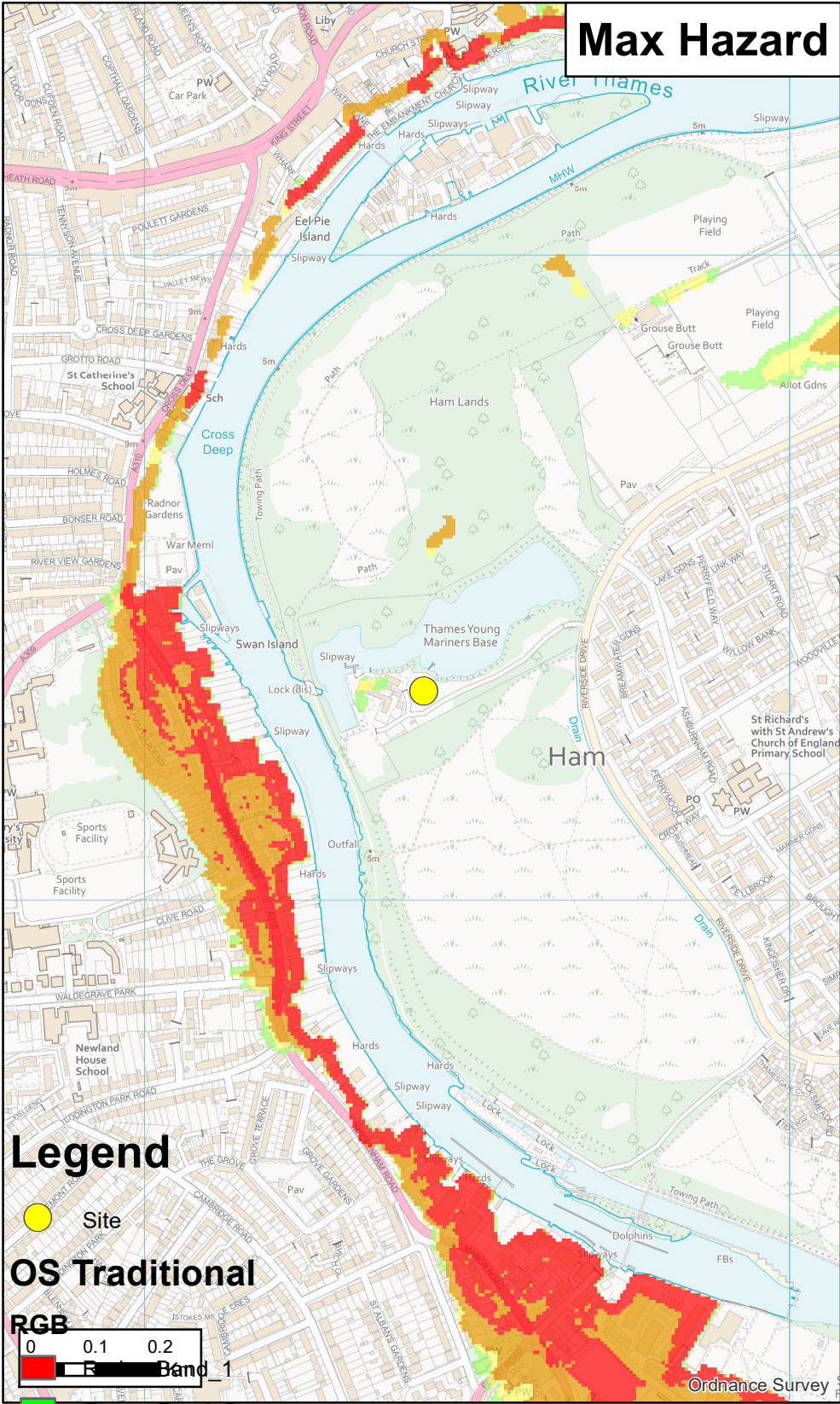
Please see our website for details on how to get planning advice, including charged-for discretionary advice, from the Environment Agency <https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals#when-to-consult>. Our planning team can be contacted at kslplanning@environment-agency.gov.uk

You should also consult the Strategic Flood Risk Assessment and flood risk local plan policies produced by your local planning authority.

You should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk Assessment where one is required, but does not constitute such an assessment on its own.

2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or overland runoff. You should discuss surface water management with your Lead Local Flood Authority.
3. Where a planning application requires a FRA and this is not submitted or deficient, the Environment Agency may well raise an objection due to insufficient information



Max Hazard		Max Depth (m)		Max Velocity (m/s)	
	Less than 0.75 (Low Hazard)		0 - 0.25		0 - 0.3
	Between 0.75 and 1.25 (Danger for Some)		0.25 - 1.00		0.3 - 1.0
	Between 1.25 and 2.00 (Danger for Most)		1.00 - 1.50		1.0 - 1.5
	Greater than 2.00 (Danger for All)		1.50 - 2.00		1.5 - 2.5
			> 2.00		> 2.5
Date Printed	06/10/2023	Scenario year	2100	Scenario Annual Chance	MLWL

This map shows the combined flood hazard to people (called a hazard rating) if our flood defences are breached at any given single location, for a range of scenarios. The hazard rating depends on the depth and velocity of floodwater, and maximum values of these are also mapped.

The map is based on computer modelling of simulated breaches covering the entire extent between Teddington Weir and the Thames Barrier. Each breach has been modelled individually and the results combined to create this map. Multiple breaches, other combinations of breaches, different sized tidal surges or flood flows may all give different results.

The map only considers the consequences of a breach, it does not make any assumption about the likelihood of a breach occurring. The likelihood of a breach occurring will depend on a number of different factors, including the construction and condition of the defences in the area. A breach is less likely where defences are of a good standard, but a risk of breaching remains.

Please contact the Environment Agency for further information on emergency planning associated with flood risk in this area.

General Enquiries No: 03708 506 506. Weekday Daytime calls cost 5p plus up to 6p per minute from BT Weekend Unlimited. Mobile and other providers' charges may vary



Thames Tidal Breach Hazard Mapping

Map Centred on TW10 7RX
KSL 325112 LMB

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