

Appendix C - Product 4 data

Product 4 (Detailed Flood Risk) for: Twickenham Riverside, London, TW1 3SD
Reference: HNL59854DL
Date: 19/09/2017

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- Flood Map for Planning (Rivers and Sea)
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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.

This information is provided subject to the enclosed notice which you should read.

Flood Map Confirmation

The Flood Map for Planning (rivers and the sea):

The 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. 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 shows Flood Zone 3 - areas with a 1% (or 0.5% in tidal areas) chance of flooding in any given year and Flood Zone 2 – areas with a 0.1% chance of flooding in any given year. In addition, the map also shows the location of some flood defences and the areas that benefit from them.

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 <http://maps.environment-agency.gov.uk>. Select “Flood Map for Planning (Rivers and Sea).”

At this Site:

The Flood Map shows that this site lies within Flood Zone 3 - with a 0.5% chance of flooding from the sea (tidal flooding) in any given year.

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 and fluvial flood zones were derived from the Teddington Fluvial Flood Risk study completed in April 2009 by Halcrow Ltd.

Model Output Data – Thames Estuary 2100

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 **2.3**; the location of these nodes is also shown on the enclosed map.

The TE2100 plan is now live and within it are a set of levels on which the flood risk management strategy is based. The plan is the overarching flood management strategy for the Thames Estuary and therefore any development planning should be based on the same underlying data.

What is the difference between the TE2100 levels and the 2008 Joint Probability levels that have previously been provided?

The values of the two sets of levels are very similar for the present day scenario. However, the TE2100 takes 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 we would normally shut the barrier, will have to be allowed through to ensure that the barrier is not shut too often. For this reason, levels upstream of the barrier will increase and the tidal walls will need to be heightened to match. The levels previously provided do not take this scenario into consideration.

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

The levels upstream 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 upstream of the Barrier is controlled and therefore any associated return period becomes irrelevant. The Thames Barrier and associated defence system have a 1 in 1000 standard which means they ensures that flood risk is managed up to an event that has a 0.1% chance of occurring in any given year. The probability of water levels upriver is ultimately controlled by operation of 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:

<http://www.environment-agency.gov.uk/homeandleisure/floods/38353.aspx>

TE2100 flood levels:

Upstream of the Thames Barrier, the levels provided are the highest levels permitted by the Barrier. Downstream of the Thames Barrier they are the 1 in 1000 (0.1%) levels.

In West London, there is a heavy influence from upstream (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 tidal defence level.

Location	Node	Easting	Northing	Present Day Water Level	Future 2065-2100 Water Level	Future 2100 Water Level
Teddington	2.2	516154	172438	5.95	6.00	6.45
	2.3	517010	173227	5.8	5.97	6.42
	2.3a	517525	173383	5.77	5.95	6.40

TE2100 defence levels:

The table below shows both the current defence level, and the TE2100 plan future defence levels. New development should either include future defence raising or demonstrate that future raising has been allowed for.

Note: The defence levels near Teddington may be lower than the water levels because they take into account high fluvial events. The defences are tidal only.

Location	Node	Easting	Northing	Current Defence Levels		Allow for future defence raising (both banks) to a level of...	
				Left	Right	2065-2100	2100
Teddington	2.2	516154	172438	6.10	6.10	6.45	6.90
	2.3	517010	173227	6.02	6.02	6.45	6.90
	2.3a	517525	173383	6.02	6.02	6.45	6.90

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.

Node	National Grid Reference		Modelled levels in mAODN for Max Likely Water Level	
	Easting	Northing	2065	2100
0	516290	173247	No flood	No flood
1	516344	173193	No flood	No flood
2	516272	173233	No flood	No flood
3	516330	173182	5.836	6.421
4	516263	173106	5.800	6.420
5	516244	173121	No flood	No flood
6	516281	173155	5.800	No flood
7	516310	173180	5.800	6.420
8	516309	173141	No flood	No flood
9	516174	173169	No flood	No flood
10	516373	173204	No flood	No flood
11	516274	173268	No flood	No flood

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 flood event. The defences are all raised, man-made and privately owned. It is the riparian owners' responsibility to ensure they are maintained to a crest level of 6.02m AODN (the Flood Defence Level in this reach of the Thames). We inspect them twice a year to ensure that they remain fit for purpose. The current condition grade for defences in the area is 2 (Good), on a scale of 1 (very good) to 5 (very poor). 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://publications.environment-agency.gov.uk/skeleton/publications/default.aspx>

Please see the 'Thames Estuary 2100' document on our website for the short, medium and long term Flood Risk Management strategy for London:

<http://www.environment-agency.gov.uk/homeandleisure/floods/125045.aspx>

Areas Benefiting from Flood Defences

This site is within an area benefiting from flood defences, as shown on the enclosed extract of our Flood Map. Areas benefiting from flood defences (ABDs) are defined as those areas which benefit from formal flood defences specifically in the event of flooding from rivers with a 1% (1 in 100) chance in any given year, or flooding from the sea with a 0.5% (1 in 200) chance in any given year. In areas protected by the Thames Barrier, the ABDs also show where defences protect up to the 0.1% (1 in 1000) chance in any given year.

If the defences were not there, these areas would be flooded. An area of land may benefit from the presence of a flood defence even if the defence has overtopped, if the presence of the defence means that the flood water does not extend as far as it would if the defence were not there.

Recorded Flood Events 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.

Other Sources of Flood Risk

The Lead Local Flood Authority for your area are responsible for local flood risk (i.e. surface runoff, ground water and ordinary watercourse) and may hold further information .

You may also wish to consider contacting the appropriate relevant Local Planning Authority and/or water/sewerage undertaker for the area. They may be able to provide some knowledge on the risk of flooding from other sources.

Additional Information

Use of Environment Agency Information for Flood Risk / Flood Consequence Assessments

Important

If you have requested this information to help inform a development proposal, then we recommend that you undertake a formal pre-application enquiry using the form available from our website:-

<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Depending on the enquiry, we may also provide advice on other issues related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

In **England**, you should refer to the Environment Agency's Flood Risk Standing Advice, the technical guidance to the National Planning Policy Framework and the existing PPS25 Practice Guide for information about what flood risk assessment is needed for new development in the different Flood Zones. These documents can be accessed via:

<https://www.gov.uk/flood-risk-standing-advice-frsa-for-local-planning-authorities>

<https://www.gov.uk/government/publications/national-planning-policy-framework-technical-guidance>

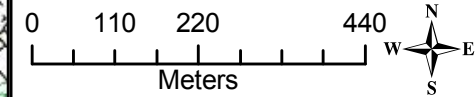
<https://www.gov.uk/government/publications/development-and-flood-risk-practice-guide-planning-policy-statement-25>

You should also consult the Strategic Flood Risk Assessment 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 / Consequence Assessment (FRA / FCA) 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. The information produced by the local planning authority referred to above may assist here.
3. Where a planning application requires a FRA / FCA and this is not submitted or deficient, the Environment Agency may well raise an objection.
4. For more significant proposals in higher flood risk areas, we would be pleased to discuss details with you ahead of making any planning application, and you should also discuss the matter with your local planning authority.

Detailed FRA/FCA for: Twickenham Riverside, London, TW1 3SD - 19/09/2017 - HNL59854DL



Legend

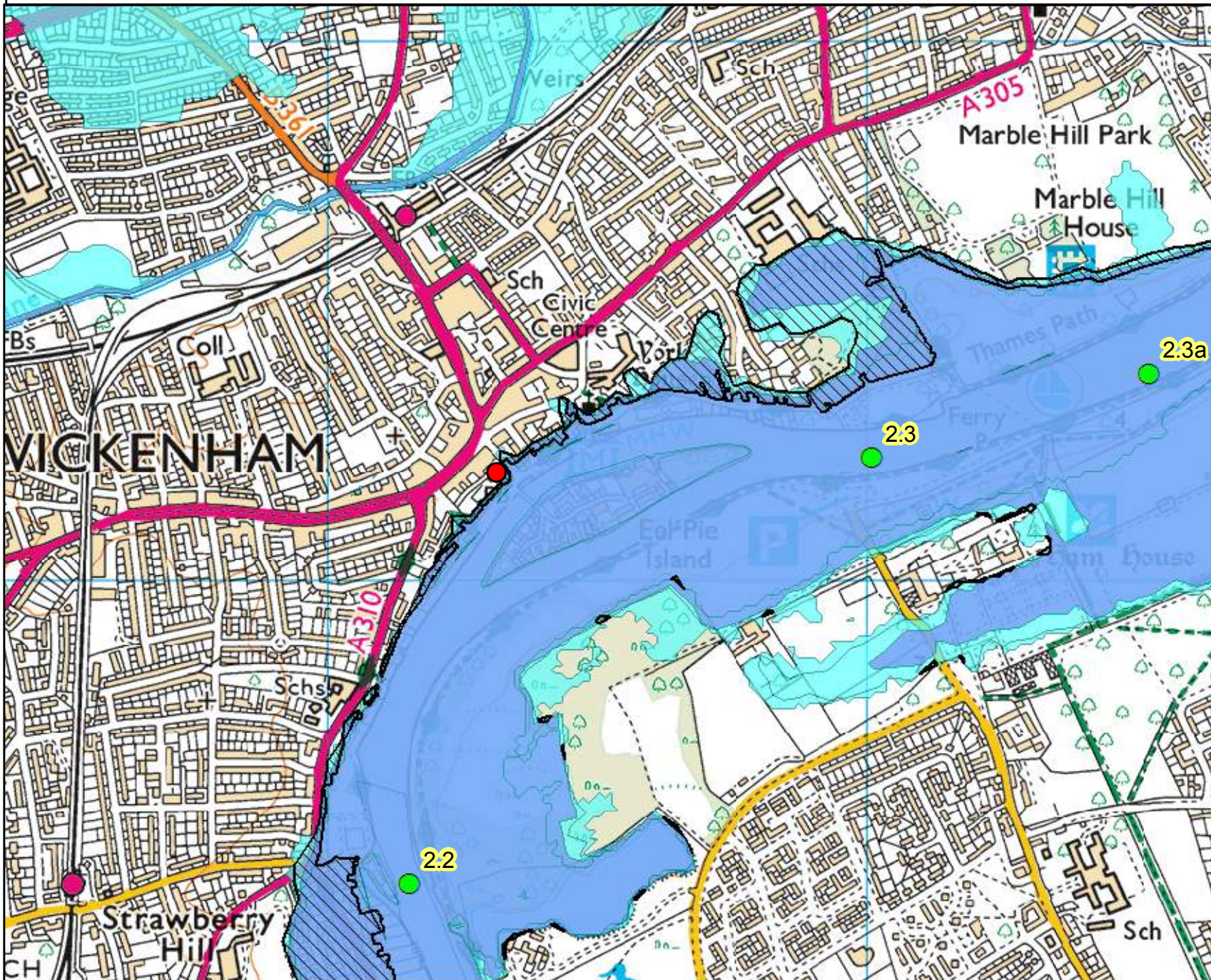
- Site Location
- TE2100Nodes
- 1707 Flood Outline
- 1928 Flood Outline
- 1953 Flood Outline
- Areas Benefiting from Flood Defences
- Flood Zone 3
- Flood Zone 2

Flood Map for Planning (assuming no defences)

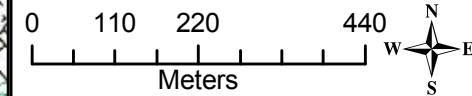
Flood Zone 3 shows the area that could be affected by flooding:

- 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.



Breach Modelling Map for: Twickenham Riverside, London, TW1 3SD - 19/09/2017 - HNL59854DL



Legend

- Site Location
- TTD Defences SDL (mAODN)
- SDL
- 5.65
- 6.02
- 6.1



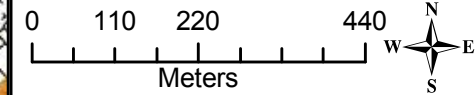
Flood Map for Planning (assuming no defences)

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.

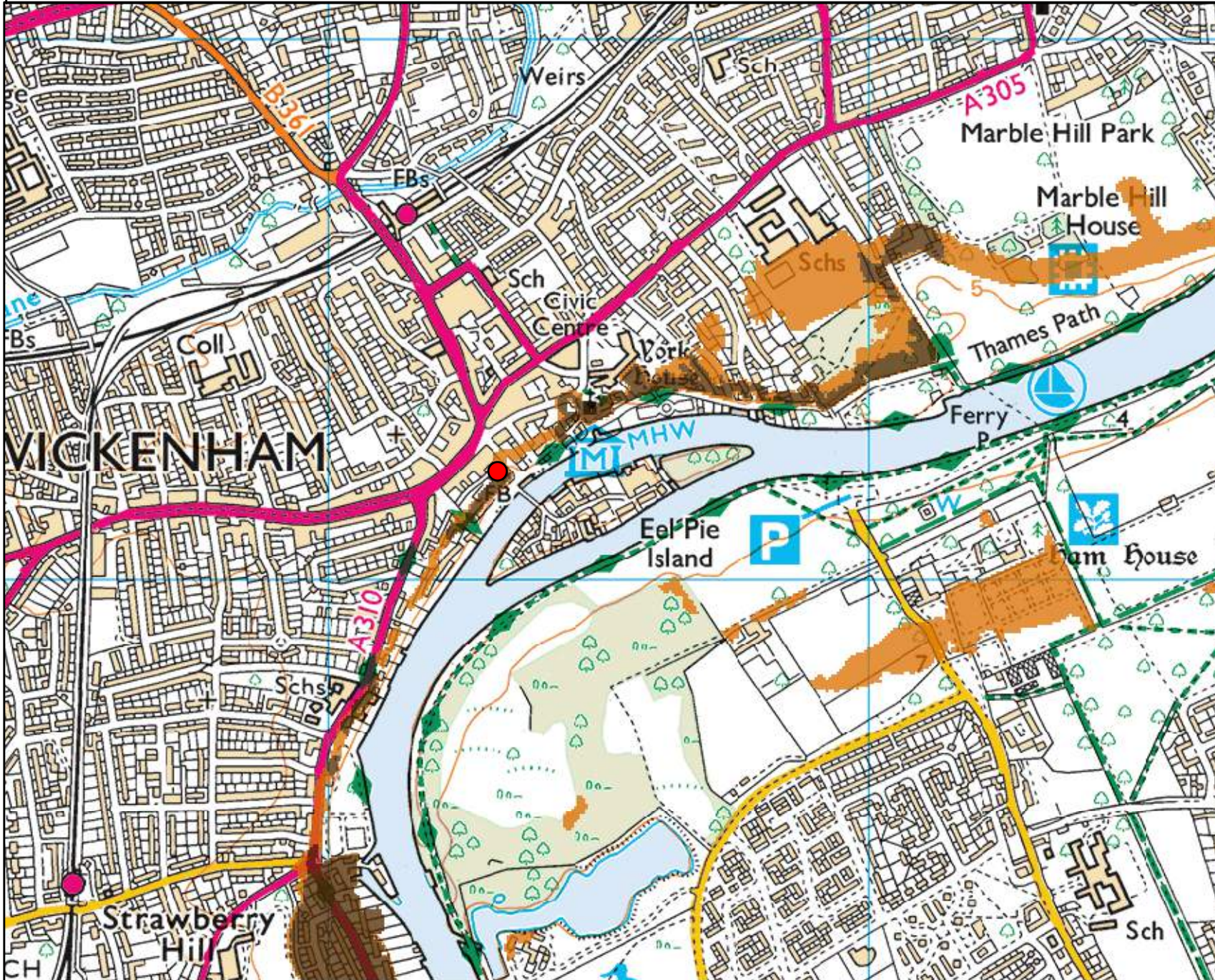
Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 0.1% chance of occurring each year.

Breach Modelling Map for: Twickenham Riverside, London, TW1 3SD - 19/09/2017 - HNL59854DL



Legend

- Site Location
- Upriver Breach Inundation Outlines**
- Epoch**
- 2014 (Current year)
- 2100

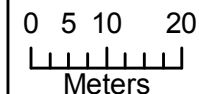


Thames Tidal Upriver Breach Inundation Modelling 2017

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.

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Modelled Flood Levels For: Twickenham Riverside, London, TW1 3SD - 19/09/2017 - HNL59854DL



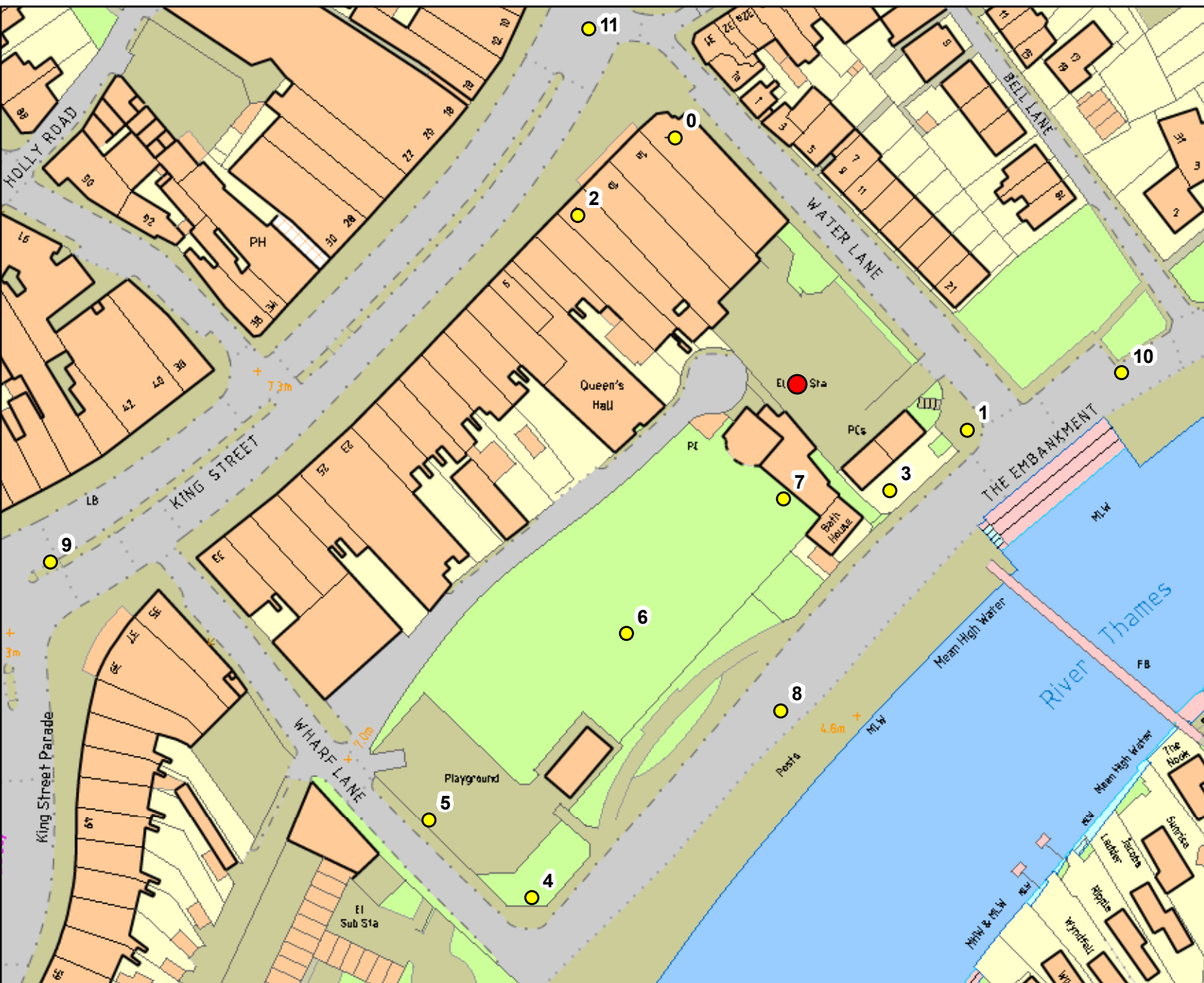
Legend

Site Location

- Site Location
- Points

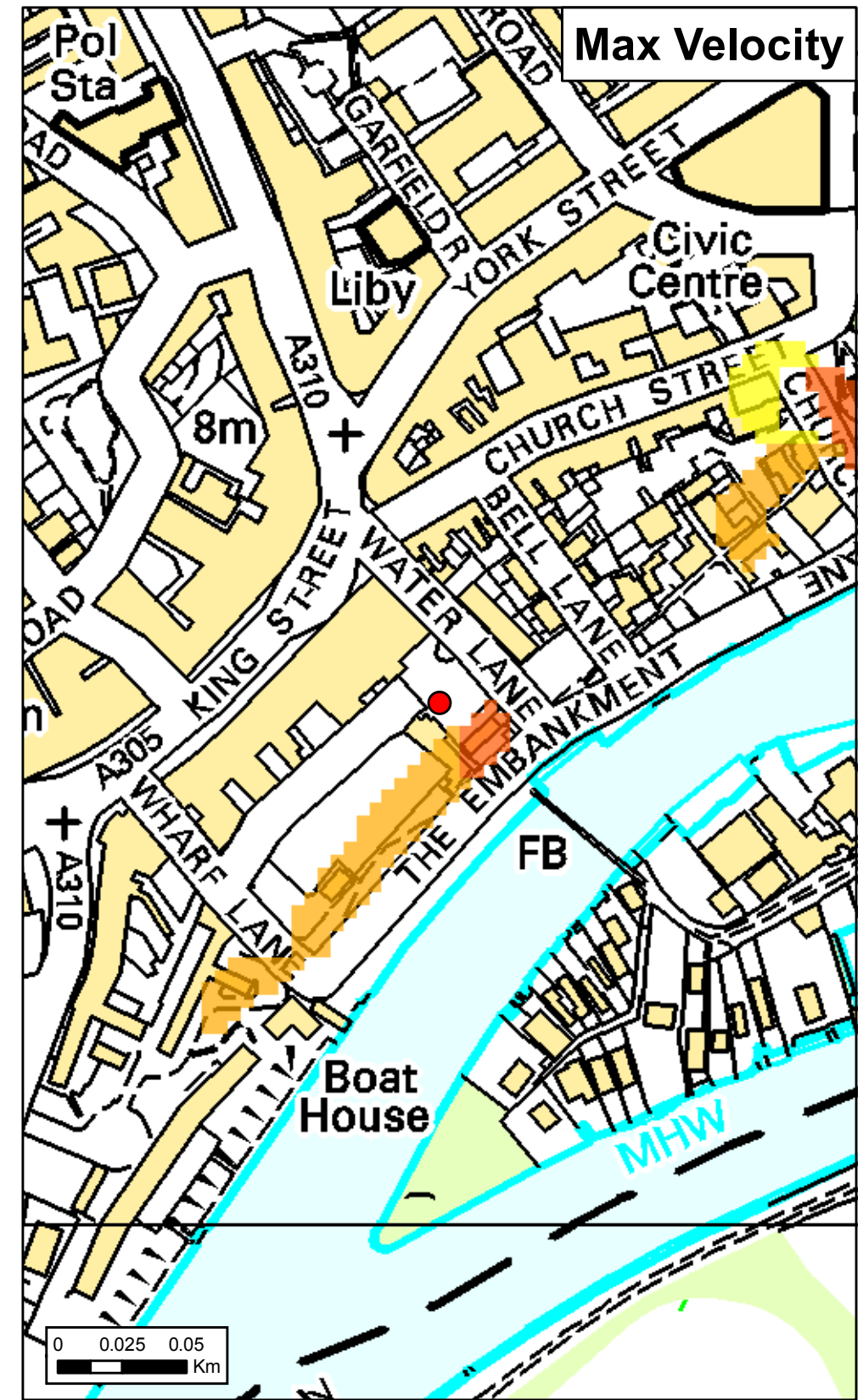
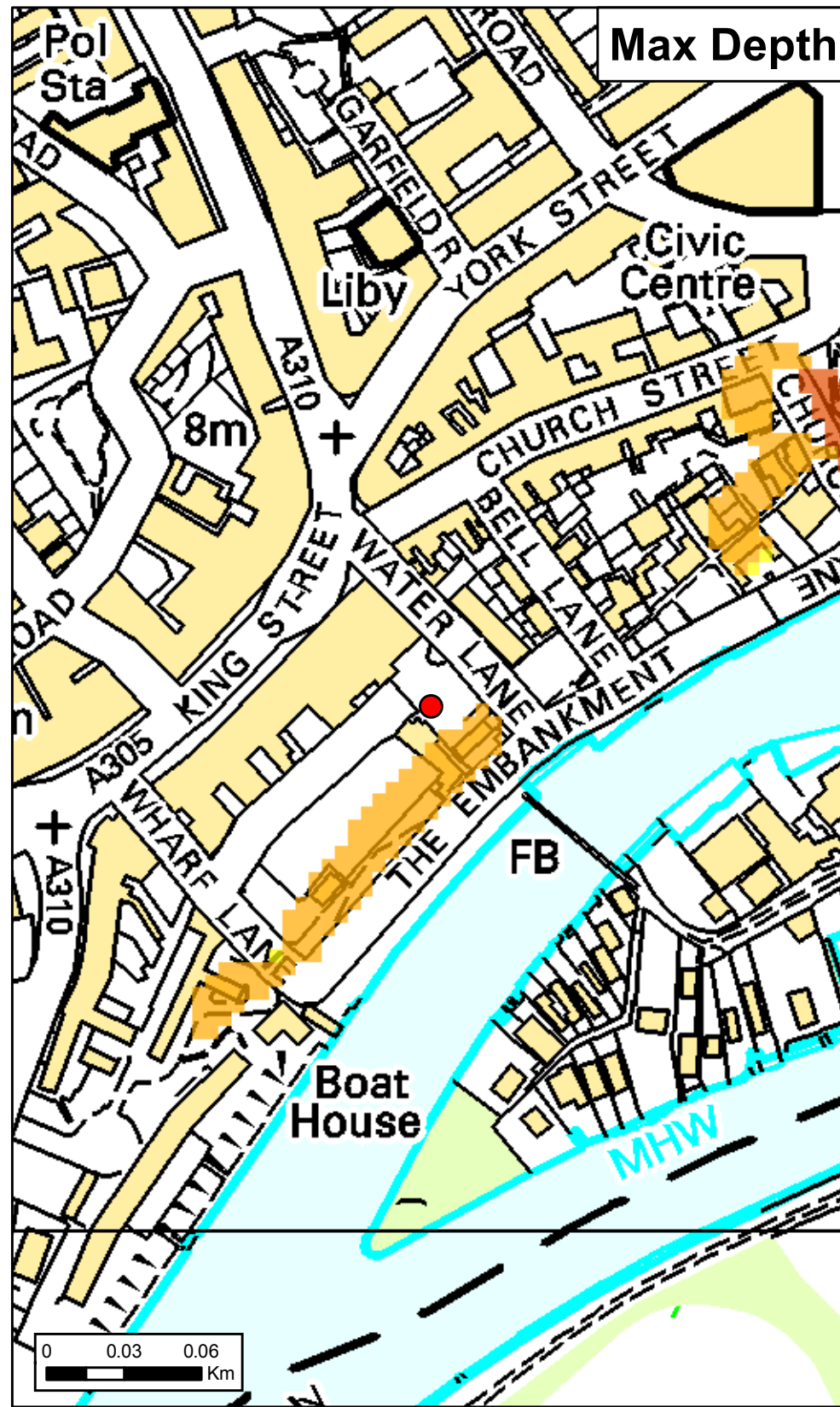
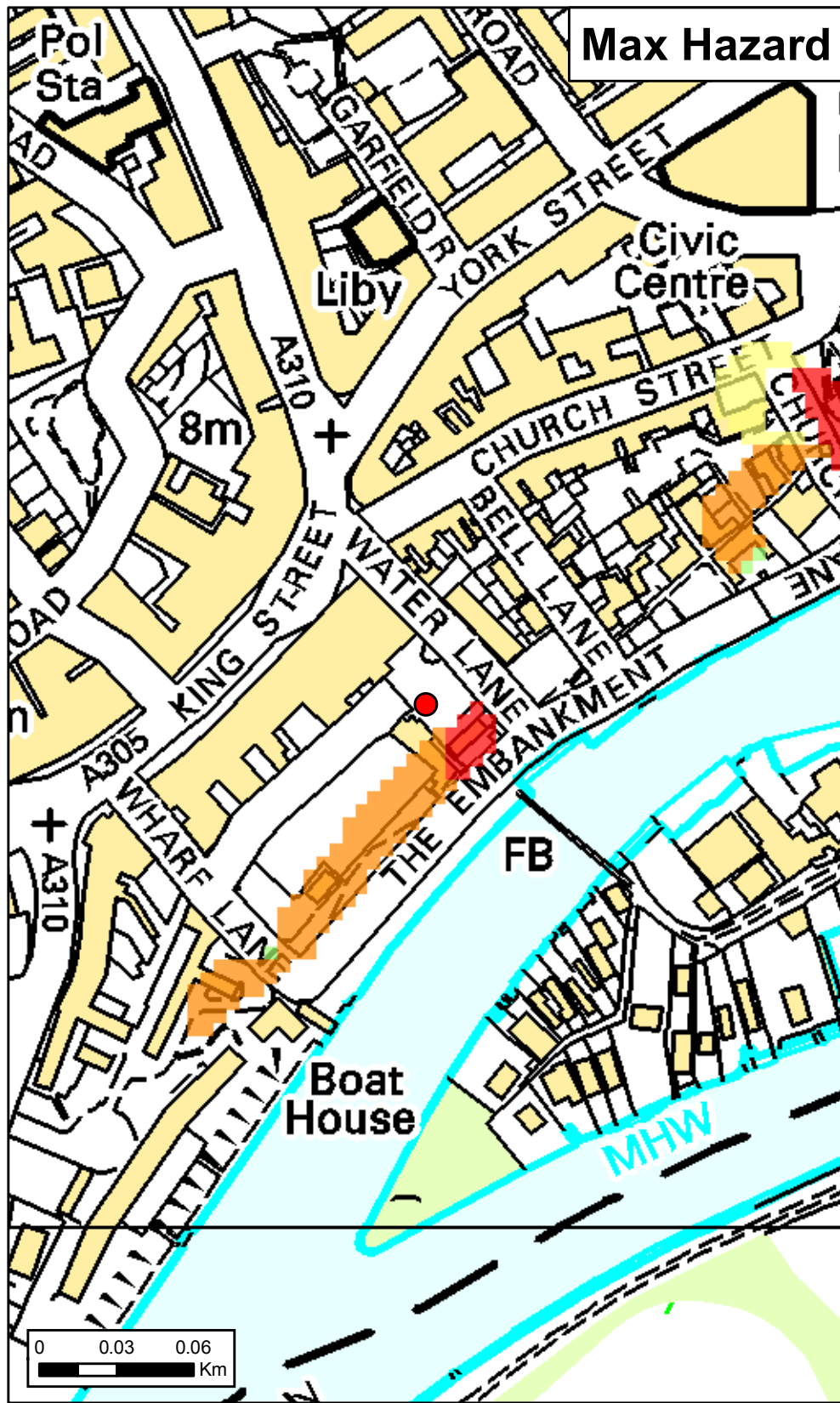
Thames Tidal Upriver Breach Inundation Modelling 2017

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.



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Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk



● Site Location		■ Modelled Breach Location	
Max Hazard		Max Depth (m)	
	Less than 0.75 (Low Hazard)		0 - 0.25
	Between 0.75 and 1.25 (Danger for Some)		0.25 - 1.00
	Between 1.25 and 2.00 (Danger for Most)		1.00 - 1.50
	Greater than 2.00 (Danger for All)		1.50 - 2.00
			> 2.00
Max Velocity (m/s)			
	0 - 0.3		
	0.3 - 1.0		
	1.0 - 1.5		
	1.5 - 2.5		
	> 2.5		
Date Printed	19/09/2017	Scenario year	2014
		Scenario Annual Chance	0.5% (1 in 200)

This map shows the level of flood hazard to people (called a hazard rating) if our flood defences are breached at certain locations, 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 at specific locations. 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.

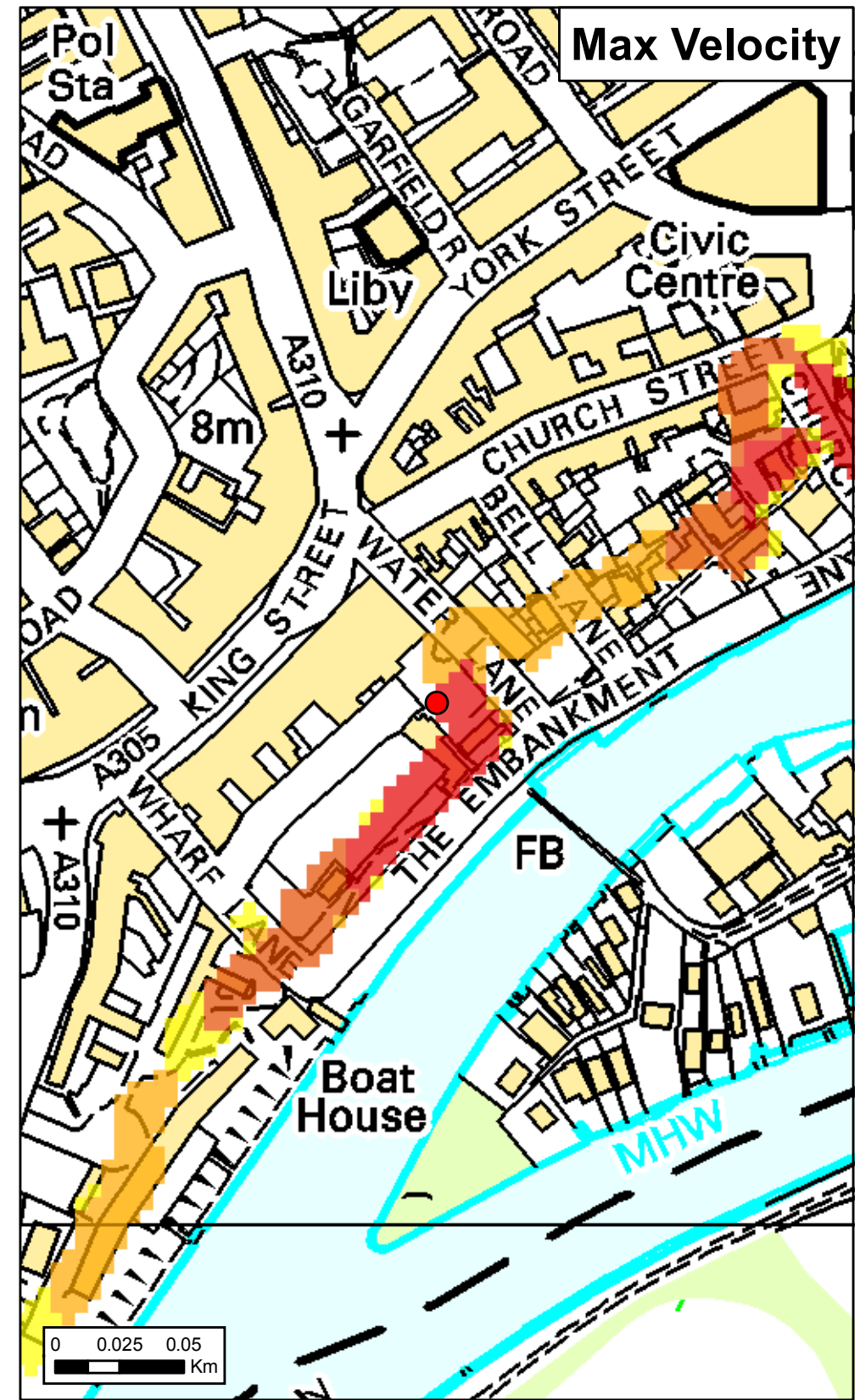
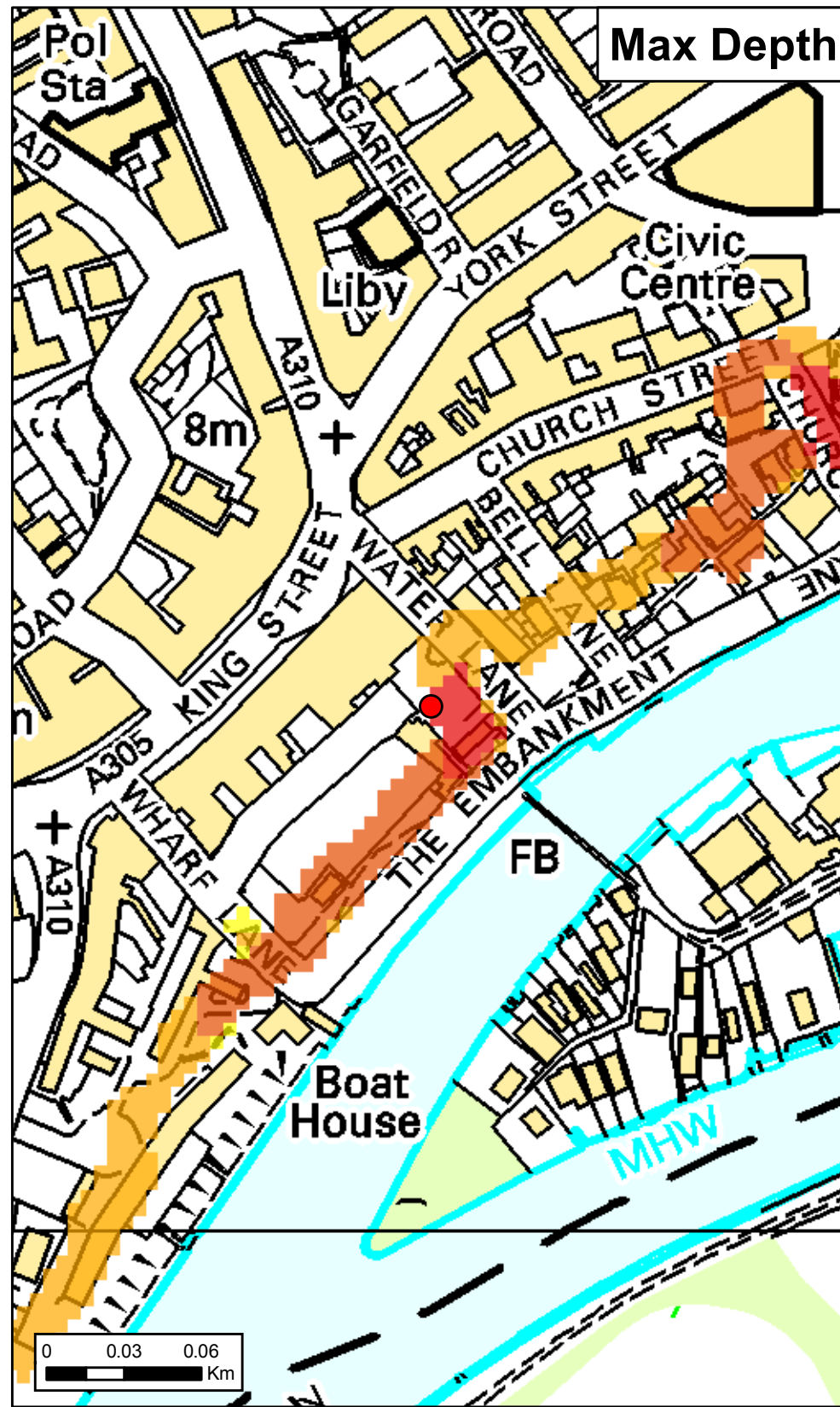
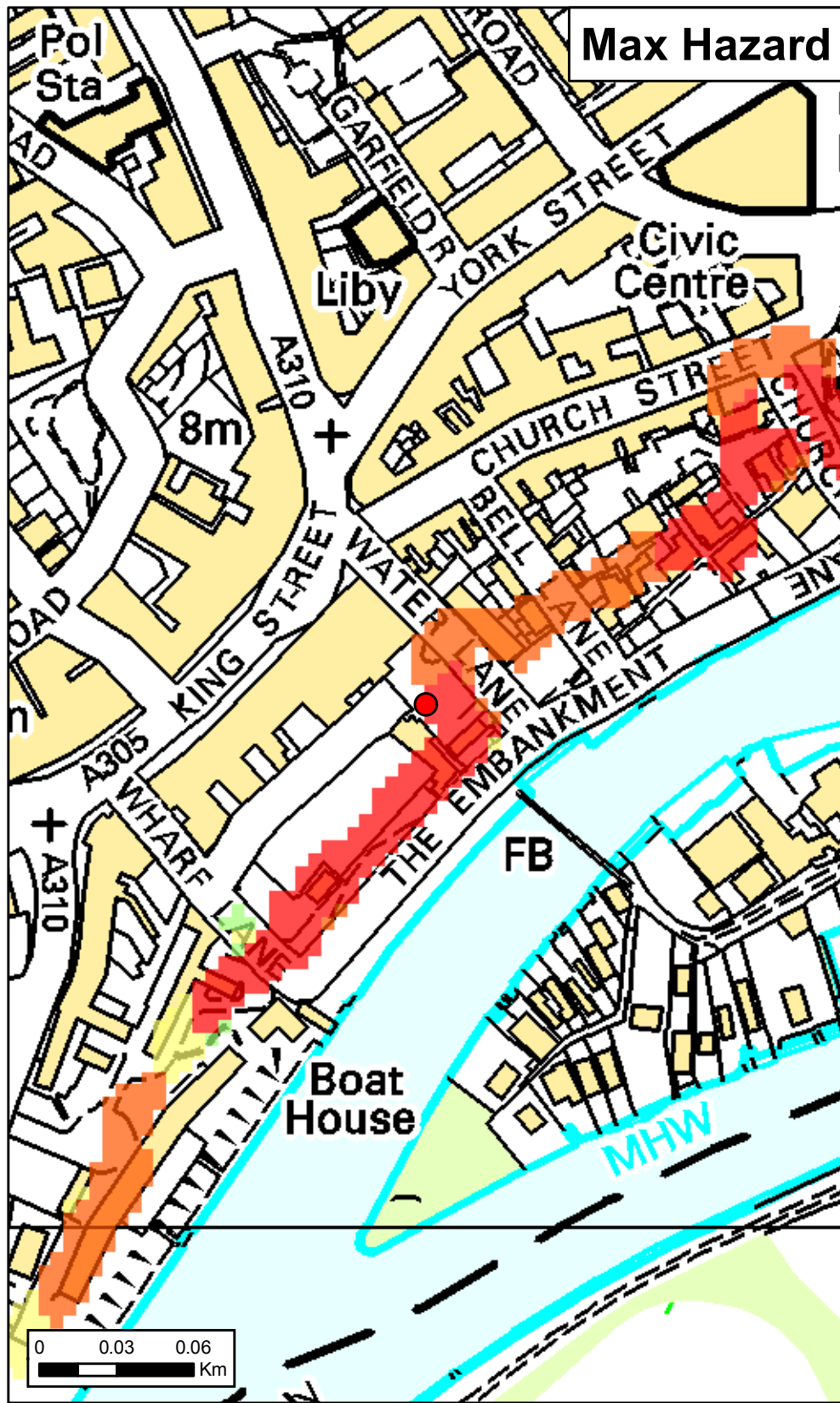
General Enquiries No: 03708 506 506. Weekday Daytime calls cost 5p plus up to 6p per minute from BT Weekend Unlimited. Mobile and other providers' charges may vary



Thames Tidal Breach Hazard Mapping

Map Centred on 516313, 173202

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● Site Location		■ Modelled Breach Location	
Max Hazard		Max Depth (m)	
	Less than 0.75 (Low Hazard)		0 - 0.25
	Between 0.75 and 1.25 (Danger for Some)		0.25 - 1.00
	Between 1.25 and 2.00 (Danger for Most)		1.00 - 1.50
	Greater than 2.00 (Danger for All)		1.50 - 2.00
			> 2.00
Max Velocity (m/s)			0 - 0.3
			0.3 - 1.0
			1.0 - 1.5
			1.5 - 2.5
			> 2.5
Date Printed	19/09/2017	Scenario year	2100
		Scenario Annual Chance	0.5% (1 in 200)

This map shows the level of flood hazard to people (called a hazard rating) if our flood defences are breached at certain locations, 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 at specific locations. 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.

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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 516313, 173202

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Product 4 (Detailed Flood Risk) for Site centred TW1 3DU NGR TQ162731. Our Ref: THM 62704

Product 4 is designed for developers where Flood Risk Standing Advice FRA (Flood Risk Assessment) Guidance Note 3 Applies. This is:

- i) "all applications in Flood Zone 3, other than non-domestic extensions less than 250 sq metres; and all domestic extensions", and
- ii) "all applications with a site area greater than 1 ha" in Flood Zone 2.

Product 4 includes the following information:

Ordnance Survey 1:25k colour raster base mapping;
Flood Zone 2 and Flood Zone 3;
Relevant model node locations and unique identifiers (for cross referencing to the water levels, depths and flows table);
Model extents showing *defended* scenarios;
FRA site boundary (where a suitable GIS layer is supplied);
Flood defence locations (where available/relevant) and unique identifiers; (supplied separately)
Flood Map areas benefiting from defences (where available/relevant);
Flood Map flood storage areas (where available/relevant);
Historic flood events outlines (where available/relevant, not the Historic Flood Map) and unique identifiers;
Statutory (Sealed) Main River (where available within map extents);

A table showing:

- i) Model node X/Y coordinate locations, unique identifiers, and levels and flows for *defended* scenarios.
- ii) Flood defence locations unique identifiers and attributes; (supplied separately)
- iii) Historic flood events outlines unique identifiers and attributes; and
- iv) Local flood history data (where available/relevant).

Please note:

If you will be carrying out computer modelling as part of your Flood Risk Assessment, please request our guidance which sets out the requirements and best practice for computer river modelling.

This information is based on that currently 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 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.

This information is provided subject to the enclosed notice which you should read.

This letter is not a Flood Risk Assessment. The information supplied can be used to form part of your Flood Risk Assessment. Further advice and guidance regarding Flood Risk Assessments can be found on our website at:

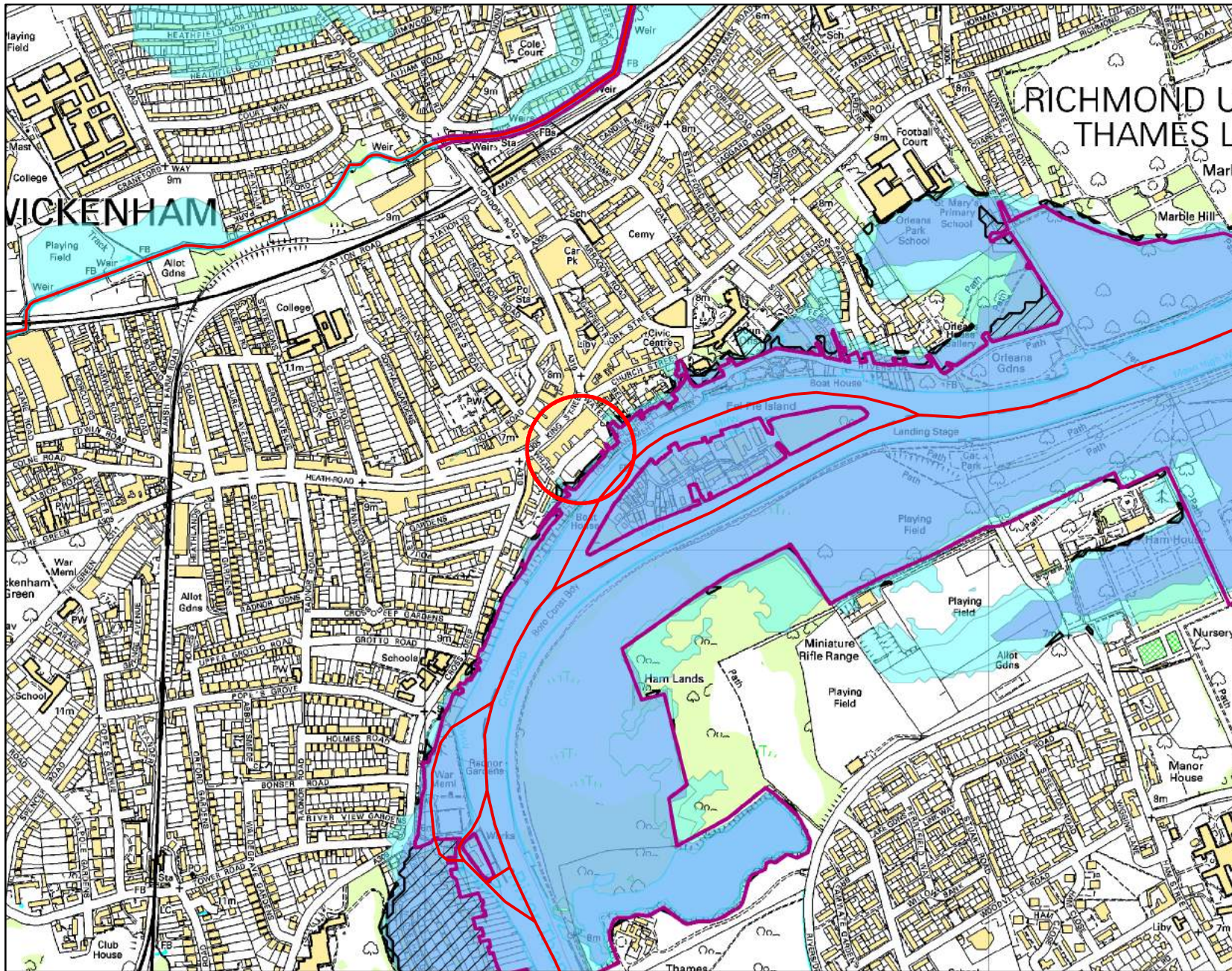
<https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities>

If you would like advice from us regarding your development proposals you can complete our pre application enquiry form which can be found at:

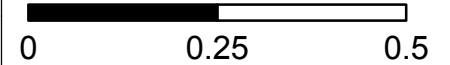
<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Flood Map For Planning centred on TW1 3DU NGR TQ162731

Created on 10/10/2017 REF:THM 62704



Kilometres



Legend

- Main River
- Flood defences
- ▨ Areas benefiting from flood defences
- Flooding from rivers or sea (FZ3)
- Extent of extreme flood (FZ2)
- ▤ Flood Map - flood storage areas

Flooding from rivers or sea without defences (Flood Zone 3) shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

The Extent of an extreme flood (Flood Zone 2) shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Model information

THM 62704

Model: Thames (Lower) Reach 4 2010

Description: Lower Thames Reach 4 (Sunbury Court Island to Teddington):

The information provided is taken from the Lower Thames Reach 4 2D Modelling Study which was completed in December 2010. It was modelled using a linked ISIS- TUFLOW model.

The model accuracy has generally been maintained to be within $\pm 200\text{mm}$ of the gauged data at the head and tail water levels at the main locks on the River Thames for the calibration event.

Model design runs:

1 in 5 / 20% Annual Exceedance Probability (AEP); 1 in 20 / 5% AEP; 1 in 50 / 2% AEP; 1 in 100 / 1% AEP; 1 in 1000 / 0.1% AEP and 1 in 100+20% / 1% AEP plus 20% increase in flows

Mapped outputs:

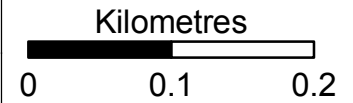
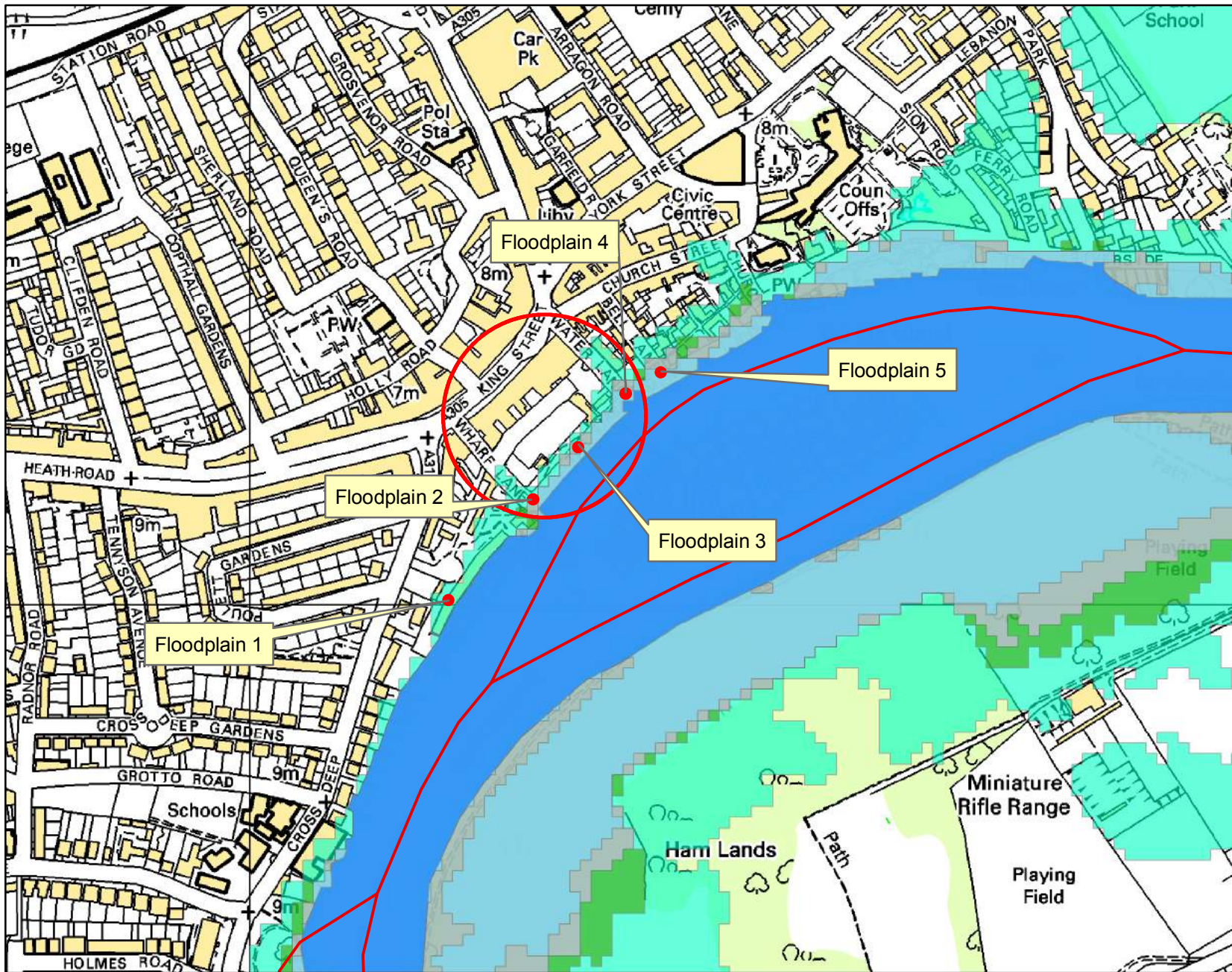
1 in 5 / 20% AEP; 1 in 20 / 5% AEP; 1 in 50 / 2% AEP; 1 in 100 / 1% AEP; 1 in 1000 / 0.1% AEP

Model accuracy:

Levels $\pm 200\text{mm}$

Detailed FRA Map centred on TW1 3DU NGR TQ162731

Created on 10/10/2017 REF:THM 62704



Legend

- Main River
- 20% AEP flood extent
- 5% AEP flood extent
- 2% AEP flood extent
- 1% AEP flood extent
- 0.1% AEP flood extent

AEP = Annual Exceedance Probability
The probability of a flood of a particular magnitude, or greater, occurring in any given year

Modelled floodplain flood levels

THM 62704

The modelled flood levels for the closest most appropriate model grid cells for your site are provided below:

2D grid cell reference	Model	Easting	Northing	flood levels (mAOD)					
				20% AEP	5% AEP	2%AEP	1% AEP	1% AEP (+20% increase in flows)	0.1% AEP
Floodplain 1	Thames (Lower) Reach 4 2010	516,186	173,006	No Data	No Data	No Data	No Data	6.14	6.9233
Floodplain 2	Thames (Lower) Reach 4 2010	516,265	173,099	No Data	No Data	5.36	5.69	6.12	6.9058
Floodplain 3	Thames (Lower) Reach 4 2010	516,308	173,147	No Data	No Data	5.35	5.68	6.11	6.897
Floodplain 4	Thames (Lower) Reach 4 2010	516,354	173,196	No Data	4.88	5.34	5.67	6.11	6.8889
Floodplain 5	Thames (Lower) Reach 4 2010	516,386	173,216	No Data	4.88	5.34	5.67	6.10	6.8851

This flood model has represented the floodplain as a grid.
The flood water levels have been calculated for each grid cell.

Note:

Due to changes in guidance on the allowances for climate change, the 20% increase in river flows should no longer to be used for development design purposes. The data included in this Product can be used for interpolation of levels as part of an intermediate level assessment.

For further advice on the new allowances please visit

<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

Historic flood data

THM 62704

Please see any data supplied by Herts and North London Area Team.

Flood Event Code	Flood Event Name	Start Date	End Date	Source of Flooding	Cause of Flooding

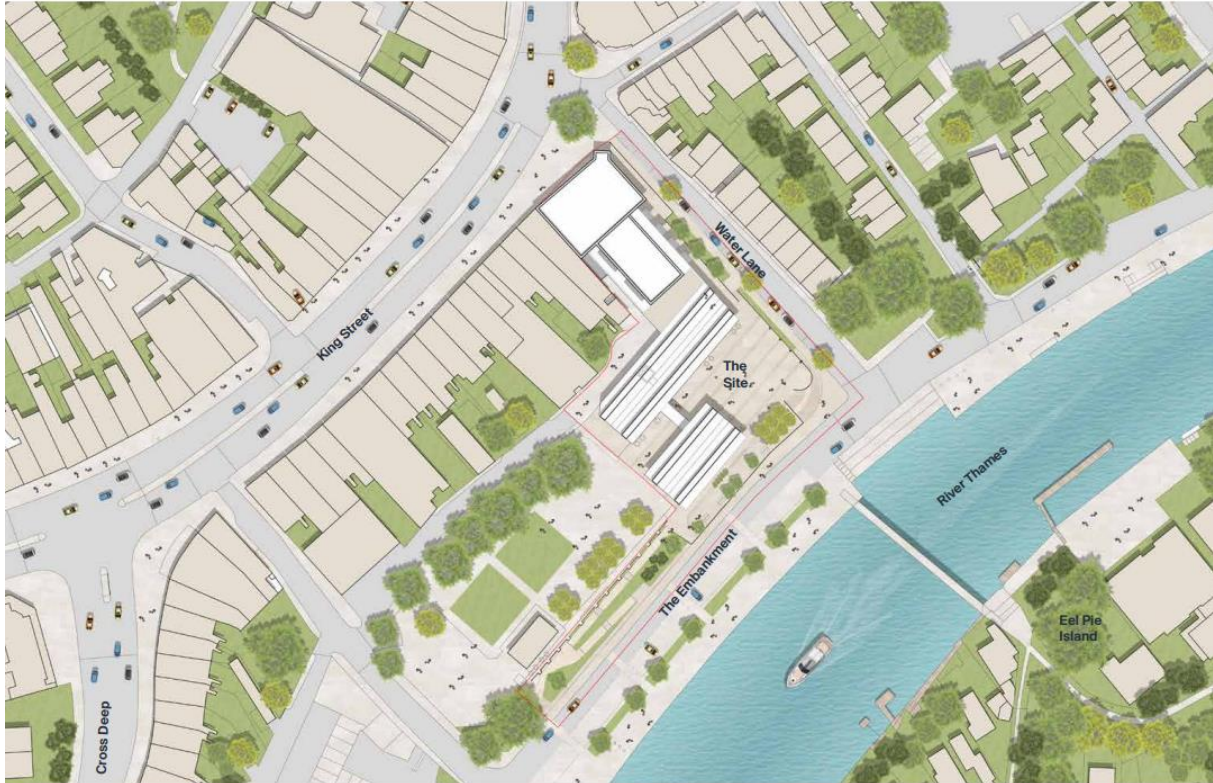
Please note the Environment Agency maps flooding to land not individual properties. Floodplain extents are an indication of the geographical extent of a historic flood. They do not provide information regarding levels of individual properties, nor do they imply that a property has flooded internally.

Start and End Dates shown above may represent a wider range where the exact dates are not available.

Appendix D - Flood Management Plan

Twickenham Rediscovered – Riverside Project

Flood Emergency Plan



Prepared by: **Sabrina Ram MEng**

Reviewed by: **Dimitris Linardatos BEng MSc CEng MICE FIHE**

Job Number: **25159**

Date	Version	Notes/Amendments/Issue Purpose
November 2017	1	Issued for planning

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1 Introduction

Price & Myers have been commissioned to produce a Flood Emergency Plan for the proposed Twickenham Rediscovered – Riverside Project in the London Borough of Richmond upon Thames. This plan should be read in conjunction with the site-specific Flood Risk Assessment (FRA).

This plan has been carried out in accordance with the planning advice note 'Guidance on Producing a Flood Emergency Plan' (London Borough of Richmond Upon Thames, 2011), Environment Agency guidance and the National Planning Policy Framework (NPPF).

In line with the NPPF, Flood Warning and Evacuation Plans should be in place for those areas at an identified risk of flooding. Developers should ensure that appropriate evacuation and flood response procedures are in place to manage the residual risk associated with an extreme flood event, and include how such plans will be implemented.

In line with the London Borough of Richmond Strategic Flood Risk Assessment (SFRA), it is recommended that all major development proposals submit a Flood Warning and Evacuation Plan. It should be noted that whilst the EA continues to object on applications where a safe access and egress cannot be achieved, the decision of what is or is not an appropriate flood emergency plan and whether access and egress arrangements are acceptable now rests with the Local Planning Authorities.

2 Scope, Objectives and Background

The FRA submitted with this planning application concludes that the lower ground car park and seasonal units are at risk of fluvial and tidal flooding. A raised table will protect the car park to a level of 5.035m AOD (the 1 in 50 year fluvial flood level) and an automatic flood barrier will provide further protection to a level of 5.635m AOD, however, the lower ground car park is designed to flood in extreme rainfall events.

The seasonal units are at risk of flooding in fluvial events with a return period greater than the 1 in 20 year. It should be noted that only 'water compatible' uses will be used within these areas and these areas are also designed to flood to extreme rainfall events.

The ground floor is above the design fluvial and tidal flood levels. Therefore, in an event of a flood, site users will be safe. In an emergency they will be able to exit the site at the junction of King Street and Water Lane. The route from the ground floor to the Junction of Water Lane and King Street is a 'dry' route.

For information on flood resilience and mitigation measures that are proposed for the development, please refer to the FRA. These measures, along with this plan, will ensure that procedures are in place for occupants/users to retreat to a safe place of refuge via a safe route should a flood event occur.

The aims of this Flood Emergency Plan are to reduce the risk to life, mitigate damage, and enable a safe and well organised evacuation of occupants of premises during a flood event. More specifically, it aims to:

- Raise awareness of the risk of flooding in the location specified
- Detail the flood warnings and estimated lead time available
- Detail how the Plan is triggered, by who and when
- Define any areas of responsibility for those participating in the Plan
- Describe what actions are required by the people in the development

- Establish a safe route to a safe location
- Outline the evacuation procedure and place of refuge to safely evacuate the occupants of a premises
- Establish procedures for implementing the Plan

The SFRA shows recorded flood incidents in close proximity to the site. There has been 1 river flood incident and 1 surface water flood incident in close proximity to the site. The SFRA also shows that there have been no recorded sewer flooding incidents in close proximity to the site.

The advice and guidance within this plan is solely for the Twickenham Rediscovered development which will be responsible to maintain the site. The development will be maintained by the local authority and the development comprises of residential units, commercial and retail space. Residential community groups, people renting the commercial space and retail space are advised to produce a Flood Emergency plan for their portion of the development. However, this falls outside of the scope of this plan. When this plan refers to 'the development', this refers to the entire Twickenham Rediscovered – Riverside Project.

3 Location and Proposal

Details of the site location can be found in the FRA, Section 2, Figure 2.2 and this shows a red line boundary of the site. The advice and guidance within this plan is solely for the area within the red line boundary.

The EA's indicative floodplain map shows that part of the site is located in Flood Zone 3a and 3b. Therefore, the site is at risk of flooding from the River Thames. The FRA concludes that the site is not at risk from groundwater, surface water and overland flows.

All entrances to the development are raised above the functional floodplain level (Flood Zone 3a). The seasonal units are classified as 'water compatible' under the NPPF. In the event that the seasonal units flood (greater than a 1 in 20 year event), flood water will be contained within the units. The units will be designed to withstand forces associated with ingress of flood water and will not contain services (electricity, mains water, etc). Building users will not be able to access the seasonal units if the EA has issued a 'Flood Alert'. Flood alerts are issued 2 hours prior to a flood event and therefore there is sufficient time for building users to escape to the ground floor level. Figure 1 shows the routes for building users to escape, prior to a storm event. From the ground floor level, building users can head north along Water Lane to King Street. King Street is situated in Flood Zone 1.

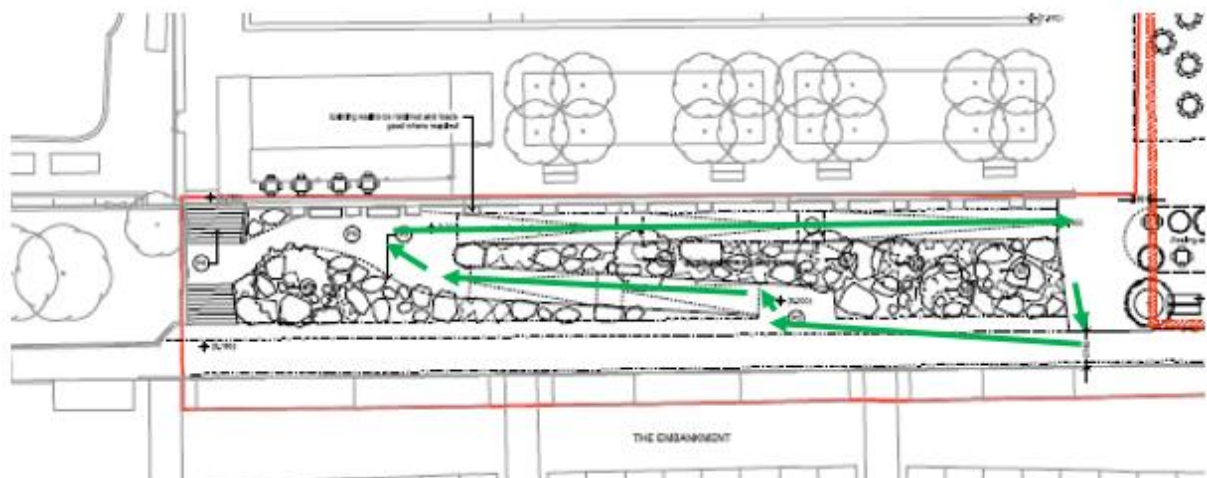


Figure 1 Seasonal Units Escape routes to the ground floor, prior to flood

Figure 2 shows the route from the ground floor to Flood Zone 1.

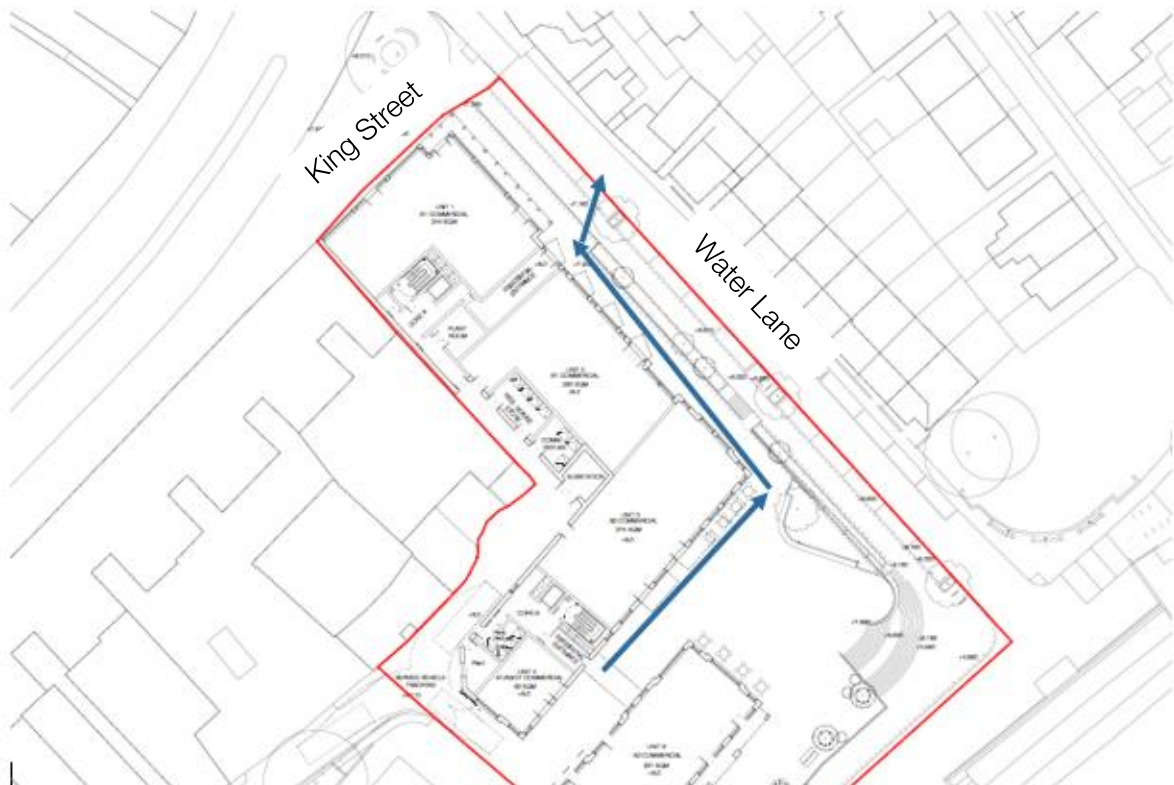


Figure 2 Route from the ground floor to the Junction of Water Lane and Kind Street

The lower ground car park is classified as 'Less Vulnerable' under the NPPF and the car park is protected up to the 1 in 50 year fluvial flood event. Car park users will not be able to access the car park when the EA issues a 'Flood Alert'. These warnings are issued 2 hours prior to a storm event. Car park users will be able to escape using the stairs at the back of the car park, prior to a storm event. Figure 3 shows the escape route for car park users to the ground floor. They will then be able to use the dry route in Figure 2 to Flood Zone 1.



Figure 3 Route from the car park to the ground floor level, prior to flood event

Commercial and retail units on the ground floor are classified as 'Less Vulnerable' under the NPPF. These building uses are above the design flood levels. Therefore, in the event that the lower level floods, they will be safe on the ground floor. They will be able to escape using the route shown in Figure 2 (if necessary).

Residential development is classified as 'More vulnerable' under the NPPF and these building uses are confined to the first floor and above. Therefore, building users in these areas will also be safe in a flood event. They can escape to the ground floor podium and exit the site via Water Lane, where the levels are higher (if necessary).

All plant is above the design flood levels and there is no key infrastructure at the lower ground level. Therefore, all key infrastructure will be operational in an event of a flood. All manhole and service covers below the flood level will be bolted down, to ensure these are not lifted in a flood event.

All building users (owners of residential units and staff serving the retail and commercial areas) will be provided with information packs, explaining what areas of the site are at risk of flooding, in an easy and understandable format. This will include information on the expected frequency and duration of flood events.

Emergency vehicles will be able to access the site from King Street during a flood event. King Street is in Flood Zone 1 and will therefore remain dry in a flood event.

4 Risk Assessment Summary

The FRA concluded that the lower ground level of the development is at risk of flooding from the River Thames and is at low risk of flooding from all other sources. Figure 4 below shows the Environment Agency flood maps. For further information on flood risk, refer to the FRA.

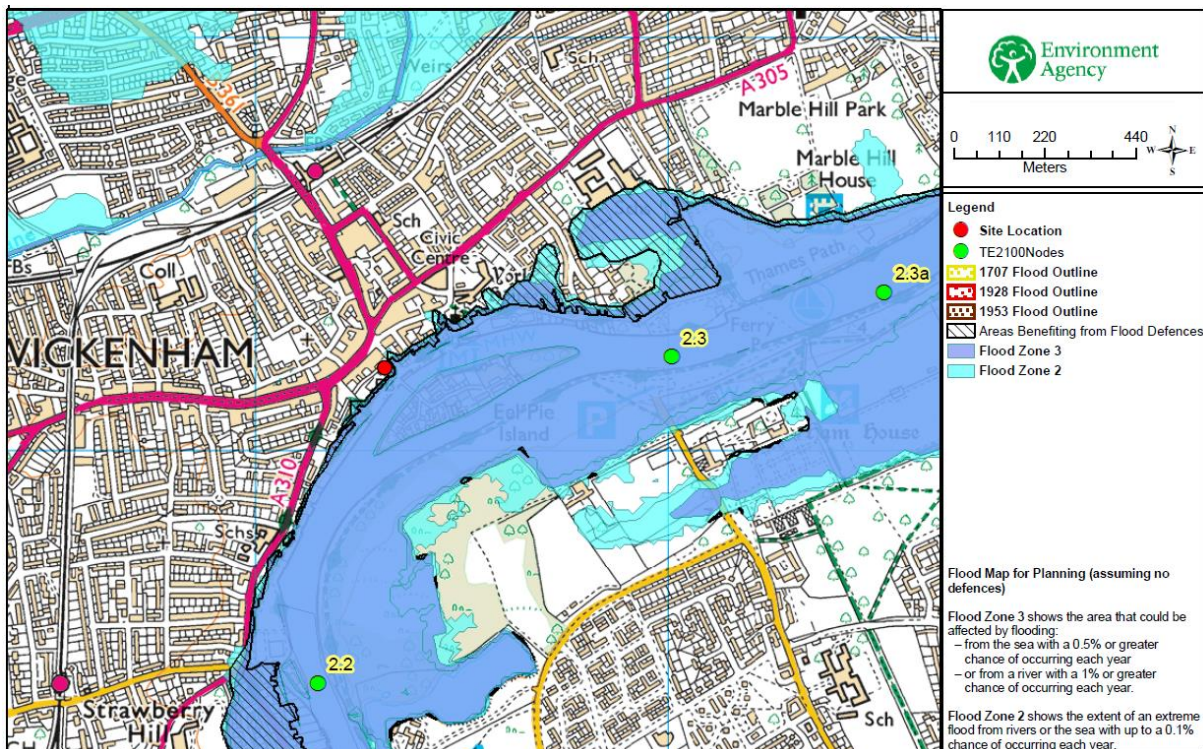


Figure 4. Flood Map for planning (Environment Agency, 2017)

At ground floor level and above, the flood hazard (risk to life) is very low, as levels are above the design flood levels. At lower ground level, the flood hazard is a function of the flood depth and

flood water velocity. It should be noted that all building users will not be able to use the lower ground floor when the EA issues a Flood Alert. Therefore, building users will have 2 hours to evacuate the short distance to the ground floor, above the flood level. From here, they can use the dry route to the junction of Water Lane and King Street.

5 Assessment of potential mitigation options

A variety of mitigation measures are proposed to protect the lower ground floor from flooding. This includes:

- A 600mm automatic flood barrier at the entrance to the car park, protecting the car park to the level of 5.635m AOD.
- No ventilation grills below the design flood levels to serve the car park
- No key infrastructure or small power provision on the lower ground level
- As the seasonal units are designed to flood, only 'Water Compatible' building uses are permitted in this area. The car park is also anticipated to flood over the lifetime of the development and therefore only 'Less Vulnerable' building uses are permitted in this area.
- Surface water will be attenuated to 2.8l/s, for the 1 in 100 plus 40% climate change event. This will reduce flood risk from overland flows.

The ground floor is raised above extreme flood levels. Therefore, no mitigation measures are provided on the ground floor and above. However, building users of the ground floors and above will receive flood warnings and flood alerts, to ensure they do not access the lower ground level when a flood is anticipated.

6 Flood Warnings

The development must be registered to the Environment Agency's Flood Warning Scheme in order to receive flood alerts. Section 363 of the SFRA states "Coordination with the emergency services and the Environment Agency is imperative to ensure the safety of residents in time of flood. Areas within the Borough that are adjoining the River Thames, and are at risk of river and/or tidal flooding, are often susceptible to widespread weather phenomenon, and considerable forewarning will generally be provided to encourage preparation in an effort to minimise property damage and risk to life. This highlights the importance of awareness raising with respect to the potential risk (and impacts) of flooding within the Borough".

All building users must register with Floodline to receive updates:

Tel: 0845 988 1188

Website: <https://www.gov.uk/sign-up-for-flood-warnings>

Flood Information packs will be provided to all residents, tenants and employees on site and this will detail how to sign up to this.

There will be notice boards across the development giving site specific and up to date flood information. It will be the responsibility of designated Flood Wardens to maintain these boards. There must be an adequate amount of flood wardens to implement the flood warning and response plan.

Once a 'Flood Alert' or 'Flood Warning' has been reported, the following actions will be undertaken. The Environment Agency is responsible for issuing severe flood warnings, but a warning by phone or in person may be received from the police.



Designated flood wardens to make clear to all staff who is responsible for what, who gives authority for carrying out agreed actions, how to keep in touch, the importance of reporting back and of following agreed safety procedures. The guiding principle is that no action is to be carried out that place at risk any individual's safety. Building users will not be permitted to access the lower ground level and the Flood Wardens will implement this. Monitors will be installed in communal areas, providing updates on flood alerts and warnings.

Alarms will sound to ensure that all building users are aware that a 'Flood Warning' has been issued. This will give information on the level and severity of the flood warning (see table 1 below). It will state that no users are permitted to use the lower ground level. The closure/evacuation of the lower ground floor will be overseen by one of the Flood Wardens.

Listen to local and watch other media to assess the developing situation. BBC RADIO LONDON 94.9 FM.

The Emergency Flood Box will be checked for contents (see appendix 2 for box contents).

The Environment Agency operates a coded warning system and this is shown below. This is a four stage warning system and each stage will trigger a set of procedures for various organisations. All Flood Wardens should be fully aware of this coded system and the actions

Flood Alert: Flooding is possible. Be prepared	
 <p>Is used from two hours to two days in advance of flooding.</p>	<p>Following Actions:</p> <ul style="list-style-type: none"> • Watch water levels • Monitor local news and weather forecasts on radio, TV or internet • Ring Floodline on 0845 988 1188 • Make sure you have what you need to put your flood plan into action • Check flood kit is fully equipped • Alert your neighbours, particularly the elderly and less able • Reconsider travel plans • Ensure all residents are accounted for
Flood Warning: Flooding is expected. Immediate action is required	
 <p>Is used from half an hour to one day in advance of flooding.</p>	<p>Following Actions:</p> <p>As with Flood Alert plus;</p> <ul style="list-style-type: none"> • Move valuables and other items to safety • Prepare flood kit • Prepare to turn off gas, electricity and other services • Be prepared for evacuation • Protect yourself and others that need your help


Severe Flood Warning: Severe flooding. Danger to life	
 <p>Is used when flooding poses a significant threat to life.</p>	<p>Following Actions: As with Flood Warning plus;</p> <ul style="list-style-type: none"> • Stay in a safe place • Turn off gas, electricity and water supplies if safe to do so • Try to keep calm, and to reassure others, especially children • Co-operate with emergency services and local authorities • Prepare for evacuation • Call 999 if you are in immediate danger
Warnings No Longer In Force: No further flooding is currently expected in your area	
<p>Is used when river or sea conditions begin to return to normal</p>	<p>Following Actions:</p> <ul style="list-style-type: none"> • Keep listening to weather reports. Be careful. Flood water may still be around for several days • Only return to evacuated buildings if you are told it is safe by emergency services

Table 1 Environment Agency Flood Warning System

The London Borough of Richmond Guidance states that developments affected by fluvial flooding, the response time for the Fluvial Thames within this borough is 18+ hours; the EA will endeavour to give at least a 2 hour lead-time, however, in all cases this may not be possible.

For tidal flooding, flood warnings will be issued by the EA no later than 2 hours before the tide reaches this area; however, it is expected that warnings will generally be issued about 6 hours in advance of high tide. The likely flood events in this flood warning area are going to be due to overtopping of defences or a breach in the defence line.

7 After the flood

All building users are not permitted to enter the lower ground level until notified that it is safe to do so from the Flood Wardens.

The Flood Wardens will co-ordinate with the emergency services the clean-up process after the flood event. Sump pumps will be required to de-water the lower ground car park.

All contact with flood water should be avoided as this can often be contaminated with sewerage, oil and other pollutants.

8 Dangers of flood water

The following information will be included on flood notice boards, throughout the development.

REMEMBER!

Don't walk through flowing water – Currents can be deceptive, and shallow, fast moving water can knock you off your feet!

Don't swim through fast flowing water – You may get swept away or struck by an object in the water!

If you have to walk in standing water, use a pole or stick to ensure that you do not step into deep water, open manholes or ditches!

Don't drive through a flooded area – You may not be able to see abrupt drop-offs and only half a metre of flood water can carry a car away!

Avoid contact with flood water – It may be contaminated with sewage, oil, chemicals or other substances!

9 Plan Usage and Dissemination

This plan should be a live document and may need to be updated in the future as a result of local policies and strategies being changed. This Flood Plan should be amended as necessary with a log kept of any changes and reasons for change.

This Plan must be periodically reviewed, as this will help to maintain awareness of the risks and the appropriate responses to be taken by site responsible wardens. The plan must be reviewed, at least every 3 years or when information changes that requires it to be amended. A refresher of awareness training is also required annually.

This plan will be used as a template for businesses within the site to develop further their own plans.

Flood packs will be given to all residents and building users of the commercial and retail space, to ensure that they are aware of this flood plan.

Appendix 1 – List of key contacts

Floodline	0345 988 1188	Local Transport (taxi)	
London Borough of Richmond upon Thames Emergency Planning	08456 122 660	Local Transport (tfl)	
Electricity Provider		Insurance company	
Water provider			
Gas provider			
Phone provider			

Appendix 2 – Emergency Flood Box Contents

1. Encapsulated procedure checklist for Flood Warden with pen
2. Dynamo radio and torch
3. A first-aid kit, including a supply of any essential medication
4. Red and white hazard tape
5. A list of useful telephone numbers
6. An up to date copy of flood warning information (EA)

Procedure list is to assist the lead Flood Warden in delivery of the response plan:

Priority	Action	Complete ✓
1	<ul style="list-style-type: none"> • Appoint lead Flood Warden • Brief staff • Summarise risk assessment and sign (appendix 3) 	
2	<ul style="list-style-type: none"> • Inform senior staff about the flood warning 	
3	<ul style="list-style-type: none"> • Continue to monitor situation by listening to dynamo radio 	
4	<ul style="list-style-type: none"> • Evacuate children and visitors. 	
5	<ul style="list-style-type: none"> • Contact emergency services. 	
<p>DO NOT ENTER THE LOWER GROUND UNTIL INSTRUCTED THAT IT IS SAFE BY THE EMERGENCY SERVICES</p>		

RESERVE FLOOD WARNING AND EVACUATION PROCEDURE

When flooding is **IMMINENT** a warning should be received from the Environment Agency or the Police by phone or in person

IF A FLOOD WARNING IS ANNOUNCED:

Inform a DESIGNATED FLOOD WARDEN IMMEDIATELY (provide details on the table below)

If there is no flood warden on site contact one by mobile or home phone

IF YOU ARE UNABLE TO CONTACT ANY FLOOD WARDEN:

Contact the Environment Agency Flooding or the emergency services.

Name:	Home:	Mobile:	Flood Warden: