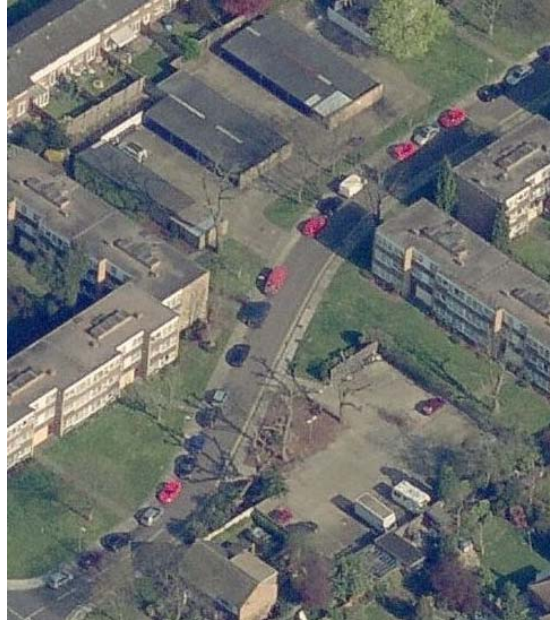




civils ltd - consulting engineers



FLOOD RISK ASSESSMENT

2 Sites on Bucklands Road
Teddington TW11 9QR

CLIENT

Richmond Housing Partnership
8 Waldergrave Road
Teddington
TW11 8GT

Ref: 5228/2.3F
Date: March 2014

CONSULTING ENGINEERS

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- 1.0 Introduction
- 2.0 Existing Site & Current Flood Conditions
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SCHEDULE OF APPENDICES

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- B Environment Agency Flood Data
- C Topographic Survey & Architect's Scheme Drawings
- D SFRA Maps
- E Micro Drainage Calculations
- F Flood Volume Displacement Calculation
- G Flood Warning & Evacuation Plan

Issue	Date	Compiled	Checked
Preliminary Issue	07 March 2014	CJ	JP
First Issue	12 March 2014	CJ	JP
Second Issue	07 July 2015	JP	
Third Issue	18 Nov. 2015	JP	

Report by: **Catherine Jenkins BEng, MSc**
Checked by: **John Pakenham BSc (Hons)**

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1.0 INTRODUCTION

- 1.1 This report has been prepared for Richmond Housing Partnership in relation to two sites on Bucklands Road, Teddington TW11 9QR and no responsibility is accepted to any third party for all or part of this study in connection with this or any other development.
- 1.2 GTA Civils Ltd was appointed by the client to provide a Flood Risk Assessment (FRA) to accompany the planning application as requested by the Environment Agency and London Borough of Richmond upon Thames in order to achieve Planning Approval at said property.
- 1.3 This report will take the form of a formal Flood Risk Assessment in accordance with the 2012 National Planning Policy Framework (NPPF) and the associated Technical Guidance document, this being the current definitive central government flood risk policy.
- 1.4 The third issue of this report includes the addressing of the following items raised in a letter from the EA, dated 16 September 2015:

Flood Voids: the dimensions of the openings and detail of the support walls have been described – see sections 3.9-3.12 inclusive and the architect’s scheme drawings in Appendix C.

Safe access/egress route: the levels along the route shown have been added to the layout drawing – see Appendix C and text description in sections 3.5-3.6.

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2.0 EXISTING SITES & CURRENT FLOOD CONDITIONS

- 2.1 The two sites lie within the London Borough of Richmond upon Thames (LBRT.) For the purposes of this report Site A is to the north and Site B is to the south. An existing site location map and aerial views of the sites are shown in Appendix A.
- 2.2 Currently Site A comprises a garage court with concrete hardstanding. Site B is a car park with concrete hardstanding. Both sites are therefore 100% impermeable.
- 2.3 The area of Site A is 1600m² and that of Site B is 1160m². The existing runoff rate in the critical '100 years' storm can be estimated for Site A as 1600m² x 158mm rainfall / 3600 = 70.2l/s; and for Site B as 1160m² x 158mm rainfall / 3600 = 50.9l/s.
- 2.4 A topographic survey (in Appendix C) shows that Site A's levels vary between 5.67m and 5.94m AOD. Site B's levels range from 6.70m to 7.92m AOD.
- 2.5 Drainage from the existing units is assumed to drain via gravity to the existing public storm and foul sewers located in the street.
- 2.6 The site's solid geology, according to the BGS online map is London Clay Formation (clay and silt) overlain by Kempton Park Gravel Formation (sand and gravel). The former is renowned for its impermeability whilst that latter's can vary. A site investigation and BRE Digest 365 soakage test results will determine the depth of gravel and infiltration rates of the ground to see if infiltration methods are feasible.
- 2.7 Site A is approximately 160m - and Site B 190m - southwest of the River Thames and Trowlock Island. The sites are both tidally and fluvially influenced – ie at the western extreme of tidal influence.
- 2.8 The Environment Agency's Flood data in Appendix B shows that Site A lies within Flood Zone 3 (FZ3), and Site B lies within Flood Zone 2 (FZ2).
- 2.9 Tidal sites within FZ3 are susceptible to a 1 in 200 chance (0.5%) of tidal flooding each year. Fluvial sites in FZ3A have an annual probability of 1% - or flooding once every 100 years on average. Tidal sites within FZ2 are susceptible to between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%), and between 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%).
- 2.10 The EA has modelled the flood level at various locations shown as nodes along the Thames giving corresponding floodplain levels on site. The EA data shows the floodplain level for both sites is **6.96m AOD** for a 1 in 100 year plus climate change storm event.
- 2.11 This vicinity does not benefit from defences as denoted by pink lines on the EA flood map. The sites are therefore highly likely to flood in the event of an extreme storm.
- 2.12 Richmond upon Thames Borough Council commissioned a Strategic Flood Risk Assessment (SFRA). The flood zones map shows Site A to be in FZ3A and Site B in FZ1 – differing to the EA flood data. The EA data will be taken as most up to date and therefore accurate. Once climate change is applied, both sites lie within in FZ3 – refer to Appendix D.

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- 2.13 The SFRA also confirms that the sites are within an undefended area and have had no local drainage issues – refer to Appendix D. Neither the EA nor LBRT’s Strategic Flood Risk Assessment (SFRA) give any indication of historical flooding from surface water or sewer failure in this vicinity. Furthermore, the SFRA groundwater map shows no historic groundwater flooding incidents on the sites.

- 2.14 The EA’s surface water map in Appendix B shows that Site A is at low to medium risk of surface water flooding and Site B is at very low risk.

- 2.15 It is concluded that the main flood risk to these sites is fluvial flooding from the River Thames. Site A is at medium risk of surface water flooding but it is contended the risk is lower than the fluvial risk. Proposed mitigation measures will reduce the risk of both fluvial and surface water flooding.

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3.0 PROPOSED SITE LAYOUT & MITIGATION

- 3.1 The planning application for Site A is the demolition of the garages, and the erection of 5No houses and a car park with 21 spaces. Proposals for Site B are to erect 2No houses and a car park with 25 spaces. See the proposed scheme drawings in Appendix C.
- 3.2 The proposed roofed area for Site A is approximately 309m² and a total impermeable area of 796m². The proposed roofed area for Site B is 138m² and a total impermeable area of 818m².
- 3.3 One of the NPPF's requirements is for the lowest finished floor level (FFL) to be set at a minimum of 0.3m above the '1 in 100 years plus climate change' floodplain level. As stated in section 2.10 the floodplain level for both sites is 6.96m AOD, and therefore the FFL will be set at **7.26mAOD**.
- 3.4 It is usual to raise the FFL by 0.3m from the ambient ground level if there is a significant surface water flood risk to site. The ambient ground levels for Site A range between 5.67m to 5.94m AOD. The FFL of 7.26mAOD is set 1.02m above the highest ground level.
- 3.5 Access to safety: a raised pathway from the entrance of each dwelling on Site A leads south to Broom Road in FZ2. The pathway will be set at a minimum of 7.26mAOD, the estimated flood level in the '1 in 100 years plus climate change' storm and 0.3m freeboard. The topographic survey shows a spot level on Broom Road of 7.9mAOD, above the minimum pathway level.
- 3.6 The lowest level along the route after the walkway (ie outside the application site) is 6.88m AOD. This is 0.08m below the predicted flood level of 6.96m AOD. According to Table 13.1 of FD2320, flood depths of up to 0.1m are safe as long as the velocity is no greater than 1.5m/s. It is contended that the velocity would be negligible to very low as the site is at the driest limit of the flood pattern and the surface will be considerably rougher (the buildings, street furniture etc. will increase the friction considerably compared to open floodplain). The resultant velocity is likely to be between 0.1m/s and 0.5m/s this close to the edge of the flood pattern. The layout drawing in Appendix C shows the ground levels along the route to safety. These increase southwards.
- 3.7 It is proposed that a Flood Warning and an Evacuation plan is incorporated for the proposed dwellings on Site A - see Appendix G. A permanently affixed durable sign shall be affixed adjacent to the electrical distribution board in each unit. It is recommended that the occupants register with the free flood warning service provided by the Environment Agency (called 'Floodline'), in order to facilitate evacuation of the premises prior to floodwaters surrounding the site. Site A is covered by this service. Site B, being in Flood Zone 2 does not require a flood evacuation plan and is not covered by the EA's flood alert service.
- 3.8 The first floor of each dwelling will act as a safe refuge. It is contended that, provided the occupants are aware of the nature of the flood risk and consider what their response would be well in advance of such an event occurring, this risk will have been mitigated.
- 3.9 Floodplain volume: Site A lies within FZ3A, putting it at high risk of flooding, as outlined in section 2. Because the increase in building footprint will displace fluvial flood water there will be a negative impact on the floodplain volume. A floodable void will balance this displaced floodplain volume.
- 3.10 As stated in section 3.3 the FFL will be set 0.3m above the critical flood depth. Even with floodable voids, floodwater will be displaced by the external cavity walls and internal supporting walls of 'hit and miss' block work. This volume is approximately 25.2m³. To maintain the floodplain volume, it is

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proposed to lower the ground level within the internal area of the units by an average of **0.07m** to compensate, whilst providing a sufficient gradient for drainage – refer to Appendix F for this calculation. The remaining external levels on site will remain as existing or lower. All ramps and stairs shall be open tread.

- 3.11 The total number of gridded openings (15 no') is shown in drawing ref 12-143 / D(27)A-17 in Appendix C. The spacings are at least 1m for every 5m of perimeter wall. The schedule of openings (marked A to O inclusive) shows each opening's length.
- 3.12 From previous discussions with EA Flood Risk Engineers, it is understood that the voids must be securely barred by 15mm durable mesh fixed behind the louvred grilles. This mesh will prevent birds and mammals from nesting in the void space.
- 3.13 Surface Water drainage strategy: It is contended that the depth of sand/gravel drift may be sufficiently deep for the use of soakaways on both sites A and B. As set out in section 2.6 above this will be confirmed by undertaking a site investigation followed by a BRE Digest 365 soakage test, to determine the soil's infiltration rate. In the likely event that the soakage test proves a soakaway unfeasible, it is proposed to discharge the surface water to the existing surface network at an attenuated rate.
- 3.14 If the infiltration rates prove to be sufficiently high, there is space for soakaways on both sites in the car park areas, whilst having a 5m distance from any structure.
- 3.15 There will be a flow limiting device for each site, such as a Hydrobrake, which shall limit the flow to 20 l/s for Site A and 15 l/s for Site B in the critical '1 in 100 years plus 30% climate change' event. Both sites are currently 100% impermeable and so the proposed flow rates are lower than the existing estimated run off rates calculated in section 2.3 of 70.2l/s and 50.9 l/s. The proposed flow rates represent a reduction of 50.2 l/s and 35.9 l/s for sites A and B respectively. This is subject to Thames Water's agreement as owner of the sewerage network.
- 3.16 There will be one underground attenuation tank per site, which shall contain the volume in this event. These will be placed immediately upstream of the control manholes. Appendix E shows the Micro Drainage calculations: Site A's tank's volume is 3m x 5m x 0.8m deep x 0.95 voids ratio = 11.4m³, and Site B's is 2m x 8.5m x 0.8m deep x 0.95 voids ratio = 12.92m³. The volume needed to be stored in the critical storm event for Sites A and B is 11.1m³ and 12.8m³ respectively.
- 3.17 According to the EA's groundwater map, the sites lie with a 'Major Aquifer High' zone – refer to Appendix B. This is classed as a sensitive area and so the runoff from the parking areas will be routed by trapped gullies to mitigate the risk of contaminating the aquifer. This complies with PPG3.
- 3.18 SUDS: due to the impermeable nature of this soil type (clay) it is contended that, by attenuating the offsite flow rate into the sewer at a rate much lower than the existing, this is sustainable and in line with the NPPF.
- 3.19 The flood risk of the application sites and the neighbouring vicinity will not increase as a result of these developments. It is therefore considered that with these measures in place, the developments comply fully with the 2012 NPPF.

- End of Report -

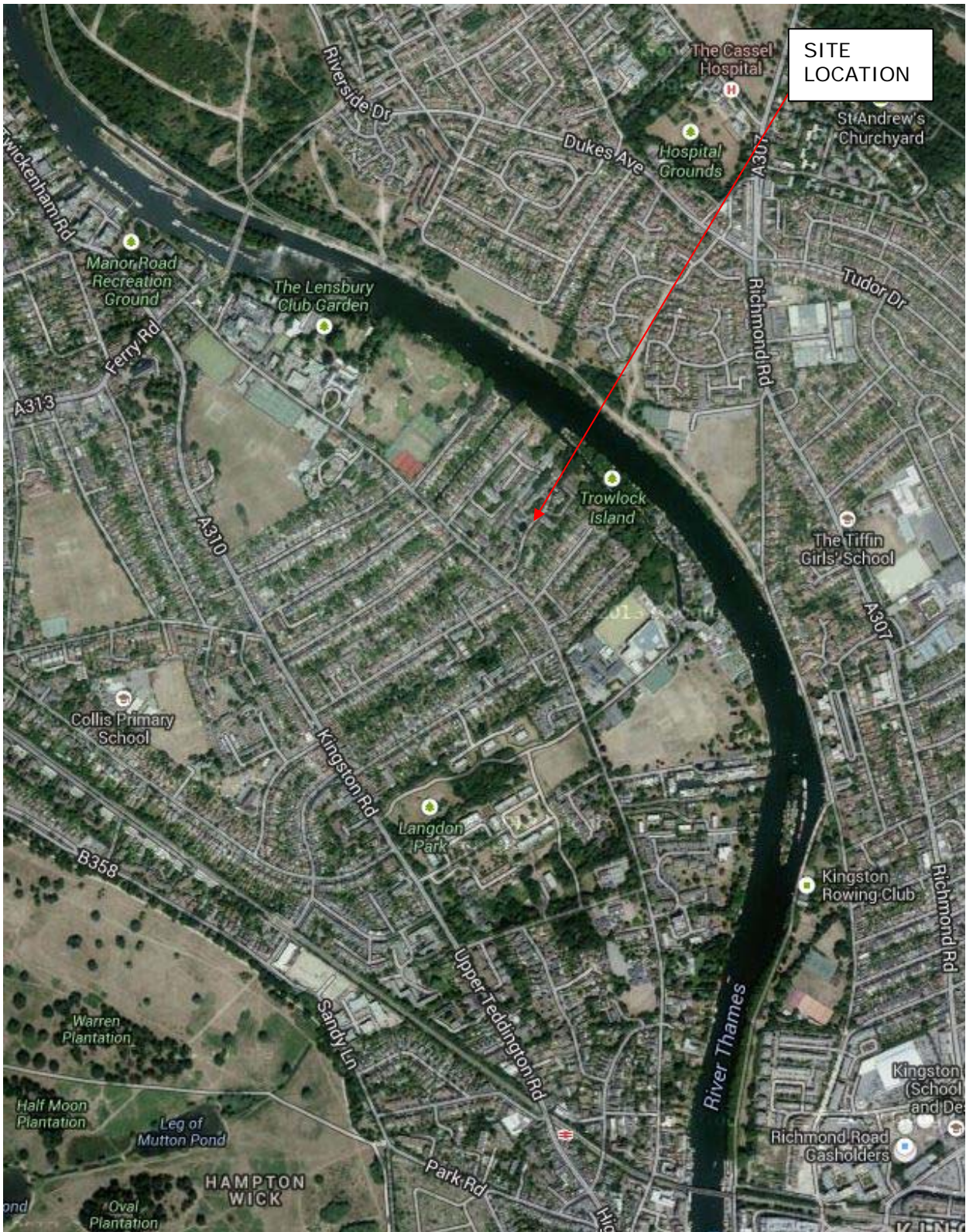
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APPENDIX A

Site Location Map & Aerial Photo



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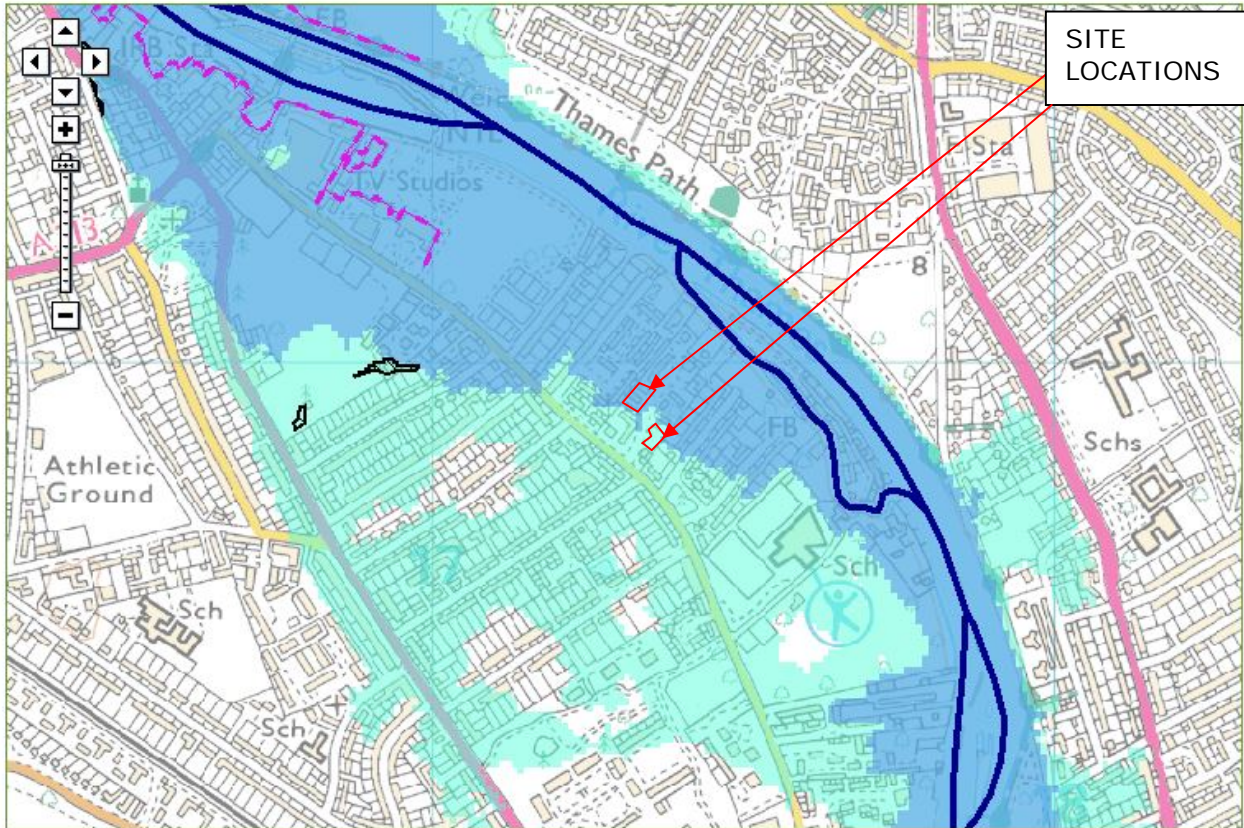
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APPENDIX B

Environment Agency Flood Data

Map of TW11 9QR at scale 1:10,000

Data search  Text only version 



Customers in Wales - From 1 April 2013 Natural Resources Wales (NRW) will take over the responsibilities of the Environment Agency in Wales.
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Flood zone Map

Site A is within Flood Zone 3, Site B is within Flood Zone 2.

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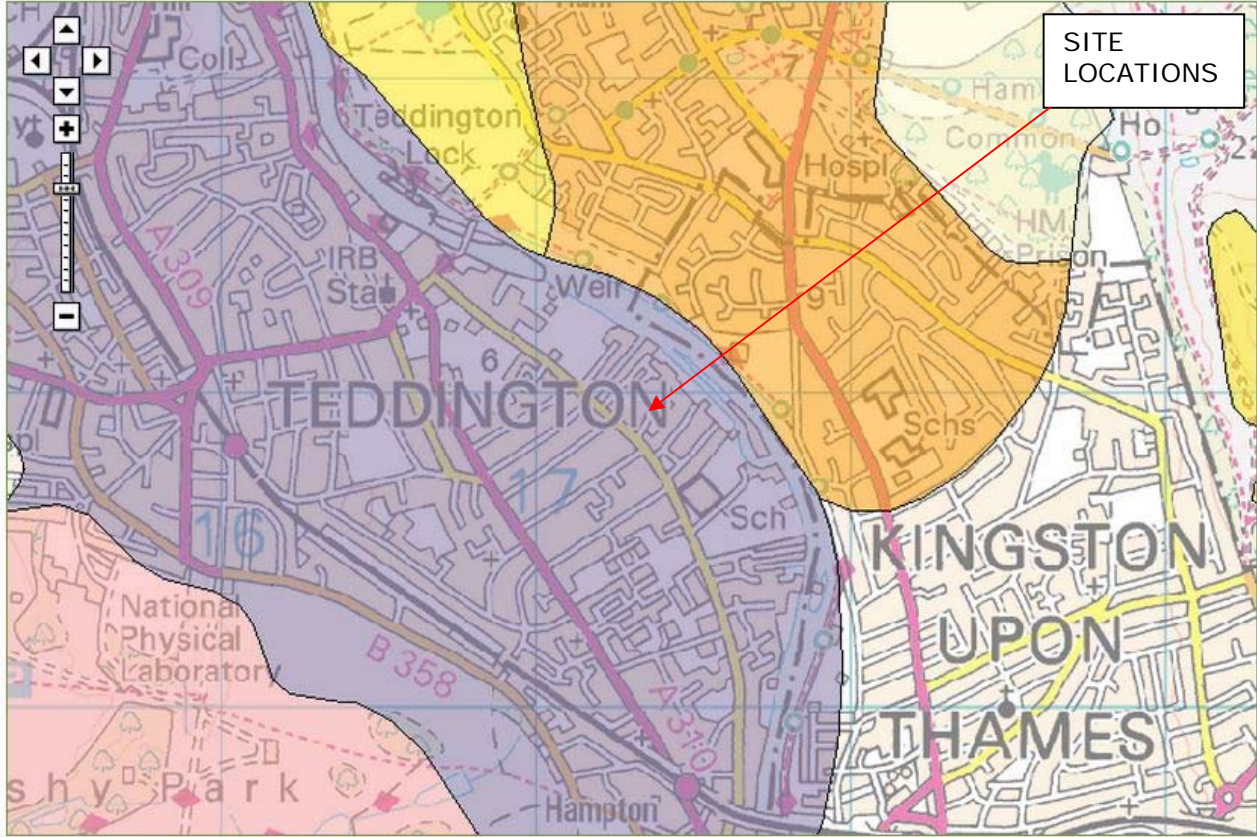
Risk of Surface Water Flooding Map

Site A is at low to medium risk of surface water flooding and Site B is at very low risk.

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X: 517,311;Y: 170,913 at scale 1:20,000

Data search Text only version



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- Major Aquifer High
- Major Aquifer Intermediate
- Major Aquifer Low
- Minor Aquifer High
- Minor Aquifer Intermediate
- Minor Aquifer Low

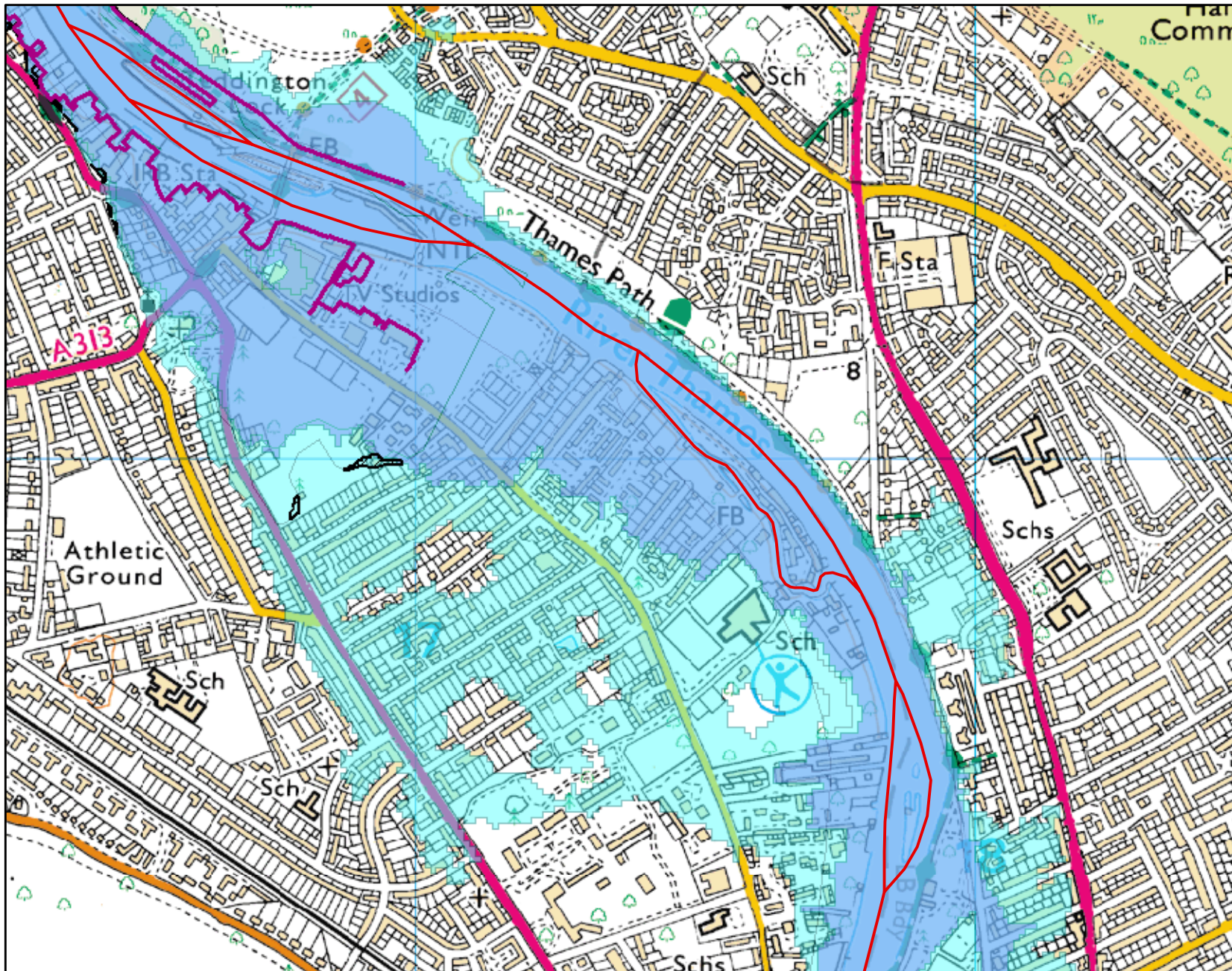
Groundwater Vulnerability Map

The sites lie within a 'Major Aquifer High' zone.

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Flood Map centred on Bucklands Road, Teddington TW11

Created 18/02/2014 REF WT12850



Kilometres

0 0.125 0.25

Legend

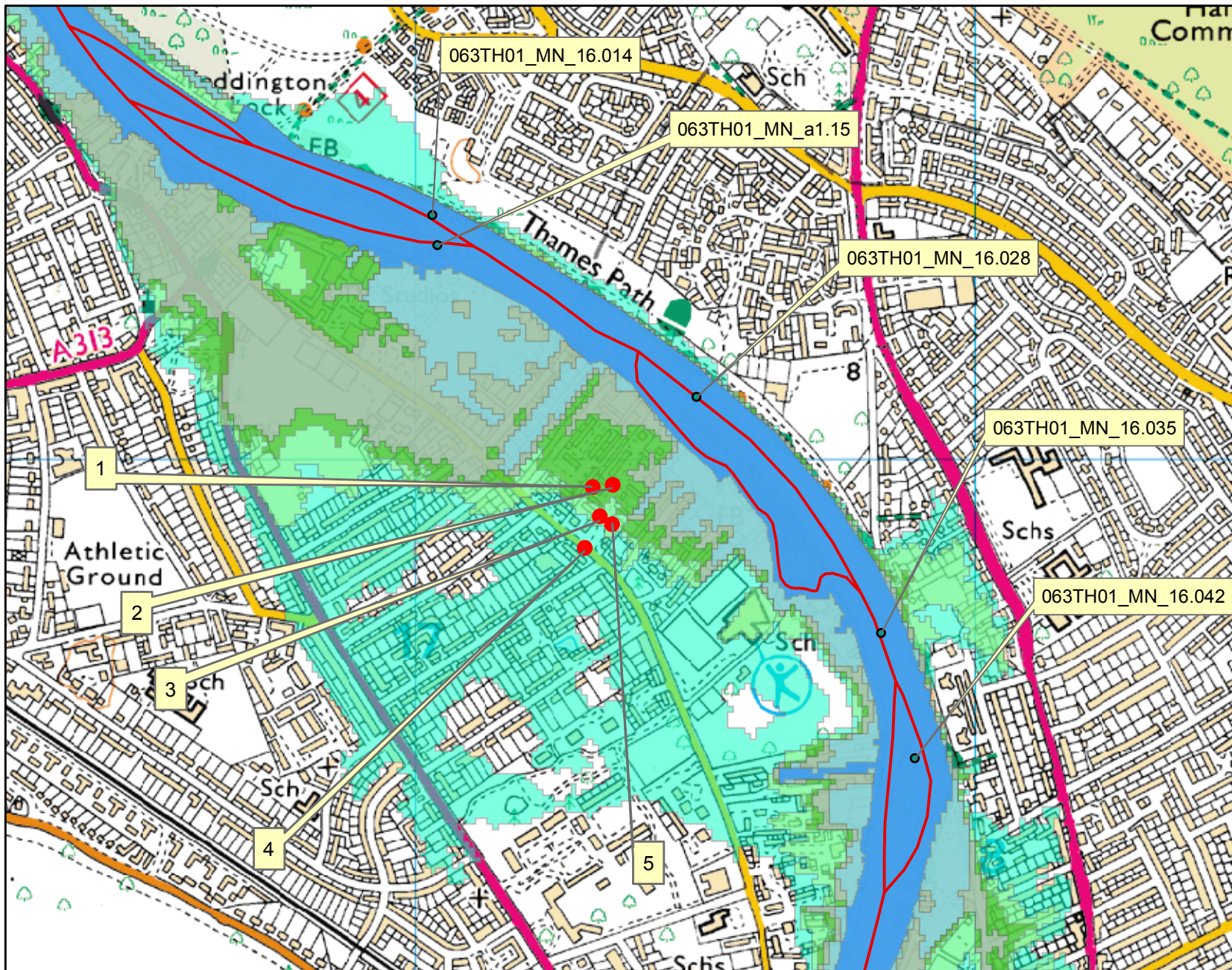
- Main River
- Flood defences
- ▨ Areas benefiting from flood defences
- Flooding from rivers or sea (FZ3)
- Extent of extreme flood (FZ2)
- ▤ Flood Map - flood storage areas

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.

Detailed Flood Map centred on Bucklands Road, Teddington TW11

Created 18/02/2014 REF WT12850



Kilometres

0 0.125 0.25

Legend

- Node Points
- Main River
- 20% AEP flood extent
- 5% AEP flood extent
- 2% AEP flood extent
- 1% AEP flood extent
- 1%CC 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

1%CC = 1% Climate Change extent
This is the 1% AEP event with an allowance for climate change (+20% on river flows)

Modelled in-channel flood flows and levels

WT12850

The modelled flood levels and flows for the closest most appropriate model node points for your site that are within the river channel are provided below:

Node label	Model	Easting	Northing	Flood Levels (mAOD)				
				20% AEP	5% AEP	1% AEP	1% AEP with climate change allowance (+20% on river flows)	0.1% AEP
063TH01_MN_16.042	Thames (Lower) Reach 4 2010	517895	170463	5.10	5.87	6.68	7.22	7.84
063TH01_MN_16.035	Thames (Lower) Reach 4 2010	517835	170687	5.01	5.77	6.57	7.10	7.70
063TH01_MN_16.028	Thames (Lower) Reach 4 2010	517506	171108	4.95	5.73	6.55	7.09	7.69
063TH01_MN_a1.15	Thames (Lower) Reach 4 2010	517044	171379	4.86	5.64	6.49	7.07	7.72
063TH01_MN_16.014	Thames (Lower) Reach 4 2010	517035	171432	4.86	5.64	6.49	7.07	7.72

Node label	Model	Easting	Northing	Flood Flows (m3/s)				
				20% AEP	5% AEP	1% AEP	1% AEP with climate change allowance (+20% on river flows)	0.1% AEP
063TH01_MN_16.042	Thames (Lower) Reach 4 2010	517895	170463	430.42	588.64	783.12	931.70	1107.97
063TH01_MN_16.035	Thames (Lower) Reach 4 2010	517835	170687	428.91	589.24	783.35	937.48	1115.00
063TH01_MN_16.028	Thames (Lower) Reach 4 2010	517506	171108	429.79	589.05	784.68	938.61	1152.70
063TH01_MN_a1.15	Thames (Lower) Reach 4 2010	517044	171379	430.72	582.79	732.24	824.11	930.06
063TH01_MN_16.014	Thames (Lower) Reach 4 2010	517035	171432	45.32	126.24	197.82	226.20	263.93

Modelled floodplain flood levels

WT12850

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	1% AEP	1% AEP with climate change allowance (+20% on river flows)	0.1% AEP
1	Thames (Lower) Reach 4 2010	517324	170950	N/A	N/A	6.54	6.96	7.69
2	Thames (Lower) Reach 4 2010	517353	170950	N/A	N/A	6.54	6.96	7.69
3	Thames (Lower) Reach 4 2010	517335	170893	N/A	N/A	6.54	6.96	7.69
4	Thames (Lower) Reach 4 2010	517308	170844	N/A	N/A	N/A	N/A	7.69
5	Thames (Lower) Reach 4 2010	517353	170879	N/A	N/A	N/A	6.96	7.69

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

Lucy Thatcher
London Borough of Richmond upon
Thames
Planning Department
Civic Centre (44) York Street
Twickenham
Middlesex
TW1 3BZ

Our ref: SL/2015/114736/01-L01
Your ref: 15/3296/FUL
Date: 16 September 2015

Dear Lucy

Site A: removal of 40 garages create a short terrace of high quality two storey houses consisting of three x three-bedroom houses and two x four-bedroom houses. Provision of 19 parking spaces in a shared surface courtyard

Garages Site A, Bucklands Road, Teddington.

Thank you for consulting us on the above application. In the absence of an acceptable Flood Risk Assessment (FRA) we **object** to the grant of planning permission and recommend refusal on this basis for the following reasons:

Reason

The proposal is for the erection of 5 residential dwellings following the demolition of existing garages. The site is located in Flood Zone 3a and the proposed development is considered as more vulnerable. The proposal would therefore result in increase in flood risk vulnerability.

The FRA by GTA Civils Ltd, ref: 5228/2.3F, dated: March 2014 submitted with this application does not comply with the requirements set out in paragraph 9 the Technical Guide to the National Planning Policy Framework. The submitted FRA does not therefore provide a suitable basis for assessment to be made of the flood risks arising from the proposed development.

In particular, the submitted FRA fails to provide sufficient evidence to demonstrate that the development will not increase flood risk elsewhere and that people will be kept safe from flood hazards identified.

Flood plain compensation

As the proposal will result in an increase in built footprint within FZ3 the applicant is required to demonstrate that the proposal will not result in a loss of flood storage.

This should be done through the provision of level for level flood storage compensation. Where the applicant has demonstrated that this is not possible the incorporation of voids may be acceptable if they are designed to our recommendation and agreed by the Local Planning Authority.



The applicant has proposed voids and volumetric compensation. For this to be acceptable they are required to demonstrate that the voids have been designed appropriately and can be maintained for the life time of the development. This should be supported by an explanation within the FRA as to why level for level compensation is not appropriate before considering other options.

The applicant has failed to supply sufficient information for us to be satisfied that the void design will provide floodplain storage up to the 1 in 100 climate change (cc) level.

The underside of the void should be set no lower than the estimated 1 in 100 year with an allowance for climate change flood level. The applicant has provided no information within their FRA or on the elevation drawings indicating the height of the proposed void.

In addition we recommend that void openings are located on all sides, and that there should be one opening for every 5m length of wall to allow for the free flow of floodwater. The submitted FRA states that there will be four grilles on the north-eastern wall, and 2 grilles on the south-western wall. The FRA states that this should be sufficient to allow floodwater to enter the void and allow the free flow of floodwater. Based on our mapped extents we are not satisfied that this would be sufficient.

In addition the elevation drawings do not make it clear where the voids are located or how they have been designed. Whilst the FRA suggests there will be 6 openings the elevation drawings seem to indicate there may be more openings. The elevation drawings also label metal grill, but it is unclear what the spacing of the grill bars are.

The applicant should supply drawings which clearly show the height of the void and the void openings and the location and design of the void openings.

The elevation drawing submitted also suggest a number of walls and fences which appear not to be designed as open to floodwaters. The applicant should provide further details on whether these are existing walls and fences, and whether they have been designed to ensure the free flow of flood water.

To provide additional compensation for the external cavity walls and internal walls the applicant has proposed volumetric compensation. Whilst we would usually request level for level compensation, this will not be possible based on the proposed method of use of voids.

If the applicant can provide details to satisfy us that the voids has been design appropriately then on this occasion we would be satisfied with the proposed volumetric compensation. The volume of floodwaters displaced from the walls is small enough to be negligible and therefore on this occasion the lowering of ground levels by 0.09m would be acceptable.

Safe Access and Egress

As the site is located in FZ3. The applicant is required to demonstrate that occupants have a route of very low hazard from the development to an area wholly outside of the 1 in 100 plus cc flood extent in accordance with FD2320 (Flood Risk Assessment Guidance for New Developments).

The applicant is proposing to erect a raised walkway from the door of each property leading to a footpath that will take occupants to Broom Road within Flood Zone 2.

The walkway will be set at a minimum height of 7.26mAOD. As this is 300mm above the 1 in 100 cc level this will ensure that occupants will have a route of very low hazard whilst they are on the walkway. The Site Layout (– Site A – Flood Risk Safe Route Strategy drg 11.143/ D(27)01 Rev A Jun 2014) indicates that the walkway will extend to a proposed refuse collection point, where it is assumed the occupants will disembark off the walkway and then walk along the route proposed on this plan on to Broom Road.

According to our detailed flood extents parts of the proposed route are within the 1 in 100 cc extent. The applicant has not provided topographical survey of the whole route or made an assessment of this route in accordance with FD2320 TR2. Therefore there is no indication of flood depths along the route in a 1 in 100 cc event.

Further information can be found at the following link:

http://evidence.environment-agency.gov.uk/FCERM/Libraries/FCERM_Project_Documents/FD2320_7399_PR_pdf.sflb.ashx

This route should be on publicly accessible land and should have a hazard rating no higher than 'very low'.

If it is not possible to achieve a 'very low' route of access and egress then we would likely recommend refusal of the planning application as during a flood event access to the development will be lost, placing an increased burden on the emergency services.

We will maintain an objection until the Local Authority is satisfied that the hazards associated with the development can be managed for its lifetime. This could be through a flood evacuation plan specific to the proposed development that enables the residents to evacuate before flooding occurs.

The FRA should provide sufficient information to enable Emergency Planners to determine if evacuation is possible. Issues to cover may include the rate of onset of flooding, the availability of flood warnings, duration of flooding, depth of flooding and the length of the evacuation route. Consideration should be given to all sources of flooding.

The applicability and requirements of a site specific flood plan to mitigate the risk of flooding should be discussed with the LPA and, if agreed, be included within the FRA. It is not our role to review and assess evacuation plans or flood management plans.

If the LPA determine that a flood plan will not mitigate the risk of flooding then the applicant should revise their proposals so as not to increase the number of residential units at this site.

The applicant is proposing to set finished floor level no lower than 7.26mAOD. This is 300mm above the appropriate 1 in 100 plus climate change flood level, therefore we are satisfied with the proposed FFL.

Overcoming our objection

You can overcome our objection by submitting an FRA which covers the deficiencies highlighted above and demonstrates that the development will not increase risk elsewhere and where possible reduces flood risk overall. If this cannot be achieved we are likely to maintain our objection to the application. Production of an FRA will not in itself result in the removal of an objection.

Decision notice request

The Environment Agency requires decision notice details for this application, in order to report on our effectiveness in influencing the planning process. Please email decision notice details to kslplanning@environment-agency.gov.uk.

I hope our comments are helpful, if you have any questions please contact me.

Yours sincerely

Joe Martyn
Planning Advisor

Direct dial 0203 263 8087

Direct e-mail kslplanning@environment-agency.gov.uk

cc bptw partnership