Figure B-5 Flood depth map for 1%CC showing for area around the site

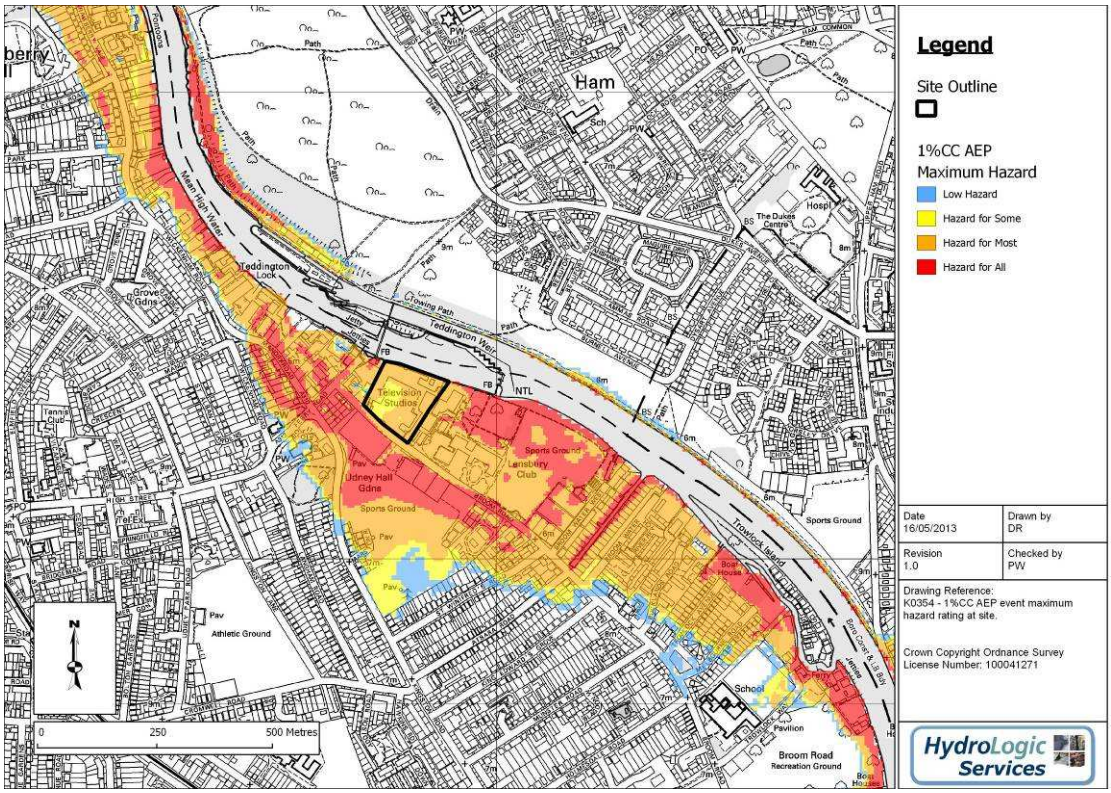


Table B-3 Approximate duration of flooding on site (fluvial)

Probability	Duration (h)
1%CC	273
1%	216
5%	0
2%	0

B.2.4 Assessment of potential Mitigation Measures

The mitigation measures for the site are largely based on suitable design with the majority of residential levels set a minimum of 300 mm above the design flood level. The exception to this are The Town Houses and Weir Cottage, both of which will be provided with flood resistance and resilience measures, built to high engineering specification. Mitigation will however be required for the subterranean car parks by deployment of flip-up flood barriers at the entrance and exit. Warnings will be provided to residents of planned closures, as outlined in Section B.3. The impacts of closing the car parks will be limited since they will often be associated with closure of the surrounding roads in any event.

This plan relies upon the availability of the Teddington Lock footbridge as a viable means of access/egress under continued extreme flood conditions. The Footbridge consists of two separate bridges separated by a small island. The two footbridges were built between 1887 and 1889, funded by donations from local residents and businesses. The western bridge consists of a suspension bridge crossing the weir stream and linking the island to Teddington. The eastern bridge is an iron girder bridge crossing the lock cut and linking the island to Ham on the Surrey bank. In recent years wooden ramps have been added to the approach to the bridge on the Ham side and to the middle part on the small island so that cycles and pushchairs etc. can avoid the steps up to and down from that section of the bridge.

B.3 Flood Procedures

B.3.1 Lead times

Warnings will be communicated to residents via the following means:

- Screen display at Site Management Office on the Piazza (Block A)
- Web site
- Email to residents (or nominated party) of any change in warnings
- Text message to residents (or nominated party) of any change
- Automated phone message if required

The information will be based on the Flood Alert Notice (see Figure B-6) and for which briefing material will be available in each property and on the web site. This will enable residents to be kept informed of the developing situation of any flood event and in particular, when the area is safe following a flood.

The communication system will be particularly important during a flood event when there is an extended period of road closure. The systems can be used to provide specific instructions.

B.3.2 Flood Warnings

Flood Warnings will be issued via the Flood Alert Notice. Whilst this will echo the formal Environment Agency warnings, it will provide a site-specific interpretation for residents along with any specific instructions.

B.3.3 Flood Alert Notice

A draft Flood Alert Notice is shown in Figure B-6, providing information in a standard format for residents. The Alert Notices should be used for small and moderate floods (as well as major floods), partly for raising the interest and awareness of flood events, but also to help residents to develop an understanding of flood risk at the site. This will pay dividends during major flood events. Additional information will be available from other sources eg web site, Management Office.

B.3.4 Actions upon receiving Alerts and Warnings

(a) General

Given that there will be no requirement for residents to evacuate the site, there is no need for an emergency evacuation procedure for residents. However, Site Staff should make provision for emergency measures for elderly/infirmed residents. All residents will be impacted by the progressive closure of access routes and by the potential requirement to use the Teddington Lock footbridge to access/egress the site. Once an alert or indication has been received that Broom Road is likely to be closed, Site Management staff will put in place the procedures for shuttle transport facility on Broom Road and deployment of the telescopic bridge.

(b) For short duration tidal/combined flooding events

Short duration tidal flooding events occur in response to minor overtopping of the existing defences. The tidal defences are slightly above the flood zone 3a/3b boundary, indicating that the current annual probability of occurrence of such events is around 5% (1 in 20).

Preparatory actions:

- Review the likely timing and severity of the event by liaison with Environment Agency and emergency services;
- Ensure relevant "amber/red" warnings are issued on display screens, email, text, web, phone, in person;
- Prepare and deploy the demountable defences for the exits to the gardens.

Action to be taken by residents will include:

- Be mindful of the overtopping of the defences and of flooding to the gardens and lower areas of car parking;
- Remove all cars parked in lower car park, either to the subterranean car park or off-site.

Amber warnings would indicate a risk of flooding within 72 hours, red warning, a risk within 24 hours.

(c) For extended" closure of Broom Road for fluvial flooding

Extended closure may occur in response to extreme fluvial or combined fluvial/tidal events.

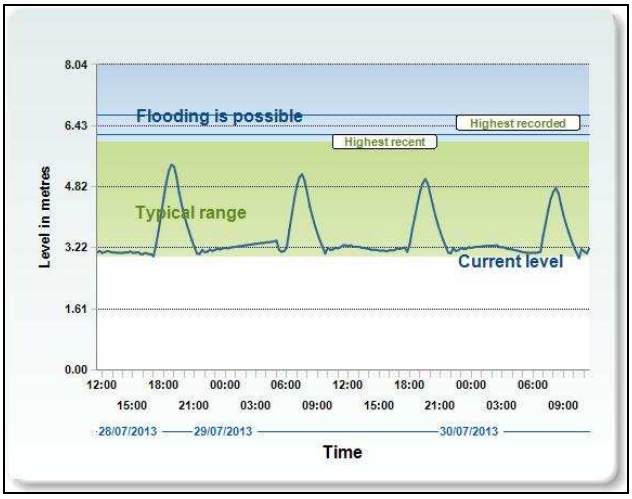
Preparatory actions:

- Review need for additional staff as the flood event may require more resources to deal with than are available from the Site Management team;
- Ensure relevant "amber/red" warnings are issued on display screens, email, text, web, phone, in person;
- Establish communication with local flood co-ordinators from Emergency Services/Council;
- Establish link to Environment Agency;
- Ensure availability of vehicles/drivers for informal "shuttle" transport for taking residents along Broom Road ie on the Teddington Bank.
- Instruct "on-call contractors" to deploy the telescopic bridge to link to the Teddington Lock footbridge;
- Prepare to deploy the car park barriers, following suitable warnings to residents.

Action to be taken by residents will include:

- Shopping for food and other essentials that may be required during an extended flood event;
- Remove all cars parked in lower car park, either to the subterranean car park or off-site.
- Relocation of vehicles that may be required for the duration of any flood event to Ham or alternative locations;
- Informing employers, colleagues, family, schools etc of the situation and of likely delays in the coming weeks;
- Familiarise oneself with the emergency arrangements; and
- Make provision, where possible, for periods of working from home.

Figure B-6 Sample display panel

<table>
<tr><th colspan="2">Teddington Riverside: Flood warning information</th></tr>
<tr><td>Environment Agency
 
</td><td>Current water level = 6.60 mAOD
 
</td></tr>
<tr><td>Flood type</td><td>FLUVIAL TIDAL SFC WATER</td></tr>
<tr><td>Access</td><td>Open/Closed Example Comments</td></tr>
<tr><td>Footbridge</td><td>OPEN All clear – likely to be busy between 4 and 6pm</td></tr>
<tr><td>Broom Road</td><td>OPEN Closed from 2100 GMT today to non-em. vehicles</td></tr>
<tr><td>Ferry Road</td><td>CLOSED Closed until further notice</td></tr>
<tr><td>Car park</td><td>CLOSED Closed until further notice</td></tr>
<tr><td>Special instructions (Example text)</td><td>• It is expected that the flood will peak at 2100 (9 pm) on date.
• Based on current forecasts, the EA do not expect Broom Road to reopen until date.
• Car parks at Riverside Drive Ham are now open.
• “Shuttle” operating from Broom Road</td></tr>
</table>

B.3.5 Safe Egress Procedures & Evacuation Routes

(a) Procedures

The availability of safe access/egress routes will be communicated via the Flood Alert Notice. This will indicate when residents will be able to use Broom Road on foot, when the shuttle is operational and when the access/egress will be via the Teddington Lock footbridge.

Due care will be needed for children, push chairs etc when using the emergency access route, both within and beyond the site. There are ramps as an alternative to the steps on the Lock footbridge and this improves the accessibility.

(b) The routes

The route along Broom Road will be familiar to residents and accessible by turning left on leaving the site. The access to Ferry Road from Broom Road is subject to closure early in any flood event due to the low elevation of the junction.

The access route from the site to the car parking area at Ham is summarised in Table B-4 and shown in Figure B-7 and. All routes internal to the site are at a minimum of 6.8 mAOD with the exception of the Town Houses. As explained in Section 4.2.2, the first part of the access route for the Town Houses will be at a level of around 6.2 mAOD through the rear gardens and for a maximum distance of 10 m. These gardens are protected from fluvial flooding by walls and from possible ingress from groundwater flooding by permanently installed sump-pumps. Access from Weir Cottage is on a walkway at a level of 6.8 mAOD, which is the agreed safe level.

Photographs are provided of the existing parts of the route external to the site in Figure B-12 to Figure B-16. The first part of the route involves permanent walkways at a safe level within the site leading to the telescopic bridge. This will traverse the garden of the Anglers' Public House. This is illustrated in Figure B-7 where the red arrow shows the proposed route from the site to the footbridge.

The telescopic bridge will be a dedicated facility, permanently stored on site and housed within a heavy duty vehicle, itself garaged in a secure lock-up in the north-west corner of the site. It will be deployed by manoeuvring the vehicle/facility on a grasscrete area of the garden such that the telescopic bridge can engage with the ramped, unlisted section of the Teddington Lock footbridge as shown in (Figure B-9). The bridge will also feature a link from the elevated walkway within the site. The deployment will be by "on-call" contractors who will be instructed by site management staff. The design specification will include a requirement for the vehicle to be deployed in standing water for durations of several days. Furthermore, the facility will be maintained by the on-call contractor with an inspection routine in accordance with the manufacturer's instructions.

Use of the bridge will need to be managed as there will be a restriction on the number of people on the bridge at any time. Its deployment will be checked at least annually as part of the annual flood drill. Residents will have the chance to walk on the bridge during such events. More frequent operational and maintenance checks will be undertaken by site management staff. Some photographs illustrating the possible form of the bridge are shown in Figure B-8.

The Teddington Lock footbridge provides access to the Ham Bank at a minimum level of 7.26 mAOD. This is above the 1%CC flood level of 6.97 mAOD and this ensures **dry access** on the Ham Bank, as per Figure 2-3.

Figure B-7 Access/Egress route via Teddington Lock footbridge – external to site

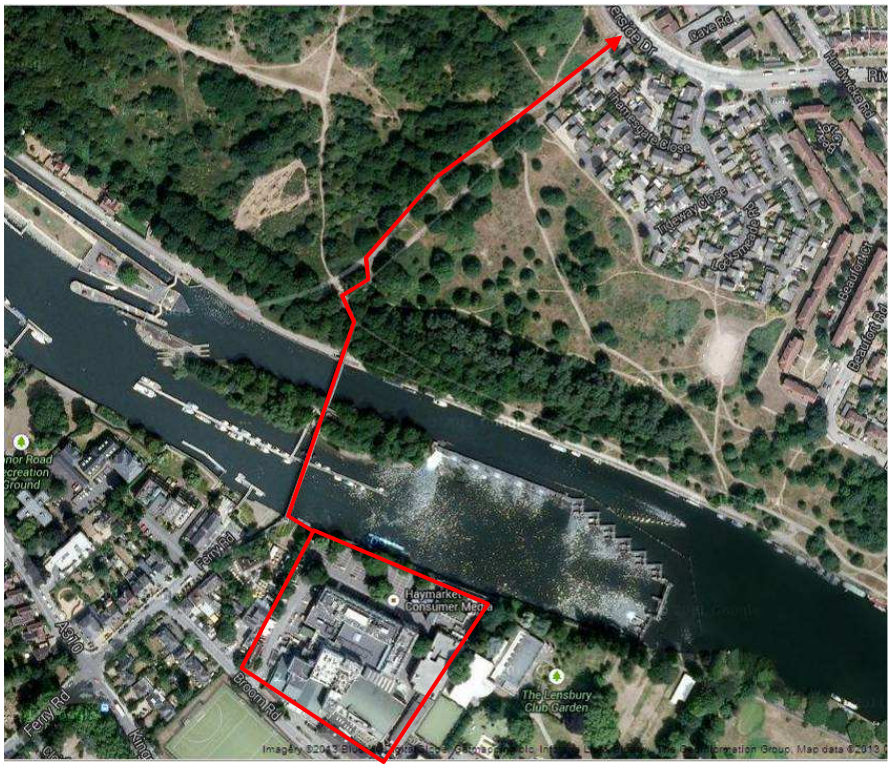
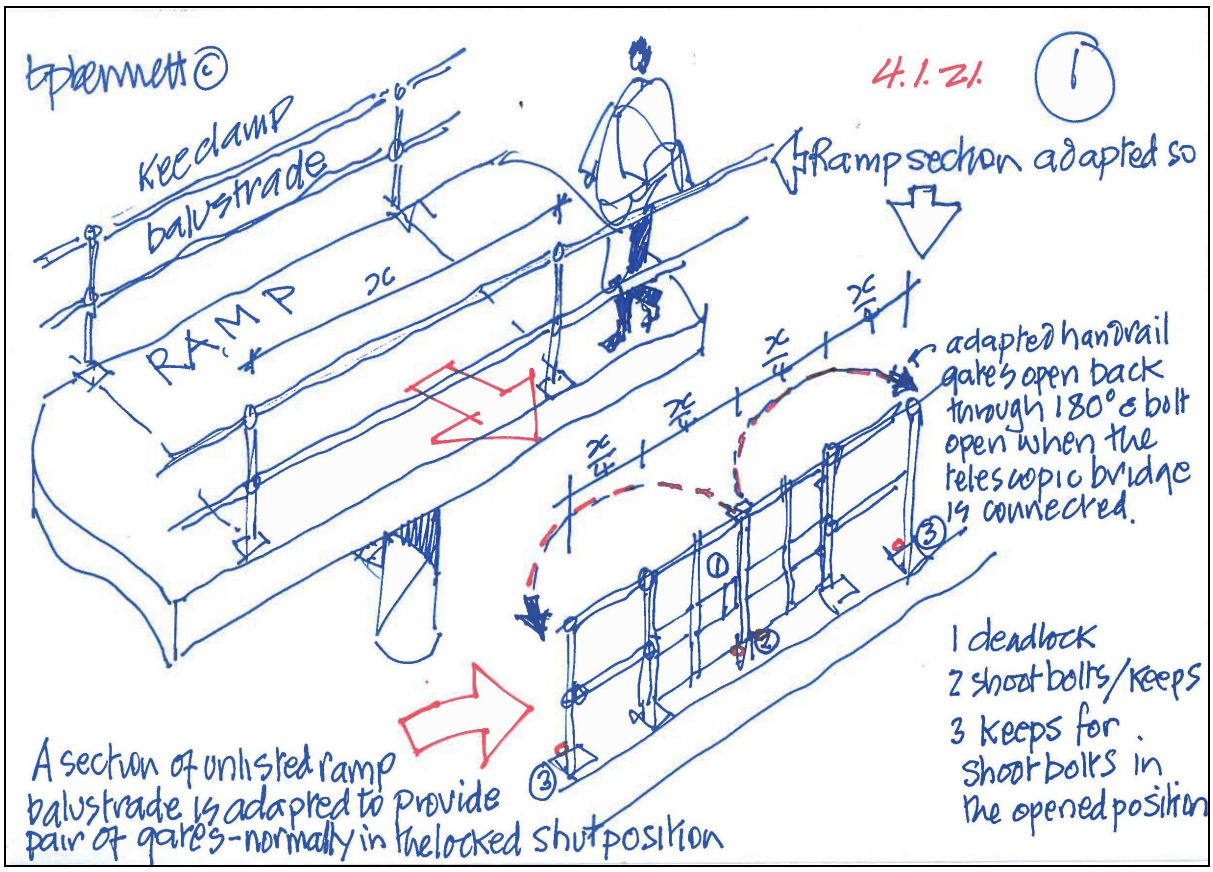


Figure B-8 Telescopic bridge design concept

Table B-4 Description of Access/Egress Route

Approx. distance (m)	Description	Hazards
-	Walkway within site	Set at 6.8 mAOD on central Piazza and along western boundary to north-west corner.
0 to 25	Telescopic bridge	At elevation of 8.0 mAOD across the Anglers' Public House
25 to 40	Teddington Lock Footbridge	Ramp on left bank, with constriction in walkway to restrict unauthorized use.
40 to 205	Bridge over lock channel	Elevated well above lock with ramps as alternative to steps.
205 to 465	Path through park	Minimum ground level at base of bridge is 7.2 mAOD. No lighting in park.

Figure B-9 Sketch of proposed connection between telescopic bridge and footbridge



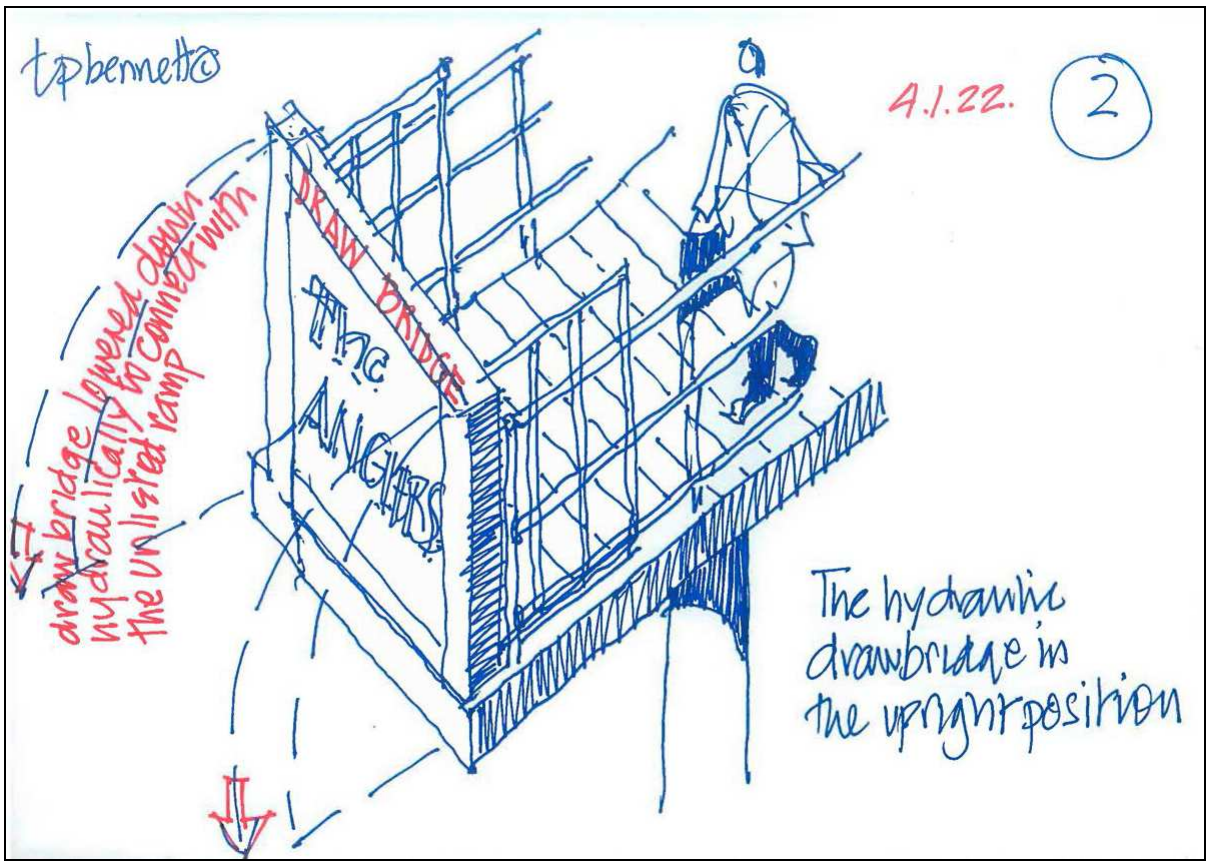


Figure B-10 Access/Egress route within the site

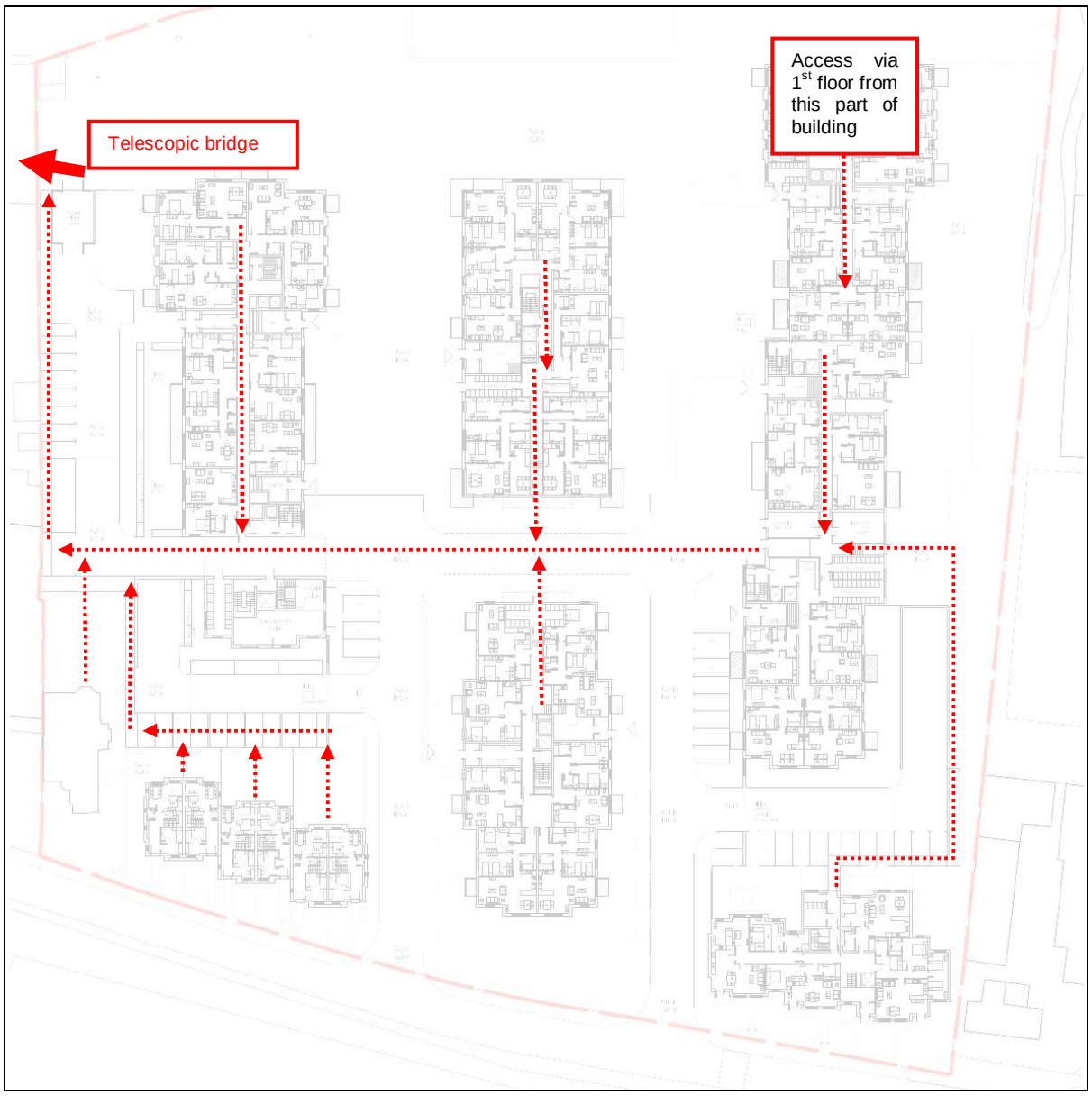


Figure B-11 Teddington Lock Footbridge showing existing access from the Anglers' Arms

Figure B-12 Teddington Lock Footbridge looking south; detail shows ramp and constrictions

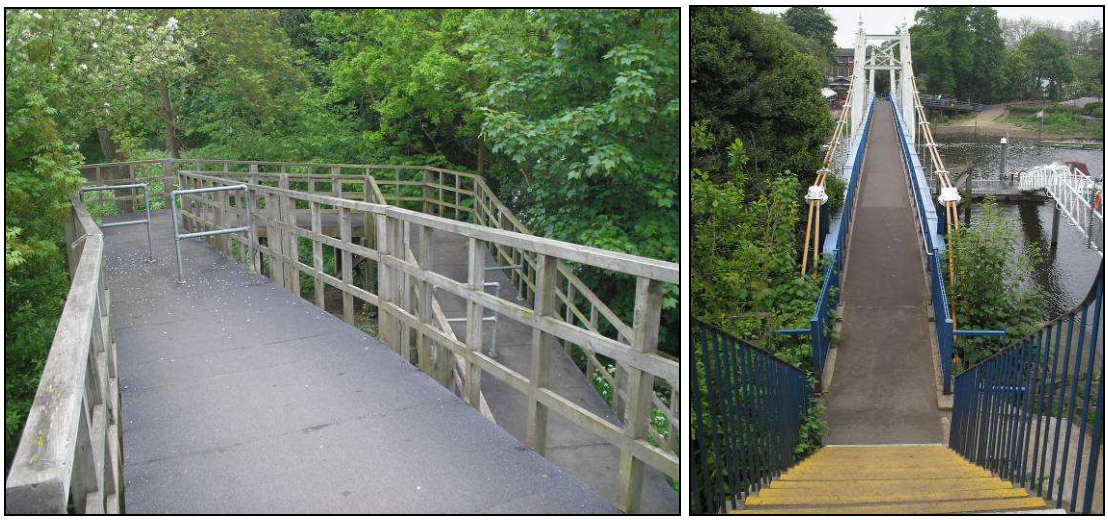
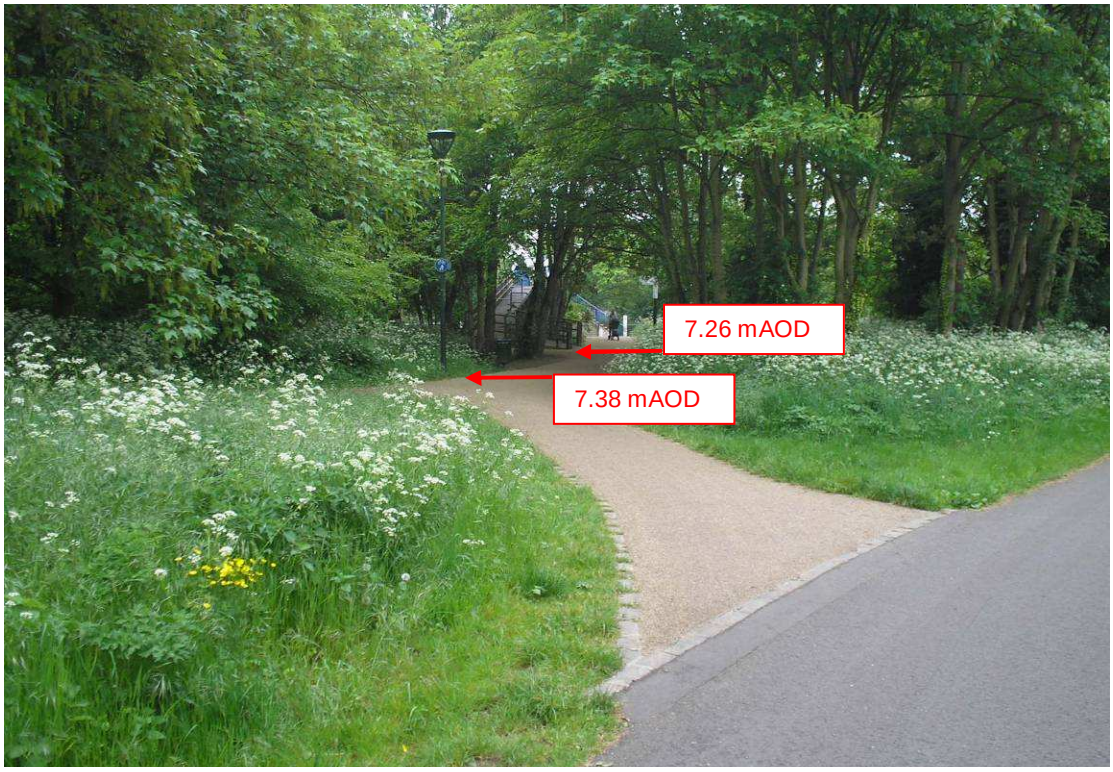


Figure B-13 Access from bridge over Lock to right (northern) bank

Figure B-14 Existing defences on Teddington bank above 6.1 mAOD (5% level at 6.06 mAOD)

Figure B-15 Existing egress from The Anglers to the foot bridge

Figure B-16 Ground levels on Ham bank – note above 1%CC flood level of 6.97 mAOD



B.3.6 On-Site and/or Temporary Refuge

The site will provide a permanent refuge from flooding as the principal residential blocks will all be above the reference design flood level, or provide internal access to higher floors. The Town Houses in Block E and Weir Cottage whose floor levels are below the reference flood level will feature "flood resistance" measures in the design. The Houses all have upper stories that can provide safe refuge. This refuge may also helpful for neighbours in Broom and Ferry Road, whose properties may be badly affected by flooding.

The ramps at the Broom Road entrance to the site will provide a flexible approach to the site, well able to cope with a range of flood levels. In *extremis*, the existence of the RNLI station just downstream of the site off Twickenham Road as shown in Figure B-17 is reassuring. This is the most upstream of four sites on the tidal Thames and has two boats available.

Figure B-17 Location of Teddington RNLI Station

B.3.7 Actions Post-Evacuation & Post Flood

It is not envisaged that the site would be evacuated, so this Section refers to actions post-Broom Road closure.

Following the reopening of Broom Road, site staff will be responsible for:

- Inspection and replace/repair as required any flood related defences, including demountable barriers, flood resistant doors, non-return valves, flip-up barriers.
- Dismantling of equipment used during the event which will need to be cleaned and checked then either returned or stored.
- Review the areas on the Ham bank used during the flood event
- Inspecting the access/egress route, including the drawbridge for any signs of damage, whether due to flooding or not and initiating any repairs that may be required.
- Cleaning of areas affected by flooding eg removal of trash and washing down areas of hard standing and paths
- Debriefing forum at which any key lessons learned from the flood can be raised. Residents' representatives should have an input to this forum.

- Preparation of Post-Event Report dealing with the sequence of events and actions, informed by the debriefing forum and encouraging feedback from residents. The Report should include a Section on Recommended Actions along with any improvements for the Emergency Plan and Warning procedures.
- Key findings from the Report should be communicated to officials from LBRT, Environment Agency and emergency services as required.

Following the reopening of Broom Road, the residents will be able to:

- Relocate their vehicles to the site
- Contribute to the Debriefing forum and Post Event Report (see above) and provide feedback on the flood event and on how procedures can be improved for subsequent events.

The time taken for residents to return to normal will be relatively short following any flood event as, once vehicles have been relocated, the only issues of import will be the washing down of flooded paths and clearance of trash.

B.3.8 Dangers of Flood Water

The proximity of the site to the River Thames means that residents should have some appreciation of the presence of water and associated hazard. This will be reinforced by warning notices at various locations and the provision of appropriate rescue equipment. Warnings should address not only the risk of drowning but also the risk of contact with contaminated flood water and the dangers of underwater obstacles. Such notices should be available for every property as part of the "residents' welcome pack". Notices should also be placed at the foot of the stairwells that give out onto the garden area.

B.4 Management of the Flood Emergency Plan

The management of the plan and in particular its updating following a flood event has already been addressed in part through the suggested Debriefing Forum and Post-Event Report. These will provide the basis for updating the Emergency Plan.

The plan will need to be reviewed ahead of any planned raising of the flood defences. This has been indicated as a possibility by the Environment Agency and will have an important consequence on the plan. Whilst flood frequency and impacts will be reduced, the plan should accommodate the reduced frequency and awareness of flood risk, coupled with the consideration for any breaches in the defences.

B.4.1 Business Continuity Plans

The site is wholly residential, so no businesses will be directly affected by the flooding. However, there is likely to be a significant indirect impact given the likely difficulty for people to travel to places of work. In the early stages of a flood, the provision of business continuity will not be a priority. However, following the peak of the flood, there may be scope for provision of business continuity support for those that either cannot reach their normal place of work or for whom this is difficult. This may be in the form of assistance for IT or of a courier service for those working from home. However, it is difficult to be specific in view of the varied businesses that residents may be engaged with and for which support may be required.

B.4.2 List of Key Contacts

A list of key contacts is given in Table B-5.

B.4.3 Plan Usage and Dissemination

The key actions that are required include:

- Provide all residents with a copy of the Flood Emergency Plan. This will highlight the key sources of information on flooding.
- The Emergency Plan would need to be kept in each residence.
- Maps prominently placed, showing the emergency access route under flood conditions
- Explanatory notes for the flood warnings to be available with the screen information and on the web site.
- Full information will also be available via the internet on warnings and actions.

An annual flood awareness drill should be undertaken and will most likely require closure of the site to members of the public. This will allow a "walk through" of the emergency procedures, from the site to the temporary car park at Ham. This will provide an opportunity to use the telescopic bridge, to show possible water levels under flood conditions, to test the various flood barriers and to highlight potential problem areas.

The drill should be undertaken by Site staff, but it is highly likely that staff from the Environment Agency and LBRT would support and contribute to this event. It could be timed to coincide with awareness campaigns run by the Environment Agency. These are typically in the autumn, which would be appropriate given that the most likely time for fluvial flood extremes is in the winter.

B.4.4 Document Control and Monitoring

This Emergency Plan has been prepared for the scheme as envisaged at the time of Planning Application. The Plan should be updated to reflect the Scheme "as built" and to refine it so that it is suitable for a non-technical readership.

The procedure for updating this plan has been described above. The document would be "owned" by the Site Management staff, who would apply relevant control procedures to ensure key changes were communicated to all residents and updated on the web site.

Table B-5 List of key Contacts

Organisation	Service	Name/number
Site office		To be advised
Environment Agency	Advice, warnings	Floodline number = 0345 988 1188
Environment Agency	Advice, warnings	http://www.environment-agency.gov.uk/default.aspx
LBRT	Council services	08456 122 660
LBRT	Emergency out of hours	020 8744 2442
Thames Valley Police	Non-emergency enquiries	101
Thames Water	24 hour service	0845 7200 898
Energy	Various	http://www.energynetworks.org/ Gives contacts for all energy companies

Table B-6 Flood emergency plan assessment form

Assessment Area/Section	Sub-criteria	Priority	Cross-reference
Scope, objectives and background	Scope, objectives and purpose of Plan	L	B.2.1
Location and proposal	Detailed site description, incl. Location	M	B.2.2
	Source of flooding	M	B.2.2
	Flood zone (SFRA and EA)	M	B.2.2
	Proposed land use/ use of building	M	B.2.2
	Important infrastructure and vulnerable areas, people and equipment	H	??
	Access/egress points	H	B.2.3 f
Risk assessment summary	Satisfactory FRA summary	L	B.2.3 a
	Flood maps	M	Figure B-4
	Flood hazard rating incl. Assessment and maps	H	B.2.3 b and e
	Impact of flooding, incl. Vulnerable people, structures, other hazards etc.	H	B.2.3 f
Mitigation measures	Assessment of potential mitigation measures and products	M	B.2.4
Flood warnings	Assessment of available flood warnings	M	B.3.2
	Advanced warning time	M	B.3.2
Flood alert notices	Dissemination of flooding warnings	M	B.3.3
Actions upon receiving flood alerts and warnings	Site specific escalation plan based on EA flood warning codes	H	B.3.4
	Alert procedures	M	Figure B-6
Safe egress and evacuation routes	Safe access to and from development	H	B.3.5 b
	Evacuation procedures	H	B.3.5 a
	People/property	M	B.3.5 a
	Evacuation routes (shown on map	H	Figure B-7
	Safe place of refuge (shown on map)	H	Figure B-7
	Welfare of people	L	B.3.6
On site and/or temporary refuge	Details of refuge, including on-site and/or temporary	M	B.3.6
	Quality of refuge	L	n/a
	Flood kit	L	n/a
Actions post evacuation	Welfare of people after evacuation	M	n/a
	Contact details of relevant authorities	L	Table B-5
	Post flooding clean up plan	L	B.3.7
After a flood	Estimated time taken for return to normal use	L	B.3.7
	Procedures required post flood	M	B.3.7
Business continuity	Advice to businesses; Continuity plans	L	B.4.1
List of key contacts	List all relevant key contacts	M	Table B-5
Dangers of flood water	Education on dangers of flood water	M	B.3.8
Plan usage and dissemination	Methods to raise plan awareness	M	B.4.3
	Awareness policy	L	B.4.3
	Exercise/test/practice of plan and evacuation	M	B.4.3
Document control	Document monitoring and review plan	L	B.4.4
	Responsibility for plan maintenance	L	B.4.4

Based on APPENDIX 3 – FLOOD EMERGENCY PLAN CHECKLIST & ASSESSMENT CRITERIA, from LBRT (2011)

Table B-7 Interpretation of Environment Agency flood warnings

EA Flood Warning	Explanation	What to do
 **FLOOD ALERT** FLOODING IS POSSIBLE. BE PREPARED.	Flooding of low laying land and roads is expected. Be alert, be prepared, and watch out.	➢ Monitor local news and weather forecasts ➢ Be aware of water levels near you. ➢ Be prepared to act on your flood plan ➢ Check on the safety of pets and livestock ➢ Prepare a flood kit of essential items ➢ Charge your mobile phone
 **FLOOD WARNING** FLOODING IS EXPECTED. IMMEDIATE ACTION REQUIRED.	Flooding of homes and businesses is expected. Act now!	➢ Move cars, pets, food, valuables and important documents to safety. ➢ Get flood protection equipment in place. ➢ Turn off gas, electricity and water supplies if safe to do so ➢ Put flood protection equipment in place ➢ Be prepared to evacuate your home. ➢ Protect yourself, your family and help others. ➢ Act on your flood plan
 **SEVERE FLOOD WARNING** SEVERE FLOODING. DANGER TO LIFE	Severe flooding is expected. There is extreme danger to life and property. Act now!	➢ Stay in a safe place with a means of escape ➢ Be ready should you need to evacuate ➢ Co-operate with the emergency services ➢ Call 999 if you are in immediate danger

Appendix C Allowances for climate change in NPPF

Table C-1 Recommended contingency allowances for net sea level rise

Administrative Region	1990-2025	2025-2055	2055-2085	2085-2115
East of England, East Midlands, London, SE England (south of Flamborough Head)	4.0	8.5	12.0	15.0
South West	3.5	8.0	11.5	14.5
NW England, NE England (north of Flamborough Head)	2.5	7.0	10.0	13.0

Table 4 (p10) from NPPF (DCLG, 2012b)

Notes:

1. For deriving sea levels up to 2025, the 4mm/yr, 3mm/yr and 2.5mm/yr rates (covering the three groups of administrative Regions respectively), should be applied back to the 1990 base sea level year. From 2026 to 2055, the increase in sea level in this period is derived by adding the number of years on from 2025 (to 2055), multiplied by the respective rate shown in the table. Subsequent time periods 2056-2085 and 2086-2115 are treated similarly.
2. Refer to Defra FCDPAG3 *Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts*, October 2006, for details of the derivation of this table. In particular, Annex A1 of this Note shows examples of how to calculate sea level rise.
3. Vertical movement of the land is incorporated in the table and does not need to be calculated separately.

Table C-2 Recommended contingency allowances for rainfall, river flow, wind and waves

Parameter	1990-2025	2025-2055	2055-2085	2085-2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%	+20%	+20%
Offshore wind speed	+5%	+5%	+10%	+10%
Extreme wave height	+5%	+5%	+10%	+10%

Table 5 (p11) from NPPF (DCLG, 2012b)

Notes:

1. Refer to *Defra FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts, October 2006*, for details of the derivation of this table.
2. For deriving peak rainfall, for example, between 2025-2055 multiply the rainfall measurement (in mm/hour) by 10 per cent and between 2055-2085 multiply the rainfall measurement by 20 per cent. So, if there is a 10mm/hour event, for the 2025-2055 period this would equate to 11mm/hour; and for the 2055/2085 period, this would equate to 12mm/hour. Other parameters in Table B.2 are treated similarly.

Appendix D Pre-Application Response from the Environment Agency

creating a better place

Environment Agency

Dr Paul Webster
HydroLogic Services
18-20 West End Road
Mortimer Common
Reading
RG7 3TF

Our ref: SL/2013/111434/01-L01
Your ref: K0358

Date: 7 August 2013

Dear Dr Webster

Conversion of Teddington studios to residential scheme at Teddington Studios Broom Road, Teddington, Middlesex, TW11 9BE.

Thank you for consulting us at the pre-application stage. Having reviewed the information submitted we would like to highlight the following issues and opportunities that will need addressing.

- Functional Flood Plain
- Sequential test
- Flood risk
- Defence raising and T2100
- Surface water drainage
- Potential for Land Contamination

We look forward to working with and are happy to review any draft reports and attend a meeting to discuss the issues raised. If you have any questions please contact me.

Yours sincerely

Joe Martyn
Planning Advisor

Direct dial 0203 263 8087
Direct e-mail joseph.martyn@environment-agency.gov.uk

Please note that the view expressed in this letter by the Environment Agency is a response to a pre application enquiry only and does not represent our final view in relation to any future planning application made in relation to this site. We reserve the right to change our position in relation to any such application. You should seek your own expert advice in relation to technical matters relevant to any planning application before submission.

Functional Flood Plain
As you are aware the site is partially located in the functional flood plain (FZ3b). Residential development is classified as more vulnerable in Table 2 (Flood risk vulnerability classification) of the Technical Guidance to the National Planning Policy Framework.

Table 1 (Flood zones) sets out the suitability of certain type of development within areas of flood risk. More vulnerable development is classed as inappropriate development in flood zone 3b. Within section 3a of the submitted document Scoping Flood Risk Assessment it is stated that the site is not considered to be is the functional floodplain as the flood defences protect the site to a level above that of the 1 in 20 year flood level. For this argument to be acceptable it should be discussed and agreed with Richmond Local Planning Authority. Functional Flood Plain is defined by LPA's with their strategic flood risk assessment (SFRA's). Until indicated to otherwise by Richmond we will consider this site to fall within 3b.

Within section 3b of the Scoping Flood Risk Assessment it is indicated the flood mapping carried out by your selves has shown that the site falls outside of flood zone 3b. We have not had to opportunity to review this information but are happy to do so to assess it technical accuracy. If the comparison of the modeled flood level and a topographic survey for the site lies outside the 1 in 20 extent we are happy to confirm this. This should then be discussed with Richmond Local Planning Authority to decide if this mean the site falls outside flood zone 3b.

If the site is deemed to fall outside of the functional floodplain to the satisfaction of Richmond Local Planning Authority then the following issues with also need to the considered through a Flood Risk Assessment.

Sequential Test
As highlighted in the document this site will have to undergo the sequential test. We are pleased to see that this is being discussed with the local authority at the earliest possible stage. We will require that evidence of this is submitted at the planning application stage.

Flood Risk
Twickenham Studio is at risk of both tidal and fluvial flooding. The defence levels near Teddington protect against the tidal event up to and including the 1 in 1000 year tidal event. They are lower than the extreme water level during fluvial dominated events. Fluvial levels are expected to reach 7.0 to 7.5m AOD in this area. This will have to be addressed through the FRA.

Defence height
Thames Estuary 2100: Improvements to the Flood Risk Management System - Implementation Guidance states that in the future the defences in this area will need to be raised to 8.9 mAOD, and the FRA should demonstrate that this will be possible for the proposed development.

In addition to planning permission, under the terms of the Water Resources Act 1991, and the Thames Region Land Drainage Byelaws, 1981, the prior written consent from us is required for proposed works or structures, in, under, over or within 16 metres of the landward side of the tidal flood defences.

Built Footprint
It will need to be shown that any increase in built footprint within the 1 in 100 chance in any year including an allowance for climate change flood extent can be directly compensated for, on a volume-for-volume and level-for-level basis to prevent a loss of floodplain storage. Please be aware that if there are no available areas for compensation above the design flood level, then compensation will not be possible and no increases in built footprint will be allowed. The use of voids, stilts or undercroft parking as mitigation for a loss in floodplain storage should be avoided as experience shows that they become blocked over time by debris or domestic effects, and we would recommend to the Local Planning Authority that these are not accepted as methods of compensation.

Finished Floor Level
We require any new developments within the floodplain to ensure that finished floor levels are set no lower than 300millimetres above the 1 in 100 chance in any year including an allowance for climate change flood level, to protect people and the property from flooding. Where this cannot be achieved due to other planning constraints, we request that floor levels are set as high as possible (for extensions to existing buildings, no lower than the existing floor levels) and that flood resilience/resistance measures are considered, where appropriate, up to the design flood level.

Safe Access
During a flood, the journey to safe, dry areas completely outside the 1 in 100 chance in any year including an allowance for climate change floodplain would involve crossing areas of potentially fast flowing water. Those venturing out on foot in areas where flooding exceeds 100millimetres or so would be at risk from a wide range of hazards, including for example unmarked drops, or access chambers where the cover has been swept away. Safe access and egress routes should be assessed in accordance with the guidance document 'FD2320 (Flood Risk Assessment Guidance for New Developments)'. Where safe, dry access cannot be achieved, an emergency flood plan that deals with matters of evacuation and refuge to demonstrate that people will not be exposed to flood hazards should be submitted to and agreed with the local planning authority.

Surface Water Drainage
For sites greater than 1 Hectare in size, a surface water strategy should be carried out as part of a FRA to demonstrate that the proposed development will not create an increased risk of flooding from surface water. The surface water strategy should be carried out in accordance with the National Planning Policy Framework and PPS25 Practice Guide, giving preference to infiltration over discharge to a watercourse, which in turn is preferable to discharge to surface water sewer.

Drainage Scheme Requirements
Infiltration rates should be worked out in accordance with BRE 365. If it is not feasible to access the site to carry out soakage tests before planning approval is granted, a desktop study may be undertaken looking at the underlying geology of the area and assuming a worst-case infiltration rate for that site. If infiltration methods are likely to be ineffective then discharge may be appropriate. In any case the surface water strategy should clearly show that:

- Peak Discharge rates from the site should meet the requirements of Policy 5.13 of the London Plan (July 2011). Policy 5.13 states that: "developers should aim to achieve greenfield runoff from their site through

incorporating rainwater harvesting and sustainable drainage", with a 50% reduction in the runoff rate being the essential standard that must be achieved (London Plan Supplementary Planning Guidance: Sustainable Design and Construction).

- Storage volumes required on site up to a 1 in 100 chance in any year including an allowance for climate change storm event can be provided;
- The site will not flood from surface water up to a 1 in 100 chance in any year including an allowance for climate change storm event, or that any surface water flooding can be safely contained on site up to this event.

Sustainable Drainage Techniques

Any surface water strategy should try to utilise sustainable drainage techniques, in accordance with the SuDS management train (Ciria C609). Guidance on the preparation of surface water strategies can be found in the Defra/Environment Agency publication "Preliminary rainfall runoff management for developments". Guidance on climate change allowances can be found within the National Planning Policy Framework
Technical Guidance.

SuDS are an approach to managing surface water run-off which seeks to mimic natural drainage systems and retain water on or near the site as opposed to traditional drainage approaches which involve piping water off site as quickly as possible. SuDS involve a range of techniques which include soakaways, infiltration trenches, permeable pavements, grassed swales, ponds and wetlands. SuDS offer significant advantages over conventional piped drainage systems in reducing flood risk by attenuating the rate and quantity of surface water run-off from a site, promoting groundwater recharge, and improving water quality and amenity.

The variety of SuDS techniques available means that virtually any development should be able to include a scheme based around these principles.
Further information on SuDS can be found in:

- PPS25 Practice Guide
- CIRIA C522 document Sustainable Drainage Systems – design manual for England and Wales
- CIRIA C697 document SuDS manual

Further Information

Our External Relations Team can provide any relevant flooding information that we have available; the model information included in section 3c for scoping flood risk assessment has been superseded. Please be aware that there may be a charge for this information. Please email: NETenquiries@environment-agency.gov.uk

For further information on our flood map products please visit our website at: www.environment-agency.gov.uk/research/planning/93498.aspx
Strategic Flood Risk Assessments (SFRA) are undertaken by local planning authorities as part of the planning process. The SFRA may contain information to assist in preparing site-specific Flood Risk Assessments (FRA) . Applicants should consult the SFRA while preparing planning applications. Please contact your local authority for further information.

Potential for Land Contamination

We will need a Preliminary Risk Assessment (PRA) to assess if land contamination may be present at the site. This should be submitted with the planning application. The PRA needs to include information on *past and current uses, if sensitive controlled waters receptors are present and if the site could pose a pollution risk.* The PRA should also consider if any aspects of the proposed development could pose a pollution risk should contamination be present (i.e. deep drilling to facilitate the installation of foundation piles, site drainage). Further work such as an intrusive site investigation may be required depending on the findings of the PRA.

We recommend that developers should:

1. Follow the risk management framework provided in CLR11, 'Model Procedures for the Management of Land Contamination', when dealing with land potentially affected by contamination;
2.
3. Refer to our 'Guiding Principles for Land Contamination' documents for the type of information that should be included in a PRA;
4.
5. Refer to our 'Groundwater Protection: policy and practice (GP3)' documents.

Of the drainage options for a site, infiltration techniques (primarily soakaways) pose the highest risk of polluting the groundwater. Some general information is provided below in relation to the use of infiltration techniques. Ultimately, any drainage design must be protective of the groundwater and in line with our 'Groundwater Protection: policy and practice (GP3)' for the use of infiltration techniques to be approved.

- If contamination is present in areas proposed for infiltration, we will require the removal of all contaminated material and provision of satisfactory evidence of its removal;
- The point of discharge should be kept as shallow as possible. Deep bored infiltration techniques are not acceptable;
- The distance between the point of discharge and the groundwater table should be a minimum of five metres;
- Only clean, uncontaminated water should be discharged into the ground.

Advice for developers

We have updated our advice for developers and it is now a joint agency document with advice from Environment Agency, Natural England and Forestry Commission, it's available to view on our website
http://www.environment-agency.gov.uk/business/sectors/136252.aspx

Appendix E Teddington Riverside: Illustrative Landscape Master Plan

Appendix F Teddington Riverside: Landscape Layout

Appendix G MicroDrainage Simulation output

Main stormwater attenuation tank

Small stormwater attenuation tank

Large soakaway

Small soakaway

Amazi Consulting Ltd		Page 1
13 Tovells Road Ipswich Suffolk IP4 4DY	Teddington Riverside Main Tank	
Date 28 May 2014 File MAIN_TANK.SRCX	Designed by LSP Checked by PW	
Micro Drainage	Source Control 2014.1.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 363 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	6.501	0.501	0.0	4.9	4.9	119.1	O K
30 min Summer	6.577	0.577	0.0	4.9	4.9	137.1	O K
60 min Summer	6.655	0.655	0.0	4.9	4.9	155.6	O K
120 min Summer	6.722	0.722	0.0	4.9	4.9	171.5	O K
180 min Summer	6.747	0.747	0.0	4.9	4.9	177.5	O K
240 min Summer	6.754	0.754	0.0	4.9	4.9	179.1	O K
360 min Summer	6.743	0.743	0.0	4.9	4.9	176.5	O K
480 min Summer	6.726	0.726	0.0	4.9	4.9	172.5	O K
600 min Summer	6.707	0.707	0.0	4.9	4.9	168.0	O K
720 min Summer	6.688	0.688	0.0	4.9	4.9	163.4	O K
960 min Summer	6.637	0.637	0.0	4.9	4.9	151.3	O K
1440 min Summer	6.534	0.534	0.0	4.9	4.9	126.8	O K
2160 min Summer	6.409	0.409	0.0	4.9	4.9	97.1	O K
2880 min Summer	6.312	0.312	0.0	4.9	4.9	74.1	O K
4320 min Summer	6.179	0.179	0.0	4.7	4.7	42.6	O K
5760 min Summer	6.124	0.124	0.0	4.4	4.4	29.4	O K
7200 min Summer	6.104	0.104	0.0	3.7	3.7	24.8	O K
8640 min Summer	6.092	0.092	0.0	3.2	3.2	21.7	O K
10080 min Summer	6.083	0.083	0.0	2.8	2.8	19.7	O K
15 min Winter	6.564	0.564	0.0	4.9	4.9	134.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	193.777	0.0	122.8	26
30 min Summer	112.974	0.0	143.3	40
60 min Summer	65.865	0.0	168.3	68
120 min Summer	38.400	0.0	196.3	126
180 min Summer	28.007	0.0	214.8	184
240 min Summer	22.388	0.0	228.9	242
360 min Summer	16.328	0.0	250.5	328
480 min Summer	13.052	0.0	267.0	388
600 min Summer	10.971	0.0	280.5	452
720 min Summer	9.520	0.0	292.1	520
960 min Summer	7.549	0.0	308.8	658
1440 min Summer	5.443	0.0	334.0	912
2160 min Summer	3.925	0.0	362.0	1284
2880 min Summer	3.113	0.0	382.7	1644
4320 min Summer	2.174	0.0	400.5	2300
5760 min Summer	1.685	0.0	414.6	2952
7200 min Summer	1.383	0.0	425.3	3680
8640 min Summer	1.177	0.0	434.1	4408
10080 min Summer	1.027	0.0	441.5	5144
15 min Winter	193.777	0.0	137.6	26

Amazi Consulting Ltd		Page 2
13 Tovells Road Ipswich Suffolk IP4 4DY	Teddington Riverside Main Tank	
Date 28 May 2014 File MAIN_TANK.SRCX	Designed by LSP Checked by PW	
Micro Drainage	Source Control 2014.1.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	6.651	0.651	0.0	4.9	4.9	154.6	O K
60 min Winter	6.739	0.739	0.0	4.9	4.9	175.6	O K
120 min Winter	6.818	0.818	0.0	4.9	4.9	194.4	O K
180 min Winter	6.851	0.851	0.0	4.9	4.9	202.1	O K
240 min Winter	6.863	0.863	0.0	4.9	4.9	205.0	O K
360 min Winter	6.857	0.857	0.0	4.9	4.9	203.6	O K
480 min Winter	6.833	0.833	0.0	4.9	4.9	197.8	O K
600 min Winter	6.810	0.810	0.0	4.9	4.9	192.3	O K
720 min Winter	6.784	0.784	0.0	4.9	4.9	186.2	O K
960 min Winter	6.718	0.718	0.0	4.9	4.9	170.5	O K
1440 min Winter	6.565	0.565	0.0	4.9	4.9	134.1	O K
2160 min Winter	6.373	0.373	0.0	4.9	4.9	88.6	O K
2880 min Winter	6.243	0.243	0.0	4.9	4.9	57.6	O K
4320 min Winter	6.121	0.121	0.0	4.3	4.3	28.6	O K
5760 min Winter	6.095	0.095	0.0	3.4	3.4	22.6	O K
7200 min Winter	6.082	0.082	0.0	2.8	2.8	19.4	O K
8640 min Winter	6.073	0.073	0.0	2.4	2.4	17.4	O K
10080 min Winter	6.067	0.067	0.0	2.1	2.1	15.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	112.974	0.0	160.6	40
60 min Winter	65.865	0.0	188.5	68
120 min Winter	38.400	0.0	219.9	124
180 min Winter	28.007	0.0	240.6	182
240 min Winter	22.388	0.0	256.5	238
360 min Winter	16.328	0.0	280.6	346
480 min Winter	13.052	0.0	299.1	440
600 min Winter	10.971	0.0	314.2	476
720 min Winter	9.520	0.0	327.2	554
960 min Winter	7.549	0.0	345.9	710
1440 min Winter	5.443	0.0	374.1	992
2160 min Winter	3.925	0.0	405.5	1364
2880 min Winter	3.113	0.0	428.7	1684
4320 min Winter	2.174	0.0	448.7	2256
5760 min Winter	1.685	0.0	464.4	2992
7200 min Winter	1.383	0.0	476.4	3672
8640 min Winter	1.177	0.0	486.3	4408
10080 min Winter	1.027	0.0	494.6	5144

Amazi Consulting Ltd		Page 3
13 Tovells Road Ipswich Suffolk IP4 4DY	Teddington Riverside Main Tank	
Date 28 May 2014 File MAIN_TANK.SRCX	Designed by LSP Checked by PW	
Micro Drainage	Source Control 2014.1.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
Site Location	GB 516650 171400 TQ 16650 71400
C (1km)	-0.024
D1 (1km)	0.332
D2 (1km)	0.304
D3 (1km)	0.225
E (1km)	0.307
F (1km)	2.513
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.342

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.114	4	8	0.114	8	12	0.114

Amazi Consulting Ltd		Page 4
13 Tovells Road Ipswich Suffolk IP4 4DY	Teddington Riverside Main Tank	
Date 28 May 2014 File MAIN_TANK.SRCX	Designed by LSP Checked by PW	
Micro Drainage	Source Control 2014.1.1	

Model Details

Storage is Online Cover Level (m) 7.000

Cellular Storage Structure

Invert Level (m) 6.000 Safety Factor 1.5
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	250.0	0.0	1.000	250.0	0.0

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0105-5000-1000-5000
Design Head (m)	1.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	105
Invert Level (m)	6.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.0
Flush-Flo™	0.295	4.9
Kick-Flo®	0.636	4.0
Mean Flow over Head Range	-	4.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	1.200	5.4	3.000	8.3	7.000	12.4
0.200	4.8	1.400	5.8	3.500	8.9	7.500	12.8
0.300	4.9	1.600	6.2	4.000	9.5	8.000	13.2
0.400	4.9	1.800	6.5	4.500	10.1	8.500	13.6
0.500	4.7	2.000	6.9	5.000	10.6	9.000	14.0
0.600	4.3	2.200	7.2	5.500	11.1	9.500	14.4
0.800	4.5	2.400	7.5	6.000	11.5		
1.000	5.0	2.600	7.8	6.500	12.0		

Amazi Consulting Ltd		Page 1
13 Tovells Road Ipswich Suffolk IP4 4DY	Teddington Riverside Secondary Tank	
Date 28 May 2014 File SECONDARY_TANK.SRCX	Designed by LSP Checked by PW	
Micro Drainage	Source Control 2014.1.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 32 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	6.607	0.607	0.0	4.0	4.0	11.5	O K
30 min Summer	6.615	0.615	0.0	4.0	4.0	11.7	O K
60 min Summer	6.563	0.563	0.0	4.0	4.0	10.7	O K
120 min Summer	6.454	0.454	0.0	4.0	4.0	8.6	O K
180 min Summer	6.359	0.359	0.0	4.0	4.0	6.8	O K
240 min Summer	6.282	0.282	0.0	4.0	4.0	5.4	O K
360 min Summer	6.182	0.182	0.0	3.9	3.9	3.5	O K
480 min Summer	6.130	0.130	0.0	3.6	3.6	2.5	O K
600 min Summer	6.108	0.108	0.0	3.3	3.3	2.1	O K
720 min Summer	6.095	0.095	0.0	2.9	2.9	1.8	O K
960 min Summer	6.079	0.079	0.0	2.4	2.4	1.5	O K
1440 min Summer	6.063	0.063	0.0	1.7	1.7	1.2	O K
2160 min Summer	6.052	0.052	0.0	1.3	1.3	1.0	O K
2880 min Summer	6.045	0.045	0.0	1.0	1.0	0.9	O K
4320 min Summer	6.037	0.037	0.0	0.7	0.7	0.7	O K
5760 min Summer	6.032	0.032	0.0	0.5	0.5	0.6	O K
7200 min Summer	6.029	0.029	0.0	0.5	0.5	0.6	O K
8640 min Summer	6.027	0.027	0.0	0.4	0.4	0.5	O K
10080 min Summer	6.025	0.025	0.0	0.3	0.3	0.5	O K
15 min Winter	6.692	0.692	0.0	4.0	4.0	13.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	193.777	0.0	14.2	17
30 min Summer	112.974	0.0	16.5	30
60 min Summer	65.865	0.0	19.3	46
120 min Summer	38.400	0.0	22.5	78
180 min Summer	28.007	0.0	24.6	110
240 min Summer	22.388	0.0	26.2	138
360 min Summer	16.328	0.0	28.6	196
480 min Summer	13.052	0.0	30.5	252
600 min Summer	10.971	0.0	32.1	308
720 min Summer	9.520	0.0	33.4	370
960 min Summer	7.549	0.0	35.3	490
1440 min Summer	5.443	0.0	38.2	734
2160 min Summer	3.925	0.0	41.3	1084
2880 min Summer	3.113	0.0	43.7	1468
4320 min Summer	2.174	0.0	45.8	2200
5760 min Summer	1.685	0.0	47.3	2864
7200 min Summer	1.383	0.0	48.5	3624
8640 min Summer	1.177	0.0	49.6	4336
10080 min Summer	1.027	0.0	50.4	5008
15 min Winter	193.777	0.0	15.9	17

Amazi Consulting Ltd		Page 2
13 Tovells Road Ipswich Suffolk IP4 4DY	Teddington Riverside Secondary Tank	
Date 28 May 2014 File SECONDARY_TANK.SRCX	Designed by LSP Checked by PW	
Micro Drainage	Source Control 2014.1.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	6.709	0.709	0.0	4.0	4.0	13.5	O K
60 min Winter	6.650	0.650	0.0	4.0	4.0	12.3	O K
120 min Winter	6.480	0.480	0.0	4.0	4.0	9.1	O K
180 min Winter	6.332	0.332	0.0	4.0	4.0	6.3	O K
240 min Winter	6.226	0.226	0.0	3.9	3.9	4.3	O K
360 min Winter	6.121	0.121	0.0	3.6	3.6	2.3	O K
480 min Winter	6.096	0.096	0.0	2.9	2.9	1.8	O K
600 min Winter	6.082	0.082	0.0	2.5	2.5	1.6	O K
720 min Winter	6.074	0.074	0.0	2.2	2.2	1.4	O K
960 min Winter	6.063	0.063	0.0	1.7	1.7	1.2	O K
1440 min Winter	6.052	0.052	0.0	1.3	1.3	1.0	O K
2160 min Winter	6.043	0.043	0.0	0.9	0.9	0.8	O K
2880 min Winter	6.038	0.038	0.0	0.7	0.7	0.7	O K
4320 min Winter	6.031	0.031	0.0	0.5	0.5	0.6	O K
5760 min Winter	6.027	0.027	0.0	0.4	0.4	0.5	O K
7200 min Winter	6.024	0.024	0.0	0.3	0.3	0.5	O K
8640 min Winter	6.022	0.022	0.0	0.3	0.3	0.4	O K
10080 min Winter	6.015	0.015	0.0	0.1	0.1	0.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	112.974	0.0	18.5	30
60 min Winter	65.865	0.0	21.6	48
120 min Winter	38.400	0.0	25.2	84
180 min Winter	28.007	0.0	27.5	116
240 min Winter	22.388	0.0	29.3	144
360 min Winter	16.328	0.0	32.1	192
480 min Winter	13.052	0.0	34.2	250
600 min Winter	10.971	0.0	35.9	308
720 min Winter	9.520	0.0	37.4	368
960 min Winter	7.549	0.0	39.6	490
1440 min Winter	5.443	0.0	42.8	734
2160 min Winter	3.925	0.0	46.3	1092
2880 min Winter	3.113	0.0	48.9	1460
4320 min Winter	2.174	0.0	51.3	2192
5760 min Winter	1.685	0.0	53.0	2912
7200 min Winter	1.383	0.0	54.4	3472
8640 min Winter	1.177	0.0	55.5	4408
10080 min Winter	1.027	0.0	10.9	6616

Amazi Consulting Ltd		Page 3
13 Tovells Road Ipswich Suffolk IP4 4DY	Teddington Riverside Secondary Tank	
Date 28 May 2014 File SECONDARY_TANK.SRCX	Designed by LSP Checked by PW	
Micro Drainage	Source Control 2014.1.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
Site Location	GB 516650 171400 TQ 16650 71400
C (1km)	-0.024
D1 (1km)	0.332
D2 (1km)	0.304
D3 (1km)	0.225
E (1km)	0.307
F (1km)	2.513
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.039

Time (mins) From:	To:	Area (ha)
0	4	0.039

Amazi Consulting Ltd		Page 4
13 Tovells Road Ipswich Suffolk IP4 4DY	Teddington Riverside Secondary Tank	
Date 28 May 2014 File SECONDARY_TANK.SRCX	Designed by LSP Checked by PW	
Micro Drainage	Source Control 2014.1.1	

Model Details

Storage is Online Cover Level (m) 7.000

Cellular Storage Structure

Invert Level (m) 6.000 Safety Factor 1.5
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	20.0	0.0	1.000	20.0	0.0

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SFP-0092-4000-1000-4000
Design Head (m)	1.000
Design Flow (l/s)	4.0
Flush-Flo™	Calculated
Objective	Future Proof
Diameter (mm)	92
Invert Level (m)	6.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	4.0
Flush-Flo™	0.261	4.0
Kick-Flo®	0.589	3.1
Mean Flow over Head Range	-	3.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.1	1.200	4.3	3.000	6.6	7.000	9.9
0.200	3.9	1.400	4.7	3.500	7.1	7.500	10.2
0.300	3.9	1.600	4.9	4.000	7.6	8.000	10.5
0.400	3.8	1.800	5.2	4.500	8.0	8.500	10.8
0.500	3.6	2.000	5.5	5.000	8.4	9.000	11.1
0.600	3.2	2.200	5.7	5.500	8.8	9.500	11.4
0.800	3.6	2.400	6.0	6.000	9.2		
1.000	4.0	2.600	6.2	6.500	9.6		

Amazi Consulting Ltd		Page 1
13 Tovells Road Ipswich Suffolk IP4 4DY	Teddington Riverside Soakaway (A = 1,000 sqm) FOS = 1.5	
Date 27 May 2014 File Teddington_soakaway.srcx	Designed by LSP Checked by PW	
Micro Drainage	Source Control 2014.1.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 520 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	4.614	0.414	1.0	35.4	O K
30 min Summer	4.676	0.476	1.0	40.7	O K
60 min Summer	4.741	0.541	1.0	46.2	O K
120 min Summer	4.801	0.601	1.0	51.3	O K
180 min Summer	4.828	0.628	1.1	53.7	O K
240 min Summer	4.840	0.640	1.1	54.7	O K
360 min Summer	4.841	0.641	1.1	54.8	O K
480 min Summer	4.831	0.631	1.1	53.9	O K
600 min Summer	4.819	0.619	1.1	53.0	O K
720 min Summer	4.807	0.607	1.0	51.9	O K
960 min Summer	4.777	0.577	1.0	49.4	O K
1440 min Summer	4.723	0.523	1.0	44.7	O K
2160 min Summer	4.651	0.451	1.0	38.5	O K
2880 min Summer	4.586	0.386	1.0	33.0	O K
4320 min Summer	4.457	0.257	0.9	22.0	O K
5760 min Summer	4.364	0.164	0.9	14.0	O K
7200 min Summer	4.301	0.101	0.9	8.7	O K
8640 min Summer	4.264	0.064	0.9	5.4	O K
10080 min Summer	4.249	0.049	0.8	4.2	O K
15 min Winter	4.664	0.464	1.0	39.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	193.777	0.0	22
30 min Summer	112.974	0.0	37
60 min Summer	65.865	0.0	66
120 min Summer	38.400	0.0	124
180 min Summer	28.007	0.0	184
240 min Summer	22.388	0.0	242
360 min Summer	16.328	0.0	360
480 min Summer	13.052	0.0	420
600 min Summer	10.971	0.0	482
720 min Summer	9.520	0.0	544
960 min Summer	7.549	0.0	676
1440 min Summer	5.443	0.0	952
2160 min Summer	3.925	0.0	1360
2880 min Summer	3.113	0.0	1756
4320 min Summer	2.174	0.0	2508
5760 min Summer	1.685	0.0	3176
7200 min Summer	1.383	0.0	3824
8640 min Summer	1.177	0.0	4496
10080 min Summer	1.027	0.0	5136
15 min Winter	193.777	0.0	22