ARUP

Subject Barnes Hospital - Interaction with TWUL

Date 14 December 2018 **Job No/Ref** 226594-00

Introduction

This note gives a summary of the consultation undertaken with Thames Water Utilities Limited (TWUL) with regards to the potable, surface and foul water supply for the new Barnes Hospital development.

Potable Water

Correspondence

30th Nov 2018:	Pre-planning application submitted to TWUL
6th Dec 2018:	TWUL reply to application stating they have capacity concerns for the water supply and need to model the system internally.
10-11th Dec 2018:	Phone calls from Arup to TWUL, clarifying the need for modelling.
12th Dec 2018:	Issue of note of findings to Montagu Evans

Consultation

TWUL stated that the water flow rate of 5.8 l/s stated in pre-application is relatively small, but will put excess strain on the network in the area. TWUL requires further internal modelling to ensure that this flow can be accommodated or confirm network upgrades that need to be made to do so.

TWUL stated that to be able to push the application through, they need information of the exact number of water outlets within the SEN School and Health Hub on the site. These are unique buildings and therefore the water usage cannot be calculated based on a maximum number of occupants, (as can be done with the residential units on the site.)

TWUL stated that receiving the information on the number of water outlets would not guarantee that no further modelling is required, but means an exact flow rate can be deduced. If this flow rate is lower than the estimated 5.8 l/s and within an acceptable range for the network, then TWUL would be able to confirm capacity, otherwise TWUL would still require further internal modelling to be carried out.

This level of MEP design has not been commissioned for the Barnes Hospital site at this stage of works, therefore TWUL cannot yet continue their internal modelling as stated in their response to the pre-planning enquiry on 6th December 2018.

Subject	Barnes Hospital - Interaction with TWUL		
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Surface Water

Correspondence

30th Nov 2018:	Pre-planning application submitted to TWUL
12th Dec 2018:	Email sent to TWUL developer services, chasing for information
14th Dec 2018:	TWUL response supporting use of SuDS, and outlining that discharge rate to be agreed with LB Richmond will be acceptable to TWUL

Consultation

A pre-planning application has been sent to TWUL, and they have confirmed that a discharge rate should be agreed with the Local Authority (LB Richmond upon Thames), and that TWUL would be about to accommodate that agreed discharge.

Foul Water

Correspondence

30th Nov 2018:	Pre-planning application submitted to TWUL
12th Dec 2018:	Email sent to TWUL developer services, chasing for information
14th Dec 2018:	TWUL response confirming that there is sufficient capacity for the proposed development to discharge foul water drainage by gravity

Consultation

A pre-planning application has been sent to TWUL, and they have confirmed that foul water drainage from the proposed development can be accommodated within their existing network.

Ms E Downey
South west lon st Georges mental health trust
Springfield University Hospital
61 Glenburnie rd
London
SW17 7DJ

Our ref: DS6056034

0800 009 3921
Monday to Friday, 8am to 5pm

14th Dec 2018

Pre-planning enquiry: Wastewater Capacity check

Dear Ms Downey

Thank you for providing details of your development with the Pre-Planning application dated 29th Nov 18' for development @ Barnes Hospital South Worple Way London SW14 8SU

{ Brownfield site developed to 53 houses+30 Flats + Special Education needs school & Helath Hub as detailed in the application}.

Foul

If your proposals progress in line with the details you've provided as above, we're pleased to confirm that there will be sufficient sewerage capacity to serve your foul discharges from your development, provided the discharge is by gravity.

Surface Water
In considering your surface water needs, we support the use of sustainable drainage on development sites.

The surface water drainage strategy should follow policy 5.13 of the London Plan. Typically greenfield run off rates of 5l/s/ha should be aimed for using the drainage hierarchy. The hierarchy lists the preference for surface water disposal as follows; Store Rainwater for later use > Use infiltration techniques, such as porous surfaces in non-clay areas > Attenuate rainwater in ponds or open water features for gradual release > Discharge rainwater direct to a watercourse > Discharge by storing and attenuating rainwater direct to a surface water sewer/drain > Discharge by storing and attenuating rainwater to the combined sewer.

Please refer to the attached document titled ''Planning your wastewater'' attached to this letter, specifically to notes relating to surface water. Also I would advise you to liaise with the LA and discuss their criteria regarding surface water discharges in that area and adhere to their stipulation. If you agree & adhere to a LA stipulation then TW will be able to accommodate that agreed discharge.

This confirmation is valid for 12 months or for the life of any planning approval that this information is used to support, to a maximum of three years.

Please note that you must keep us informed of any changes to your design – for example, an increase in the number or density of homes. Such changes could mean there is no longer sufficient sewerage capacity.

What happens next?

Please make sure you submit your connection application, when you are ready, giving us at least 21 days' notice of the date you wish to make your new connection/s.

If you've any further questions, please contact me.

Yours sincerely

Siva Sivarajan

Developer Services- Wastewater Adoptions Engineer
Office:0203 577 7752 Mobile: 07747842608
siva.sivarajan@thameswater.co.uk

Thames Water Utilities Ltd, Clearwater Court, Vastern Road, Reading, Berkshire, RG1 8DB
Find us online at developers.thameswater.co.uk

TW internal ref: DTS 24141

From: Tim Beech <tim.beech@thameswater.co.uk>
Sent: 04 December 2018 10:55
To: Hamish Tozer
Cc: Stuart Jordan
Subject: [External] RE: Barnes Hospital

Hi Hamish,

We need to ensure all responses go through the appropriate system via developer services, comments from myself or my team hold no weight internally unless on the corporate system. Therefore on this occasion you'll need to wait to go through the system like all the other developers submitting enquires.

We deal with 96 local authorities and unfortunately I'm not close enough to understand each of their policies. It might be something the GLA are imposing through the London Plan? When developer services pick this up they'll consult my team and we'll ensure we get this one done as soon as we can.

Thanks,

Tim Beech
South London Infrastructure Planning Manager
Wastewater Strategy, Planning & Investment
Thames Water Utilities Ltd
Reading STW, Island Road
Reading, RG2
0RP
☎ 07747640588
(40588) tim.beech@thameswater.co.uk

Promoting intelligent investment in our wastewater assets.

From: Hamish Tozer [mailto:Hamish.Tozer@arup.com]
Sent: 03 December 2018 18:05
To: Tim Beech
Cc: Stuart Jordan
Subject: RE: Barnes Hospital

Hi Tim, thanks for your quick response.

We submitted an application on Friday 30 Nov, and are already getting considerable pressure from the planning consultants to confirm when Thames Water will respond – we understand we don't go to the top of the list, though the LPA are refusing to validate the application until we can confirm capacity of drainage and water supply (note we haven't found this is required by other planning authorities, are you able to shed some light on whether this will become more common throughout London?).

The driver for this pressure is that the client and council have particularly tight funding deadlines for the Special Education Needs School, and the planning application needs to be validated ASAP so that these funding streams can be achieved.

We received a response on submission that we would hear back by this Fri 7 Dec, which is very much appreciated, though given the pressure from the planning consultants is there any way for you to check in or push this along on your end? We'd very much appreciate it, even if simply 'no impact study required' or 'further information required'.

Happy to discuss on the phone if you'd prefer, my number is below.

Many thanks,

Hamish Tozer
Senior Civil Engineer
MIEAust CPEng

Arup
13 Fitzroy Street London W1T 4BQ United Kingdom
d: +44 20 7755 4092
www.arup.com

Please note I will be on leave from Mon 17 Dec, returning Mon 7 Jan

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From: Tim Beech <tim.beech@thameswater.co.uk>
Sent: 28 November 2018 14:00
To: Hamish Tozer <Hamish.Tozer@arup.com>
Cc: Stuart Jordan <Stuart.Jordan@arup.com>
Subject: [External] RE: Barnes Hospital

Hi Hamish,

All new enquiries need to go through our developer services department to ensure sites are tracked and logged appropriately. The question below is now a free service (think previously there was a fee).

https://developers.thameswater.co.uk/Developing-a-large-site/Planning-your-development/Water-and-wastewater-capacity

Thanks,

Tim Beech
South London Infrastructure Planning Manager
Wastewater Strategy, Planning & Investment
Thames Water Utilities Ltd
Reading STW, Island Road

Reading, RG2
0RP
☎ 07747640588
(40588) tim.beech@thameswater.co.uk

Promoting intelligent investment in our wastewater assets.

From: Hamish Tozer [mailto:Hamish.Tozer@arup.com]
Sent: 28 November 2018 12:58
To: Tim Beech
Cc: Stuart Jordan
Subject: Barnes Hospital

Hi Tim,

We've previously been in contact in 2016 regarding the redevelopment of the Springfield Hospital site in LB Wandsworth. We're now supporting the SWLStG NHS Trust in assessing their Barnes Hospital site in LB Richmond upon Thames, for a similar redevelopment (part of the decant of Springfield Hospital), although on a much smaller scale at 1.4 ha total site area. The proposed site will have three residential blocks, a Health Hub, and a Special Education Needs (SEN) school, on South Worple Way SW14 8SU.

We have prepared an FRA including drainage strategy, and this has been submitted to the LB Richmond upon Thames – they have requested that we "*provide evidence in the form of written confirmation as part of the planning application that capacity exists in the public sewerage and water supply network to serve the development*" (Policy LP 23 of their Local Plan), hence this email.

I've extracted the essentials of our drainage proposals from our FRA below (we are not commissioned to design the potable water supply so I've just provided the scale of development from the architects).

Could you please review and let me know if you can confirm that capacity is available for these proposed discharge / demand rates, or outline additional information / studies required to be provided / undertaken, for which we can then outline a way forward to LB Richmond upon Thames to address the requirement in italics above. We acknowledge that there is a formal process which should apply, though are looking to provide some assurance to the council, however if you're not able to confirm this currently, then we would appreciate advice on the fastest way to resolve this.

Surface Water Drainage

- Two connections to existing TWUL network, one to existing manhole TQ2175 TW1705, one new manhole at north east corner of site, approx. 60m east of existing manhole TQ2175 TW1704 – this site appears to be at the head of the TWUL surface water drainage network, and existing pipes are very shallow;
- Design storm is 1:30 year plus 40% allowance for climate change;
- Attenuate surface water runoff on site in a small number of shallow buried systems (approx. 600 m3 total volume), restricting discharge for whole site to the greenfield runoff rate calculated for a 1:30 year design storm of approx. 5.0 l/s – we expect this to be lower than the existing discharge rate.

Foul Water Drainage

- One connection to existing TWUL network, to existing manhole TQ2175 TW1702 – this appears to be the head of the network;
- Estimated foul water drainage peak discharge rates:
    - Residential 1.8 l/s
    - Health Hub 7.9 l/s
    - SEN School 0.5 l/s

Potable Water Supply

- 83 residential units (three of these in converted existing buildings);
- GIA Schedule:

	GIA Sq.m
Total Existing Floor Space	6,952 Sq.m *
Floorspace to be demolished	6,714 Sq.m *
Floorspace to be retained	238 Sq.m *
New Build Floorspace Health Hub	2,500 Sq.m
New Build Floorspace SEN	2,402 Sq. m
New Build Floorspace Residential	6,918 Sq. m
Total Floorspace of New Facilities	12,058 Sq. m*

*All areas are based on scaled drawings and therefore are indicative.

- Estimated potable water peak demand flow rates:
    - Residential 1.0 l/s
    - Health Hub 4.1 l/s
    - SEN School 0.7 l/s

Thanks,

Hamish Tozer
Senior Civil Engineer
MIEAust CPEng

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From:	Downey, Emily <Emily.Downey@swlstg.nhs.uk>
Sent:	06 December 2018 14:31
To:	Hamish Tozer; Anna Russell-Smith (Anna.Russell-Smith@Montagu-Evans.co.uk); Tom Cole (tom.cole@montagu-evans.co.uk); John Cohu
Cc:	Clark, Joseph
Subject:	[External] FW: Clean Water pre-planninf capacity check for Barnes Hospital, South Worple Way, London, SW14 8SU
Attachments:	Barnes Hospital, South Worple Way, London, SW14 8SU Water Capacity concerns.pdf

FYI – the letter says 53 houses and 30 flats – does that need correcting to all flats?

Thanks,
Emily

Emily Downey
EMP Project Support Officer

T: 020 3513 5992
E: emily.downey@swlstg.nhs.uk
A: Estates and Regeneration
South West London and St. George's Mental Health NHS Trust
Newton Building 3, Entrance 2 Ground Floor *Please note new office address*
Springfield University Hospital
61 Glenburnie Road, London SW17 7DJ

From: DEVELOPER.SERVICES@THAMESWATER.CO.U
[mailto:DEVELOPER.SERVICES@THAMESWATER.CO.UK]
Sent: 06 December 2018 14:20
To: Downey, Emily
Subject: Clean Water pre-planninf capacity check for Barnes Hospital, South Worple Way, London, SW14 8SU

Dear Emily,

Thanks for your application.

I tried calling you without any luck to discuss water requirement for comemrcial units.

However based on our understanding please find attached letter for your above development.

Should you have any queries please feel free to contact me.

Thanks & regards,

Aparna Yadav

Thames Water-Asset Development

02035778757

Visit us online www.thameswater.co.uk , follow us on twitter www.twitter.com/thameswater or find us on www.facebook.com/thameswater. We're happy to help you 24/7.

How is your care and treatment? Go online at: https://feedback.swlstg-tr.nhs.uk and let us know how we are doing.

Emily Downey
South West London and St George Mental.

Water pre-planning
Our ref DS6055991

6th December 2018

Pre-planning enquiry: Capacity concerns

Dear Emily

Thank you for providing information on your development at Barnes Hospital, South Worple Way, London, SW14 8SU consisting of 53 houses, 30 flats, Special education needs school and health hub.

We've assessed your proposals and concluded from our initial review that our supply network will have enough capacity to supply 83 residential units, but unfortunately we're unable to meet the needs of your full development at this time as actual water requirement for special education needs school and health hub is unknown.

In order to ensure we make the appropriate upgrades – or 'off-site reinforcement' – to serve the remainder of your development, we'll need to carry out modelling work and, if required, design a solution and build the necessary improvements. This work is done at our cost.

How long could modelling and reinforcement take?

Typical timescales for a development of your size are:

Modelling: 6 months
Design: 6 months
Construction: 6 months
Total: 18 months

If the time you're likely to take from planning and construction through to first occupancy is longer than this, we'll be able to carry out the necessary upgrades in time for your development. If it's shorter, please contact me on the number below to discuss the timing of our activities.

What do you need to tell us before we start modelling?

We're responsible for funding any modelling and reinforcement work. We need, though, to spend our customers' money wisely, so we'll only carry out modelling once we're confident that your development will proceed.

In order to have this confidence, we'll need to know that you **own the land and have either outline or full planning permission**. Please email this information to us as soon as you have it.

If you'd like us to start modelling work ahead of this point, we can do this if you agree to underwrite the cost of modelling and design. That means we'll fund the work – but you agree to pay the cost if you don't achieve first occupancy within five years.

I've attached an example of our underwriting agreement. Please call me on the number below if you'd like to discuss this or want to request a copy of the agreement to complete.

If the modelling shows we need to carry out reinforcement work, then before we start construction we'll need you to supply us with notification that you've confirmed your F10 – Notification of construction project - submission to the Health and Safety Executive.

What do I need to do next?

If you've satisfied the points above, then you should compare your own timeline with the typical timescales we've suggested for our activities. If the time you're likely to take from planning and construction through to first occupancy is **more** than the total time we're likely to take, we'll be able to carry out the necessary upgrades in time for your development.

If it's **less** than this, you might want to ask us to start modelling earlier – in which case we'll require you to underwrite the cost, as noted above.

If you can confirm whether you can provide the confidence we need we'll be able to start modelling if you still need it – but we won't do so until you've confirmed that you need it.

Please note that you must keep us informed of any changes to your design – for example, an increase in the number or density of homes. Such changes could mean there is no longer sufficient supply capacity.

If you've any further questions, please contact me on 02035778757.

Yours sincerely

Aparna Yadav

Thames Water

From: Richie Turner
Sent: 12 December 2018 17:38
To: developer.services@thameswater.co.uk
Cc: Hamish Tozer; Stuart Jordan
Subject: RE: Pre-Planning Enquiry - Barnes Hospital

Good afternoon,

I am wondering if there are any updates on the below application for the Barnes Hospital site, we have heard from you regarding the potable water supply to the site, however not about the surface or foul water supply.

We would happy to speak to whoever is dealing with the request if they require any more information from us.

Kind regards,

Richie Turner
Graduate Engineer | Infrastructure
MEng (Hons), GMICE

From: Richie Turner
Sent: 30 November 2018 18:39
To: 'developer.services@thameswater.co.uk' <developer.services@thameswater.co.uk>
Cc: Hamish Tozer <Hamish.Tozer@arup.com>; Stuart Jordan <Stuart.Jordan@arup.com>
Subject: Pre-Planning Enquiry - Barnes Hospital [Filed 30 Nov 2018 18:38]

Good afternoon,

Please see attached a pre-planning enquiry form for a new development at the Barnes Hospital site on South Worple Way in London Borough of Richmond-upon-Thames, (Postcode SW14 8SU.)

Attached is the completed enquiry form, with a site Flood Risk Assessment stapled on the back. Appendix E of the FRA shows a Proposed Drainage Plan with proposed sewers and connections. Please let me know if any additional information is needed.

I look forward to hearing your response.

Kind regards,

Richie Turner
Graduate Engineer | Infrastructure
MEng (Hons), GMICE

Arup
13 Fitzroy Street London W1T 4BQ United Kingdom
d: +44 20 7755 3394
www.arup.com

ARUP

Pre-planning enquiry

Application form

Please complete this form and return it to us at
developer.services@thameswater.co.uk or
Thames Water, Developer Services, Clearwater Court,
Vastern Road, Reading, RG1 8DB.

Thames Water

Application for a pre-planning enquiry

Please complete all sections of this form in BLOCK CAPITALS

If you're using this form to request a budget estimate, please note that you should be able to calculate the likely charges involved in your scheme by consulting our guide, 'Charging arrangements for new connection services', on our website.

Are you a: Developer ☒ Consultant ☐ Land promoter ☐ (Please tick one.)

Is your application for: Water ☐ Wastewater ☐ Both ☑ (Please tick one.)

Would you like a water budget estimate? Yes ☐ No ☒

(We can only offer a wastewater budget estimate after modelling, if required).

A - About the person applying

Company name SOUTH WEST LONDON AND ST GEORGES MENTAL HEALTH TRUST

Title Mr ☐ Mrs ☐ Ms ☑ Miss ☐ Dr ☐ Other

First name(s) EMILY

Last name DOWNEY

Preferred contact number 020 3513 5000

Alternative number 020 3513 3663

Email address Emily.Downey@swlstg.nhs.uk

Full postal address

Address line 1 SPRINGFIELD UNIVERSITY HOSPITAL

Address line 2 61 GLENBURNIE RD

Town LONDON

County GREATER LONDON Postcode SW17 7DJ

B - Nominated contact

Who should we contact to process your application? Applicant ☐ Someone else ☑

(Please tick one.)

If someone else:

Company name ARUP

Title Mr ☑ Mrs ☐ Ms ☐ Miss ☐ Dr ☐ Other

First name(s) HAMISH

Last name TOZER

Preferred contact number 020 7755 4092

Alternative number

Email address: Hamish.Tozer@arup.com

Full postal address

Address line 1: 13 FITZROY STREET (1ST FLOOR)

Address line 2: FITZROVIA

Town: LONDON

County: GREATER LONDON Postcode: W1T 4BQ

C - Where the work is taking place

What is the address of the property being connected?

Same as applicant ☐ Same as nominated contact ☐

Somewhere else ☑ (Please tick one.)

If somewhere else:

Site name: BARNES HOSPITAL

Full postal address

Address line 1: BARNES HOSPITAL

Address line 2: SOUTH WORPLE WAY

Town: LONDON

County: GREATER LONDON Postcode: SW14 8SU

D - About the site

What is the local authority? LONDON BOROUGH OF RICHMOND-UPON-THAMES

Ordnance Survey grid ref ~~21203~~ 21210 ~~75684~~

Type of site: Greenfield ☐ Brownfield ☑ Mixed ☐

How big is the site? 1.4 hectares

When do you intend to have first occupancy? MM: 12 YYYY: 2019 (Approximate date if necessary)

E - Planning status (if you've already started the planning process)

Is the development identified in the local plan? Yes ☐ No ☒ Don't know ☐ If Yes, reference number

Does it have outline planning permission? Yes ☐ No ☒ Don't know ☐ If Yes, reference number

Does it have full planning permission? Yes ☐ No ☒ Don't know ☐ If Yes, reference number

Does the development have building regulations permission? Yes ☐ No ☒ Don't know ☐

When do you intend to start on site? MM: 04 YYYY: 2019

F - About the water supply

If you're proposing a water storage tank, what is its capacity? [ ] m^3

When will you want your first domestic connection laid on? MM [ ] YYYY [ ]

For water supplies, what is the estimated flow rate required for your site? [5.8] litres/sec (Not required if applying only for wastewater.)

G - Existing sewerage connections (Not required if applying only for water.)

	Foul water	Surface water
Does the site have the following sewerage connections?	☑	☑
What is the type of discharge method?	☐ Gravity ? ☑ Pumped .	☑ Gravity ? ☐ Pumped ?
If sewage is pumped, what is the pump rate?	[ ] litres/sec	[ ] litres/sec
Amount of existing impermeable area per connection	N/A	1.2 ha. to TWUL manhole TQ2175 TW1704
What are the existing connection points? (For example, 'X' number of domestic and commercial properties drain into manhole 'Y' / sewer with diameter of 'Z'.)		

H - Proposed sewerage connections (Not required if applying only for water.)

	Foul water	Surface water
Does the site have the following sewerage connections?	☑	☑
What is the type of discharge method?	☑ Gravity ☐ Pumped	☑ Gravity ☐ Pumped
If sewage is pumped, what is the pump rate?	☐ litres/sec	☐ litres/sec
What is your proposed approach to surface water drainage?	N/A	☐ Traditional piped system ☑ Sustainable drainage system (SuDS)
Do you propose using separate highway and surface water drainage systems?	N/A	☐ Yes ☑ No
If the surface water rate is attenuated, to what rate is it attenuated?	N/A	5 litres/sec
Amount of proposed impermeable area per connection	N/A	0.47 ha to New Manhole (east of MH TQ2175TW1704) 0.48 ha to TQ2175TW1705
What are the proposed connection points? (For example, 'X' number of domestic and commercial properties drain into manhole 'Y' / sewer with diameter of 'Z'.)	83 residential units + Special Education Needs school + Healthcare ~~centre~~ Hub Drain to manhole TQ2175TW1702, diameter unknown	New MH Area = 0.47ha Discharge = 2.2 l/s Pipe dia = 150mm (Assumed) TQ2175TW1705 Area = 0.48ha Discharge = 2.8 l/s Pipe dia = 150mm (assumed)

Please note: The developer is expected to follow the local authority's drainage strategy and be able to demonstrate how the proposed (attenuated) discharge rate of any surface water flows has been calculated. For developments in Greater London, please refer to the London Plan Drainage Hierarchy (Policy 5.13). We will challenge the rates provided if they are not in line with those based on the local drainage strategies.

I - Additional information (where available)

When we're assessing your development needs, it's important that we know what buildings (if any) currently exist on the site. It may be, for example, that the infrastructure serving those properties is already sufficient to cater for your proposed development.

We realise it may be too early in your process to complete this table, but any information you can provide at this stage will help improve the accuracy of our assessment and could prevent us from requesting data in the future.

Property type	Existing site	Proposed site
General housing (units 3 person+)		53
Flat (units up to 2 person)		30 ~~55~~
Primary school (max. pupil capacity)		
Senior school (max. pupil capacity)		
Boarding school (max. pupil capacity)		
Assembly hall (max. capacity)		
Cinema (max. capacity)		
Theatre (max. capacity)		
Sports hall (max. capacity)		
Hotel (total bedrooms)		
Guest house (total bedrooms)		
Motel (total bedrooms)		
Holiday apartment (capacity)		
Leisure park (capacity)		
Caravan park standard (per space)		
Caravan site standard (per space)		
Camping site standard (per space)		
Camping site serviced (per space)		
Public house (max. capacity)		
Restaurant / Day care centre (max. capacity)		
Drive in restaurant (max. capacity)		
Hospital (per bed)		~~(GIA 1,992 m²)~~
Nursing / Care home (per bed)		
Offices (gross internal area in m²)		
Shopping centre (gross internal area in m²)		
Warehouse (gross internal area in m²)		
Commercial premises (gross internal area in m²)		
Manufacturing unit (gross internal area in m²)		
Other (please state units and description) Super SPECIAL EDUCATION NEEDS SCHOOL Health Hub (day facilities only)		(GIA 2,402 m²) GIA 1,992 m²)

J - Enclose your documents

Please make sure any attachments are in PDF format and don't exceed a total of 20MB in size per email.

All drawings must be of suitable detail and have a drawing reference number on them.

What we need from you to process your application:

Site location plan	This should show the site with nearby buildings, roads and any sewers.
Scaled site layout	This should show existing and proposed layouts.
Site drainage strategy plan (if available at this stage)	This should show all proposed sewers, pipe sizes and gradients. (Not required if applying only for water.)

Please also let us know if you have a **schedule of planned works** showing how you might phase your development.

Please note, without this information we may need to make assumptions about your requirements when calculating your budget estimate (if requested).

K - How we'll use this information

We'll use the information you give on this application form, and potentially share it with our delivery partners, to provide the service you've requested.

This could include contacting you to discuss your application and/or provide more details, visiting the site where work needs to be carried out, and invoicing you when appropriate. Your feedback is important to us, so we may also use the information to ask for your feedback on how we can improve our performance.

We won't use this information for marketing purposes without contacting you to seek your consent.

You can find Thames Water's privacy policy at thameswater.co.uk/Legal/Privacy.

L - Declaration

I confirm to the best of my knowledge that the information in this application is complete and correct.

Print name	HAMISH TOZER
Position within company	SENIOR ENGINEER
Company	ARUP
Date	29/11/2018
Signature	

Submitting your application

Please email your completed form to developer.services@thameswater.co.uk or send it to Thames Water Developer Services, Clearwater Court, Vastern Road, Reading RG1 8DB.

Once we've assessed your application, we'll write to tell you the result within 21 calendar days.

Where we know there's sufficient capacity we'll tell you, but if we're concerned there may not be, we'll advise you of the next steps. We'll also let you know if we need further information from you.

Getting in touch

For enquiries regarding this application or any other questions relating to your building or development work please contact us on:

thameswater.co.uk/developerservices

developer.services@thameswater.co.uk

0800 009 3921
Monday – Friday, 8am – 5pm

Thames Water, Developer Services, Clearwater Court,
Vastern Road, Reading, Berkshire RG1 8DB

This leaflet can be supplied in braille or audio-tape upon request.

Thames Water

03/18

South West London and St George's Mental Health NHS Trust

Barnes Hospital

Flood Risk Assessment

BAH-FRA-2018

2nd Issue | 2 November 2018

Job number 226594

Ove Arup & Partners Ltd
13 Fitzroy Street
London
W1T 4BQ
United Kingdom
www.arup.com

ARUP

Document Verification

ARUP

Job title		Barnes Hospital			**Job number** 226594
Document title		Flood Risk Assessment			**File reference** 04-05-03
Document ref		BAH-FRA-2018			
Revision	**Date**	**Filename**	Barnes Hospital FRA - Oct 2018.docx		
Draft 1	15 Oct 2018	**Description**	Draft for review		
			Prepared by	Checked by	Approved by
		Name	Richie Turner	Hamish Tozer	Stuart Jordan
		Signature			
Issue	26 Oct 2018	**Filename**	Barnes Hospital FRA - Oct 2018 - Issue.docx		
		Description	Final Issue		
			Prepared by	Checked by	Approved by
		Name	Richie Turner	Hamish Tozer	Stuart Jordan
		Signature			
2nd Issue	2 Nov 2018	**Filename**	Barnes Hospital FRA - Nov 2018 - Issue.docx		
		Description	2nd Issue		
			Prepared by	Checked by	Approved by
		Name	Richie Turner	Hamish Tozer	Stuart Jordan
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
				Issue Document Verification with Document	✓

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Executive Summary

Arup has been commissioned by the South West London and St George's Mental Health Trust (SWLStG) to prepare a site-specific Flood Risk Assessment (FRA) to support a full planning application for the proposed Barnes Hospital development.

This FRA has been undertaken in accordance with the National Planning Policy Framework (NPPF) (July 2018), the London Plan (March 2016), the London Borough of Richmond upon Thames (LBRT) Local Plan (adopted July 2018) and the LBRT Strategic Flood Risk Assessment (March 2016). Refer to Appendix A for a summary of relevant legislation and planning policy documents.

The findings of this site-specific Flood Risk Assessment are as follows:

- The site is in Flood Zone 1 and at a low risk of river or sea flooding (<0.1% annual probability);
- Future climate change effects are not expected to significantly increase the risk of flooding from sources except rainfall;
- The site is at a low risk of flooding from other sources such as surface water, sewers, groundwater, and artificial sources;
- The groundwater level is a minimum of 2.7 m below ground level, and previous borehole logs show sandy gravel down to approximately 10 m below ground level. Therefore, infiltration is considered a feasible method of discharge of surface water, however this is subject to further ground investigation;
- Surface water runoff is proposed to be captured primarily by permeable paving, with a geo-cellular sub-base replacement layer providing attenuation. Disposal is intended to be by infiltration and discharge at a restricted rate into existing Thames Water surface water sewers within South Worple Way.

1 Introduction

This FRA assesses the flood risk to the SWLStG Barnes Hospital development site, considering changes to the current flood risk caused by the development and from climate change. It also considers a preliminary drainage strategy for the site, in accordance with Sustainable Drainage Systems (SUDS) objectives to restrict the rate of surface water discharge from the site into the existing drainage network.

2 Existing Site

2.1 Location

The Barnes Hospital site lies on South Worple Way at SW14 8SU in the London Borough of Richmond upon Thames (LBRT). The site is approximately 1.4 hectares and is located to the south of the River Thames, bounded by South Worple Way to the north, Old Mortlake Burial Ground to the west, Grosvenor Avenue residences to the south and South Worple Avenue (public footpath) to the east. National Rail tracks are located along the far side of South Worple Way.

The site is currently occupied by the existing hospital and associated facilities which provide community and in-patient mental health services. It is made up mostly of buildings and hard standing with a small amount of green space.

A topographical survey was undertaken by XYZ Land Chartered Surveyors dated February 2016. It shows that the site levels across the site are generally in the range of +5.8 to +6.5 mAOD.

Figure 1 below illustrates the location of the site.

2.2 Flood Zone

The Environment Agency (EA) produces flood maps for the UK, which show the areas at risk of fluvial and/or tidal flooding. These express the risk of flooding as an annual probability of occurrence.

The EA has provided a Product 1, which is a Flood Map for planning. This shows that the site is located in Flood Zone 1 (i.e. a very low risk of flooding from rivers or sea, with < 0.1 % annual probability). This Flood Map is included in Figure 2 and Appendix C.

Figure 1: Location of Barnes Hospital site

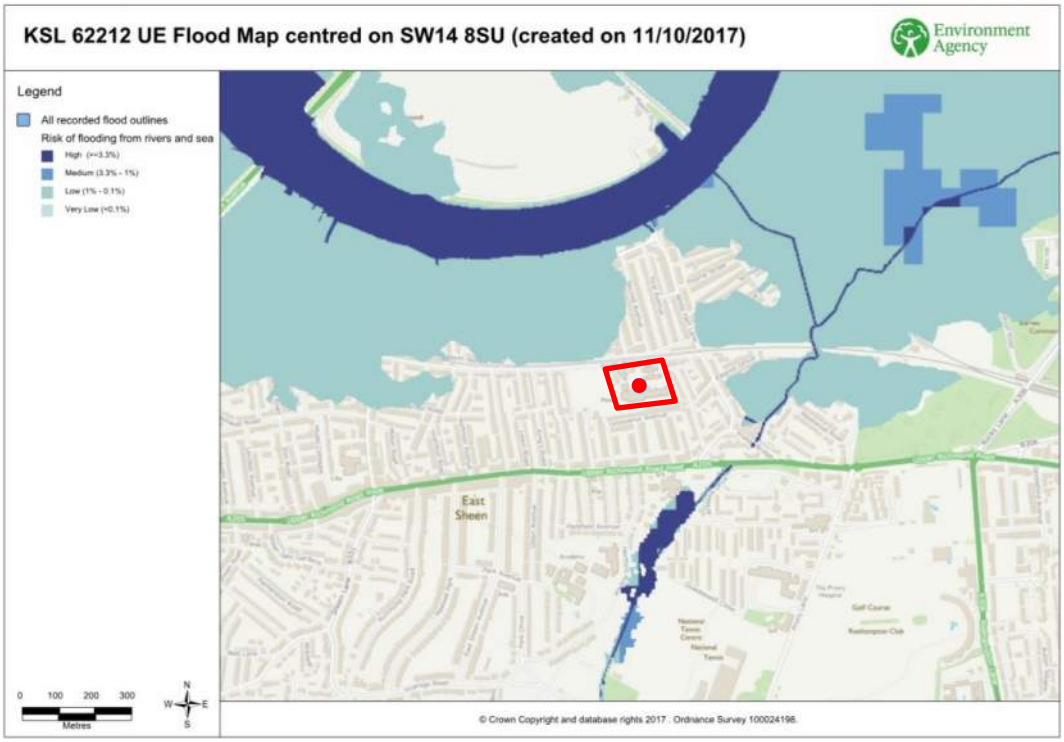


Figure 2: EA Product 1 showing risk of flooding from rivers and sea

3 Proposed Development

Outline planning permission for the demolition and comprehensive redevelopment (phased development) of land at Barnes Hospital to provide a mixed use development comprising a health centre (Use Class D1), a Special Educational Needs (SEN) School (Use Class D1), up to 80 new build residential units (Use class C3), the conversion of two of the retained BTMs for use for up 3no. residential units (Use Class C3), the conversion of one BTM for medical use (Use Class D1), car parking, landscaping and associated works. All matters reserved save for the full details submitted in relation to access points at the site boundaries.

The new buildings and roads will replace the majority of the existing arrangement on site. The extent of site considered by this report is indicated by the black and dashed red boundary in Figure 3, which shows an illustrated masterplan of the site.

Figure 3: Proposed ground floor plan for the development. (Source: Squire & Partners Architects)

4 Climate Change

4.1 Fluvial and Tidal Flooding

Since the proposed site is within Flood Zone 1, climate change is not expected to have a significant impact on the risk of fluvial or tidal flooding.

4.2 Surface Water Flooding

Rainfall intensity is anticipated to increase with climate change. The upper end allowance, as defined by the EA for a design life of 100 years (typical for residential development), is +40%. This has been taken into account when developing the surface water drainage strategy in Section 6.

4.3 Sewer Flooding

Climate change is not expected to have a significant impact on the risk of flooding from foul water drainage through existing foul water sewers, as foul water is primarily from internal sources.

4.4 Groundwater Flooding

Since the measured groundwater level is between 2.7-4.5m below proposed ground level, climate change is not expected to significantly increase the risk of flooding from groundwater.

5 Site Specific Flood Risk

A Level 1 Strategic Flood Risk Assessment (SFRA) has been carried out for the LBRT in June 2008 with updates in August 2010 and March 2016, which is applicable for this site. The SFRA has a strong emphasis on flooding from the river and sea.

Additionally, the LBRT Surface Water Management Plan 2011 (SWMP) assesses the surface water flood risk within the borough, using both historical information and undertaking pluvial modelling to determine the future flood risk for a range of rainfall events. These identify the areas of significant surface water and groundwater flooding risk and options to address this.

The National Planning Policy Framework (NPPF) (published in July 2018) and accompanying Planning Practice Guidance highlight the risk of flooding from the following sources:

- Fluvial (river) and tidal (sea);
- Pluvial (surface water);
- Groundwater;
- Drainage (surface water and foul);
- Reservoirs, canals, and other artificial sources.

5.1 Fluvial and Tidal Flooding

5.1.1 Environment Agency Fluvial Flood Maps

The Environment Agency (EA) produces flood maps for the UK, which show the areas at risk of fluvial and/or tidal flooding. These express the risk of flooding as an annual probability of occurrence.

The EA has provided a Product 1, which is a Flood Map for planning. This shows that the site is located in Flood Zone 1 (i.e. a very low risk of flooding from rivers or sea, with < 0.1 % annual probability). This Flood Map is included in Figure 4 and Appendix C.

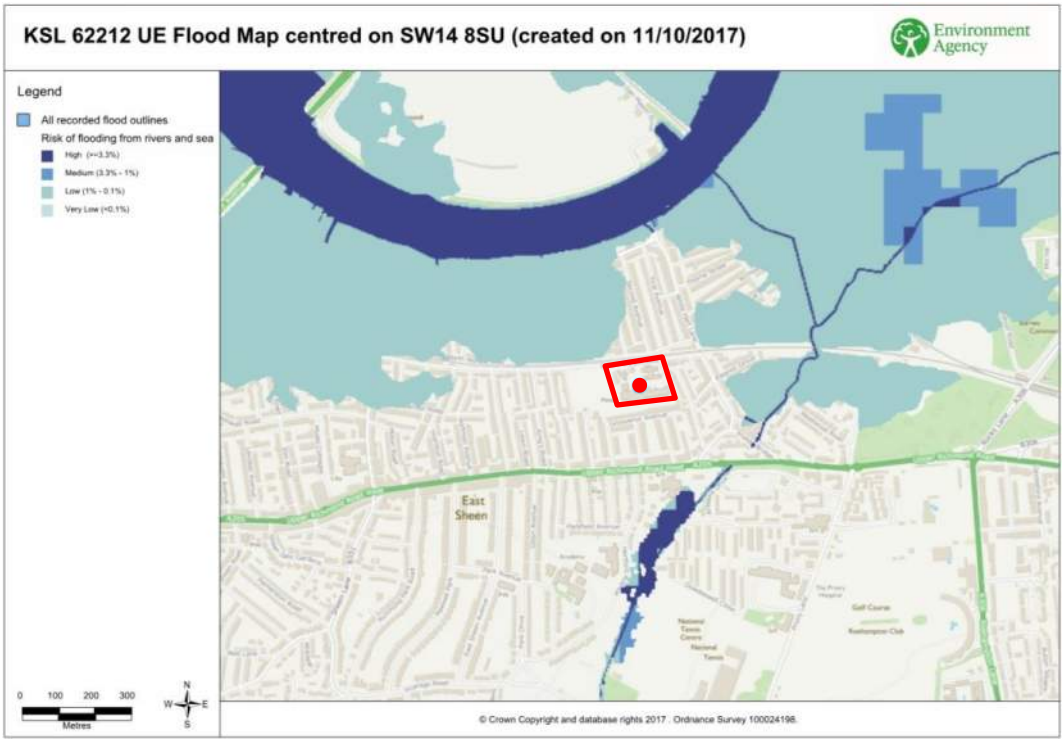


Figure 4: EA Product 1 showing risk of flooding from rivers and sea

5.1.2 Strategic Flood Risk Assessment

A Level 1 Strategic Flood Risk Assessment (SFRA) has been carried out for the LBRT in March 2016 in accordance with Planning Policy Statement 25: Development & Flood Risk. An extract of the SFRA maps show flood zones for planning is shown in Figure 5.

The SFRA shows the site is within Flood Zone 1, which is consistent with the EA flood maps.

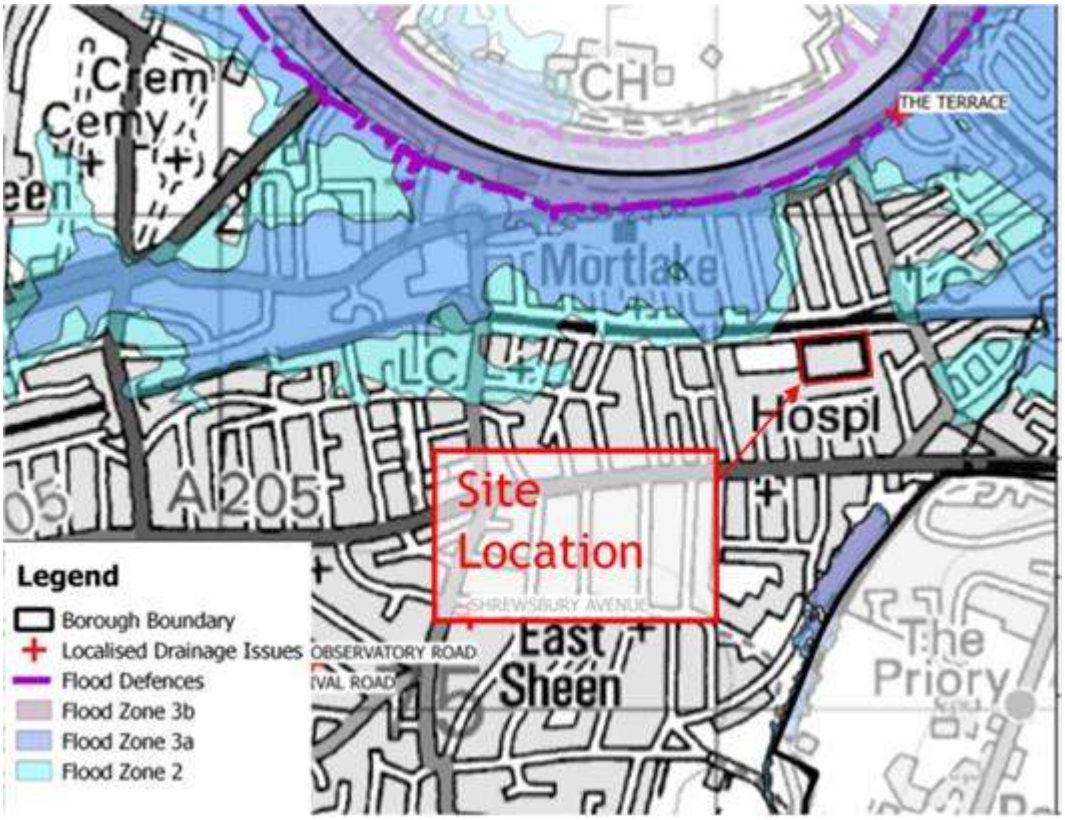


Figure 5: Extract from LBRT SFRA for Barnes

5.2 Pluvial (Surface Water) Flooding

The LBRT SFRA includes an assessment of the risk of flooding from surface water. This is driven by topography rather than existing drainage networks, and therefore is focussed on obstructions to overland flow.

Figure 6 is an extract from the SFRA, which shows that the Barnes Hospital site may have a flooding depth of 0.00 – 0.15 m. This is expected to be primarily due to the very flat topography of the site, rather than flow from off-site, and should be mitigated by a proposed surface water drainage network.

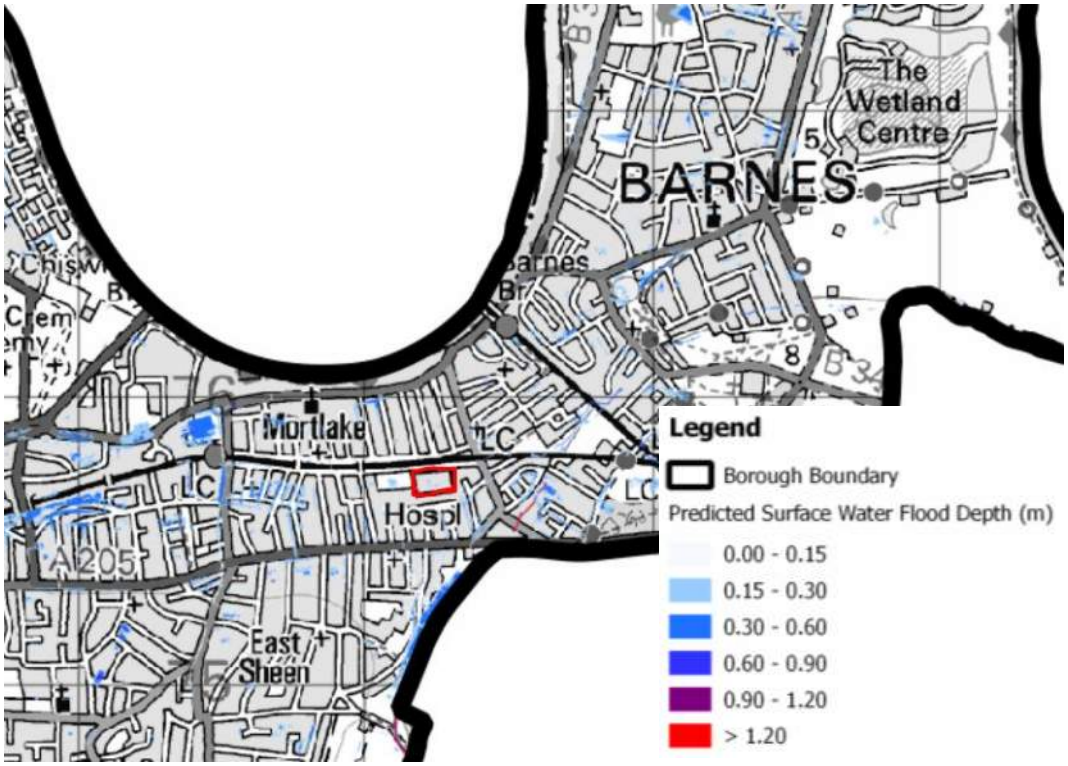


Figure 6: SFRA risk of flooding from surface water (for 1% chance of flooding in any one year) – approximate site boundary in red

5.3 Sewer Flooding

The LBRT SFRA shows that there have been between 1 and 5 reported incidences of sewer flooding within the vicinity of the site, though does not give any further detail on the exact location of these incidents, see Figure 7. This number is relatively low over a large area, hence sewer flood risk is considered to be low.

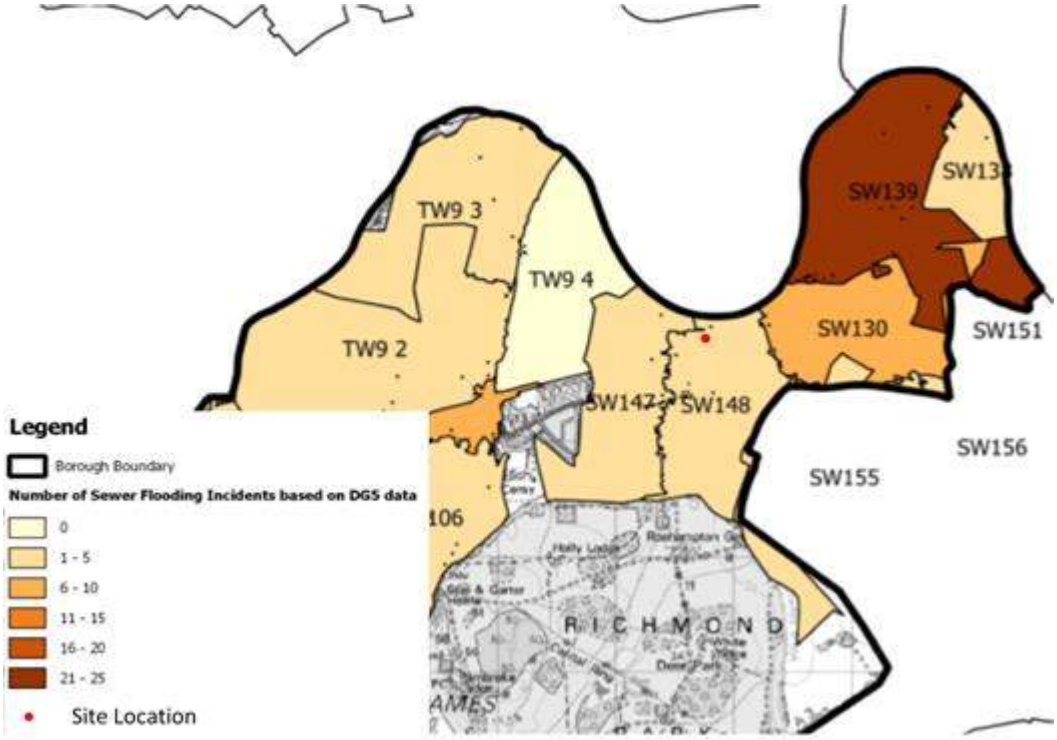


Figure 7: SFRA historic sewer flooding incidents

5.4 Groundwater Flooding

The LBRT SFRA includes the British Geological Survey (BGS) susceptibility to groundwater flooding assessment. An extract is included in Figure 8, which shows that the Barnes Hospital site does have a potential for groundwater flooding of property situated below ground.

Current proposals for the site include some subterranean car parking. It is expected that these elements would include sufficient waterproofing measures.

The risk of flooding from groundwater is considered to be low.

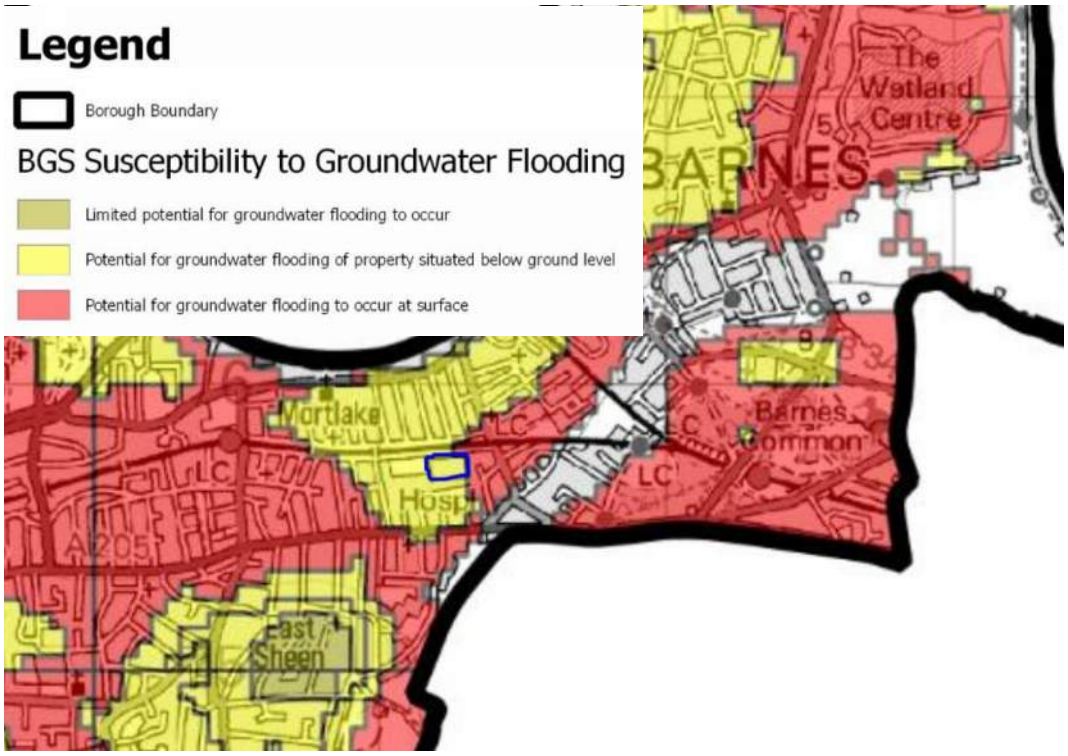


Figure 8: SFRA BGS susceptibility to groundwater flooding – approximate site boundary in blue

5.5 Artificial Sources of Flooding

The EA produce maps showing flood risk to the site due to the breach of a large reservoir. It can be seen in Figure 9, below, that the site has a negligible risk of being exposed to such flooding.

Figure 9: Extract of the EA Map showing risk of flooding from Artificial Water Sources

6 Surface Water Management

6.1 Preliminary Surface Water Drainage Study

Thames Water Utilities Limited (TWUL) have been identified as the local provider for surface water collection and operate services in South Worple Way, Lodge Avenue, Grosvenor Avenue and Buxton Road east of South Worple Avenue.

The Barnes Hospital site generally drains from south to north served by a private on-site network of sumps, downpipes, slot drains, manholes and pipes which discharge to an existing Ø225 mm TWUL sewer located in South Worple Way. The connection is located at the head of the TWUL network at a depth to invert ranging from 0.76-1.83 m, with one length running east before discharging into White Hart Lane, and one length falling to the west before discharging to a culvert beneath South Worple Way. From here, it is likely that this infrastructure feeds into a larger local network, leading to the Thames River, though this was not shown on the extents of the received utility records.

6.1.1 SUDS Assessment

The London Plan 2016 and the relevant Supplementary Planning Guidance (Sustainable Design and Construction 2014) advise developers to aim for 'greenfield' runoff rate from their development. This is defined as the runoff rate from a site in its natural state, prior to any development. For previously developed sites, runoff rates should not be more than three time the calculated greenfield rate.

The Flood and Water Management Act 2010 designate Lead Local Flood Authorities (for this site it is London Borough of Richmond and Thames) to establish requirements for design, building and operating Sustainable Urban Drainage Systems (SuDS) for approval of new developments. Developers will be required to utilise SuDS unless there are practical reasons for not doing so.

SuDS should be fully justified by adopting techniques in a hierarchical manner, maximising the use of those techniques higher up the hierarchy and those that deliver multi-functional benefits before considering others further down the hierarchy:

1. Store rainwater for later use;
2. Use infiltration techniques, such as porous surfaces in non-clay areas;
3. Attenuate rainwater in ponds or open water features for gradual release;
4. Attenuate rainwater by storing in tanks or sealed water feature for gradual release;
5. Discharge rainwater direct to a watercourse;
6. Discharge rainwater to a surface water sewer/drain;
7. Discharge rainwater to the combined sewer.

It is anticipated that the new development will require a new on-site surface water network to infiltrate and/or attenuate onsite before release to the TWUL network in South Worple Way at an appropriate rate to be agreed with TWUL.

Appropriate SuDS techniques for this site could include green/blue roofs, rainwater collection for greywater use, permeable pavements, filter drains/strips, swales, underground attenuation tanks and flow control devices. Space for these items should be incorporated into the development masterplan where practicable.

It is proposed that the site will discharge to the existing Ø225 mm TWUL network in South Worple Way. A new connection to the Ø225 mm sewer in Buxton Road may be a viable alternative.

The new network will be designed to adoptable standards and the extent of adoption will need to be discussed and agreed with TWUL.

The following works are recommended to progress the design:

- Further site visits and ground investigations of soil permeability and local hydrogeology to determine the viability of infiltration methods;
- Further site investigations to verify location, level and condition of connection to TWUL sewer;
- A review of a range of SuDS systems to assess the opportunities for inclusion in the development including surface water runoff prevention, runoff rate and volume reduction;
- Development of an integrated surface water drainage strategy for the development's masterplan which incorporates a SuDS management train with consideration for key issues including: construction and utility phasing, adoption strategy, suitability of existing connection points to external networks, details of new connections required to external networks, the extent of off-site reinforcements required and location of proposed utility corridors and building discharge locations;
- Consultation with and payment to TWUL to complete a sewer impact study to assess the impact of the proposed development flows on their existing drainage network.

6.2 Proposed Surface Water Drainage

The proposed strategy for surface water drainage primarily collects run off from roads and buildings within a new surface water network, using a permeable paving strategy to collect run off and transfer it to an on-site attenuation tank for storage and infiltration, before discharging by a restricted outflow to a Thames Water manhole within South Worple Way.

6.2.1 Feasibility of Infiltration

Geology

Available published map data from the British Geological Survey, see Figure 10 below, indicates the following strata will be encountered at or near surface within the site boundary:

- Kempton Park Gravel Formation (comprising sand and gravel, locally with lenses of silt, clay or peat);
- London Clay Formation (comprising clay, silt and sand).

It is anticipated that artificial deposits (made ground and re-worked deposits) will be encountered as a result of historical developments.

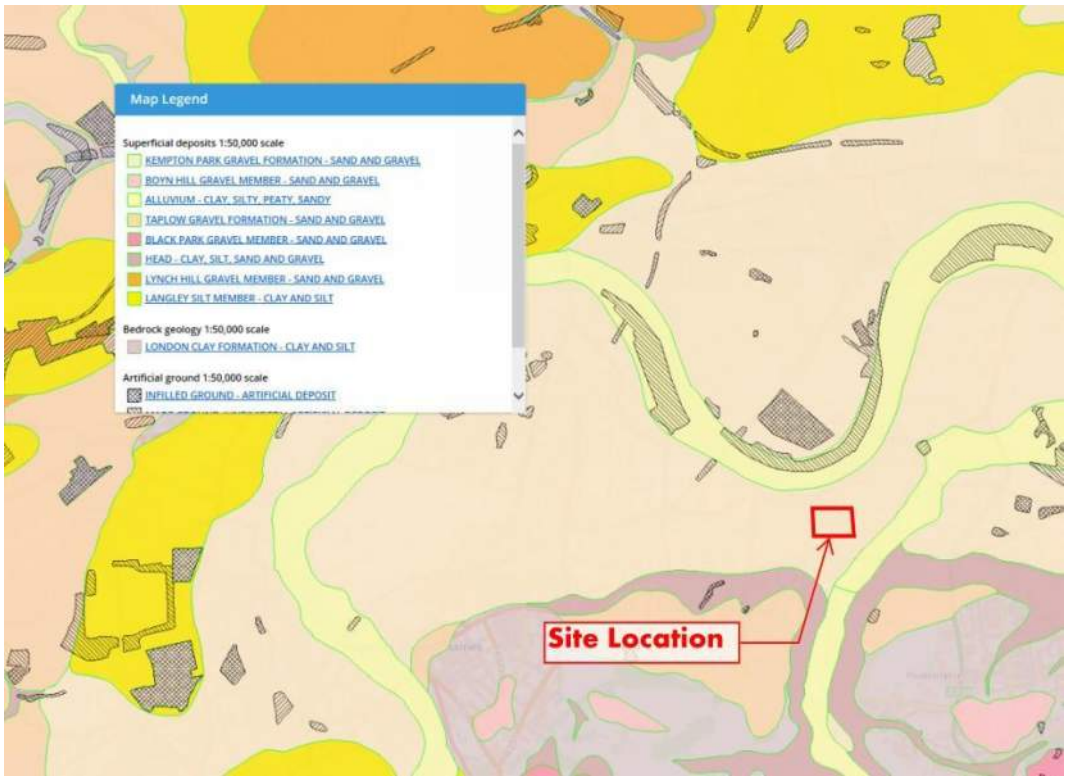


Figure 10: Superficial deposits and bedrock geology.

Borehole Records

A selection of historical borehole records, obtained from the BGS, were reviewed to confirm shallow ground conditions. Borehole record locations are shown on Figure 11 below and included the following:

- TQ27NW12
- TQ27NW11
- TQ27NW423

Figure 11: Borehole record locations

Borehole records generally confirm that there is a presence of sandy gravel to approximately 10 m below ground level followed by a clay formation to a depth of 45 m. This would indicate that infiltration methods could be viable for this site.

Records also indicated a groundwater level between 2.7 to 4.5 m below ground level. Ground water levels on site should be confirmed. There is a negligible risk of the site being exposed to groundwater flooding.

Allowing infiltration of surface water reduces the amount of water going into the existing network and also allows for the construction of a smaller attenuation tank on site. For the purposes of this FRA, two designs for the attenuation tank (one with and one without use of infiltration), have been made.

6.2.2 Greenfield Runoff Estimation

The greenfield runoff from the site was estimated using the online tool at uksuds.com; the results are included in Table 1 and Appendix D.

Table 1: Greenfield Runoff Rates

Design Storm	Greenfield Runoff Rate (l/s)
Qbar	2.19
1 in 1 year	1.86
1 in 30 years	5.04
1 in 100 years	6.98

6.2.3 Drainage Strategy

The site has a very flat topography, with a range of ground levels between 6.5 mAOD in the south-west corner of site and 6.0 mAOD just north of the centre of the site. The existing surface water drainage pipe in South Worple Way (north of site) is very shallow, at a depth of 0.76 m to invert (invert level (IL) of 5.28 mAOD) at its highest point, a manhole immediately adjacent to the proposed site egress.

The surface water drainage strategy is to store the runoff from a 1 in 30 year design storm (+40% allowance for climate change) below ground, and restrict the discharge into the existing TWUL network in South Worple Way to the estimated greenfield runoff rate for a 1 in 30 year design storm of approximately 5.0 l/s.

For the design of the surface water drainage, the buildings, healthcare / school car parking and access road to the residential underground car park are assumed to be 100% impermeable. These areas can be seen in the site plan (Appendix E). The strip of soft landscaping, approximately 8.0 m wide, along the west and south-western edges of the site is assumed to have no positive drainage (i.e. infiltrates naturally). The remainder of the site area is assumed 50% impermeable; a conservative estimate considering the site is predominantly soft landscaping intersected by footpaths. The total impermeable area is therefore approximately 0.95 ha.

A MicroDrainage Quick Storage Estimate was used to obtain an approximate volume of attenuation storage required for a 1 in 30 year rainfall event. Without infiltration this volume is 667 m^3, and with infiltration this is 601 m^3 (refer to Appendix B).

6.2.4 Proposed Solution

The proposed surface water drainage solution divides the attenuation and discharge into two separate areas: The healthcare / school area on the eastern side of the site and the residential area on the western side.

Eastern area

The volume of water to be attenuated in the eastern area of the site is 338 m^3 (refer Appendix B). The solution in the eastern area is to use permeable paving with geocellular sub-base replacement within the healthcare centre car park. The geocellular elements could be 600 mm deep and therefore would require a total surface area of approx. 560 m^2 to attenuate the area, with no infiltration. A potential layout for the geocellular area is in Figure 12. The remainder of the eastern area would be drained via channel drains and shallow pipes to discharge into the geocellular units.

Utilities required to/from the healthcare / school buildings could be routed around areas with geocellular storage, or utility corridors could be created through the geocellular system if necessary.

Western Area

To attenuate storm water on the western (residential) area of the site, geocellular blocks with a total depth of 900 mm could be installed under the soft landscaping between the residential blocks. These will have a cover of 150mm to allow for grass growth on the land above. The volume of water to be attenuated is approx. 330 m^3 without infiltration, therefore a total surface area of 366 m^2 would be required. A potential layout for the geocellular area is also shown in Figure 12. The remainder of the western area in hard landscaping could be drained via channel drains and shallow pipes to discharge into the geocellular units.

Utilities required to/from the residential blocks could be routed around areas with geocellular storage, or utility corridors could will be created through the geocellular system if necessary.

Figure 12: Proposed locations of geocellular surface water attenuation.

6.2.5 Proposed Connections

Two connections are proposed from the site, and shown in Figure 12 above. The eastern attenuation will connect to a new manhole on the existing drainage pipe in South Worple Way to the north-east of site, which would have an estimated IL of 5.20 mAOD. The permeable paving/geocell in the eastern area would have an IL of approximately 5.34 mAOD and so a 1% pipe grade for the short (approx. 12 m) distance between the attenuation tank and existing pipe is feasible for this connection.

The western area is to connect into the existing manhole TW1705 on South Worple Way. The pipe at this manhole is Ø225 mm with an IL of 4.60 mAOD. The base of the western geocellular tanks will be at approximately 5.10 mAOD, hence a 1% pipe grade over the approximately 66 m length would allow this connection.

6.3 Proposed Foul Water Drainage

6.3.1 Existing Network

The existing foul network around the Barnes Hospital site shows an existing foul water drainage pipe in South Worple Way to the north of the site. It is assumed that the site currently drains to manhole TQ2175NW1702 at the start of this run. The manhole in South Worple Way is 3.80m deep (CL: 6.43m, IL: 2.63m.) There is another drainage route on South Worple Avenue to the south east of the site, with an unknown depth. See Figure 13 below.

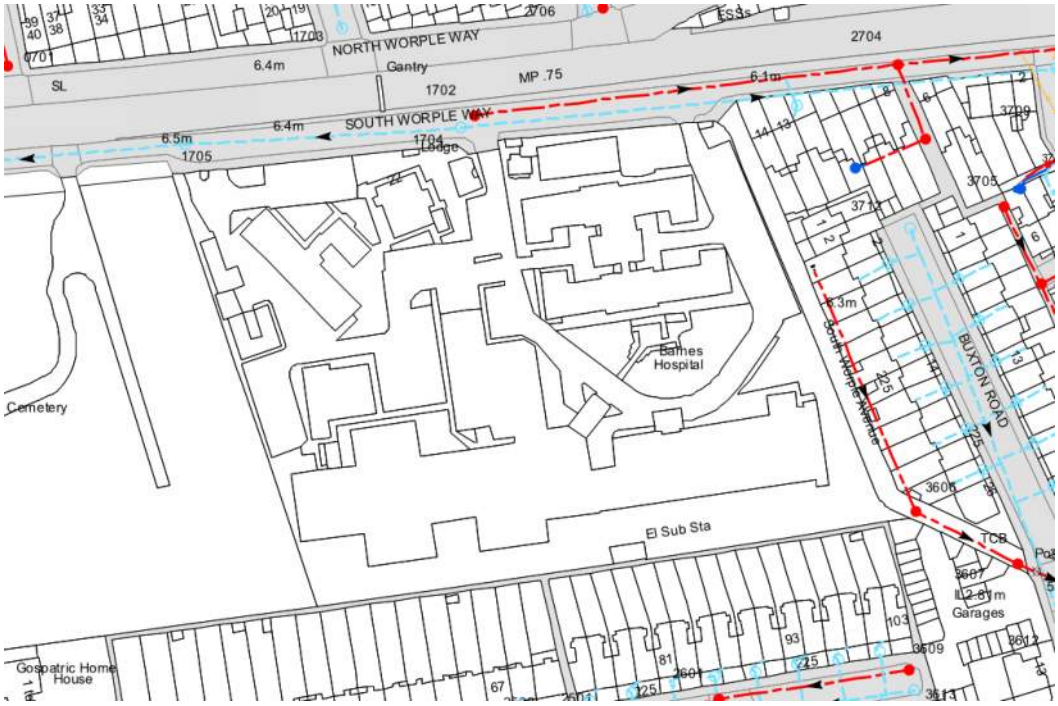


Figure 13: Existing drainage around Barnes hospital site (from Thames Water (TWUL) Asset Location Search (ALS))

6.3.2 Proposed Network

The proposed foul water drainage solution for the site is to gather the foul water from all buildings on site in manholes and pipes, and direct the flow north to the existing manhole TQ2175 NW1702 on South Worple Way. An indicative pipe network is shown in Figure 14. The pipe network will be designed to the standards set out in SfA 7th Edition.

6.3.3 Proposed Connections

One foul water connection is proposed from each building on the site. Foul water from the buildings will flow by gravity to these points and any foul water from the basements will be pumped up to these points. An indicative location for these can be seen on Figure 14.

There is one proposed connection to the existing manhole in South Worple Way. This will be routed into the existing connection in the manhole if possible, or this manhole could be rebuilt if required.

A survey of the existing network in this area should be carried out before finalising the design to establish the depth of the existing incoming pipe to manhole TQ2175 NW1702. A maximum allowable outflow to the existing network is to be agreed with TWUL before design completion.

Figure 14: Indicative FW network design

7 Conclusion

The findings of this site-specific Flood Risk Assessment are as follows:

- The site is in Flood Zone 1 and at a low risk of river or sea flooding (<0.1% annual probability);
- Future climate change effects are not expected to significantly increase the risk of flooding from sources except rainfall;
- The site is at a low risk of flooding from other sources such as surface water, sewers, groundwater, and artificial sources;
- The groundwater level is a minimum of 2.7 m below ground level, and previous borehole logs show sandy gravel down to approximately 10 m below ground level. Therefore, infiltration is considered a feasible method of discharge of surface water, however this is subject to further ground investigation;
- Surface water runoff is proposed to be captured by permeable paving and shallow drainage, directed to geo-cellular tanks under the sub-base; providing attenuation. Disposal is intended to be by infiltration and at a restricted rate of 5.0 l/s into existing Thames Water surface water sewers within South Worple Way;
- Foul water drainage from buildings will be collected in a series of new manholes and pipes and discharged to the existing manhole TQ2175NW1702 in South Worple Way.

Appendix A

Background Legislation and Guidance

A1 Legislation

A1.1 Floods Directive (2007/60/EC)

The aim of the Directive[1] is to provide a consistent approach across the European Union to reducing and managing the risks posed by flooding to human health, the environment, cultural heritage and economic activity. The Floods Directive is to be delivered in conjunction with the objectives of the Water Framework Directive (2000/60/EC) to deliver a better water environment through river basin management.

In the UK the Floods Directive is transposed into law via the Flood Risk Regulations (2009) by setting out the duties of local government in assessing flood risk to their area.

A1.2 Flood Risk Regulations (2009)

The Flood Risk Regulations[2] transpose the Floods Directive (2007/60/EC) into law in England and Wales.

The Regulations required the Lead Local Flood Authority (LLFA), in this case LBRT, to produce:

- a Preliminary Flood Risk Assessment (PFRA) by December 2011;
- flood hazard and flood risk maps by December 2013; and
- a Local Flood Risk Management Strategy by December 2015.

A1.3 The Flood and Water Management Act (2010)

The Flood and Water Management Act 2010 (FWMA)[3], which received Royal Assent on 8th April 2010, takes forward some of the proposals in three previous documents published by the UK Government:

- Future Water;
- Making Space for Water; and
- The Government's Response to the Sir Michael Pitt's Review of the summer 2007 Floods.

The Act gives the EA a strategic overview of the management of flood and coastal erosion risk in England. In accordance with the Government's Response to the Pitt Review, it also gives upper tier local authorities in England responsibility for

[1] European Parliament and Council, October 2007. Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks.
[2] UK Parliament, November 2009. The Flood Risk Regulations 2009, 2009 No. 3042.
[3] UK Parliament, April 2010. The Flood and Water Management Act 2010, 2010 c. 29.

preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas.

A1.4 The Water Resources Act (1991) and Water Act (2003, 2014)

The Water Resources Act 1991[4] provides legislation for the control of the pollution of water resources. Under this Act, offences of polluting controlled waters occur if a person knowingly permits any poisonous, noxious or polluting matter or any solid waste matter to enter any controlled waters. The Water Resources Act also provides an all-embracing system for the licensing of the abstraction of water for use, which is administered by the EA. The Water Acts (2003[5], 2014[6]) modernise water legislation and amend the Water Resources Act 1991 to improve long-term water resource management.

A1.5 Land Drainage Acts (1991, 1994)

The water quality and flood risk management of controlled waters including rivers and aquifers is protected by legislation under the Land Drainage Acts (1991[7], 1994[8]).

A1.6 Land Drainage Byelaws (1981)

This law was made by the Thames Water Authority under Section 34 of Land Drainage Act 1976. The Thames Water Authority Land Drainage Byelaws 1981[9] are in force in the Thames Region of the EA. They are now enforced by the EA by virtue of the Water Resources Act and the Environment Act. These Byelaws have effect within the area of the Thames Regional Flood Defence Committee of the National Rivers Authority for the purposes of their functions relating to land drainage and flood risk management.

[4] UK Parliament, November 2009. Water Resources Act 1991, 1991 c. 57.
[5] UK Parliament, November 2003. Water Act 2003, 2014 c. 37.
[6] UK Parliament, May 2014. Water Act 2014, 2014 c. 21.
[7] UK Parliament, July 1991. Land Drainage Act 1991, 1991 c. 59.
[8] UK Parliament, July 1994. Land Drainage Act 1994, 1994 c. 25.
[9] Environment Agency, April 2014. Thames water authority: land drainage byelaws, Thames Region: Land Drainage Byelaws.

A2 National Policy and Guidance

A2.1 National Planning Policy Framework (July 2018)

The NPPF[10] includes policies on flood risk and minimising the impact of flooding under '14. Meeting the challenge of climate change, flooding and coastal management' (Paragraphs 155-165).

The NPPF states that:

- Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.
- Strategic policies should be informed by a Strategic Flood Risk Assessment (SFRA), and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as Lead Local Flood Authorities (LLFA) and internal drainage boards.
- All plans should apply a sequential, risk-based approach to the location of development – taking into account the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk
- When determining any planning applications, Local Planning Authorities (LPAs) should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

  a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;

  b) the development is appropriately flood resistant and resilient;

  c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;

  d) any residual risk can be safely managed; and

  e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.
- Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

[10] Ministry of Housing, Communities and Local Government, July 2018. National Planning Policy Framework.

a) take account of advice from the LLFA;

b) have appropriate proposed minimum operational standards;

c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and

d) where possible, provide multifunctional benefits.

A2.2 National Planning Practice Guidance (November 2016)

The NPPG[11], comprising a web-based resource, has been issued to ensure the effective implementation of the NPPF and contains a section covering Flood Risk and Coastal Change. With regard to planning for flood risk, the Guidance assesses the suitability of the development type with respect to the flood risk zone in which it lies.

The NPPG also provides an overview of the expected effect of climate change and recommends contingency allowances for sensitivity ranges for peak rainfall intensities. Advice regarding allowance for climate change was updated in February 2016.

A2.3 Sewers for Adoption (2012)

An adopted drainage network needs to meet the criteria outlined in Sewers for Adoption[12]. A piped drainage system is required to not flood the ground in a 1 in 30 year flood, or surcharge for a 1 in 2 year event, using a design storm with the critical duration relevant to the site (i.e. the worst-case for a given return period). Private drainage systems also tend to use these criteria as a basis for design. Adoption of new sewers or abandonment of old sewers should take place in accordance with the Water Industry Act 1991, Sections 104 and 116 respectively.

A2.4 National Encroachment Policy for Tidal Rivers and Estuaries (2005)

The EA's National Encroachment Policy for Tidal Rivers and Estuaries has been approved by the Regional Flood Defence Committees of England and Wales. The EA is generally opposed to works on tidal rivers and estuaries that cause encroachment, but treat developments on a case by case basis.

[11] Department for Communities and Local Government, November 2016. Planning practice guidance.
[12] Water UK/WRc plc, August 2012. Sewers for Adoption (7th Edition): A design and construction guide for developers.

A3 Regional Policy and Guidance

A3.1 The London Plan: The Spatial Development Strategy for London Consolidated with Alterations Since 2011 (March 2016)

The document in its current state is The London Plan (2011) consolidated with Revised Early Minor Alteration to The London Plan (2013), Further Alterations to The London Plan (2015), Housing Standards Minor Alterations to The London Plan (March 2016) and Parking Standards Minor Alterations to The London Plan (March 2016)[13].

The London Plan is the overall strategic plan for London setting out an integrated economic, environmental, transport and social framework for the development of London; it recognises the need to address the increasing effects of climate change as predictions show there are more people likely to be living and working on the floodplain.

Relevant policies from the Plan are outlined below:

Policy 5.12: Flood risk management

The policy states:

- Development proposals must comply with the flood risk assessment and management requirements set out in the NPPF on flood risk over the lifetime of the development and have regard to measures proposed in Thames Estuary 2100 and Catchment Flood Management Plans.
- Developments which are required to pass the Exceptions Test set out in the NPPF will need to address flood resilient design and emergency planning by demonstrating that:
    1. The development will remain safe and operational under flood conditions;
    2. A strategy of either safe evacuation and/or safely remaining in the building is followed under flood conditions;
    3. Key services including electricity, water etc. will continue to be provided under flood conditions; and
    4. Buildings are designed for quick recovery following a flood.
- Development adjacent to flood defences will be required to protect the integrity of existing flood defences and wherever possible should aim to be set back from the banks of watercourses and those defences to allow their management, maintenance and upgrading to be undertaken in a sustainable and cost effective way.

[13] Greater London Authority, March 2016. The London Plan: The Spatial Development Strategy for London consolidated with alterations since 2011.

Policy 5.13: Sustainable drainage

The policy states:

- Development should utilise Sustainable Urban Drainage Systems (SuDS) unless there are practical reasons for not doing so, and should aim to achieve Greenfield runoff rates and ensure that surface water runoff is managed as close to its source as possible in line with the following drainage hierarchy:
    1. Store rainwater for later use;
    2. Use infiltration techniques, such as porous surfaces in non-clay areas;
    3. Attenuate rainwater in ponds or open water features for gradual release;
    4. Attenuate rainwater by storing in tanks or sealed water features for gradual release;
    5. Discharge rainwater direct to a watercourse;
    6. Discharge rainwater to a surface water sewer/drain;
    7. Discharge rainwater to the combined sewer.
- Drainage should be designed and implemented in ways that deliver other policy objectives of this plan, including water use efficiency and quality, biodiversity, amenity and recreation.

Policy 7.13: Safety, security and resilience to emergency

The policy states that developments should maintain a safe, secure environment and minimise potential physical risks, including those arising from flooding and related hazards.

A3.2 The London Plan: Supplementary Planning Guidance - Sustainable Design and Construction (April 2014)

The Supplementary Planning Guidance (SPG)[14] sets out the Mayor's priorities with regard to flooding as follows:

- Through their Local Flood Risk Management Strategies boroughs should identify areas where there are particular surface water management issues and develop policies and actions to address these risks.
- Developers should maximise all opportunities to achieve greenfield runoff rates in their developments.
- When designing their schemes developers should follow the drainage hierarchy set out in London Plan policy 5.13.

[14] Greater London Authority, April 2016. Sustainable Design and Construction Supplementary Planning Guidance.

- Developers should design Sustainable Drainage Systems (SuDS) into their schemes that incorporate attenuation for surface water runoff as well as habitat, water quality and amenity benefits.
- Development in areas at risk from any form of flooding should include flood resistance and resilience measures in line with industry best practice.
- Developments are designed to be flexible and capable of being adapted to and mitigating the potential increase in flood risk as a result of climate change.
- Developments incorporate the recommendation of the TE2100 plan for the future tidal flood risk management in the Thames Estuary.
- Where development is permitted in a flood risk zone, appropriate residual risk management measures are to be incorporated into the design to ensure resilience and the safety of occupiers.

A3.3 Thames Estuary 2100 Plan (2012)

The Thames Estuary 2100 (TE2100) Strategy[15] has been prepared by the EA to consider flood risk management for the next 100 years. The plan that has been prepared looks at the work that is needed to maintain and improve the flood defences protecting London and the Thames Estuary, including the Thames Barrier.

A3.4 Thames Region Catchment Flood Management Plan (2008)

A Catchment Flood Management Plan (CFMP) is a high-level strategic plan prepared by the EA, which identifies long-term (50 to 100 year) policies for sustainable flood risk within a catchment.

The relevant key messages contained within the Thames Region CFMP[16] are that:

- Climate change will be the major cause of increased flood risk in the future. In urban areas and areas of narrow floodplain, flooding from heavy rainfall will be more regular and more severe. Surface water, sewer and fluvial flooding can occur within minutes of a severe rainfall event. Flooding can therefore occur at any time of the year, and there is very little time to provide flood warnings.
- It is increasingly necessary to recognise the value of flood plain in reducing the effects of flooding. Technical, environmental and economic constraints mean there are likely to be very few flood defence schemes in areas of narrow floodplain in the foreseeable future.
- Development and urban regeneration provide a crucial opportunity to manage flood risk. The location, layout and design of development can all reduce

[15] Environment Agency, November 2012. TE2100 Plan: Managing flood risk through London and the Thames estuary.
[16] Environment Agency, December 2009. Thames Catchment Flood Management Plan: Summary Report December 2009.

flood risk. For example, the use of SuDS can help to control surface water (design).

A3.5 River Basin Management Plan, Thames River Basin District (2015)

River Basin Management Plans[17] are plans for protecting and improving the water environment and have been developed in consultation with organisations and individuals. They contain the main issues for the water environment and actions required. The River Basin Management Plans have been approved by the Secretary of State (SoS) for the Department of the Environment, Food and Rural Affairs (Defra) and the Welsh Minister.

[17] Department for Environment Food & Rural Affairs/Environment Agency, February 2016. River basin management plans: 2015, Thames river basin district RBMP: 2015.

A4 Local Guidance

A4.1 London Borough of Richmond upon Thames Strategic Flood Risk Assessment (SFRA)

The SFRA document was prepared in consultation with the Environment Agency and determines the level of flood risk across the borough. The SFRA is used to inform and support the Borough's flooding policies in its emerging Local Development Framework, (LDF) in accordance with the NPPF.

The SFRA states:

- *This residual risk (of flooding) is associated with a number of potential risk factors including (but not limited to):*
    - *a flooding event that exceeds that for which the local drainage system has been designed*
    - *the residual danger posed to property and life as a result of flood defence failure or exceedance*
    - *general uncertainties inherent in the prediction of flooding*
    - *reservoir failure*
- *For all sites greater than 1ha in area, a Flood Risk Assessment / Sustainable Drainage Strategy must be prepared. The potential impacts of the development to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water runoff must be considered.*
- *Details of proposed sustainable drainage systems (SuDS) that will be implemented to ensure that runoff from the site (post redevelopment) does not exceed greenfield runoff rates. Any SuDS design must take due account of groundwater and geological conditions.*
- *The risk of other sources of flooding (e.g. urban drainage and/or groundwater) must be considered.*
- *There are four main approaches to designing for flood risk:*
    - *Flood Avoidance: Constructing a building and its surroundings (at site level) in such a way to avoid being flooded.*
    - *Flood Resistance: Constructing a building in such a way to prevent flood water entering the building and damaging its fabric.*
    - *Flood Resilience: Constructing a building in such a way that although flood water may enter the building its impact is reduced.*
    - *Flood Repairable: Constructing a building in such a way that although flood water enters a building, elements that are damaged by flood water can be easily repaired or replaced. This is also a form of flood resilience.*
- *A planning solution to flood risk management should be sought wherever possible, steering vulnerable development away from areas affected by flooding in accordance with the Sequential Test.*

- *Where other planning considerations must guide the allocation of sites following the application of the Sequential Test, specific recommendations have been provided to assist the Borough and the developer to meet the Exception Test. These should be applied as development control recommendations for all future development (refer Section 7.4).*
- *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.*
- *When constructing new properties, permanent flood resistance measures are always preferable to temporary measures as they do not require intervention by the property occupants.*

A4.2 London Borough of Richmond upon Thames Local Plan (adopted 2018)

A4.2.1 Core Strategies

The core strategy document was adopted in 2009 and contains strategic policies to guide the future development of the Borough. It sets out the Strategic Planning Framework for the Borough for the next 15 years, taking account of the other plans and strategies and will serve as the delivery mechanism for the spatial elements of the Community Plan.

CP3 Climate Change – Adapting to the Effects.

- *Development will need to be designed to take account of the impacts of climate change over its lifetime, including:*
  - *Water conservation and drainage*
  - *Flood risk from the River Thames and its tributaries*
- *The Council's Strategic Flood Risk Assessment and advice from the Environment Agency can be used to identify the strategic flood risk, which will then need to be assessed at site level when development is proposed.*
- *Developers should undertake site specific flood risk assessments (FRAs) as set out in chapter 3 of PPS 25 Practice Guide and relevant CIRIA guidance. The FRA will need to demonstrate to the satisfaction of the Council that any flood risks to the development, or additional risk arising from the proposal will be successfully managed with the minimum environmental effect, and that necessary flood risk management measures are sufficiently funded to ensure that the site can be developed and occupied safely throughout its proposed lifetime.*
- *With respect to flooding specifically, community management measures will be taken forward through the Council's Emergency Planning measures, in conjunction with others such as Thames Water, TLS, the Environment Agency and the Emergency Services.*

A4.2.2 Development Management Plan

The DMP was adopted in 2011 and contains the detailed policies which will be used when new developments are considered. It takes forward the strategic objectives in the Core Strategy and is consistent with it and with National and Regional Policies.

Policy DM SD 6 – Flood Risk

- *Development will be guided to areas of lower risk by applying the Sequential Test asset out in paragraph 3.1.35.*
- *Developments and Flood Risk Assessments must consider all sources of flooding and the likely impacts of climate change.*
- *Where a Flood Risk Assessment is required and in addition to the Environment Agency's normal floodplain compensation requirement, attenuation areas to alleviate fluvial and/or surface water flooding must be considered where there is an opportunity.*
- *In areas at risk of flooding, all proposals on sites of 10 dwellings or 1000sqm of non-residential development or more are required to submit a Flood Warning and Evacuation Plan.*

Policy DM SD 7 – Sustainable Drainage

- *All development proposals are required to follow the drainage hierarchy when disposing of surface water and must utilise Sustainable Drainage Systems (SuDS) wherever practical. Any discharge should be reduced to greenfield run-off rates wherever feasible.*
- *When discharging surface water to a public sewer, developers will be required to provide evidence that capacity exists in the public sewerage network to serve their development.*

Policy DM SD 8 – Flood Defences

- *The effectiveness, stability and integrity of the flood defences, river banks and other formal and informal flood defence infrastructure within the borough will be retained and provision for maintenance and upgrading will be ensured.*
- *The removal of formal or informal flood defences is only acceptable if this is part of an agreed flood risk management strategy by the Environment Agency*
- *The Environment Agency must be consulted for any development that could affect a flood defence infrastructure.*

Policy DM SD 9 – Protecting Water Resources and Infrastructure

- *The borough's water resources and supplies will be protected by resisting development proposals that would pose an unacceptable threat to surface water and groundwater quantity and quality. This includes pollution caused by water run-off from developments into nearby waterways.*
- *New developments should also consider the following:*

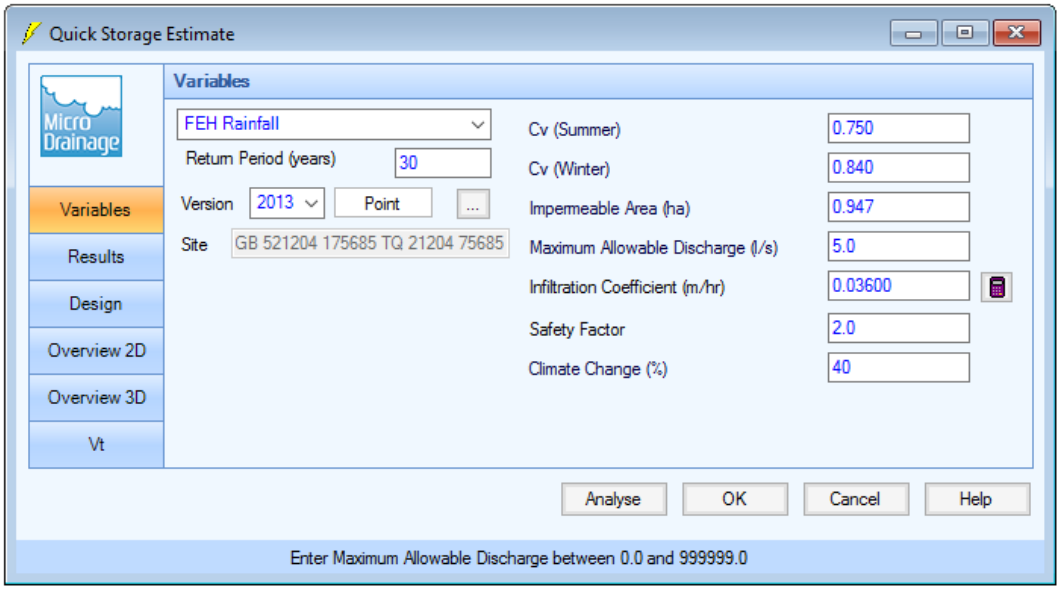
1. *utilising rainwater harvesting and greywater recycling for all non-potable uses to reduce the consumption of potable water wherever possible, and*
2. *designing of landscaping to minimise water demand.*

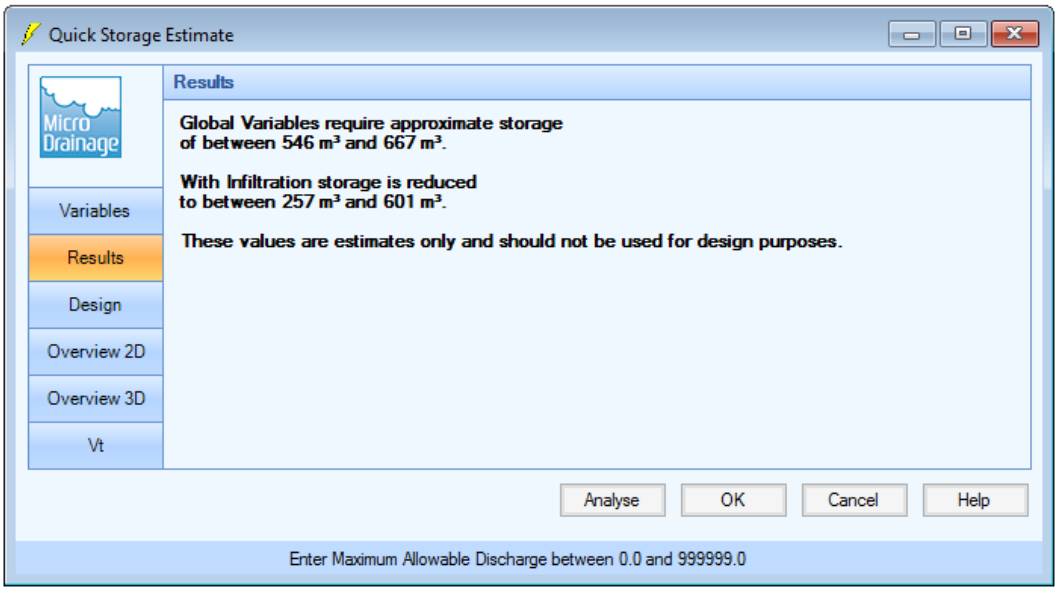
- *Where rivers have been classified by the Environment Agency as having 'poor' status (currently the River Crane, the Beverley Brook and the River Thames, upstream of Teddington), any development affecting such rivers is encouraged to improve the water quality in these areas.*

Appendix B

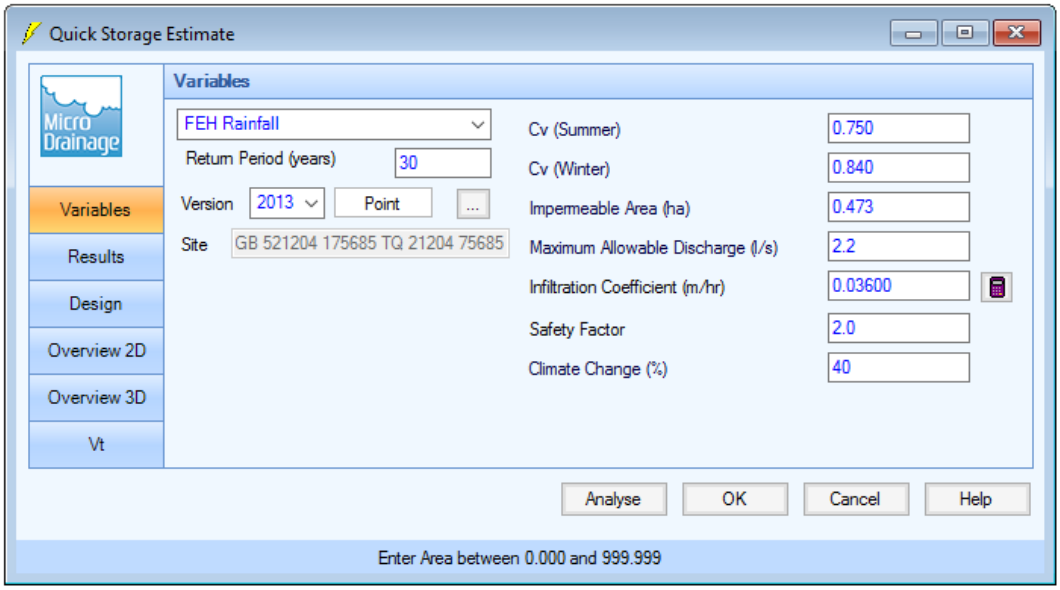
Micro Drainage Calculations

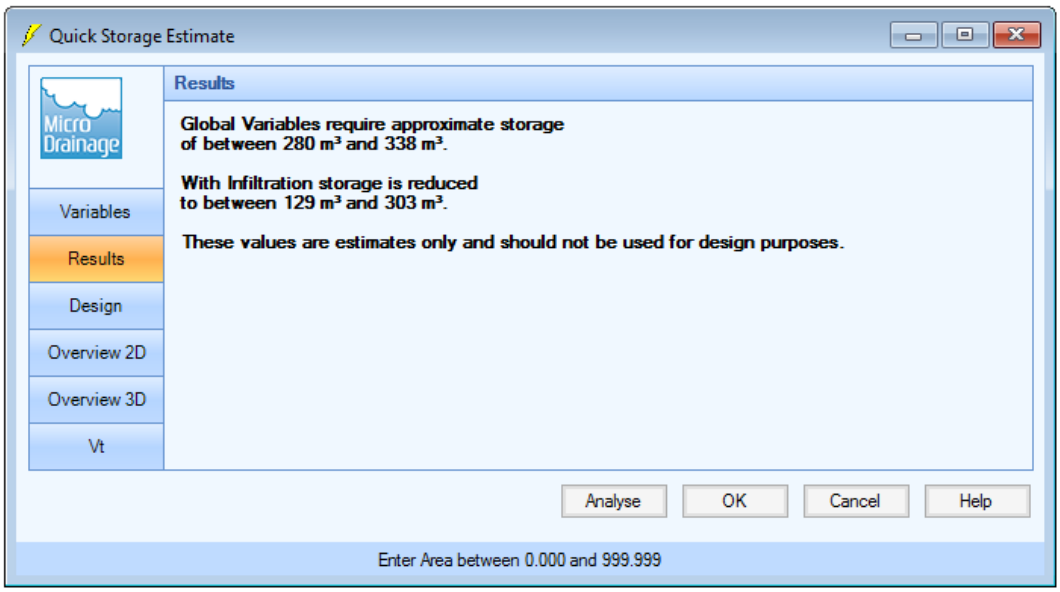
Whole Site


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
FEH Rainfall
Return Period (years)
30
Version
2013
Point
Site
GB 521204 175685 TQ 21204 75685
Cv (Summer)
0.750
Cv (Winter)
0.840
Impermeable Area (ha)
0.947
Maximum Allowable Discharge (l/s)
5.0
Infiltration Coefficient (m/hr)
0.03600
Safety Factor
2.0
Climate Change (%)
40
Analyse
OK
Cancel
Help
Enter Maximum Allowable Discharge between 0.0 and 999999.0

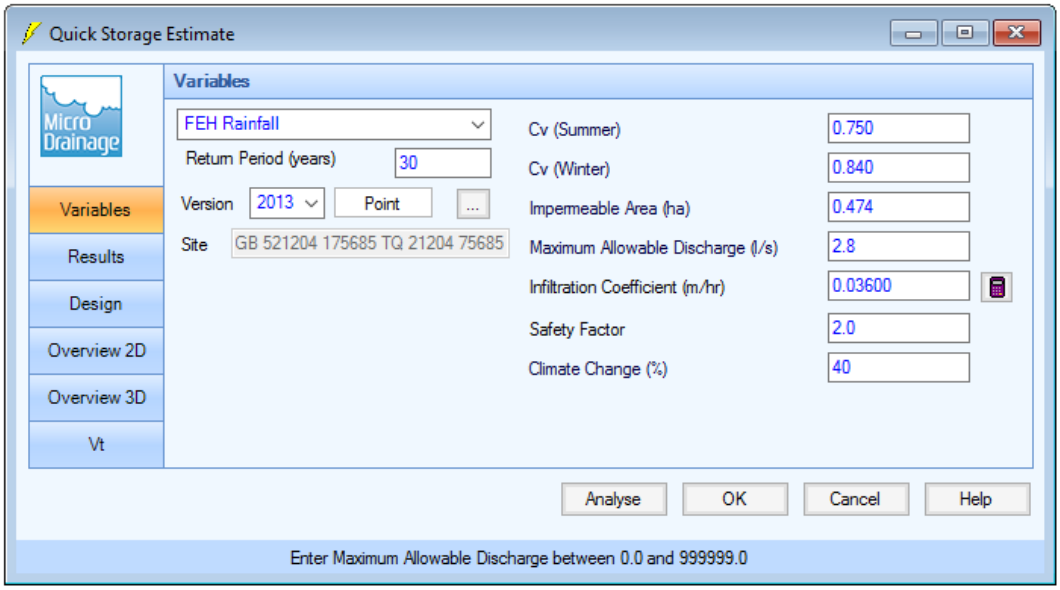

Quick Storage Estimate
Micro Drainage
Results
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Global Variables require approximate storage
of between 546 m³ and 667 m³.
With Infiltration storage is reduced
to between 257 m³ and 601 m³.
These values are estimates only and should not be used for design purposes.
Analyse
OK
Cancel
Help
Enter Maximum Allowable Discharge between 0.0 and 999999.0

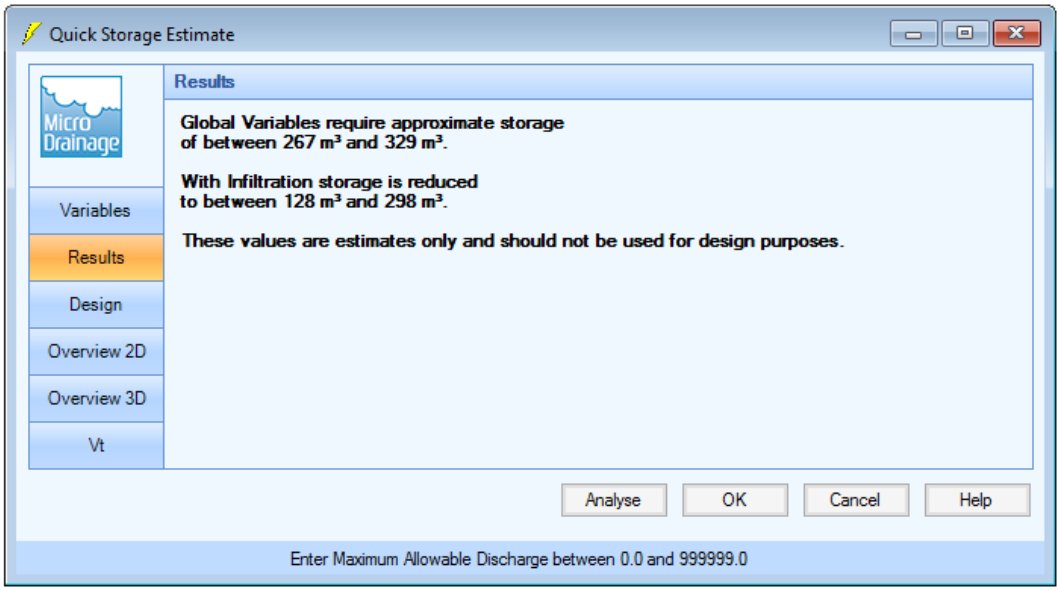
Eastern Site (Healthcare Centre and School)





Western Site (Residential)





Appendix C

Environment Agency Product 1

KSL 62212 UE Flood Map centred on SW14 8SU (created on 11/10/2017)

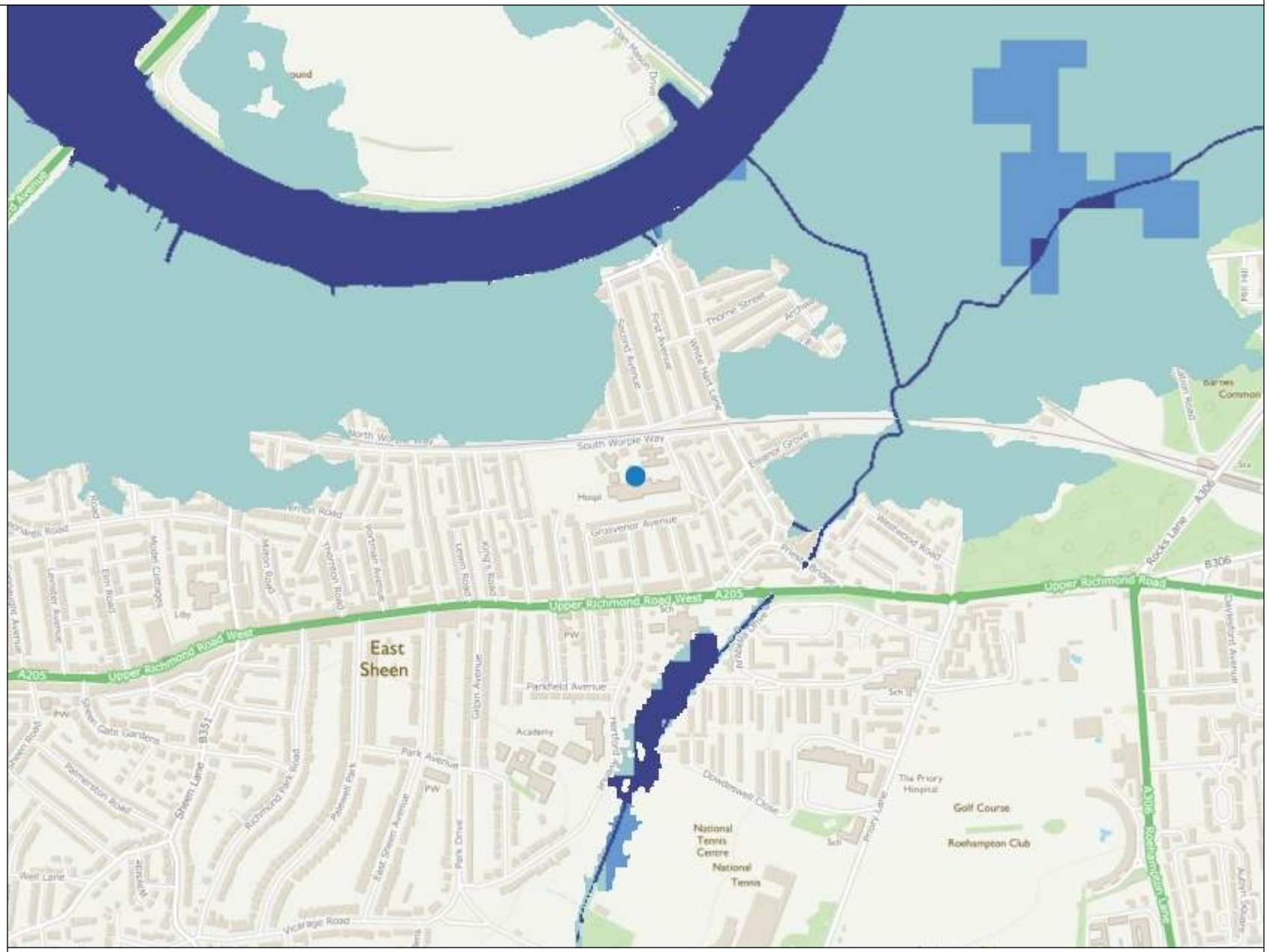
Environment Agency

Legend

All recorded flood outlines

Risk of flooding from rivers and sea

- High (>=3.3%)
- Medium (3.3% - 1%)
- Low (1% - 0.1%)
- Very Low (<0.1%)



0 100 200 300

Metres

N W E S

Appendix D

Greenfield Runoff Estimation

HR Wallingford
Working with water

Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Hamish Tozer
Site name:	Barnes Hospital
Site location:	SW14 8SU

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	51.46725° N
Longitude:	0.25641° W

Reference:	6147910
Date:	2017-10-13T11:55:22

Methodology	IH124

Site characteristics

Total site area (ha)	1.45

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	2	2
HOST class	---	---
SPR/SPRHOST	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm)	596	596
Hydrological region	6	6
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.3	2.3
Growth curve factor: 100 year	3.19	3.19

Notes:

(1) Is Q_{BAR} < 2.0 l/s/ha?

Normally limiting discharge rates which are less than 2.0 l/s/ha are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consents are usually set at 5.0l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set in which case blockage work must be addressed by using appropriate drainage elements

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	2.19	2.19
1 in 1 year (l/s)	1.86	1.86
1 in 30 years (l/s)	5.04	5.04
1 in 100 years (l/s)	6.98	6.98

Appendix E

Proposed Drainage Plan

TQ2175 TW1705
CL: 6.43
IL: 4.60

TQ2175 TW1704
CL: 6.04
IL: 5.28

TQ2175 TW1702
CL: 6.43
IL: 2.63

New Manhole Connection
CL: 6.1 (approx.)
IL: 5.2 (approx.)

Demarcation Chamber
SfA Type 3 IC

SfA Type 2 Manhole

Indicative basement outline

Area not positively drained.

SfA Type 3 Inspection Chamber

EX SW

EX FW

SOUTH WORPLE WAY

SOUTH WORPLE AVENUE

Vehicle Entrance

Pedestrian Entrance

Residential Block A

Resi

Resi

Residential Refuse Store for Collection Only

Health Hub

366 sq m
(0.9m depth)

564 sq m
(0.6m depth)

OLD MORTLAKE BURIAL GROUND

8 m

Residential Block B

Residential Block C

External Amenity Space
775 Sq. m

SEN School

Secondary External Amenity Space
772 Sq. m

N

NOTES:
DO NOT SCALE FROM THIS DRAWING.
ALL DIMENSIONS TO BE CHECKED ON SITE.
ALL OMISSIONS AND DISCREPANCIES TO BE REPORTED TO THE ARCHITECT IMMEDIATELY.

Legend:

- Site Boundary
- Existing Surface Water (SW) pipe
- Existing Foul Water (FW) pipe
- New SW Pipe
- New FW Pipe
- SW Attenuation Tank
- SfA Type 2 Manhole
- SfA Type 3 Inspection Chamber
- Indicative basement outline

Barnes Hospital
Proposed Combined Drainage and Attenuation

Barnes Hospital
02 Nov 2018 | For Information | RCT

Rev P01

ARUP