



EUSTON TOWER

Drainage & SuDS Strategy

December 2023



British Land Property Management Limited

Euston Tower

Drainage and SuDS Strategy

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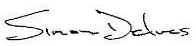



This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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Glossary

Acronym	Definition
AEP	Annual Exceedance Probability
BGS	British Geological Society
EA	Environment Agency
CDA	Critical Drainage Area
FRA	Flood Risk Assessment
FRMS	Flood Risk Management Strategy
FZ	Flood Zone
LBC	London Borough of Camden
LFRZ	Local Flood Risk Zone
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
mAOD	Meters Above Ordnance Datum
NPPF	National Planning Policy Framework
PFRA	Preliminary Flood Risk Assessment
SFRA	Strategic Flood Risk Assessment
SPZ	(Groundwater) Source Protection Zone
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
TWUL	Thames Water Utilities Ltd.

Executive Summary

Ove Arup and Partners Limited (“Arup”) has been commissioned by British Land Property Management Limited (hereafter British Land) to prepare a Drainage Strategy report including a Building Research Establishment Environmental Assessment Method (BREEAM) New Construction 2018 Pol 03 Credit Assessment in support of the detailed planning application associated with the proposed development at Euston Tower.

Drainage proposals outlined in this report can be summarised as follows:

- Attenuation will be provided within a combination of both blue roofs and an attenuation tank within the basement.
- Surface water captured from the roofs will be harvested and re-used to serve the WC’s within the building.
- In line with the significant redevelopment of the public realm surround Euston Tower, surface water drainage and SuDS features, including vegetated areas and bio-retention features are proposed.
- Infiltrating drainage techniques are not viable due to the presence of the basement extending beneath external areas and London clay geology below.
- The existing point of connection to the public sewer network will be maintained and will be reduced to a maximum of 5 l/s/ha for all storm events up to the critical design event of 1 in 100 year + climate change, in line with Thames Water Utilities Ltd requirements.
- Foul drainage flows are expected to increase due to the proposed building alterations and it is likely that these flows will be pumped within the building, utilising the existing connection to the public sewer.

Based on our understanding of the Site setting and the proposals, it is considered that the development can be constructed and operated safely and will not increase flood risk elsewhere.

1. Introduction

Ove Arup & Partners Limited (“Arup”), has been commissioned by British Land to prepare a Drainage Strategy Report and Building Research Establishment Environmental Assessment Method (BREEAM) Assessment for the proposed development works at Euston Tower, 286 Euston Road, London, NW1 3DP (hereafter referred to as “the Site”)

The proposals include major retrofit and development at the current Euston Tower including the partial retention (retention of existing core, foundations and basement), disassembly, reuse and extension of the existing building. The 32-storey building will be for use as offices and research, development floorspace, learning and community space at ground, first and second floors, and associated external terraces.

This report should be read in conjunction with the Arup Flood Risk Assessment, report ref: 281835-ARP-XX-XX-RP-CD-0001.

1.1 Scope of Report

The scope and output of this report is as follows:

- Outline ways in which the site will manage surface water and assess the ability of the site to utilise sustainable drainage systems.
- Propose measures for the management of residual risks; and
- Assess the site against BREEAM UK New Construction 2018 Pol 03 and confirm eligibility for credits available.

1.2 Consultation

In preparation of this report Arup has consulted with Thames Water Utilities Limited (TWUL) as the local drainage authority in the submission of a pre-development enquiry to confirm local capacity.

1.3 Limitations

This report has been prepared for the use of British Land (the Applicant) in relation to the proposed development at Euston Tower. It takes into account the Applicant’s particular instructions and requirements and addresses their priorities at the time. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party in relation to it, except as provided for in Arup’s agreement with British Land.

Arup has based this report on the sources detailed within it and believes them to be reliable but cannot and does not guarantee the authenticity or reliability of third-party information. Reasonable skill and care have been exercised in preparation of this report in accordance with the technical requirements of the brief.

This report has been prepared based on current legislation, statutory requirements, planning policy and industry good practice at the time of writing. Any subsequent changes or new guidance may require the findings, conclusions and recommendations made in this report to be reassessed in light of the circumstances. Should the proposed layout or use of the site change, the assessments and conclusions presented in this report may need to be revised.

2. Policy and Guidance

The following section details specific local policy and guidance pertinent to flood risk and surface water drainage that are applicable to the proposals. This section does not outline National Legislation, Regulations or Guidance which is provided in Appendix A.

2.1 London Borough of Camden Local Plan 2017

The London Borough of Camden (LBC) Local Plan sets out the Council's planning policies ensuring Camden has an effective response to the changing circumstances of the borough. Published in 2017 it sets out the borough's vision until 2031. The following policies directly relate to flood risk and climate change considerations.

Policy CC2: *Adapting to Climate Change*

Policy CC2 states all development should adopt appropriate climate change adaptation measures such as:

- *the protection of existing green spaces and promoting new appropriate green infrastructure*
- *not increasing, and wherever possible reducing, surface water run-off through increasing permeable surfaces and use of Sustainable Drainage Systems*
- *incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and*
- *measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.*

Any development involving 5 or more residential units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement.

Policy CC3: *Water and Flooding*

Specifically, policy CC3 states the following requirements for developments:

- *incorporate water efficiency measures*
- *avoid harm to the water environment and improve water quality*
- *consider the impact of development in areas at risk of flooding (including drainage)*
- *incorporate flood resilient measures in areas prone to flooding*
- *utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible*
- *not locate vulnerable development in flood-prone areas.*

Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable.

2.2 LBC Surface Water Management Plan (June 2013)

The LBC Surface Water Management Plan (SWMP) June 2013 study forms part of the wider Drain London Tier 2 project and builds on previous studies by the Borough in its role as a LLFA. It outlines the predicted risk and preferred surface water management strategy.

2.3 Camden Planning Guidance Water and Flooding CPG (March 2019)

CPG provides advice and information on how LBC apply planning policies. The adopted CPG documents are 'material considerations' in planning decisions. A number of CPG documents were adopted in March 2019 including "Water and Flooding CPG".

The Water and Flooding CPG encourages sites to meet London Plan runoff reduction targets (discussed further below) and drainage designs to accommodate all storm events up to and including the 1 in 100-year 6 hour storm event (including allowances for climate change).

It also continues to promote the use of the SuDS hierarchy when considering management of surface water and rainwater harvesting tanks and green roofs are preferred over other SuDS ranked lower down, such as attenuation tanks.

Specifically, the Water and Flooding CPG states that LBC expect the following to support planning:

"A drainage report is required for all major applications, basement development, and vulnerable development in areas identified as at risk of flooding (details of what this should include can be found in paragraph 8.67 of the Local Plan). The Council will expect plans and application documents to describe how water will be managed within the development, including an explanation of the proposed SuDS, the reasons why certain SuDS have been ruled out and detailed information on materials and landscaping. The Council will expect developments to achieve a greenfield surface water run-off rate where feasible once SuDS have been installed."

2.4 The London Plan (March 2021)

Policy SI 12 – Flood Risk Management and Policy SI 13 – Sustainable Drainage (extracted below) are pertinent in the content this report.

2.4.1 Policy SI 13 – Sustainable Drainage

The key aims of Policy SI 13 are replicated below:

- a. *Lead Local Flood Authorities should identify – through their Local Flood Risk Management Strategies and Surface Water Management Plans – areas where there are particular surface water management issues and aim to reduce these risks. Increases in surface water runoff outside these areas also need to be identified and addressed.*
- b. *Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:*
 - *rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)*
 - *rainwater infiltration to ground at or close to source*
 - *rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)*
 - *rainwater discharge direct to a watercourse (unless not appropriate)*
 - *controlled rainwater discharge to a surface water sewer or drain*
 - *controlled rainwater discharge to a combined sewer.*
- c. *Development proposals for impermeable surfacing should normally be resisted unless they can be shown to be unavoidable, including on small surfaces such as front gardens and driveways.*

Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improved water quality, and enhanced biodiversity, urban greening, amenity and recreation.

2.5 Thames Water Utilities Limited

In accordance with the Building Act 2000 Clause H3.3, positive connections to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal methods have been examined and proven to be impracticable.

The disposal hierarchy being: 1st Soakaways; 2nd Watercourses; 3rd Sewers.

Only when it can be proven that soakage into the ground or a connection into an adjacent watercourse is not possible would TWUL consider a restricted discharge into the public surface water sewer network.

TWUL request that every attempt should be made to use flow attenuation and SUDS/storage to reduce the surface water discharge from the Site as much as possible.

If they are consulted as part of any planning application, TWUL Planning team would ask to see why it is not practicable to attenuate the flows to Greenfield run-off rates i.e. **5l/s/hectare** of the total Site area (or if the Site is less than 1 hectare in size then the flows should be reduced by 95% of existing flows).

3. Environmental Setting

3.1 Site Location

Euston Tower is situated within the LBC, and the ward of Regent's Park. The Site is bounded by Euston Road (south), Hampstead Road (east), Brock Street (north) and Regent's Place (west). The Site covers an area of circa 0.81ha, comprised of a single, ground plus an existing 36-storey tower.

Ordnance Survey co-ordinates for the site are approximately: 529181E, 182344N and the approximate boundary of the site is shown in red in Figure 1 below.

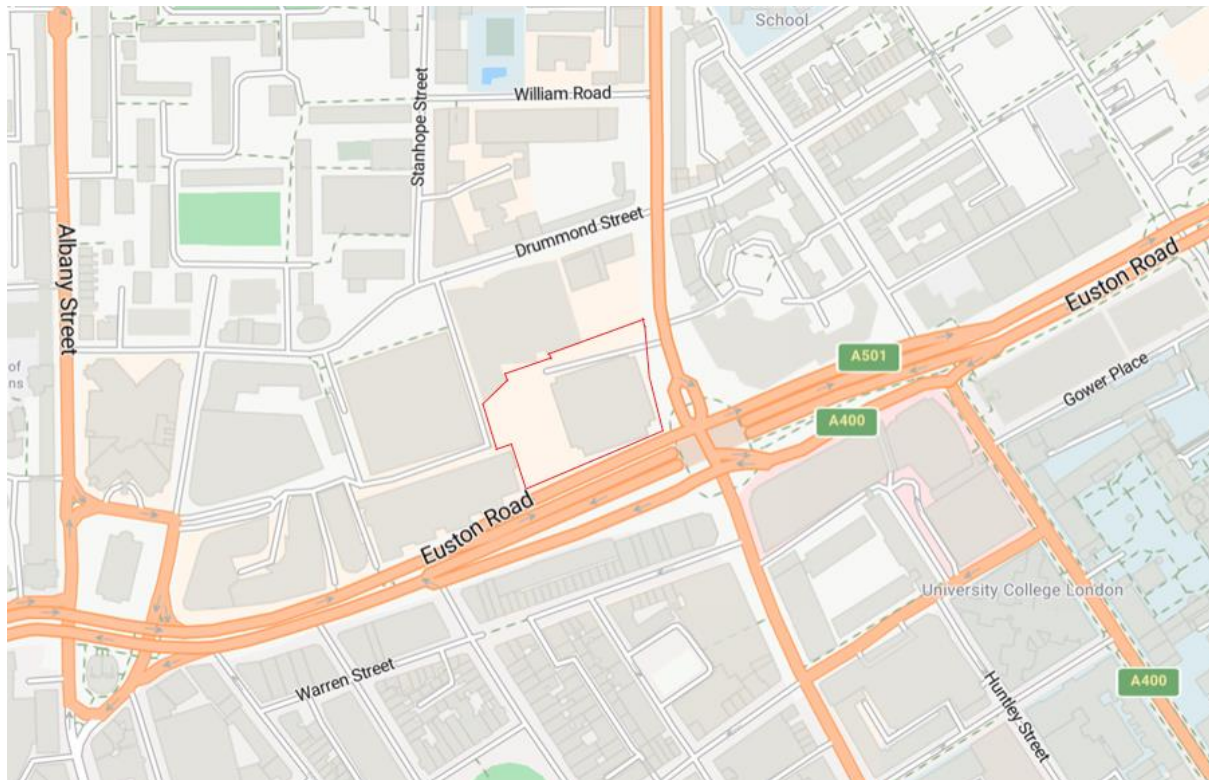


Figure 1: Site Location Map (Bing Maps – Indicative Red Line)

3.2 Existing Site

The tower has been largely vacant for several years, predominantly comprising office uses on the upper floors, however there are still retail uses currently in operation at ground floor level. The Site does not fall within a conservation area (CA); however, Fitzroy Square CA and Bloomsbury CA are both located in proximity (south). There are no elements of the Site that are statutory or locally listed. A Certificate of Immunity from listing has been submitted and at the time of submission is still pending in respect of the existing tower.

The building is made up of 4,395m² retail space on the ground & first floor, and 31,271m² of office space across the existing floors 2-36. Access to retail units is from ground level either within the building or from the street.

Located within the basement are plant rooms, services, transformer chambers (which are not accessible to the public), as well as a larger carpark which is accessible to the public.

3.3 Existing Topography

A topographical survey undertaken in June 2018 by Plowman Craven (ref 34979T-01-4 issue 1 and 34979T-01-2 issue 1 within Appendix B) shows that the current site levels are predominantly flat, ranging between approximately 27.0 and 28.0 metres Above Ordnance Datum (mAOD). The level immediate adjacent to the existing building is consistently 27.8mAOD.

Euston Road runs from west to east of the building, with a high point located at the junction of Hampstead and Euston Road of 27.70m AOD and a low point of 27.40m AOD further south-west of Euston Tower. Brock Street to the north of the building is also similarly level, ranging from 27.62mAOD north-east of the Site to 27.69m AOD on the north-west.

3.4 Existing Rivers/Water Bodies

The nearest major watercourse is the River Thames which is located 2.2km to the southeast of the Site.

The nearest surface water body identified is the Boating Lake in Regent's Park which is approximately 1.0km to the west of the site.

3.5 Geology

The British Geological Society (BGS) 1:50,000 geological mapping indicates that the Site is underlain with London Clay Formation with Clay, Silt, and Sand.

BGS 1:50,000 geological mapping indicates that the Site is underlain with superficial deposits of Lynch Hill Gravel with sand and gravel.

Made Ground is expected to be encountered below the surface and will be variable in composition. It is associated with the historical site development.

3.6 Hydrogeology

Shallow or perched ground water above the London Clay is expected to be present at this site due to the presence of

There are no groundwater source protection zones within 1 km radius from the site.

3.7 Existing Drainage Infrastructure

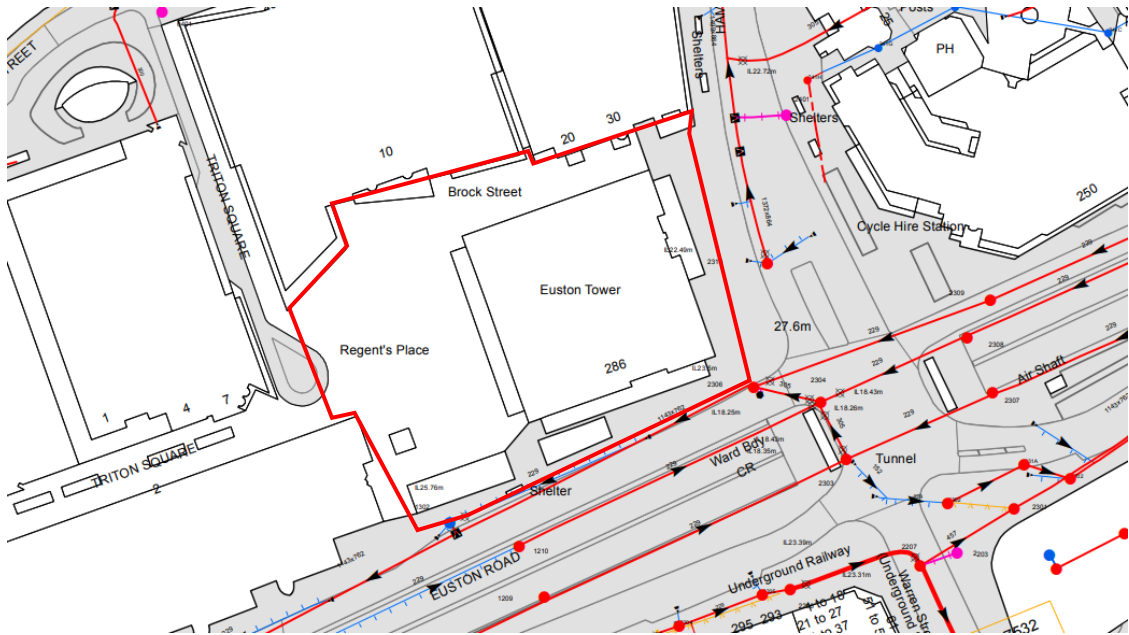


Figure 2: Existing Thames Water Sewers

As shown in Figure 2 above, Thames Water asset mapping identifies the following existing combined sewers within proximity to the Site:

- 1143 x 762 combined sewer in Euston Road immediately south of the Site draining east to west.
- 2no. 229 dia. combined sewers further south within Euston Road draining west to east.
- 1372 x 864 in Hampstead Road to the east of the Site draining in a northerly direction.

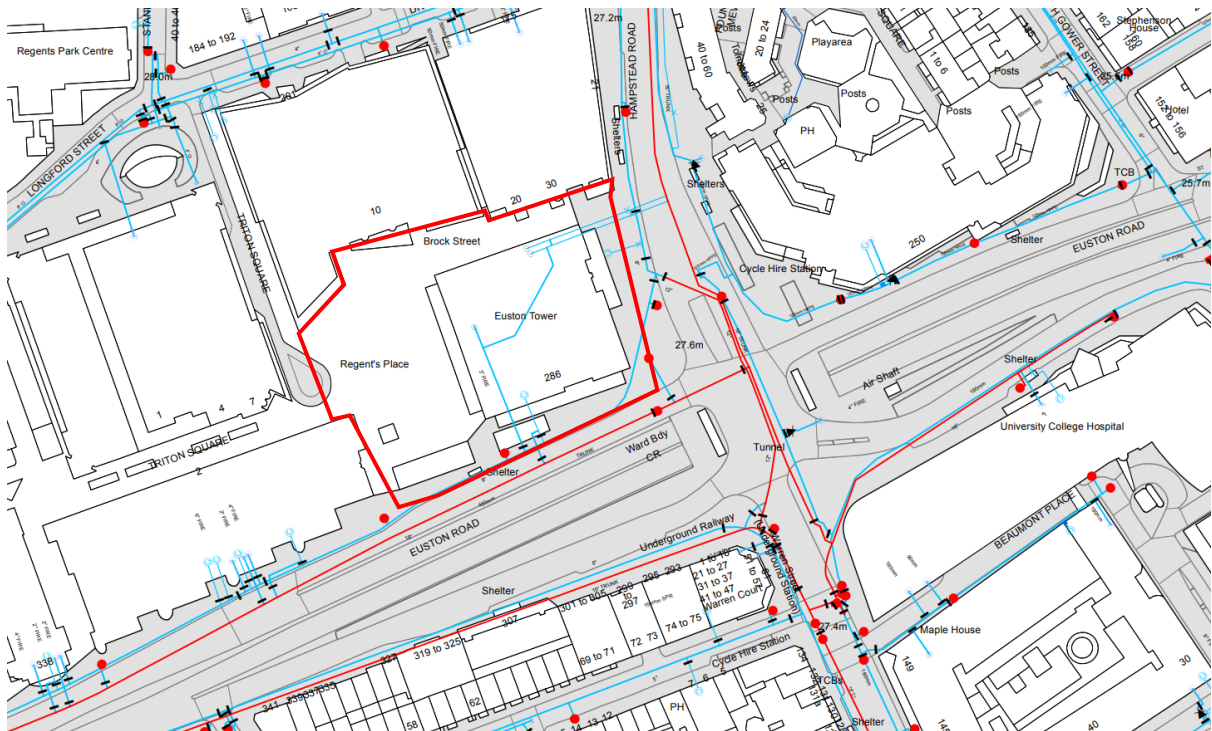


Figure 3: Existing Thames Water Potable Water Mains

As shown in Figure 3 above, Thames Water asset mapping identifies the following existing water mains within close proximity to the Site:

- 4inch water mains running within Euston Road, Hampstead Road and across the development site.
- 16inch trunk mains running in Euston Road and Hampstead Road.

4. Proposed Development

4.1 Development Proposals

Redevelopment of Euston Tower, including the partial retention (retention of existing core, foundations and basement), disassembly, reuse and extension of the existing building, to provide a 32-storey building for use as offices and research and development floorspace (Class E(g)) and office, retail, café and restaurant space (Class E) and learning and community space (Class F) at ground, first and second floors, and associated external terraces. Provision of public realm enhancements, including new landscaping, and provision of new publicly accessible steps and ramp. Provision of short and long stay cycle storage, servicing, refuse storage, plant and other ancillary and associated works.

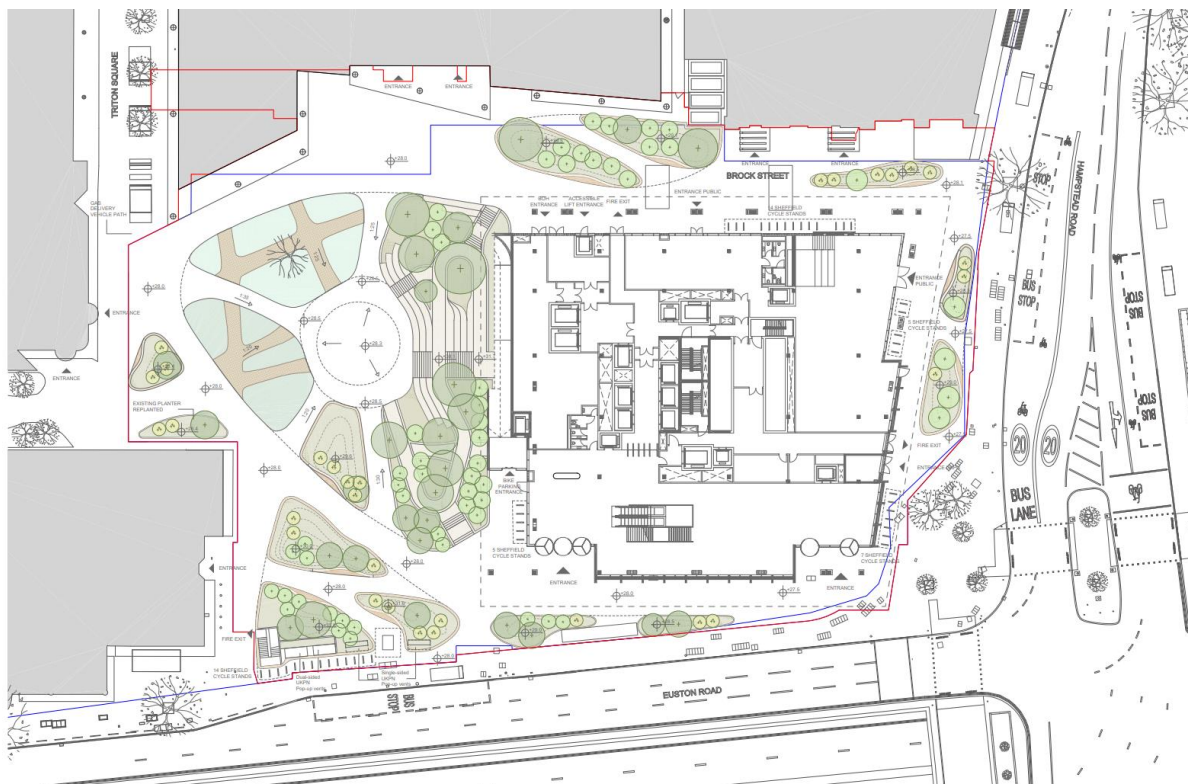


Figure 4: Proposed ground floor of development including landscaping

As shown in Figure 4 above, the public realm surrounding the development will also be significantly redeveloped to include vegetated areas and areas for surface water cleansing. In turn also reducing overall impermeable surfaces.

For detailed layout proposals see 3XN drawings included within Appendix C.

5. Drainage Strategy

5.1 Surface Water Drainage

The following section of the report provides details of the estimated existing brownfield runoff rates, an indicative calculation for the scale of attenuation required to facilitate the proposals and a review of appropriate SuDS that can be considered viable based on the development proposals.

5.1.1 Existing

The modified rational method (based on 60minute winter rainfall event intensity) provides an estimate of surface water run-off rates from rainfall intensity. The proposed brownfield development sees a reduction of impermeable area in comparison to pre-development which equates to total post development impermeable area of 0.6ha.

Rainfall data has been obtained from Flood Estimation Handbook (FEH) online mapping to determine approximate existing discharge rates at the Site. The 30-minute storm durations were used within these calculations as typical duration storm events and the Rational Method applied:

$$Q = 2.78 CIA, \text{ where;}$$

Q = flow (l/s);

C = runoff coefficient (1);

I = rainfall (mm/hr); and

A = catchment area (ha).

Table 1: Pre-development discharge rates

Rainfall Event	Rainfall Depth 30-min (mm)	Intensity (mm/hr)	Total Existing Site Discharge Rate (l/s) (A=0.60ha)
1 in 2 Year	11.5	14.3	23.9
1 in 10 Year	22.2	27.0	45.0
1 in 30 Year	30.6	37.3	62.2
1 in 100 Year	41.0	50.3	83.9

5.1.2 Existing Connections

A drainage survey has been undertaken by Plowman Craven in 2019 (Appendix B) which indicates a total of three connections into the existing TWUL combined sewers within the remit of this development. Two are located along the east and are assumed to connect into Hampstead Road and one along the south which is assumed to connect within Euston Road.

5.1.3 Proposed discharge rates

Discussions with TWUL have confirmed that discharge rates should be restricted to 5 l/s/ha, hence attenuation volumes are provided to ensure this is met and therefore discharge will be restricted to 3.0 l/s.

5.1.4 Climate Change

Current NPPF Guidance stipulates that to allow for the predicted impacts of climate change on surface water runoff, increases to peak rainfall intensity should be used.

Table 2 is an extract from the updated government guidance in relation to climate change allowances for the London Management Catchment for the 1% annual exceedance event. For development with a lifetime beyond 2100 the upper end allowances should be assessed at both the 1% and 3.3% annual exceedance probability events for the 2070s epoch.

The development should be designed for the upper end allowance in the 1% annual exceedance probability event.

Table 2: Peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline) (Source: Environment Agency Climate Change Guidance)

Annual Exceedance Probability Event	Allowance	Total potential change anticipated for the '2050s' (Development lifetime up to 2060)	Total potential change anticipated for the '2070s' (Development lifetime 2061 to 2125)
3.3%	Upper end	20%	35%
3.3%	Central	20%	40%
1%	Upper end	20%	40%
1%	Central	25%	40%

In line with Environment Agency guidance, an allowance of 40% for the effects of climate change to the year 2125 should be used to achieve the policy requirements for the proposed development.

Applying a 40% additional allowance will enable surface water from storm events up to and including the 1 in 100-year event plus climate change to be safely stored on-Site without detriment to existing flood risk. As a result, the proposed surface water drainage strategy will serve to improve the resilience of the existing Site to the anticipated changes in rainfall patterns.

5.2 Opportunities for SuDS

Chapter 14 (paragraph 169) of the NPPF recommends that Sustainable Drainage Systems (SuDS) should be utilised, where possible, within all new drainage schemes. SuDS generally mimic the natural drainage patterns of the undeveloped Site allowing infiltration into the ground (where feasible) and controlling outflow rates from the development. This reduces the impact and risk of flooding on downstream developments and can provide additional benefits such as pollution control, increased biodiversity and provision of water-based amenity space.

Table 3 below provides a detailed Site-specific assessment of the suitability of a variety of SuDS considered within the proposed surface water drainage strategy.

Table 3: Detailed SuDS Suitability Appraisal

SuDS Type	Site Suitability	
Blue Roof	A roof specifically intended and designed to store water. This can be via open water surfaces, storage within or beneath porous medium or modular surfaces, within shallow geo-cellular crates or below a raised decking/impermeable surface.	
	Advantages	Disadvantages
	No additional land take making them effective within dense urban Sites and can contribute significantly to overall Site attenuation requirements.	Additional weight and cost to structure (compared to normal roof design). Damage to waterproof membrane can be critical. Does not always provide treatment dependent on system.
Site Suitability	Blue roofs are considered feasible at the Site, but siting and sizing will need to be co-ordinated with structural design. It is likely that any blue roof system will have a restricted discharge rate to maximise attenuation.	

SuDS Type	Site Suitability		
Green Roof	Multi-layered system that covers the roof of a building with vegetation/landscaping over a drainage layer. Designed to intercept and retain rainfall, reducing the volume of runoff and attenuating peak flows. Typically, either defined as intensive or extensive systems depending on the nature of the selected flora.		
	Advantages	Disadvantages	
	Mimics greenfield state of building footprint for high density developments, good removal of pollutants, ecological benefits, insulates buildings, sound absorption.	Additional weight, not appropriate for steep roofs, maintenance of roof vegetation. Damage to waterproof membrane can be critical.	
<i>Site Suitability</i>	Living roofs are considered a potential option once all plant details required on the roof are confirmed. Planting type, species, and layout will need to be co-ordinated with structural design.		
Rainwater Harvesting	The collection of rainwater (usually within underground storage tanks) for later re-use in either buildings (treated), wash down facilities (commercial) or irrigation.		✓
	Advantages	Disadvantages	
	Can provide source control of storm water runoff, reduces demand on mains water.	Use is dependent on demand requirements, contributing surface area, and seasonal rainfall characteristics	
<i>Site Suitability</i>	Rainwater harvesting is to be included within the proposals. Water harvested from the roof will be used to flush WCs within the building.		
Infiltration Systems/ Soakaways	Any system which stores and discharges water directly to the underlying soils. These are typically soakaways, infiltration trenches, infiltration basins or infiltration blankets.		✗
	Advantages	Disadvantages	
	Provides groundwater recharge, ease of construction and can have minimal land take subject to design. Manages surface water at source.	Increased risk of groundwater ingress and pollution. Not suitable for poor draining soils or where infiltrating water may pit structural foundations at risk. Uncertainty over long term performance. Requires comprehensive geotechnical knowledge of underlying soils.	
<i>Site Suitability</i>	Given the underlying geology and basement beneath the building and public realm area, this is not a viable option.		
Swales	Swales are linear vegetated drainage features in which surface water can be stored or conveyed. They can be designed to allow infiltration, where appropriate.		✗
	Advantages	Disadvantages	
	Can be incorporated into landscaping proposals, offers good removal of pollutants and reduces runoff rates and volumes. Relatively low cost.	Not suitable for steep areas and requires significant land take (not suitable for high density urban Sites). Not suitable in areas with roadside parking.	
<i>Site Suitability</i>	Given the urban setting of the development the inclusion of swales is not viable or appropriate.		
Filter Drains	Filter drains are shallow trenches filled with stone/gravel that accept runoff through sheet flow and provide temporary subsurface storage (typically provided adjacent to highways or as interception features). They can drain via infiltration or be lined and positively drained via a perforated collection pipe.		✗

SuDS Type		Site Suitability	
	<p>Advantages</p> <p>Hydraulic benefits achieved with filter trenches, trenches can be incorporated into Site landscaping and fit well beside roads and car parks.</p>	<p>Disadvantages</p> <p>High clogging potential without effective pre-treatment, limited to small catchments, high cost of replacing filter material.</p>	
<i>Site Suitability</i>	Given the urban setting of the development the inclusion of filter drains is not viable or appropriate.		
Bio-retention Systems/Rain Gardens	Shallow planted features, which receive runoff directly from adjacent hardstanding. Typically under drained, surface water will infiltrate to the underlying piped drainage system and in doing so promote storage, plant up-take and filtration.		
	<p>Advantages</p> <p>Easily incorporated into soft landscaping, flexible shape and planting mix and provide good degree of storage (reducing the below ground requirement). High degree of pollutant removal and high biodiversity potential. Reduces need for surface drainage (gullies, channels etc) and low cost.</p>	<p>Disadvantages</p> <p>Requires considered use of water tolerant plant species and landscaping & management. Susceptible to clogging if poorly managed and not suitable for steeply sloping Sites.</p>	✓
	Bio retention features would be well suited to the public realm/landscaping proposals and should be considered at the detailed design stage. Surface water will drain through these features and into the below ground attenuation feature, hence providing surface water treatment before discharge to the existing network. However, due to the shallow depth between public realm and top of basement and the high density of existing and proposed utilities, it may be difficult to provide bio-retention features in all desired locations.		
<i>Site Suitability</i>			
Tree Pits	Tree pit systems generally accept sheet runoff from adjacent hardstanding areas in the same manner as bio-retention systems. They can be used in urban settings and provide a range of aesthetic benefits.		
	<p>Advantages</p> <p>Easily incorporated into soft landscaping with high degree of pollutant removal and high biodiversity potential. Reduces need for surface drainage (gullies, channels etc) and low cost.</p>	<p>Disadvantages</p> <p>Limited tree species/size depending on system and requires careful co-ordination with services due to root spread</p>	✗
	Due to the shallow depth between public realm and top of basement tree pits do not provide a viable option.		
<i>Site Suitability</i>			
Permeable Pavements	Pavements that allow rainwater to infiltrate through the surface and into the underlying layers. The water is temporarily stored before infiltrating the ground (unlined) or discharging to the sewerage system (lined).		
	<p>Advantages</p> <p>Provides low-level treatment of highway-derived pollutants (as recognised by the EA) and reduces need for surface drainage (gullies, channels etc). Available in a range of surface types (not just block paving).</p>	<p>Disadvantages</p> <p>Often requires increased construction depth and not suitable for use with Type 1 sub-base. May not be applicable for heavy traffic loadings and irregular maintenance required in certain situations. Not suitable for utility routes.</p>	
	Due to the shallow depth between public realm and top of basement, a thin layer of tanked permeable paving could be provided across parts of the public realm to act as a conveyance and cleansing feature for surface water. Further consideration is to be given to this at the detailed design stage.		
<i>Site Suitability</i>			

SuDS Type	Site Suitability		
Detention Basins	Detention basins are surface storage basins that provide flow control through attenuation of storm water runoff. They facilitate settling of particulate pollutants. Typically dry, they can also offer multi-functional recreational use.		✘
	Advantages	Disadvantages	
	Can cater for a wide range of rainfall events, easy to maintain, potential for dual land use, can be incorporated in to landscaping proposals and low cost.	Not suitable for steep areas, significant land take and little reduction in runoff volume	
<i>Site Suitability</i>	Given the urban setting of the development, detention basins are not considered a suitable SuDS feature. However, see above bio-retention features which can act as vegetated storage features.		
Ponds	Ponds can provide both storm water attenuation and treatment. They are designed to support emergent and submerged aquatic vegetation along their shoreline.		✘
	Advantages	Disadvantages	
	Good removal capability of urban pollutants, high potential ecological, aesthetic and amenity benefits, can cater for all storm events and good community acceptability.	No reduction in runoff volume; Anaerobic conditions can occur without regular inflow; Significantly land take; No suitable for steep Sites;	
<i>Site Suitability</i>	Given the urban setting of the development, ponds are not considered a suitable SuDS feature. However, see above bio-retention features which can act as vegetated storage features.		
Sub-Surface/Geo-cellular Storage	As there is extremely limited public realm/external space and given the urban setting of the development the inclusion larger above ground features is not viable or appropriate.		✔
	Advantages	Disadvantages	
	Modular and flexible, dual usage (infiltration/storage, high void ratios, can be installed beneath trafficked and soft landscaped areas.	No water quality treatment.	
<i>Site Suitability</i>	Attenuation tanks for surface water are proposed within the basement. Shallow geo-cellular attenuation may also be provided within the public realm to supplement storage provided within bioretention and open features.		
Rills/Canals	Formal linear drainage features in which surface water can be stored or conveyed. They can be incorporated with water features such as ponds or waterfalls where appropriate.		✔
	Advantages	Disadvantages	
	Negate the need for underground pipework. Can provide some attenuation. Possible reduction in runoff volume via plant uptake and infiltration.	Potential trip/wheel hazard, disabled access issues.	
<i>Site Suitability</i>	Rills could be well suited to public realm areas and provide shallow conveyance of water which would be well suited to this development. Further consideration should be undertaken at detailed design stage.		

Legend

- ✓ - Suitable for consideration on Site
- ✗ - Not suitable for consideration on Site
 - Further consideration to be carried out during detailed design

5.3 SuDS Selection Summary

Further to the assessment above, Table 6 provides a summary of SuDS that are considered viable within the context of the proposals, SuDS where opportunities to implement should be explored at detailed design stage and SuDS which are not appropriate for the proposals due to spatial constraints and existing ground conditions:

Table 4: SuDS Selection Summary

SuDS Type	Site Suitability		
	Suitable for consideration on Site	Further consideration to be carried out during detailed design	Not suitable for consideration on Site
Blue Roof			
Green Roof			
Rainwater Harvesting			
Infiltration Systems/Soakaways			
Swales			
Filter Drains			
Bio-retention Systems/Rain Gardens			
Tree Pits			
Permeable Pavements			
Detention Basins			
Ponds			
Sub-surface Storage			
Rills/Canals			

5.4 Surface Water Attenuation and Distribution

It is proposed that the surface water which falls directly onto the roof will be captured within blue roofs and a water harvesting system to be used to flush WC's throughout the Tower. However, it cannot always be assumed that there will be capacity within the water harvesting system, for example if two extreme rainfall events occur immediately after one another. Hence, attenuation storage is proposed to be provided within the basement to supplement that within the blue roof system. When required, discharge from this attenuation tank will be pumped into the existing combined sewer (via a demarcation chamber and gravity pipe), utilising existing points of connection..

Surface water runoff generated from external hardstanding within the public realm is proposed to be drained via a series of shallow drains or rills towards bioretention areas and a combination of above and shallow below ground storage before draining into the existing point of connection within Euston Road. These SuDS will act primarily as conveyance and cleansing routes, however during heavy rainfall events they will also provide storage. These proposals provide water quality benefits as well as valuable amenity space for local people and building users.

Based upon a limiting surface water discharge rate of 3.0l/s and using Innovyze Microdrainage Hydraulic Modelling Software, a "Quick Storage Estimate" has determined that the Site is required to attenuate 450m³. As a conservative measure and for the purpose of this application, it is assumed that all attenuation will be provided within the basement. Further detailed modelling will be undertaken at a later date to determine exact split of attenuation volumes.

5.5 Compliance with London Plan

In accordance with the London Plan 2021 development proposals should ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:

1. rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
2. rainwater infiltration to ground at or close to source
3. rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
4. rainwater discharge direct to a watercourse (unless not appropriate)
5. controlled rainwater discharge to a surface water sewer or drain
6. controlled rainwater discharge to a combined sewer.

In line with the above, Table 5 below demonstrates compliance with the drainage hierarchy.

Table 5: London Plan Drainage Hierarchy

Hierarchy	Surface Water Management	Considered Within Design?	Design Comments
1	Rainwater use as a resource	Yes	Rainwater harvesting will be included within the design.
2	Rainwater infiltration to ground at or close to source	No	Due to the basement beneath and London Clay beneath, infiltration is not possible.
3	Rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)	Yes	Blue/Green roofs are viable to attenuate storm water on site, with downstream outflows restricted to an approved/acceptable discharge rate before entering public surface water sewer.
4	Rainwater discharge direct to a watercourse (unless not appropriate)	No	No watercourses close to the Site
5	Controlled rainwater discharge to a surface water sewer or drain	No	No surface water sewers close to the Site
6	Controlled rainwater discharge to a combined sewer	Yes	The Site currently discharges to a combined public sewer and will continue to do so.

5.6 Exceedance Routes

In an exceedance level event where the drainage strategy is unable to accommodate rainfall effectively, it is anticipated that flows will follow the topography towards Hampstead Road and Euston Road. Existing levels across the development are very flat and therefore levels are to be designed in such a way to ensure flood waters are directed away from building thresholds.

5.7 SuDS Maintenance Schedules

It is the intention that the surface water drainage and SuDS features will be managed and maintained by the building management.

The following tables outline the minimum maintenance requirements for the different elements of the proposed strategy and are intended to form the basis of a final detailed operation and maintenance strategy document produced by the appointed private management company.

Maintenance requirements have been informed by the guidance outlined within CIRIA C753 and current best practice. The following information would also be supplemented by manufacturer’s specifications and be dependent on the specific type of system/products used.

Blue roof maintenance information has been combined from two sources, namely the Stormwater Management Guidance Manual (Philadelphia) and the National Federation of Roofing Contractors Technical Guidance Note for the construction and design of Blue Roofs. The frequency of maintenance needs to be determined by conducting monthly inspections in the first year of installation.

Table 6: Operation and Maintenance Requirements for Blue roofs

Maintenance Schedule	Required Action
Regular Inspections	Inspect outlet structures, and storage areas for trash and sediment accumulation
	Inspect waterproofing system visible at all upstands to ensure no gaps have formed
Regular Maintenance	Remove debris from drainage outlets and outlet screens to prevent clogging
	Remove excessive build-up of sediment around the outlet controls or within the storage cells
	Inspect for leaks
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed. Ensure all rainwater pipes are free from blockages and that water flows freely through them
	Survey inside of tank for sediment build-up and remove if necessary

Table 7: Operation and Maintenance Requirements for Bio-retention Systems

Maintenance Schedule	Required Action	Frequency
Regular Inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine is maintenance is necessary.	Quarterly
	Check operation of underdrains by inspection of flows after rain.	Annually
	Assess plants for disease infection, poor growth, invasive species and replace as necessary.	Quarterly
	Inspect inlets and outlets for blockage.	Quarterly
Regular Maintenance	Remove litter and surface debris and weeds.	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density.	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays.	Quarterly to biannually

Maintenance Schedule	Required Action	Frequency
Occasional Maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required.	As Required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch.	As Required
Remedial Actions	Remove and replace filter medium and vegetation above.	As required but likely to be >20 years

Table 8: Operation and Maintenance Requirements for Geo-Cellular Attenuation Tanks

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance).	Monthly
	Remove sediment from pre-treatment structures and/or internal forebays.	Annually, or as required
Remedial Actions	Repair/rehabilitate inlets, outlet, overflows and vents.	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually
	Survey inside of tank for sediment build up and remove if necessary.	Every 5 years or as required.

5.8 Foul Drainage

5.8.1 Existing

The Asset Location Search Sewer Map from Thames Water Utilities Limited (TWUL) (see Figure 5) shows that there are multiple combined sewers directly east within Hampstead Road and south within Euston Road. Refer to Appendix D for the full Asset Location Search from TWUL.

No adoptable Thames Water assets are located within the development parcel and therefore foul water is assumed to drain via private connection from Euston Tower into the adjacent combined sewer.

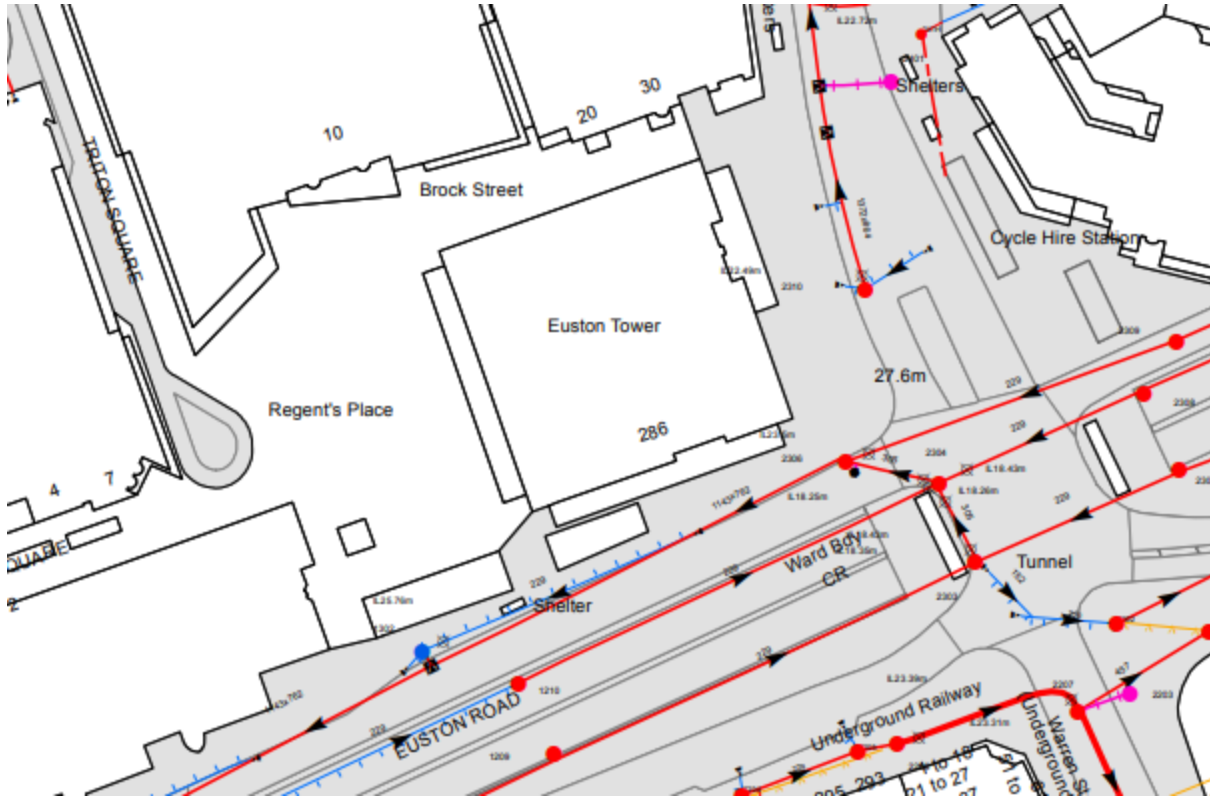


Figure 5: Extract from the Asset Location Search Sewer Map (TWUL, 2023)

5.8.2 Proposed

Foul flows from the building will be discharged to the TWUL combined sewer within Hampstead Road. Due to the change in building use, there will be an increase in the foul discharge from the building. The rate of discharge will be agreed with TWUL prior to connection. A pump system will be required to discharge flows into a demarcation chamber which then drains under gravity to the proposed point of connection.

6. BREEAM Assessment

The assessment criteria for BREEAM New Construction 2018 Pol 03 (Chapter 12.0 “Pollution”) is made up of three parts:

- Flood risk management (2 credits)
- Surface Water run-off (2 credits)
- Minimising water course pollution (1 credit)

The total number of credits available is 5 for Pol 03.

6.1 Flood Resilience

Pol 03 – Flood Resilience is formed by a maximum of two credits. The aim of these credits is to encourage development in low flood risk areas (for which two credits are available), or to take measures to reduce the impact of flooding on buildings in areas with a medium or high risk of flooding (for which one credit is available).

To achieve the maximum two credits available for flood resilience, the following criterion must be met for sites. A prerequisite for both is that:

1. An appropriate consultant is appointed to carry out and demonstrate the development's compliance with all criteria.

Low Flood Risk (Max 2 credits)

2. A site-specific flood risk assessment (FRA) confirms the development is in a flood zone that is defined as having a low annual probability of flooding. The FRA takes all current and future sources of flooding into consideration.

Medium or high flood risk (1 credit)

3. A site-specific FRA confirms the development is in a flood zone that is defined as having a medium or high annual probability of flooding and is not in a functional floodplain. The FRA must take all current and future sources of flooding into consideration.
4. To increase the resilience and resistance of the development to flooding, one of the following must be achieved:
 - a. The ground level of the building and access to both the building and the site, are designed (or zoned) so they are at least 600 mm above the design flood level of the site's flood zone.
 - b. The final design of the building and the wider site reflects the recommendations made by an appropriate consultant in accordance with the hierarchy approach outlined in section 5 of BS 8533:2017

6.1.1 Flood Resilience – Compliance

As the site lies within Flood Zone 1 it is an area that has a low annual probability of flooding, classifying it as a low flood risk.

The site can therefore be assessed under criterion 1 and 2 and can therefore be awarded both credits for Flood Resilience.

6.2 Pol 03 – Surface Water Run-off

There are two credits available under *Pol 03 – Surface Water Runoff*. To achieve a maximum two credits, the following criterion must be met for sites. A prerequisite of both is that:

5. Surface water run-off design solutions must be bespoke, i.e. they must take account of the specific site requirements and natural or man-made environment of and surrounding the site. The priority levels detailed in the Methodology must be followed, with justification given by the appropriate consultant where water is allowed to leave the site.

One credit can be awarded – Surface Water runoff rate:

6. For brownfield sites, drainage measures are specified so that the peak rate of run-off from the site to the watercourses (natural or municipal) shows a 30% improvement for the developed site compared with the pre-developed site. This should comply at the 1-year and 100-year return period events.
7. For Greenfield sites, drainage measures are specified so that the peak rate of run-off from the site to the watercourses (natural or municipal) is no greater for the developed site than it was for the pre-development site. This should comply at the 1-year and 100-year return period events.
8. Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified Sustainable Drainage Systems (SuDS) are in place.
9. Calculations include an allowance for climate change. This should be made in accordance with current best practice planning guidance.

One credit can be awarded – Surface Water runoff volume:

10. Flooding of property will not occur in the event of local drainage system failure (caused either by extreme rainfall or a lack of maintenance);

And Either

11. Drainage design measures are specified so that the post-development run-off volume, over the development lifetime, is no greater than it would have been prior to the assessed site's development. This must be for the 100-year 6-hour event, including an allowance for climate change (see criterion).
12. Any additional predicted volume of run-off for this event is prevented from leaving the site by using infiltration or other SuDS techniques.

OR (only where criteria 11 and cannot be achieved):

13. Justification from the appropriate consultant indicating why the above criteria cannot be achieved, i.e. where infiltration or other SuDS techniques are not technically viable options.
14. Drainage design measures are specified so that the post-development peak rate of run-off is reduced to the limiting discharge. The limiting discharge is defined as the highest flow rate from the following options:
 - a. The pre-development one-year peak flow rate
 - b. The mean annual flow rate (Qbar)
 - c. 2L/s/ha.

For the one-year peak flow rate, the one-year return period event criterion applies.

15. Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified SuDS are in place.
16. For either option, above calculations must include an allowance for climate change; this should be made in accordance with current best practice planning guidance.

6.2.1 Surface Water Run-off – Compliance

Surface water run-off design considers the specific site requirements and man-made environment of and surrounding the site.

One credit can be awarded for criterion 6, as post-development discharge rates are reduced by at least 30% compared to pre-developed site. This is compliant at both 1-year and 100-year events.

This design follows the modified rational method (based on 30minute winter rainfall event intensity), which provides a direct estimate of surface water run-off rates from rainfall intensity. The Proposed Development sees a decrease in discharge rate, as shown in Table 9.

Table 9: Pre and post-development discharge rates

Return Period	Existing Rate (l/s)	Proposed Rate (l/s)	Reduction (%)
1 in 2 Year	23.9	3.0	87
1 in 100 Year	83.9	3.0	96

A second credit can be awarded for meeting criterions 10, 13, and 14. Criterion 10 can be met as flooding of the property in the event of local drainage failure will be averted using the following methods:

1. Design of a site drainage model in order to map and understand flooding events so that a drainage system can be designed to mitigate the drainage failure.
2. Manipulate the surrounding landscape and site design to drain flooding to low points away from the property.

While criterion 11 is met as the post-development run-off volume won't increase due to the impermeable site area remaining unchanged, criterion 12 cannot be met. This is due to the impermeable urban nature of the site, halting any drainage via infiltration. The site itself is also susceptible to elevated groundwater levels due to the superficial deposit of permeable Lynch Hill gravel, suggesting that infiltration is difficult at the site as well. As such criterion 13 is met due to criterion 12 not being a technically viable option.

Criterion 14 outlines 3 parameters; a, b, and c as the potential limiting discharge rates. Listed below are the calculated rates:

- a. The pre-development two-year peak flow rate = **23.9 l/s**
- b. The mean annual flow rate (Qbar) = **0.4 l/s**
- c. 2L/s/ha. = **1.2 l/s**

A peak limiting discharge can be defined as 38.3 l/s as outlined in criterion 14. The post-development peak rate of runoff value of 3.0 l/s as shown in Table 9 is therefore less than the peak limit value, and so in line with criterion 14.

The criterion for both credits can therefore be met and the site can be awarded both credits for Surface Water Run-off.

6.3 Pol 03 – Minimising Watercourse Pollution

One credit is available under *Pol 03 – Minimising Watercourse Pollution* providing that the following can be demonstrated:

17. There is no discharge from the developed site for rainfall up to 5 mm (confirmed by the appropriate consultant).
18. Areas with a low-risk source of watercourse pollution, an appropriate level of pollution prevention treatment is provided, using appropriate SuDS techniques.
19. Areas with a high risk of contamination or spillage of substances, such as petrol and oil, have separators (or an equivalent system) are installed in surface water drainage systems.
20. Chemical or liquid gas storage areas have a means of containment fitted to the site drainage system (i.e. shut-off valves). This is to prevent the escape of chemicals to natural watercourses in the event of a spillage or bunding failure.
21. All water pollution prevention systems have been designed and installed in accordance with the recommendations of documents such as the SuDS manual² and other relevant industry best practice. They must be bespoke solutions taking account of the specific site requirements and natural or man-made environment of and surrounding the site.
22. A comprehensive and up to date drainage plan of the site will be made available for the building or site occupiers.
23. Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified SuDS must be in place.
24. All external storage and delivery areas are designed and detailed in accordance with the current best practice planning guidance.

6.3.1 Pol 03 – Minimising Watercourse Pollution – Compliance

The proposals will not prevent the first 5mm of rainfall in any given event discharging into the receiving system from leaving the developed site.

Given the above, the development does not meet the minimum requirements for minimising watercourse pollution and therefore the associated credit cannot be awarded.

6.4 BREEAM Pol 03 Credit Summary

Table 10: BREEAM Pol 03 Credits Summary

Criteria	Credits Available	Criteria Satisfied?	Credits Awarded
Flood Risk	2	Yes Site located in Flood Zone 1 defended (very low risk)	2
Surface Water Runoff	1 1	Yes. The impermeable area of the site will not be increased Run off will be reduced by at least 50% from existing 1 in 100yr event.	1 1

Criteria	Credits Available	Criteria Satisfied?	Credits Awarded
Minimising Watercourse Pollution	1	No Site cannot prevent first 5mm of rainfall from leaving the development in any given event.	0
TOTAL			4

Therefore in terms of BREEAM Pol 03 Chapter 12.0 “Pollution”, the measures taken across this development mean that 4 credits can be awarded.

7. Conclusion

The following points are considered pertinent to the proposed development's suitability for this Site:

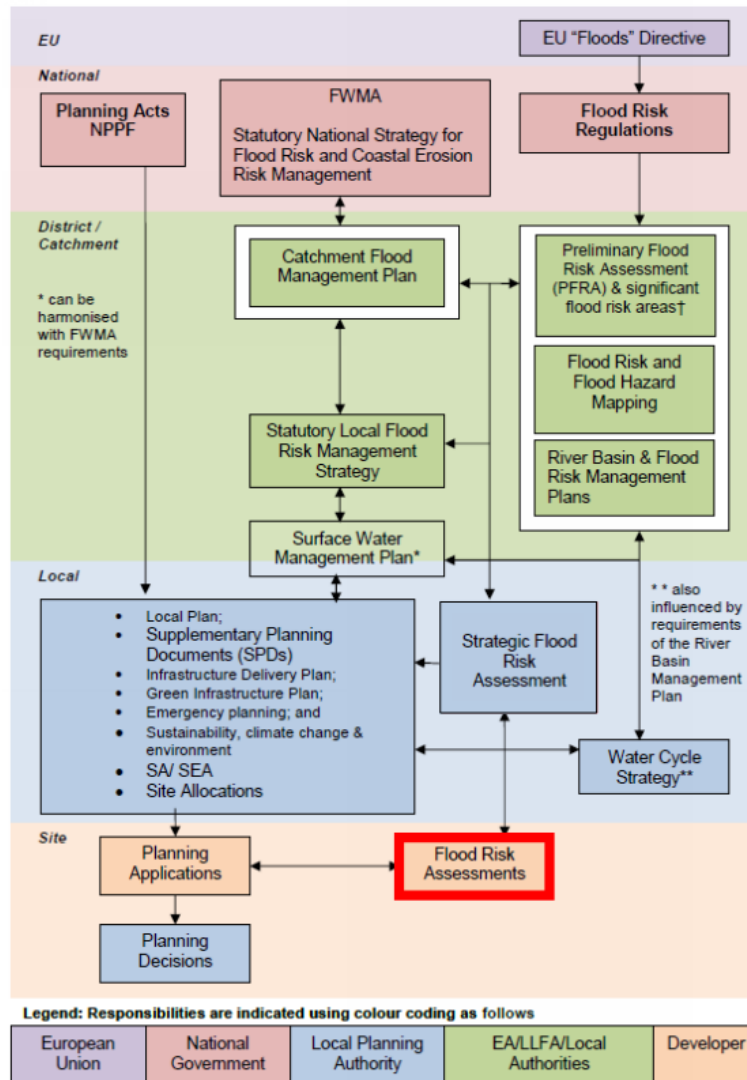
- It is proposed that the existing points of connection to TWUL assets will be maintained.
- Surface water that is captured within the roof will be harvested and re-used to flush WCs within the building.
- Attenuation will be provided within a combination of blue roof systems and storage within the basement, as well as within bioretention features within the public realm.
- It is proposed that, where possible, bio-retention features and green roof SuDS features are provided to increase water cleansing and also provide local amenity space.
- Foul water flows are expected to increase due to the proposed alterations and it is proposed that these flows will be pumped within the building to the existing point of connection.
- A total of 4 credits can be awarded for the development proposal under BREEAM UK New Construction 2018 Chapter 12.0 "Pollution", Pol 03

Appendix A

Relevant Policy

National Legislation, Regulations, and Flood Risk Guidance

The overarching aim of development and flood risk planning policy in the UK is to ensure that the potential risk of flooding is considered at every stage of the planning process. The following diagram outlines the key planning policy for flood risk management and associated documents.



International Planning Policy

Water Framework Directive (2000/60/EC)

The Water Framework Directive (WFD) sets out objectives prioritising future water protection across the European Union, with the aim of achieving improvements in the quality of polluted water bodies and maintaining the quality of clean water bodies.

Member states were required to transpose the Water Framework Directive (WFD) into domestic law by December 2003. This took place in England and Wales through the WFD England and Wales

Regulations 2003 (WFD Regulations). In the UK, the Environmental Agency (EA) is the ‘competent authority’ under the WFD Regulations.

Member water bodies are categorised as: ‘rivers’; ‘lakes’; ‘transitional waters’; ‘coastal waters’; or ‘groundwaters’. Each is identified within each category as being ‘at risk’; ‘probably at risk’; ‘probably not at risk’; or ‘not at risk’ of failing WFD objectives with regard to ‘water abstraction and flow regulation’; ‘physical or morphological alteration’; or ‘alien species’.

Under the WFD Regulations, each river basin district must have a river basin management plan in place which sets out environmental objectives for the district and a programme of measures to be applied in order to achieve those objectives. Water in rivers, estuaries, coasts and aquifers will improve as a result of the measures set out in the river basin management plans.

EU Floods Directive (2007/60/EC)

The aim of the Directive 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 by setting out the duties of local government in assessing flood risk to their area.

National Policy and Guidance

Environmental Permitting Regulations (2016)

The Environmental Permitting Regulations 2016 consolidate and replace the 2010 Regulations and subsequent amendments. The permitting regime covers a range of activities that release emissions to land, air and water, or that involve waste.

Schedule 21 relates to water discharge activities and Schedule 25 relates to flood risk activities. Schedule 22 relates to groundwater activities and the regulations place a duty on regulating authorities to implement the Water Framework Directive.

The Water Resources Act (1991) and Water Acts (2003, 2014)

The Water Resources Act 1991 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 1991 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, 2014) modernise water legislation and amend the Water Resources Act 1991 to improve long-term water resource management.

Flood Risk Regulations (2009)

The Flood Risk Regulations 2009 transpose the Floods Directive (2007/60/EC) into law in England and Wales.

The regulations required the Lead Local Flood Authority (LLFA), 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.

The Flood and Water Management Act (2010)

The Flood and Water Management Act 2010 (FWMA), which received Royal Assent on 8 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 FWMA 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 preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas.

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, 1994).

National Planning Policy Framework (2019)

The NPPF includes policies on flood risk and minimising the impact of flooding under Section 14, Meeting the challenge of climate change, flooding and coastal change (Paragraphs 155 – 165). The NPPF supersedes the Planning Policy Statement 25 (PPS25).

The NPPF states that:

Local Plans should be supported by a Strategic Flood Risk Assessment (SFRA) and develop policies to manage flood risk from all sources, taking account of advice from the EA and other relevant flood risk management bodies, such as LLFAs and internal drainage boards.

Local Plans should apply a sequential, risk-based approach to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change.

When determining planning applications, Local Planning Authorities (LPAs) should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific flood risk assessment following the Sequential Test, and if required the Exception Test, it can be demonstrated that:

- *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; and*
- *development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of Sustainable Urban Drainage Systems (SuDS).*

National Planning Policy Framework (20)

The NPPF includes policies on flood risk and minimising the impact of flooding under Section 10, Meeting the challenge of climate change, flooding and coastal change (Paragraphs 152 – 173). The NPPF states that:

Strategic policies should be informed by a strategic flood risk assessment, 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 and internal drainage boards.

All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property.

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

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

Sewerage Section Guidance Appendix C – Design and Construction Guidance (2020)

[Design and Construction Guidance for foul and surface water sewers offered for adoption under the Code for adoption agreements for water and sewerage companies operating wholly or mainly in England ("the Code")]

Adopted drainage networks need to meet the criteria outlined in the Design and Construction Guidance (2020). A piped drainage system is required to not surcharge for a 1 in 1-, 1 in 2-, or 1 in 5-year event depending on site conditions or flood the ground in a 1 in 30-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.

DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems (2015)

The DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems provides guidance on:

- Flood risk outside the development;
- Peak Flow Control;
- Volume Control;
- Flood Risk within the development;
- Structural Integrity;
- Designing for Maintenance Considerations
- Construction

Key extracts from this document are provided below:

Peak flow control

S2 For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.

Volume control

S4 Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.

S6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

Flood risk within the development

S7 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.

S8 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.

S9 The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property.

The standards are supported by Practice Guidance prepared by the Local Authority SuDS Officer Organisation (LASOO).

Appendix B

Topographical & Drainage Survey

Appendix C

Masterplan Proposals

Appendix D

Thames Water Asset Mapping

Asset location search



Property Searches

Groundwise Searches Ltd
Suite 8 Chichester House
45 Chichester Road
SOUTHEND ON SEA
SS1 2JU

Search address supplied At Euston Road
London
NW1 3DP

Your reference 24168DM

Our reference ALS/ALS Standard/2019_4026031

Search date 20 June 2019

Keeping you up-to-date

Notification of Price Changes

From 1 September 2018 Thames Water Property Searches will be increasing the price of its Asset Location Search in line with RPI at 3.23%.

For further details on the price increase please visit our website: www.thameswater-propertysearches.co.uk
Please note that any orders received with a higher payment prior to the 1 September 2018 will be non-refundable.



Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13



searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk



0845 070 9148



Search address supplied: At Euston Road, London, NW1 3DP

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This search provides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk

Web: www.thameswater-propertysearches.co.uk

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an 'as constructed' record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

Asset location search



Property Searches

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2019 4026031



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 529174,182376

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
4201	n/a	n/a
3210	27.3	23.75
2239	27.61	n/a
3233	27.3	23.01
2202	27.29	23.84
32BB	n/a	n/a
2207	27.68	23.11
32BA	n/a	n/a
2203	n/a	n/a
3202	24.09	22.39
32BC	n/a	n/a
2301	27.15	22.66
3301	27.23	22
2302	27.65	26.37
33DE	n/a	n/a
3334	27.3	24.02
3302	26.91	25.05
231A	n/a	n/a
2303	20.54	18.43
2304	20.54	n/a
2307	20.78	18.64
3303	26.27	n/a
331A	n/a	n/a
2308	20.78	18.64
2309	26.97	24.83
3304	23.78	21.81
3305	26.07	25.01
3306	23.78	21.81
3307	26.3	25.26
3308	26.13	24.55
241H	n/a	n/a
241G	n/a	n/a
341C	n/a	n/a
241J	n/a	n/a
3422	25.42	n/a
341B	n/a	n/a
3425	n/a	n/a
3426	n/a	n/a
3403	27.64	n/a
341A	n/a	n/a
241F	n/a	n/a
241I	n/a	n/a
241E	n/a	n/a
241C	n/a	n/a
241A	n/a	n/a
241B	n/a	n/a
2402	n/a	n/a
2405	26.62	n/a
3502	25.1	19.82
251B	n/a	n/a
251A	n/a	n/a
3505	25.36	20.44
3513	26.14	19.95
3601	n/a	n/a
4504	24.17	18.71
45CD	n/a	n/a
2103	n/a	n/a
2102	27.79	23.7
211A	n/a	n/a
211B	n/a	n/a
311C	n/a	n/a
3122	27.54	23.16
4145	n/a	n/a
141B	n/a	n/a
2503	n/a	n/a
151C	n/a	n/a
151D	n/a	n/a
151A	n/a	n/a
151B	n/a	n/a
16BA	n/a	n/a
9601	28.62	n/a
9602	28.25	26.76
0601	27.87	24.26
0502	27.89	23.7
0604	26.47	23.67
0605	n/a	n/a
0501	n/a	n/a
1601	26.06	n/a
151E	n/a	n/a
9417	n/a	n/a
9401	27.98	24.1
941B	n/a	n/a
0403	27.49	24.69
0205	28.04	17.64
0207	27.63	17.81
0401	n/a	n/a
0203	n/a	n/a
0202	27.66	25.77
1205	27.69	26.52
1204	27.64	26.83
1206	27.53	26.71



















Manhole Reference	Manhole Cover Level	Manhole Invert Level
1302	27.54	18
141A	n/a	n/a
1207	27.44	26.62
1210	24.63	22.45
1209	24.63	22.45
1208	27.29	26.5
2204	27.22	26.17
2306	27.85	18.18
2205	27.43	26.12
2310	27.22	25.74
2401	n/a	n/a
2206	27.5	25.5
1103	27.84	24.08
9117	28.23	26.23
011A	n/a	n/a
0104	27.97	24.59
0108	n/a	25.02
011B	n/a	n/a
1105	26.99	n/a
011D	n/a	n/a
011E	n/a	n/a
0107	27.83	24.8
01FD	n/a	n/a
011F	n/a	n/a
01FE	n/a	n/a
91AE	n/a	n/a
011C	n/a	n/a
1106	26.79	25.34
1107	26.91	25.39
9103	n/a	n/a
0134	28.09	25.32
1201	n/a	n/a
9201	28.27	17.5
121A	n/a	n/a

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ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

-  **Foul:** A sewer designed to convey waste water from domestic and industrial sources to a treatment works.
-  **Surface Water:** A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.
-  **Combined:** A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.
-  **Trunk Surface Water**
-  **Trunk Foul**
-  **Storm Relief**
-  **Trunk Combined**
-  **Vent Pipe**
-  **Bio-solids (Sludge)**
-  **Proposed Thames Surface Water Sewer**
-  **Proposed Thames Water Foul Sewer**
-  **Gallery**
-  **Foul Rising Main**
-  **Surface Water Rising Main**
-  **Combined Rising Main**
-  **Sludge Rising Main**
-  **Proposed Thames Water Rising Main**
-  **Vacuum**





Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

-  Air Valve
-  Dam Chase
-  Fitting
-  Meter
-  Vent Column




Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

-  Control Valve
-  Drop Pipe
-  Ancillary
-  Weir






End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

-  Outfall
-  Undefined End
-  Inlet






Other Symbols

Symbols used on maps which do not fall under other general categories








-  /  Public/Private Pumping Station
-  Change of characteristic indicator (C.O.C.I.)
-  Invert Level
-  Summit

Areas

Lines denoting areas of underground surveys, etc.

-  Agreement
-  Operational Site
-  Chamber
-  Tunnel
-  Conduit Bridge

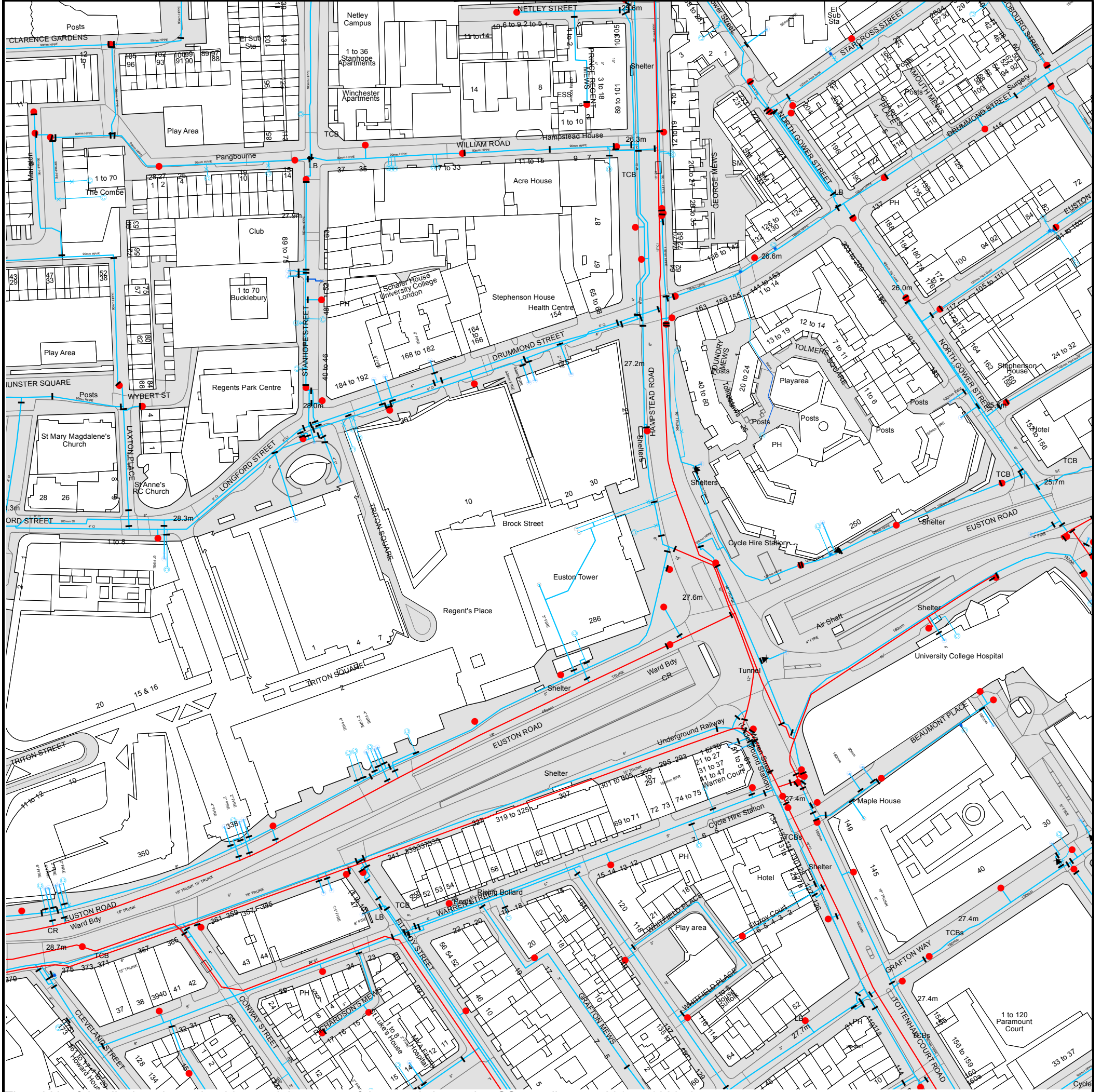
Other Sewer Types (Not Operated or Maintained by Thames Water)

-  Foul Sewer
-  Surface Water Sewer
-  Combined Sewer
-  Gully
-  Culverted Watercourse
-  Proposed
-  Abandoned Sewer

Notes:

- 1) All levels associated with the plans are to Ordnance Datum Newlyn.
- 2) All measurements on the plans are metric.
- 3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
- 4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
- 5) 'na' or '0' on a manhole level indicates that data is unavailable.
- 6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Asset Location Search Water Map - ALS/ALS Standard/2019 4026031



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 529174, 182376.








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ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)


- 
Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.
- 
Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.
- 
Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.
- 
Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.
- 
Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.
- 
Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.
- 
Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

-  General Purpose Valve
-  Air Valve
-  Pressure Control Valve
-  Customer Valve

Hydrants








-  Single Hydrant

Meters










-  Meter

End Items

Symbol indicating what happens at the end of a water main.

-  Blank Flange
-  Capped End
-  Emptying Pit
-  Undefined End
-  Manifold
-  Customer Supply
-  Fire Supply



Operational Sites

-  Booster Station
-  Other
-  Other (Proposed)
-  Pumping Station
-  Service Reservoir
-  Shaft Inspection
-  Treatment Works
-  Unknown
-  Water Tower

Other Symbols

-  Data Logger

Other Water Pipes (Not Operated or Maintained by Thames Water)

-  **Other Water Company Main:** Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.
-  **Private Main:** Indicates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.