OD Camden Hotel Ltd.

5-17 Haverstock Hill

Drainage Strategy Report

HH-ARP-REP-601

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1 Introduction

Arup has been commissioned by OD Camden Hotel Ltd. to produce the drainage strategy of the proposed storm and foul networks for the proposed redevelopment on 5-17 Haverstock Hill. The planning application relates to proposals for comprehensive redevelopment of the site to provide high quality residential and hotel spaces.

This drainage strategy has been produced to support the planning application.

2 Policy

The drainage strategy proposed for the development in the London Borough of Camden needs to comply with the following policies on SUDS:

1. Camden Plan Policy CC3
2. London Plan Policy 5.13 and draft New London Plan policy SI13
3. The National Planning Policy Framework (NPPF)

2.1 Camden Plan Policy CC3

Policy CC3 Water and flooding states:

The Council will seek to ensure that development does not increase flood risk and reduces the risk of flooding where possible.

We will require development to:

a. incorporate water efficiency measures;

b. avoid harm to the water environment and improve water quality;

c. consider the impact of development in areas at risk of flooding (including drainage)

d. (including drainage);

e. incorporate flood resilient measures in areas prone to flooding;

f. utilise Sustainable Drainage Systems (SuDS) in line with the drainage

g. hierarchy to achieve a greenfield run-off rate where feasible; and

h. 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.

The Council will protect the borough's existing drinking water and foul water infrastructure, including the reservoirs at Barrow Hill, Hampstead Heath, Highgate and Kidderpore.

2.2 London Plan Policy 5.13 and draft New London Plan Policy SI13

The relevant clauses of Policy 5.13 – Sustainable Drainage are:

"Development should utilise sustainable urban drainage systems (SUDS)… aim to achieve greenfield run-off rates and ensure that surface water run-off 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*
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."*

Policy SI13 Sustainable drainage states:

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.*

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 in line with the following drainage hierarchy:*

   1. *rainwater harvesting (including a combination of green and blue roofs)*
   2. *infiltration techniques and green roofs*
   3. *rainwater attenuation in open water features for gradual release*
   4. *rainwater discharge direct to a watercourse (unless not appropriate)*
   5. *rainwater attenuation above ground (including blue roofs)*
   6. *rainwater attenuation below ground (the benefit of attenuation above compared to below ground or in a basement is that)*
   7. *pumping is normally not required to empty the attenuation tank.*
   8. *rainwater discharge to a surface water sewer or drain*
   9. *rainwater discharge to a combined sewer.*

C. *Development proposals for impermeable paving should be refused where appropriate, including on small surfaces such as front gardens and driveways.*

D. Drainage should be designed and implemented in ways that address issues of water use efficiency, river water quality, biodiversity, amenity and recreation.

2.3 The National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF), published in March 2012 and updated in February 2019, includes policies on flood risk and minimising the effect of flooding. The NNPF requires local authorities to adopt proactive strategies to mitigate and adapt to climate change, taking into consideration flood risk, coastal changes, water supply and demand considerations.

3 Site Description

The site is located at NW3 2BL and is bounded to the north-east by Haverstock Hill (A502), Chalk Farm London Underground Station to the south east, Adelaide Road (B509) to the south and to the north-west by the Eton Place private residential property. The London Underground Northern Line is located beneath Haverstock Hill to the north-east of the site. Figure 1 shows the location of the proposed site.

The development covers approximately 0.207ha and it is a large six-storey property (known as Eton Garage), a car park built in 1939.The building incorporates also six retail units on Adelaide Road and a former car showroom for 60 vehicles on Haverstock Hill. The garage was last used by Metropolitan Police for storage of stolen vehicles.

The proposal will deliver mixed use development consisting in residential, commercial and hotel space.

Figure 1 Location Plan

3.1 Site Topography

A topographical survey was undertaken by Greenpatch Group Ltd. and is included in Appendix A. According to the survey the site is relatively flat with levels varying between 32.62mAD to 31.7mAD.

There is vehicular access on site from both Adelaide Road with levels around 32.5mAD and Haverstock Hill with levels at 32.4mAD.

3.2 Hydrological Setting

A review of the EA Main River map indicated that the closest watercourse to the site is the Regent's Canal, located approximately 0.6km away to the south-east. There are no other hydrological features located on site, with the exception of the drainage infrastructure.

3.3 Existing Drainage

3.3.1 Existing Drainage Infrastructure

Thames Water (TW) asset map shows that there are combined sewers running along Adelaide Road:

- 1397x864mm combined sewer on Adelaide road
- 300mm combined sewer on Haverstock Hill

Figure 2 shows a snippet of the TW asset information. TW asset records show that there is a private drainage network running across the site, connecting into TW sewer, before discharging into the 1397x864mm sewer in Adelaide Road. The condition of these manholes (MH) and pipes is unknown. The TW records show that the existing sewer within the site does not extend into adjacent properties however, it is not clear the extent of catchment that the private combined sewer is draining. A CCTV survey must be undertaken to determine if there are any connections incoming from Chalk Farm Station into the private combined sewer. The outcome of this survey will determine whether a connection through the property needs to be maintained.

The cover level of the combined sewer in Adelaide Rd. is 32.3mAD according to the TW asset map. The inverts levels (IL) of the combined sewer in Adelaide Road, close to the site are between 28.97mAD and 26.37mAD, while depths range between 3.7m and 4.7m deep. The IL of the sewer laid in Haverstock Hill is expected to be between 30.98mAD and 27.24mAD close to the site, at a depth ranging between 2.7m and 3.8m.

It is not clear what the private combined sewer is draining. A CCTV survey must be undertaken to determine if there are any connections incoming from Chalk Farm Station into the private combined sewer.

There are no storm water sewers or foul sewers in the vicinity of the site. Thames Water asset information is included in Appendix B.

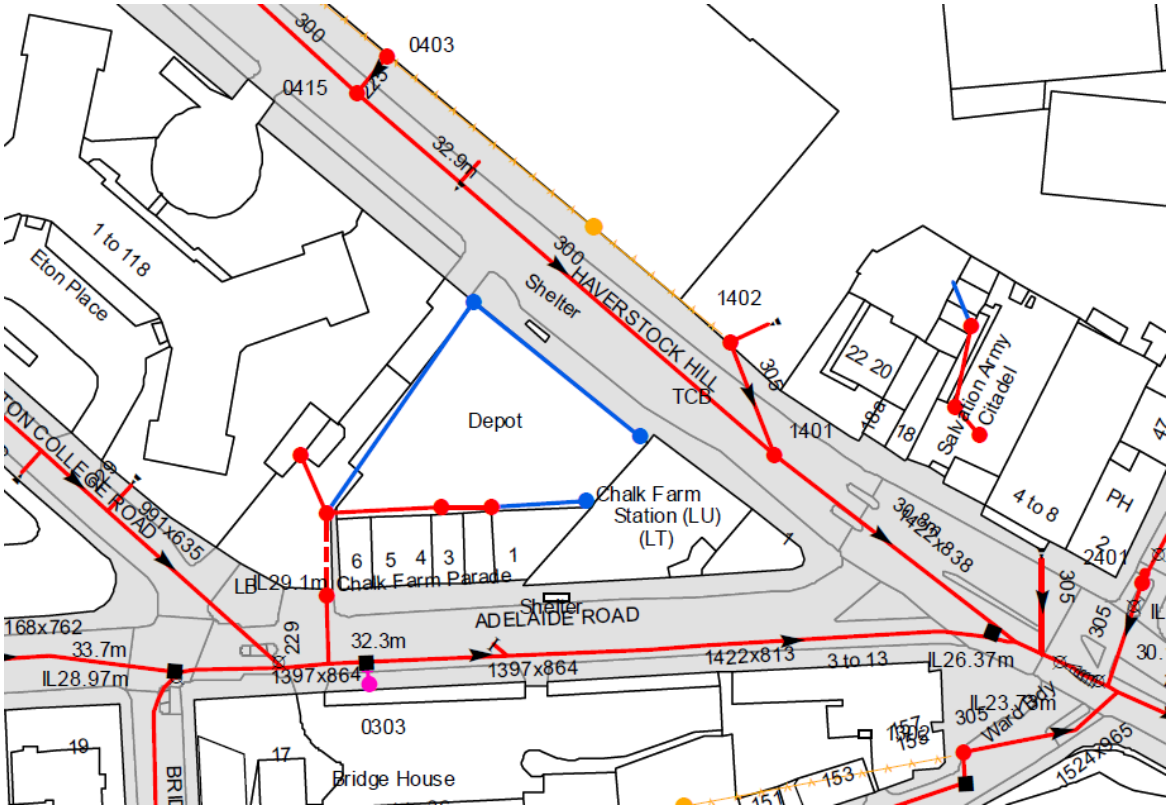


Figure 2 Thames Water asset information

3.4 Assessment of Flood Risk

3.4.1 Fluvial and tidal flood risk

The EA produces flood maps for the UK, which identify the areas at risk of flooding from fluvial and/or tidal flooding. These flood maps are available on the GOV.UK website. The magnitude of the flooding events considered are defined in terms of annual probability of occurrence. As shown in Figure 3, the site is located within Flood Zone 1. Flood Zone 1 is assessed as having less than 0.1% annual exceedance probability from river or sea flooding.

In conclusion, the development is located within Flood Zone 1 and the risk of fluvial and tidal is low.

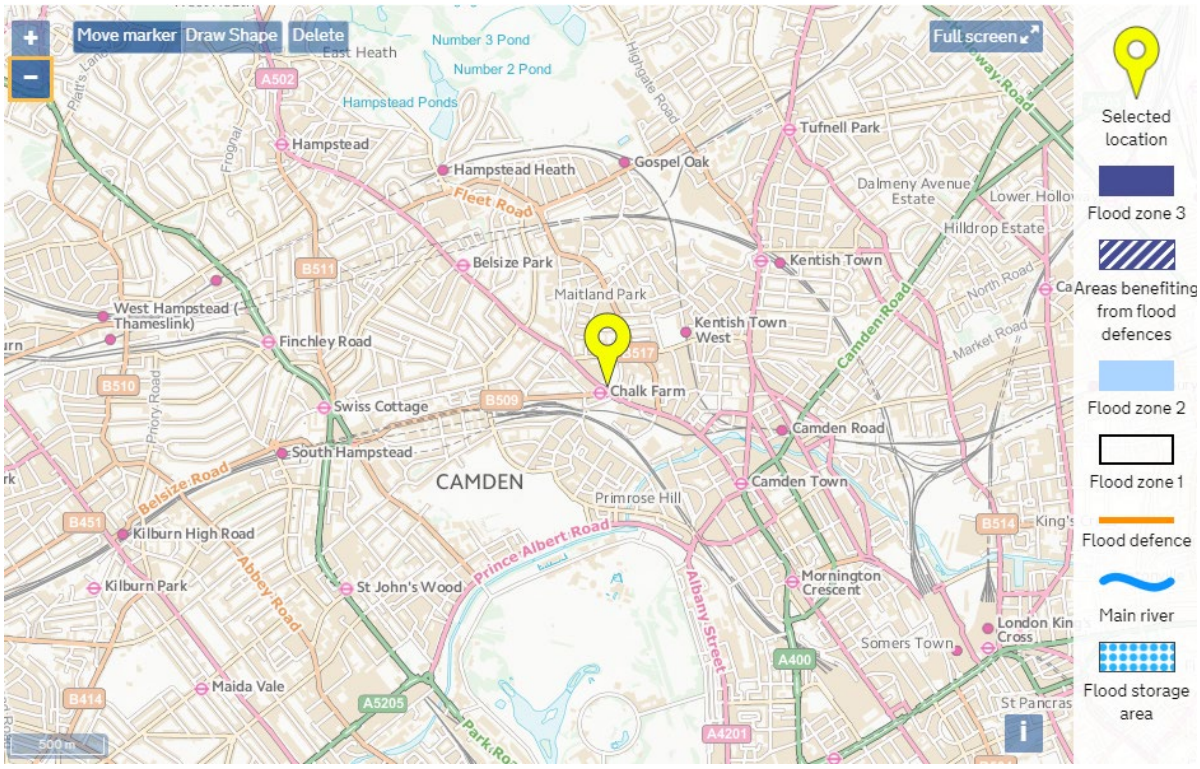


Figure 3 EA Flood map for planning - Rivers and Sea (EA, 2020)

3.4.2 Surface Water and Sewer Flooding

The North London Strategic Flood Risk Assessment (SFRA) and the LB Camden Surface Water Management Plan both identify surface water flooding as the key flood risk issue in the Borough.

The surface water flood risk map in Figure 4 indicates that the Site is considered as being at a “Very Low” risk of flooding from surface water. The “Very Low” risk of flooding is identified as having less than 1 in 1000-year (0.1%) Annual Probability of flooding.

The map shows that the adjacent paved areas to the north and to the south of the Site as “Medium” (1 in 100-year Annual Probability of flooding) susceptibility to surface water flooding.

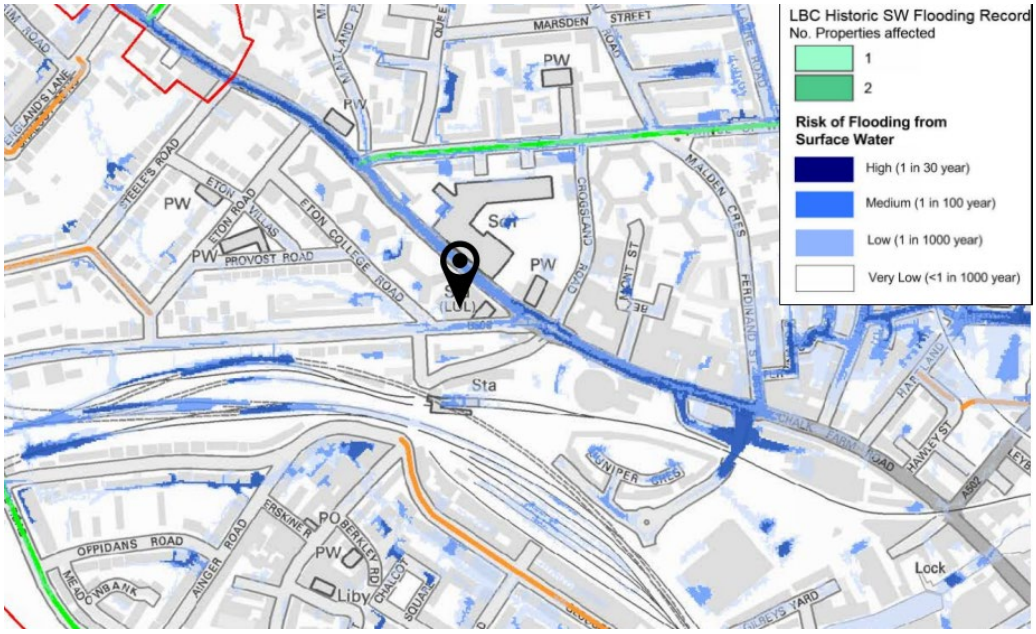


Figure 4 Surface water flooding map in LBC

3.4.3 Groundwater Flooding

The SFRA states that the site is not located in an area which is considered as vulnerable to groundwater flooding, as shown in Figure 5.

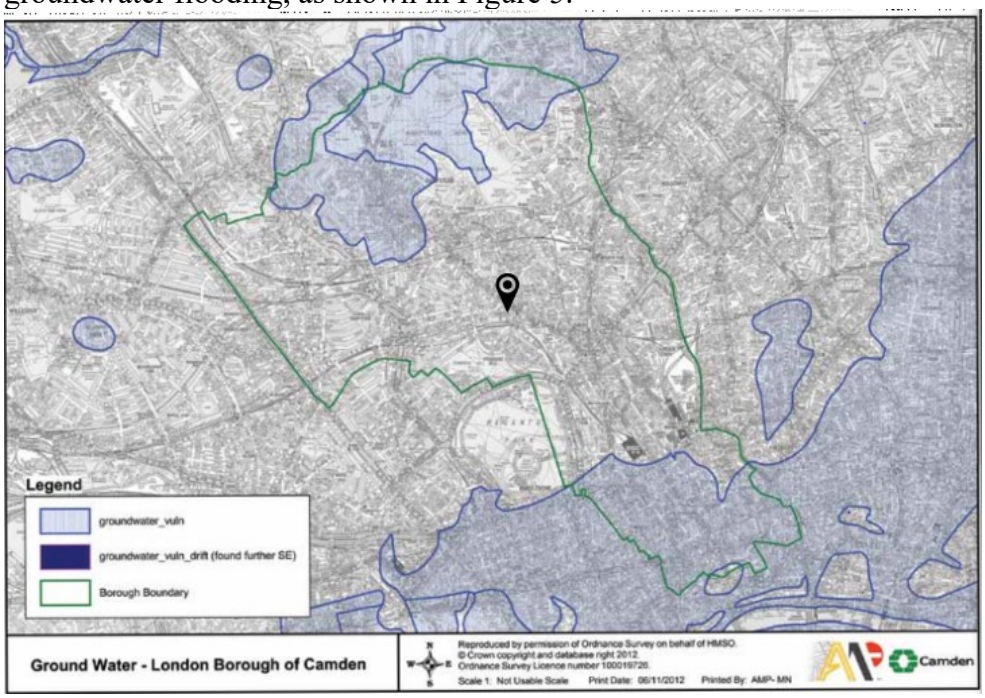


Figure 5 LBC Groundwater vulnerability map

3.4.4 Flood Risk from Sewers

The SFRA states that there are no recorded incidents of sewer flooding on site. Internal sewer flooding incidents have been reported in NW3 3 and NW3 4 postcode area. The sewer and water

main flood information is reported at postcode level as presented in Figure 6. As such, is it difficult to directly address the site risk. To stop the sewer flows from backing up within the development the use of non-return valves will have to be considered subject to Thames Water approval.

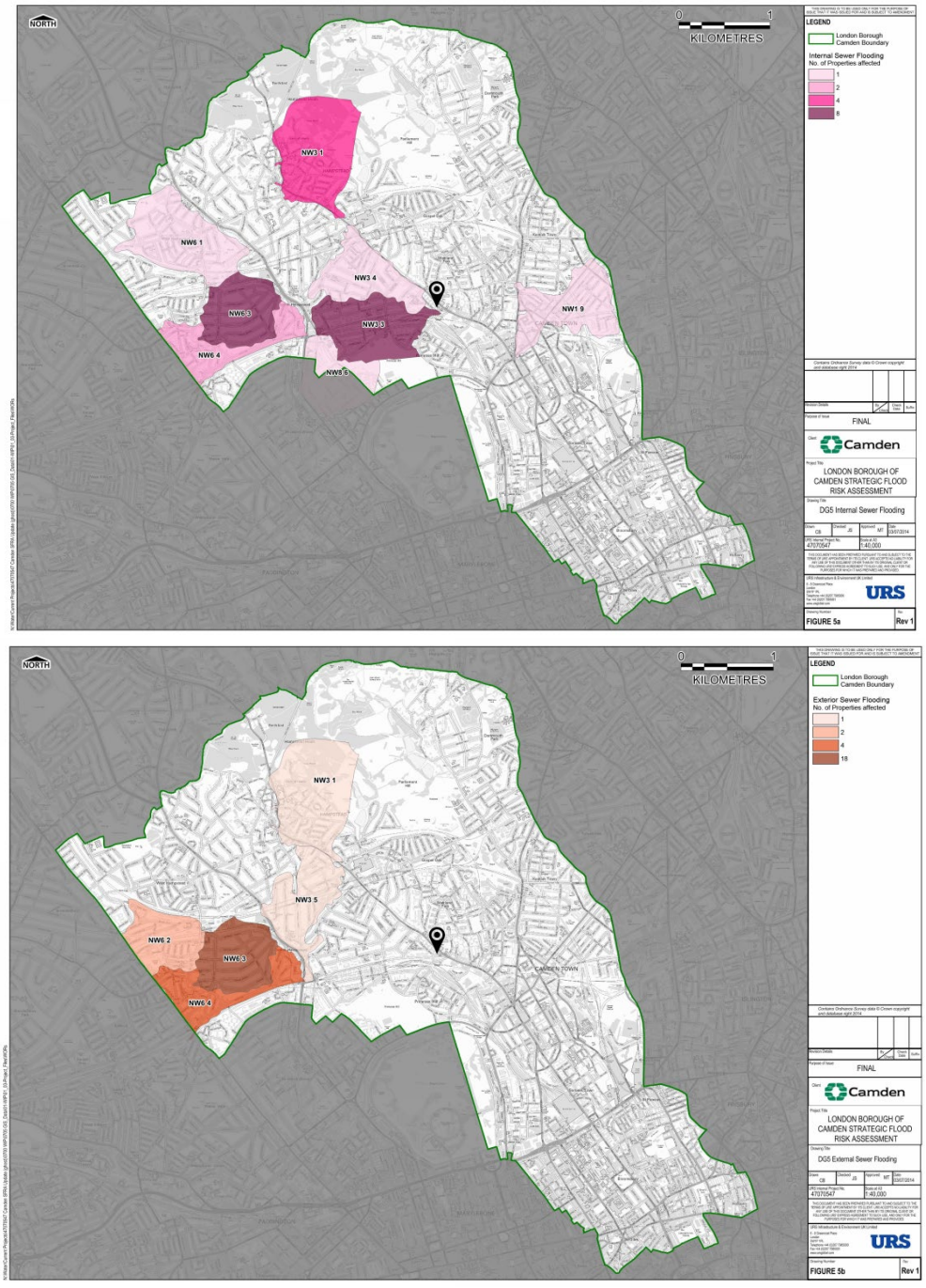


Figure 6 LBC DG5 sewer flooding map

3.4.5 Flood risk from reservoirs, canals and other sources

The EA flood map in Figure 7 confirms that the site is not at risk of reservoir flooding. Figure 8 identifies the nearest waterway as Regent's Canal, approximately 0.6km away.

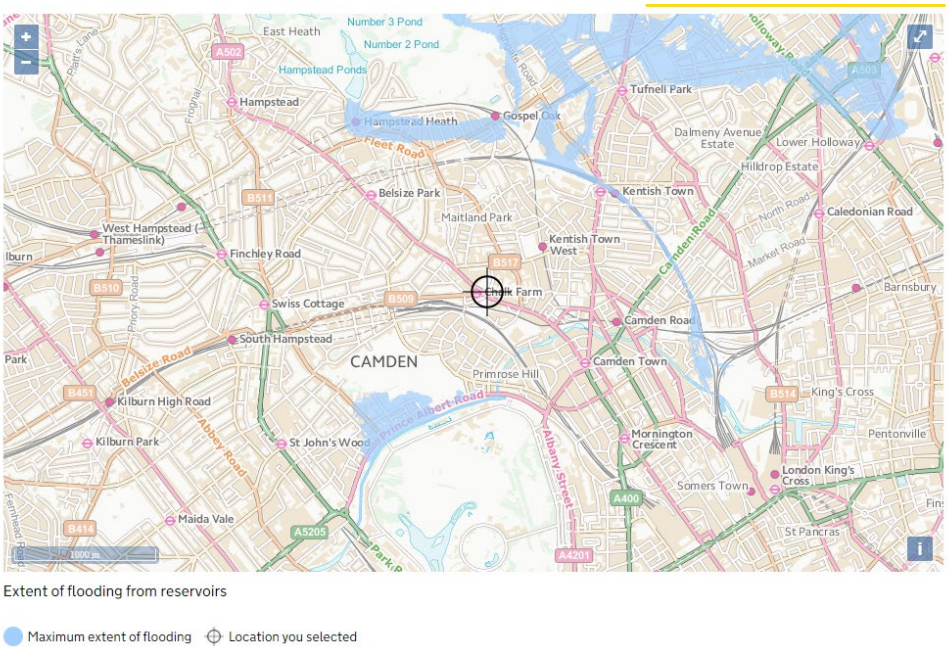


Figure 7 Flood map for reservoir flooding

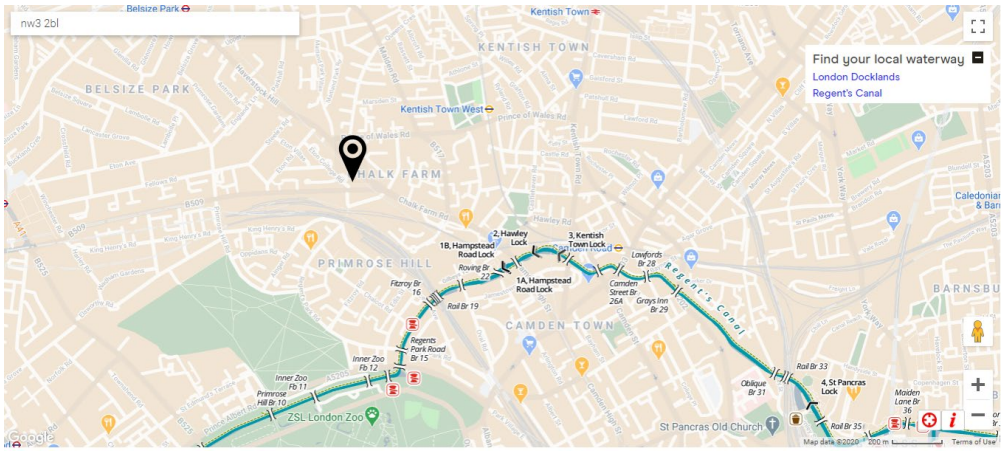


Figure 8 Map of canals in the local area

3.5 Existing Surface Water Runoff Rate

The actual surface water flows from the site are unknown. Using the Modified Rational Method, the surface water discharge was estimated for the existing site:

$$Q = 2.78 C_v C_r i A$$

Where:

Q=Peak discharge (l/s)

C_v=Volumetric runoff coefficient

C_r=Dimensionless routing coefficient

I=Rainfall Intensity (mm/hr)

A=Catchment area (ha)

The Wallingford Procedure recommends that when used in urban catchments the following values can be used:

C_v=0.75 (range between 0.6 to 0.9)

C_r=1.3

The existing total site area is approximately 0.207ha and is assumed 100% impermeable. Therefore, the existing site runoff rate for the 100-year storm is calculated as:

A=0.207ha

i=80.42mm/hr (for 100-year return period 30 minutes duration)

On this basis the pre-development runoff rate, Q, for the 1 in 100-year return period storm event of 30-minute duration is estimated to be 45.78l/s.

3.6 Existing Foul Water Flow Rate

An estimate of the existing peak foul flow rate was made based on the sanitary fittings in the building. The existing peak flow rate was estimated by the MEP engineer (Quinn Ross) and as the development was built in 1939, the existing peak flow rate was determined using the 1977 edition of IOP guidance, Table C3 and estimated to be 10.98l/s.

4 Proposed Surface Water Drainage

4.1 Managing Surface Water and SUDS

The government and the local authority have implemented strict regulation on the provision of Surface Water Management. Major planning applications need to demonstrate compliance with the LBC policy by submitting a Surface Water Drainage Statement.

The expectations from LBC are that new developments must not increase the risk of flooding. Where there is known to be a risk of flooding, it is expected that mitigation measures will be put in place with Sustainable Drainage Systems (SUDS).

In Camden SUDS systems must be designed in accordance with London Plan Policy 5.13. The London Plan Policy 5.13 Sustainable Drainage states that:

"*Development should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:*

- *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 to a watercourse;*

- *attenuate rainwater by storing in tanks or sealed water features for gradual release to a watercourse;*
- *discharge rainwater direct to a watercourse;*
- *discharge rainwater to a surface water drain;*
- *discharge rainwater to the combined sewer."*

SUDS will be used where practicable throughout the site to provide source control, improve water quality and to reduce flood risk. Before discharging the surface water to the public sewer all options set out in the drainage hierarchy have been exhausted. It should be noted that opportunities to infiltrate to ground are extremely limited due to the underlying geology and the proposed development. More information regarding the ground conditions on site are presented in Appendix F.

Table 1 identifies the SUDS methods proposed for the site within the development.

Table 1 Suds Hierarchy Consideration

SUDS Hierarchy		Consideration
1	Store rainwater for later use	Rainwater harvesting has not been considered. However, a 5m^3 tank for greywater recycling is proposed for the site.
2	Use infiltration techniques, such as porous surfaces in non-clay areas and green roofs	Opportunities to infiltrate to ground are extremely limited due to the underlying geology and the proposed layout of the development.
3	Attenuate rainwater in ponds or open water features for gradual release	Due to spatial constraints open ponds are not a feasible solution
4	Attenuate rainwater by storing in tanks or sealed water features for gradual release to a watercourse;	It is proposed to use blue roofs and green roofs on most of the available roof areas to attenuate rainwater and improve biodiversity. Below ground geo-cellular tank have been proposed to attenuate the runoff fallen on the hardstand areas. Surface water discharge would be restricted at the outfall with the use of vortex flow control (Hydrobrake or similar approved).
5	Discharge rainwater direct to a watercourse	The nearest water course is Regent's Canal, 0.6km south-east of the site, therefore it isn't considered a feasible solution.
6	Discharge rainwater to a surface water drain	There are no nearby surface water sewers.

7	Discharge rainwater to the combined sewer	The site is discharging to a combined Thames Water sewer at greenfield runoff rate.

4.1.1 Greenfield Runoff Rate and Storage Estimate

Greenfield run-off rates are defined as the runoff rates from a site in its natural state prior to any development. Typically, this is between 2 l/s/ha and 8 l/s/ha.

Greenfield runoff rate for the site was calculated using the Flood Estimation Handbook produced by the Institute of Hydrology, which is based on the QMED equation (Kjeldsen et al, 2008).

The total area of the proposed site development is 0.207ha. The greenfield runoff rate was calculated for various rainfall events. It is proposed to adopt the minimum discharge rate of 5l/s. Reducing surface water flows to less than 5l/s is not advised as it will cause low flows and potential maintenance issues (blockages), therefore 5l/s per connection has been proposed. This is in line with current standing guidance. Table 2 presents an overview of the greenfield runoff rate calculations.

QBAR=1.14l/s

Table 2 Haverstock Hill - Greenfield Runoff Rate Estimate

Return Period Storm	Greenfield Runoff Rate	Proposed Run-Off
	l/s	l/s
1:1 years	0.88	5
1:30 years	2.38	5
1:100 years	3.31	5
1:100 years (+40% CC)	4.6	5

Based on the above discharge restrictions, storage requirements have been estimated using Innovyze Microdrainage Source Control software to determine the required attenuation volume for the site. Following the EA standing advice, a 40% climate change allowance has been used for the 100year return period rainfall event to calculate the required attenuation volume. In Table 3 are shown the attenuation estimates determined using MicroDrainage Source Control.

Table 3 Haverstock Hill - Attenuation volume estimates

Return Period Storm	Proposed Run-Off	Tank Volume (Minimum)	Tank Volume (Maximum)	Estimated Attenuation Required
	l/s	m3	m3	m3
1:10 years	5	26	41	40
1:30 years	5	38	56	60
1:100 years	5	54	78	80
1:100 years (+40% CC)	5	86	119	120

It is anticipated that approximately 120m^3 of attenuation is required in below or above ground attenuation.

4.2 Proposed drainage strategy

The proposed development includes a basement (with plant rooms, storage and switch room) and ground floor building footprints occupying approximately 90% of the site area, hence infiltration of surface water runoff is not a feasible solution for the site. Moreover, the available information indicates that site comprise the London Clay Formation, classified as Unproductive Strata (rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow). Given the low mass permeability of the London Clay, for drainage design it has been assumed that the soils on the Site are, for practical purposes, impermeable.

Surface water runoff is proposed to be attenuated at source wherever possible. Feasible solutions include blue/green roofs on the residential and hotel units, as well as a below ground attenuation. A flow control device will also be included on the downstream pipework to provide a final restriction of the total storm water discharged from the site.

A blue roof manufacturer was contacted to recommend solutions for attenuation on each of the residential blocks and within the courtyard. A return period of 100 years and allowance for climate change of 40% was specified.

For the available roof areas for blue and green roofs, preliminary designs were provided as presented in Table 4. These assume two outfalls per blue roof system. The number of outlets influences the runoff rate and it was set as minimum 0.2l/s for some outfalls (for the smaller roofs) and 0.5l/s for the bigger roofs.

The remaining impermeable areas include the roof areas where plant is to be installed, internal courtyard and the service yard area. Further attenuation for these areas is required in order to be able to achieve the 5l/s proposed discharge.

Table 4 Roof attenuation solution

Location	Green/blue roof area (m2)	Depth of attenuation (mm)	Void ratio	Volume of attenuation (m3)	Outlet discharge flow (l/s)
3rd Level	72	108	90%	7.0	0.2
Fifth level	374	130	87%	42.3	0.5
Sixth level	267	130	87%	30.2	0.5
Seventh level	341	130	87%	38.6	0.5
			Total	118.1	1.7

The above roof areas proposed to be used as attenuation are shown in Figure 9 below. These have been developed together with the wider team, considering structural loading, plant placement and waterproofing requirements.

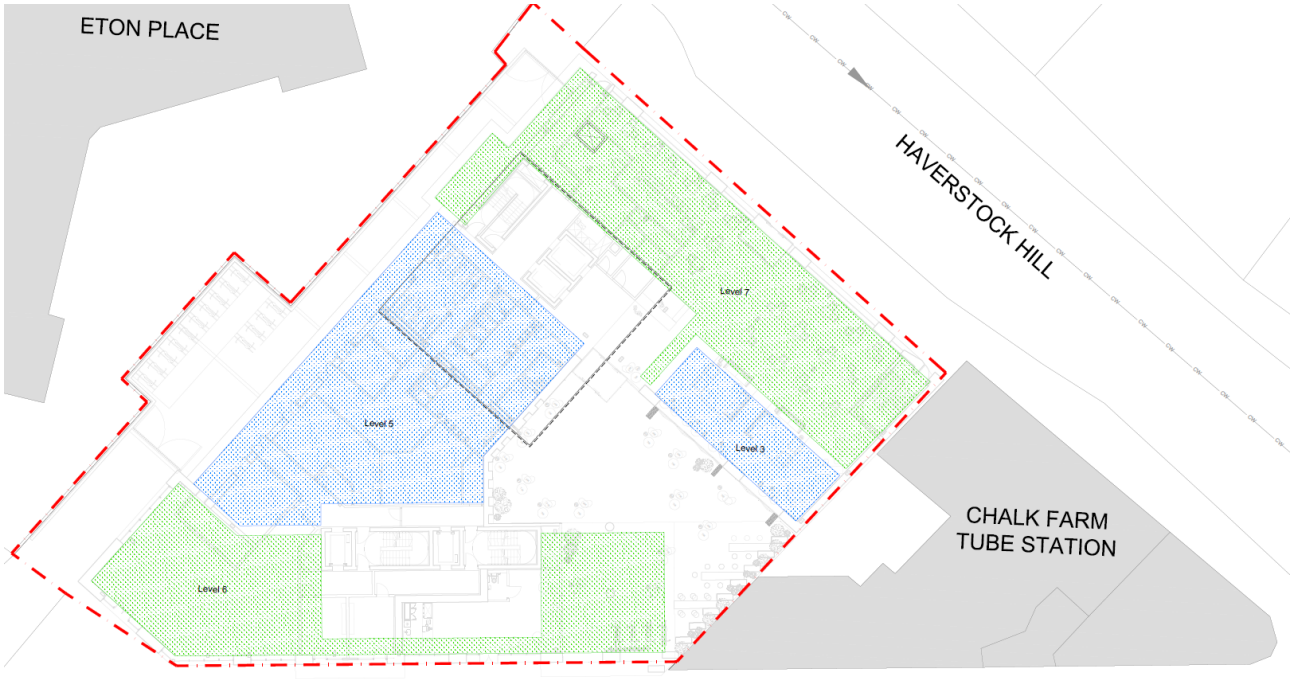


Figure 9 Green and blue roof attenuation proposed for Haverstock Hill site

For the remaining areas a below ground attenuation will be required to further reduce surface water runoff to 5l/s. Geo-cellular attenuation is proposed for the service yard to attenuate the surface water runoff. The volume required for the below ground attenuation was calculated for the 100-year storm event plus 40% climate change allowance. The total below ground attenuation volume needed is approximately 30m^3. The attenuation in the blue/green roofs and below ground is subject to further development during the next stage, which may result in varying attenuation within each area whilst ensuring the overall surface water discharge is limited to 5l/s.

Surface water will discharge from the attenuation tank at a restricted 5l/s for all rainfall events up to and including 100-year storm event plus 40% climate change. A single outfall will be connected to the sewer owned by TWUL in Adelaide Road via the combined sewer which crosses the site. As the on-site combined sewers are mostly below the proposed building footprint, it is proposed to abandon and remove all drainage pipes and manholes that are clashing with the proposed building. Subject to the results of the CCTV survey it may be required to replace the on-site network to maintain any connections to adjacent properties. Please refer to Appendix D for the Proposed Drainage Layout.

The combined sewer just outside of the site boundary will be retained and a new manhole is proposed in the footpath on Adelaide Road, south of the site boundary to discharge the proposed Storm and Foul flows generated on site. The new drainage connection will need to be agreed with Thames Water Utilities Ltd (TWUL).

A CCTV survey is required for the on-site private and TWUL owned sewers to determine if there are any other connections from off-site discharging into the existing network.

This quantity of attenuation and a generous allowance for the remaining areas of the site will comfortably achieve a reduction in peak discharge of approximately 91% from existing conditions, which would be consistent with the requirements of the London Plan.

5 Foul Water Strategy

It is proposed to route the foul water from the ground floor and upper floors at high level in the basement of the hotel and below the slab of the ground floor (for both the hotel and residential units) before discharging via gravity in the on-site TWUL owned combined sewer on Adelaide Road. The foul water in the basement will be pumped to high level and discharge into the proposed gravity foul network in the service yard.

A new foul sewer is proposed in the service yard to pick up the hotel, residential and retail discharges. The proposed on-site foul network will be picked up by the storm water sewer which will become a combined sewer before discharging to the Thames Water sewer.

5.1 Foul flow rate

The proposed peak flow rate was provided by the MEP Engineer. The total peak flow rate from the proposed development is 21.65l/s. Table 5 summarizes the proposed peak flow rates of the building. For existing peak flow rate please refer to Section 2.5.1 of this report.

For below slab drainage strategy please refer to Appendix G.

Table 5 Summary of existing and proposed peak foul flow rate

Outfall	Existing peak flow rate (l/s)	Proposed Peak Flow Rate (l/s)
Hotel Outfall	10.98	12.95
Residential Outfall		7.5
Retail Outfall		1.2

6 Maintenance Plan

The ongoing maintenance and management of the proposed surface water drainage system will fall under the responsibility of the site owner. Best practice information is provided in the CIRIA SUDS Manual, excerpts of which have been included below for:

1. Regular Maintenance
2. Occasional Maintenance
3. Remedial Actions

6.1 Greywater Recycling

The manufacturer of the greywater recycling system has provided the maintenance plan for the recommended equipment. Table 6 below gives a recommended maintenance schedule. Following further design development of the greywater recycling design, the maintenance requirements and detailed plan can be prepared.

Table 6 Recommended maintenance regime as provided by the supplier

Frequency	Required action
Annual	All biannual service parameters Cleaning of tank as required Service inspection by professional organisation confirming correct operation of all components including data logger readout inspection against expected performance
Biannual	Filter maintenance including backwash Confirmation of system functionality including disc filters, valves etc. Test of all control parameters Visual inspection for cleanliness of collection and treated water tanks Assess production volumes and adjust as required
Monthly	Visual Inspection of system for any leaks or damage. Visual inspection of Sodium Hypochlorite levels and topping up as required. Confirmation that water is being supplied to site. Check Control Panel readout and report any faults to SDS

6.2 Green Roofs

The SUDS Manual 2015 Table 12.5 (below in Figure 10) gives a recommended maintenance schedule for green roofs. Following further design development of the green/blue roof solutions on the building roofs, the maintenance requirements and a detailed plan can be prepared.

TABLE 12.5 Operation and maintenance requirements for green roofs

Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (ie year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment, replace dead plants as required (where > 5% of coverage)	Annually (in autumn)
	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

Figure 10 Typical maintenance for green roofs (CIRIA SUDS Manual 2015)

6.3 Attenuation storage tank

Attenuation tanks are used to collect and store water prior discharging to the combined sewer on Adelaide Road. The SUDS Manual 2015 Table 21.3 (below in Figure 11) gives a recommended maintenance schedule for attenuation tanks:

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks

Maintenance schedule	Required action	Typical 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
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	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

Figure 11 Typical maintenance of attenuation tanks (CIRIA SUDS Manual 2015)

6.4 Flow control device

The flow control device is located at the end of the system to restrict surface water flows discharging from the site. The maintenance schedule was compiled from the Hydro-International website. Typical maintenance is presented in Table 7.

Table 7 Typical maintenance of vortex flow control

Maintenance schedule	**Required action**	**Frequency**
Regular Maintenance	Debris removal (leaves, rubbish, tree branches) from the drainage network	Monthly
Remedial Actions	When flooding occurs dur to blockages in the drainage network, drain down manhole(s) and jet pipes to remove blockages.	As required
Monitoring	Inspect unit and hose down if required	Monthly for the first three months; Every six months after

7 Other Considerations

7.1 Adoption

It is unlikely that any SUDS feature or the drainage network will be adopted by Thames Water. The owner of the site will be responsible for the long-term management of surface water drainage assets and SUDS components.

7.2 Consultation

Thames Water and LBC will be consulted for associated approvals.

Consultation with Thames Water has been initiated to agree the foul and storm water discharges to their sewer. Thames Water's initial response suggests that there is limited capacity in the existing sewer network and therefore offsite reinforcement works may be required to accept the proposed flow from the development. This will be discussed further with Thames Water, post planning, as part of the next stage of design.

Consultation is ongoing.

8 Conclusions

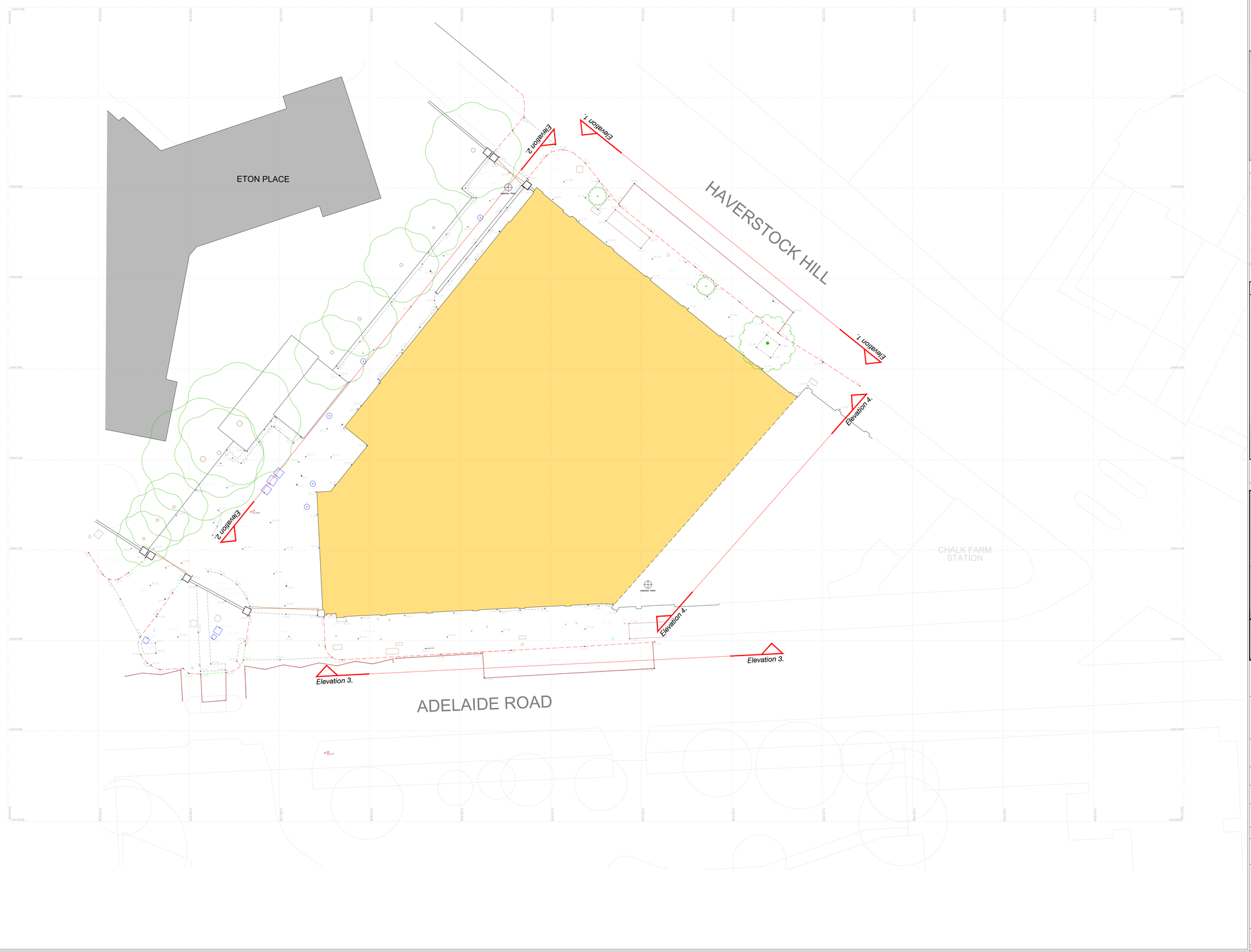
The proposed drainage strategy has been prepared to support the planning application of the proposed development 5-17 Haverstock Hill, NW3 2BL and concludes that:

- The proposed Haverstock Hill redevelopment is located in Flood Zone 1 and has a 'Low Probability' of flooding.
- The site is considered as being at a 'Very Low' susceptibility to surface water flooding.
- The site is in an area where there is no potential for groundwater flooding.
- A surface water drainage strategy has been developed to accommodate the runoff during storm events up to 100 year plus 40% climate change allowance.
- It is proposed to discharge the surface water runoff at a controlled rate of 5l/s. Approximately 149m^3 of attenuation are proposed in the form of blue/green roofs and below ground attenuation. An additional 5m^3 of grey water will be stored and treated for internal reuse.
- The proposed drainage strategy will reduce the surface water runoff from the existing site by approximately 90%.

This report has demonstrated that flood risk can be managed within the proposed site. As such, the development is in accordance with the planning requirements or NPPF and the local planning policy guidance in relation to flood risk and SUDS.

Appendix A

Topographical Survey



N

OS Note:

The Ordnance Survey tile is to be used as a guide only.

OS Buildings *Surveyed Buildings*

This survey has been orientated to the Ordnance Survey (O.S) National Grid OSGB36(15) via Global Navigational Satellite Systems (GNSS) and the O.S. Active Network (OS Net).

A true OSGB36 coordinate has been established near to the site centre via a transformation using the OSTN15GB & OSGM15GB transformation models.

The survey has been correlated to this point and a further one or more OSGB36(15) points established to create a true O.S. bearing for angle orientation.

No scale factor has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied.

Please refer to Survey Station Table to enable establishment of the on-site grid.

Building Survey Legend:

SHt 1.00 HHt 2.12	Sill Height from FFL. Head Height from FFL.
SL 51.03m HL 52.82m	Sill Level from defined datum. Head Level from defined datum.
Susp CHt: 2.00 Struct CHt: 3.00	Suspended Ceiling Height from FFL. Structural Ceiling Height from FFL.
Susp Ceil: 30.00m Struct Ceil: 31.00m	Suspended Ceiling Level from datum. Structural Ceiling Level from datum.
IFL: 100.00m +100.00m	Internal Floor Level (General). Internal Floor Level (Specific).
Insertion Point	Insertion Point for overlay drawings of other floors or details.

Incoming Services

Elec | Gas | Water

Topographical Survey Legend:

Buildings, Wall, Kerb line, Line marking, Drop kerb, Centre line, Overhead Cable, Concrete edge, Tarmac edge, Grass verge, Canopy/Overhang, Verge, Station and Name, Station Level, Tree / Bush / Sapling, Area of Undergrowth, Woodland, R Ridge Level, E Eaves Level, F Flat Roof Level, Gate

Fence types: IW Interwoven, IR Iron Railings, WM Wire Mesh, PR Post & Rail, PW Post & Wire, CL Chain Link, WP Wooden Panels, CP Concrete Panels, SP Steel Palisade

IC	Inspection chamber	BollI	Bollard
PInv	Pipe invert	IB	Illuminated bollard
Gy	Gully	Bin	Rubbish bin
Bg	Back gully	Vp	Vent pipe
Dp	Down pipe	Gif	Ground light
Pipe	Pipe above ground	Lbox	Letter box
MH	Manhole	Ldr	Ladder
WL	Water level	Sty	Stile
Fl	Flood light	IFL	Internal floor level
Lp	Lamp post	THL	Threshold level
Tp	Telegraph post	Sp	Sign post
Ep	Electricity post	TH	Trishole
Tl	Traffic light	BH	Borehole
Box	Box Wall	ELC	Electric
Sv	Stop valve	BT	British Telecom
St	Stop tap	CTbox	Control box
Er	Earth rod	TT	Tactile
Wm	Water meter	BP	Brick paved
Gas	Gas valve	CPS	Concrete paving slab
Av	Air valve	CVR	Cover
ICU	Unidentified inspection	IC	Inspection chamber
Wo	Wash out	Rwall	Retaining wall
Re	Rodding eye	UTL	Unable to lift
BB	Bellaire beacon	TOL	Tree canopy level
CTV	Cable tv	G	Girth
Mkr	Marker post	MG	Multi girth
Gmkr	Gas marker post	Stmp	Tree Stump
So	Soffit	CL	Cover level
		IL	Invert level

Rev	Date	Description	Drawn	Q. Ref.

greenhatch group

- Topographical Surveys
- Site Engineering
- Utility / CCTV Surveys
- Bathymetric Surveys
- Measured Building Surveys
- 3D Laser Scanning
- 3D Revit & BIM Models
- Area, Lease & Fire Plans

Rowan House
Duffield Road
Little Eaton
Derby
DE21 5DR
Tel (01332) 830044 Fax (01332) 830055
admin@greenhatch-group.co.uk
www.greenhatch-group.co.uk

St Albans: Unit 8,The Courtyard, Alban Park, St Albans, Hertfordshire, AL4 0LA, t. (01727) 854481

Newcastle: 24 Riverside Studios, Amethyst Road, Newcastle Bus. Park, Newcastle-U-Tyne, NE4 7YL, t. (01912) 736391

Central London: 27 Cornwall Terrace Mews, Regents Park, London, NW1 5LL, t. (0207) 2241806

CLIENT

STAR Real Estate

PROJECT

5-17 Haverstock Hill London NW3 2BP

TITLE

Existing Location Plan

SCALE	DATE
A1@ 1: 200	19.05.20
DRAWN	QUALITY REF
SL	GH7564

Level datum	See OS notes above
Grid orientation	See OS notes above
Job number	33507a

Drawing No. 33507a_01_P | Rev. 0

Comments

This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.

All dimensions should be checked on site prior to design and construction.

Some services may have been omitted due to parked vehicles.

Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:

Appendix B

Thames Water Asset Records

Asset Location Search

Conisbee
1 - 5

LONDON
N1 1DH

Search address supplied 5-17
Haverstock Hill
London
NW3 2BL

Your reference 140870

Our reference ALS/ALS Standard/2015_3161923

Search date 6 October 2015

You are now able to order your Asset Location Search requests online by visiting
www.thameswater-propertysearches.co.uk

Asset Location Search

Search address supplied: 5-17, Haverstock Hill, London, NW3 2BL

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 searchprovides 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

Asset Location Search

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.

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.

Asset Location Search

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: 0845 850 2777
Email: developer.services@thameswater.co.uk

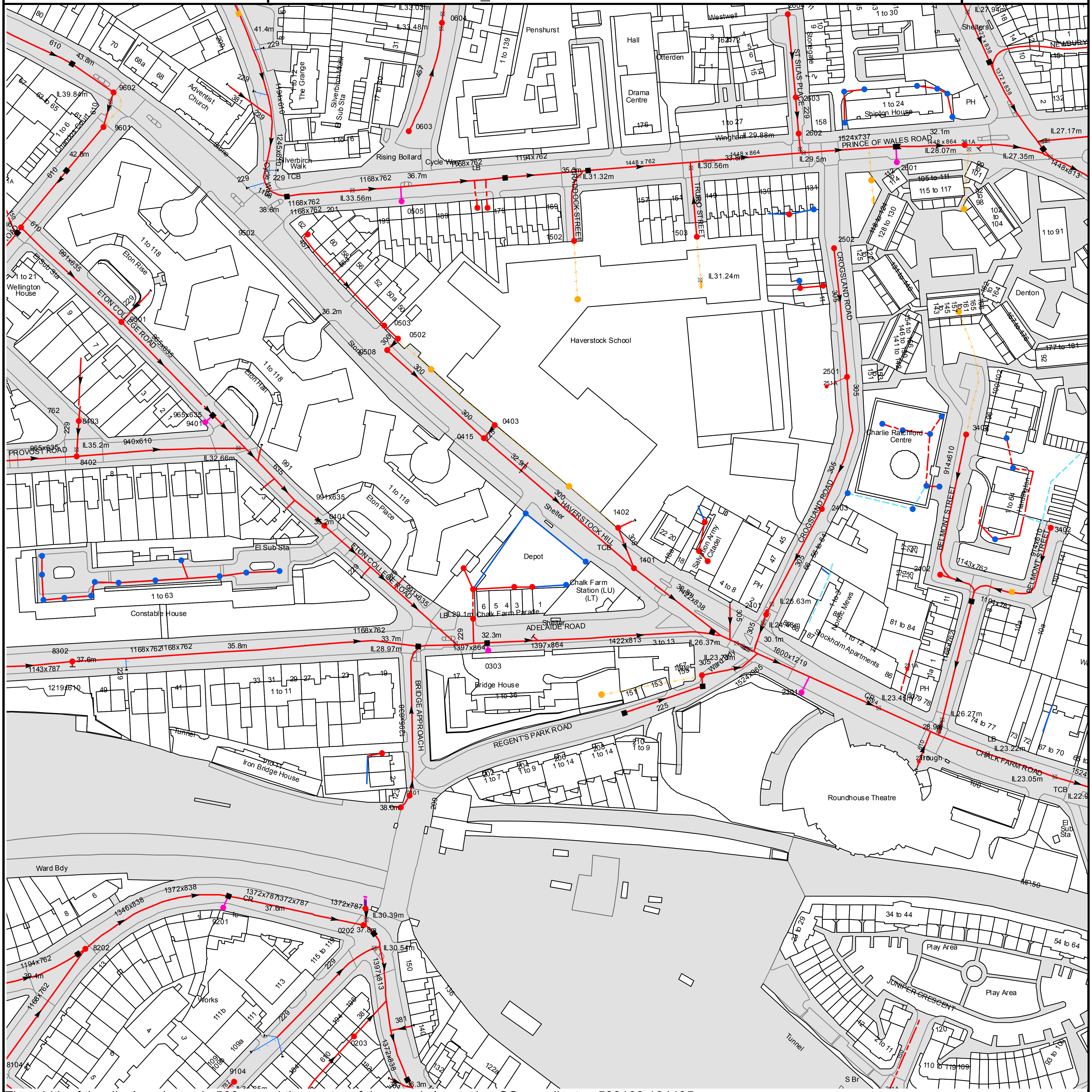
Clean Water queries

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: 0845 850 2777
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2015_3161923



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 528108,184435

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.

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
25AJ	n/a	n/a
2502	32.8	30.44
25CB	n/a	n/a
2601	n/a	n/a
361A	n/a	n/a
2602	n/a	n/a
26BG	n/a	n/a
26BF	n/a	n/a
26CB	n/a	n/a
26BJ	n/a	n/a
26BI	n/a	n/a
26CA	n/a	n/a
26BH	n/a	n/a
2402	29.91	26.52
34BF	n/a	n/a
3402	29.85	26.86
2403	30.82	28.25
24BJ	n/a	n/a
24BI	n/a	n/a
24CA	n/a	n/a
24CE	n/a	n/a
34BC	n/a	n/a
34BB	n/a	n/a
3403	30.31	27.29
24CD	n/a	n/a
24CC	n/a	n/a
24CB	n/a	n/a
24CH	n/a	n/a
251A	n/a	n/a
2501	31.9	29.5
25BA	n/a	n/a
25BB	n/a	n/a
25CC	n/a	n/a
0506	n/a	n/a
0507	n/a	n/a
0505	n/a	n/a
0603	36.8	35.2
9601	n/a	n/a
2603	n/a	n/a
9602	n/a	n/a
0604	37.04	n/a
2604	33.43	32.52
94BB	n/a	n/a
84BA	n/a	n/a
94BG	n/a	n/a
94BI	n/a	n/a
94BJ	n/a	n/a
94CA	n/a	n/a
04BJ	n/a	n/a
1401	31.06	27.24
14BG	n/a	n/a
14BC	n/a	n/a
94CB	n/a	n/a
14BB	n/a	n/a
1402	n/a	n/a
0401	35	31.73
14BA	n/a	n/a
04BI	n/a	n/a
0415	33.15	30.98
0403	n/a	n/a
9401	n/a	n/a
8403	39	36.04
0508	34.63	32.85
0502	34.89	33.53
0503	n/a	n/a
9501	40.21	36.45
1502	n/a	n/a
1503	n/a	n/a
9502	37.1	35.88
8302	37.27	33.48
84AH	n/a	n/a
84AI	n/a	n/a
84AG	n/a	n/a
84AF	n/a	n/a
8402	38.71	34.76
8506	43.11	38.89
9104	n/a	n/a
0203	n/a	n/a
8202	n/a	33.31
0202	37.99	30.25
021A	n/a	n/a
9201	n/a	n/a
031A	n/a	n/a
0301	37.57	29.57
231B	n/a	n/a
03BI	n/a	n/a
2301	n/a	n/a
1302	30.77	26.84
231A	n/a	n/a
0303	n/a	n/a
041A	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
2401	30.19	n/a
84AJ	n/a	n/a
04BH	n/a	n/a
04BG	n/a	n/a
04BF	n/a	n/a
14BF	n/a	n/a

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.

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

Gulley

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.

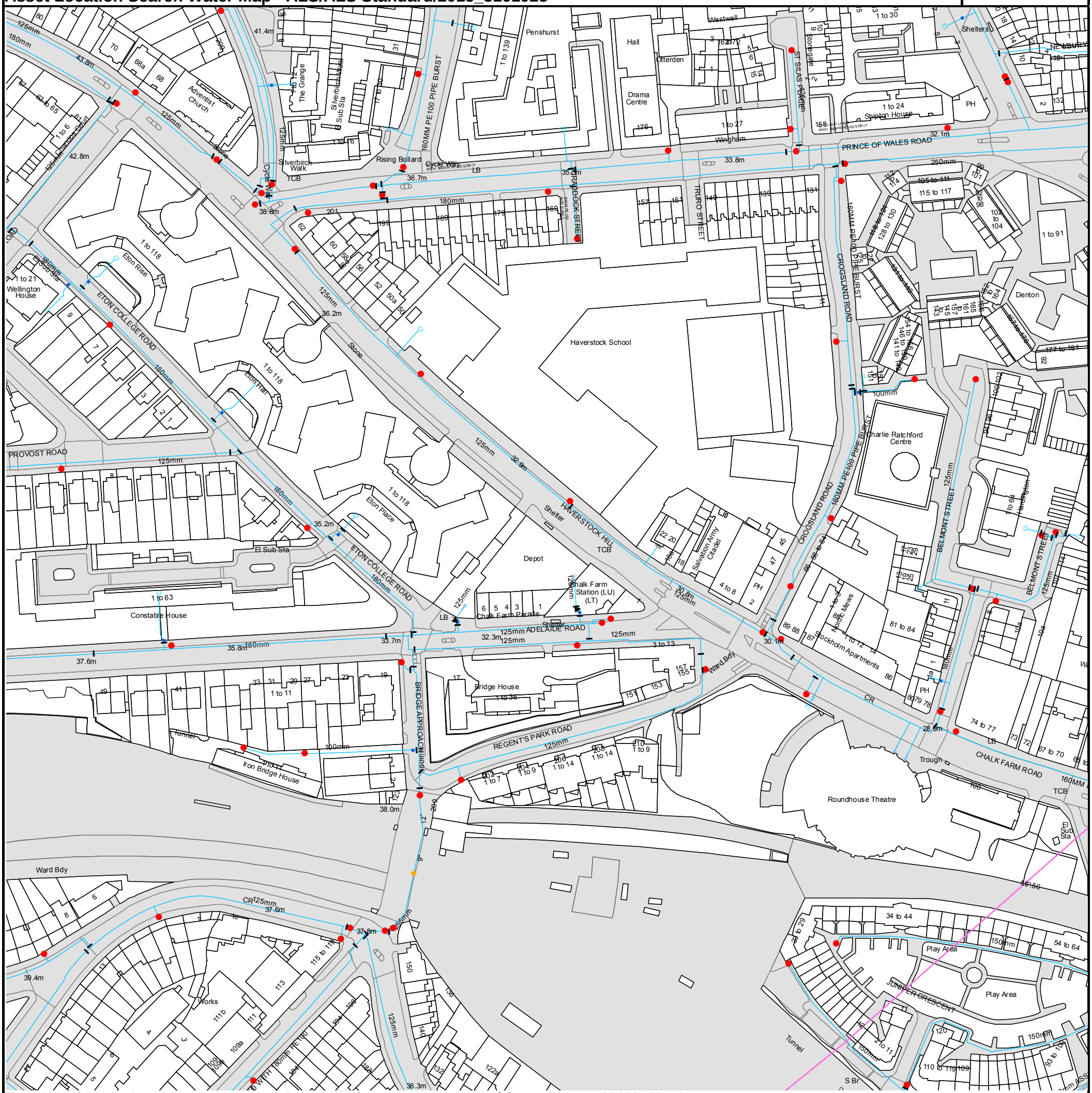
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

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 milimetres. 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/2015_3161923



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 528108, 184435.

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.

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

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.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

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.

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

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')

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: Indiates 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.

Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to him at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0845 070 9148** quoting your invoice number starting CBA or ADS.	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.

Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if he finds that you have suffered actual loss as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details

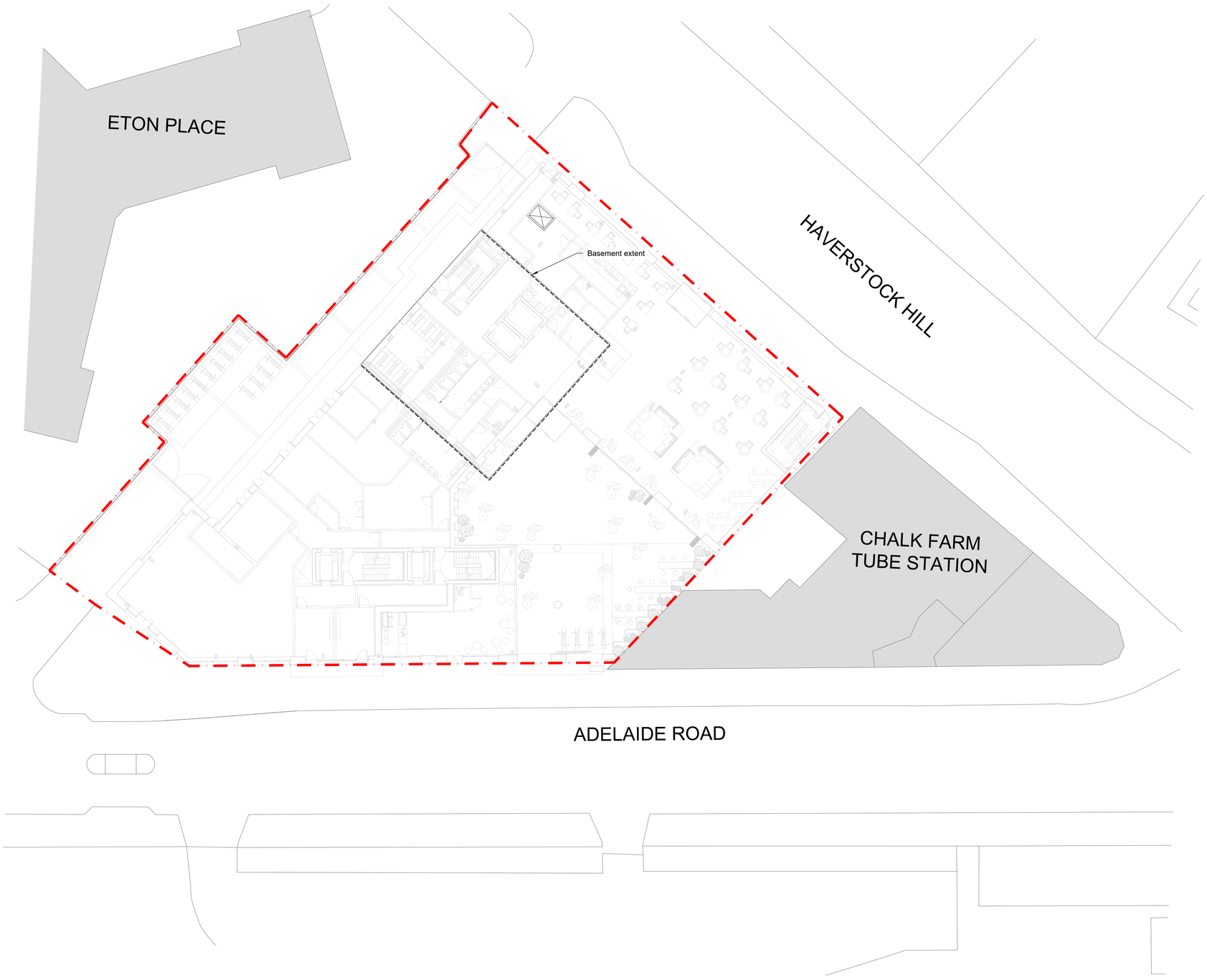
The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE

Appendix C

Masterplan



NOTES

1. Site Postcode: NW3 2BL.
2. Do not scale from this drawing.
3. Existing drainage shown is based on historical TWUL asset search information and is to be confirmed by survey on site.

LEGEND

Red Line Boundary

Issue	Date	By	Chkd	Appd
P02	28/10/20	RO	RO	TMcD
For Information				
P01	23/09/20	RO	RO	TMcD
For Information				

ARUP

13 Fitzroy Street
London W1T 4BQ
Tel +44(0)20 7636 1531 Fax +44(0)20 7580 3924
www.arup.com

Client
Best Star Real Estate 2

Job Title
Haverstock Hill

Key Plan

Drawing Title
Proposed Masterplan Layout

Scale at A1 1:200

Discipline Civil

Job No **268265-00**

Drawing Status **For Information**

Drawing No **HH-ARP-DR-C-0002** **P02**

0 5 10 Metres
Scale 1:200

Do not scale

Appendix D

Proposed Drainage Plan

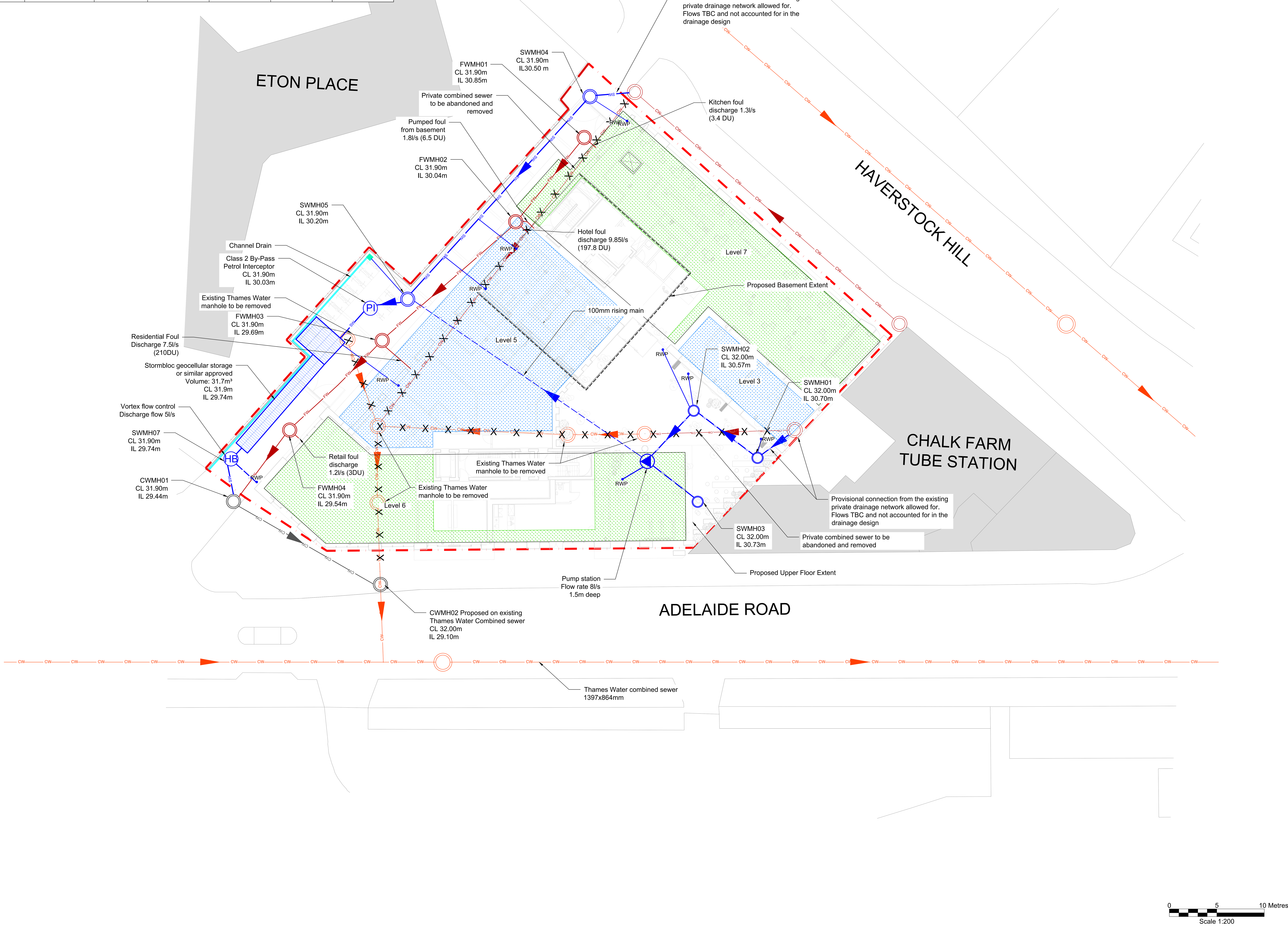
A1

Blue Roof Attenuation Information

Roof Level	Blue Roof Depth	Area	Porosity	Volume	Outlet Flow	No. of Outlets
Level 3	108mm	72m^2	90%	7m³	0.2 l/s	2
Level 5	130mm	374m^2	87%	42.3m³	0.5 l/s	2

Biodiverse Roof - Attenuation Information

Roof Level	Green Roof Depth	Area	Porosity	Volume	Outlet Flow	No. of Outlets
Level 6	130mm	267m²	87%	30.2m³	0.5 l/s	2
Level 7	130mm	341m²	87%	38.6m³	0.5 l/s	2



NOTES

1. Do not scale from this drawing.
2. Position and invert levels of existing Thames Water chambers and sewers to be confirmed on site prior to the commencement of any works.
3. The position of the blue/green roof outfalls are indicative. Architect and/or MEP engineer to confirm the exact locations as appropriate.
4. Proposed drainage to be coordinated with existing underground services.
5. Cover levels are indicative and shall be adjusted locally to suit finished ground level.
6. Where new sewers are constructed within 5m of a new or existing tree the sewer shall be concrete encased against root intrusion.
7. CCTV survey to be undertaken on the private combined sewer and Thames Water sewer on site to determine any additional connections required to be accounted for.

LEGEND

Red Line Boundary

Proposed Utilities

- Foul Water Sewer & Manhole
- Combined Sewer & Manhole
- Stormwater Sewer & Manhole
- Stormwater Rising Main
- Stormwater Channel Drain
- Stormwater Attenuation Tank
- Flow Control/Hydrobrake Chamber
- Petrol Interceptor
- Stormwater Pump Station
- Blue Roof Attenuation
- Blue Roof Outlet/Rainwater Pipe

Existing Utilities

- Combined Sewer & Manhole (Thames Water Asset)
- Foul Water Sewer & Manhole (Private Asset)

Existing Utilities to be abandoned

- Combined Sewer & Manhole (Thames Water Asset)
- Foul Water Sewer & Manhole (Private Asset)

Issue	Date	By	Chkd	Appd
P02	28/10/20	TB	RO	TMcD
For Information				
P01	21/09/20	TB	RO	TMcD
For Information				

ARUP

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www.arup.com

Client
Best Star Real Estate 2

Job Title
Haverstock Hill

Key Plan

Drawing Title
Proposed Drainage Layout

Scale at A1: 1:200

Discipline: Civil

Job No: 268265-00

Drawing Status: For Information

Drawing No: HH-ARP-DR-C-0001 P02

Do not scale

Appendix E

LBC SUDS Pro-Forma

Camden

GREATERLONDONAUTHORITY

LoDEG

1. Project & Site Details		
	Project / Site Name (including sub-catchment / stage / phase where appropriate)	Haverstock Hill
	Address & post code	5-17 Haverstock Hill NW3 2BL
	OS Grid ref. (Easting, Northing)	E 528102
		N 184423
	LPA reference (if applicable)	
	Brief description of proposed work	Redevelopment of the existing site consisting in residential, hotel and commercial spaces.
	Total site Area	2070 m^2
	Total existing impervious area	2070 m^2
	Total proposed impervious area	2070 m^2
	Is the site in a surface water flood risk catchment (ref. local Surface Water Management Plan)?	The site is locatedin an area considered at "Very Low" risk of flooding from surface water
	Existing drainage connection type and location	1397x864mm combined sewer in Adelaide Road.
	Designer Name	Raluca Olariu
	Designer Position	Consultant
	Designer Company	Arup

2. Proposed Discharge Arrangements			
	2a. Infiltration Feasibility		
	Superficial geology classification	Superficial geology - Made Ground Drift Geology - London Clay	
	Bedrock geology classification	Chalk	
	Site infiltration rate	1.00E-05	m/s
	Depth to groundwater level	1.87-3.72	m below ground level
	Is infiltration feasible?	No	
	2b. Drainage Hierarchy		
		Feasible (Y/N)	*Proposed (Y/N)*
	1 store rainwater for later use	N	N
	2 use infiltration techniques, such as porous surfaces in non-clay areas	N	N
	3 attenuate rainwater in ponds or open water features for gradual release	N	N
	4 attenuate rainwater by storing in tanks or sealed water features for gradual release	Y	Y
	5 discharge rainwater direct to a watercourse	N	N
	6 discharge rainwater to a surface water sewer/drain	N	N
	7 discharge rainwater to the combined sewer.	Y	Y
	2c. Proposed Discharge Details		
	Proposed discharge location	New MH on Chalk Farm Parade footpath	
	Has the owner/regulator of the discharge location been consulted?	Yes, consultation is ongoing	

Camden

GREATERLONDONAUTHORITY

LoDEG

3. Drainage Strategy

3a. Discharge Rates & Required Storage

	Greenfield (GF) runoff rate (l/s)	*Existing discharge rate (l/s)*	*Required storage for GF rate (m^3)*	*Proposed discharge rate (l/s)*
Qbar	1.14			
1 in 1	0.88	10.81	32	5
1 in 30	2.38	34.12	65	5
1 in 100	3.31	45.87	84	5
1 in 100 + CC			127	5
Climate change allowance used		40%		
3b. Principal Method of Flow Control		Vortex Flow control		

3c. Proposed SuDS Measures

	Catchment area (m^2)	*Plan area (m^2)*	*Storage vol. (m^3)*
Rainwater harvesting	0		0
Infiltration systems	0		0
Green roofs	850	608	49
Blue roofs	430	446	69
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	0	0	0
Pervious pavements	0	0	0
Swales	0	0	0
Basins/ponds	0	0	0
Attenuation tanks	790		30
Total	**2070**	**1054**	**148**

4. Supporting Information

4a. Discharge & Drainage Strategy	*Page/section of drainage report*
Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	DESK STUDY & GROUND INVESTIGATION REPORT - 5-17 Haverstock Hill London NW3 (Ref: J15316)
Drainage hierarchy (2b)	page 13 of Drainage Strategy Repor
Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	Appendix B -Thames Water asset map
Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	Section 3.5 of the Drainage Strategy Report
Proposed SuDS measures & specifications (3b)	Section 4.2 of the Drainage Strategy report
4b. Other Supporting Details	*Page/section of drainage report*
Detailed Development Layout	HH-ARP-DR-C-0002
Detailed drainage design drawings, including exceedance flow routes	HH-ARP-DR-C-0001
Detailed landscaping plans	
Maintenance strategy	ction 6 of the drainage Strategy Rep
Demonstration of how the proposed SuDS measures improve:	
a) water quality of the runoff?	N/A
b) biodiversity?	N/A
c) amenity?	N/A