AMBIENTAL

ENVIRONMENTAL ASSESSMENT

Flood Risk Assessment and Surface Water Drainage Strategy (SWDS) 5257

28-30 Avenue Road,

Primrose Hill,

London,

NW8 6BU

Ambiental Environmental Assessment
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Document Issue Record

Project: Flood Risk Assessment (FRA) and Surface Water Drainage Strategy (SWDS)

Prepared for: ME7 Ltd

Reference: 5257 FRA SWDS

Site Location: 28-30 Avenue Road, Primrose Hill, London, NW8 6BU

Proposed Development: It is understood that the proposed development is for the construction of a two-storey dwelling.

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1. Introduction

1.1 Ambiental Environmental Assessment has been appointed by ME7 Ltd to undertake a Flood Risk Assessment (FRA) and Surface Water Drainage Strategy (SWDS) for the proposed development at 28 Avenue Road, Primrose Hill, London, NW8 6BU (Figure 1).

1.2 The existing site comprises of open green space (grass and trees), with a dilapidated tennis court, car parking area and gate house at the entrance to the property. It is understood that the proposed development is for the construction of a 2-storey residential house, with a total of 10 bedrooms across the first and second floors and an indoor swimming pool at basement level. The proposal is also for the construction of a single-storey tennis pavilion, single-storey pool house and pool area, as well as soft landscaping for the driveway and parking area. The existing tennis court and gate house at the current site will remain post-development.

1.3 Topographic levels within the redline application boundary vary between approximately 40.26mAOD and 44.56mAOD. Analysis of the LiDAR data indicates that the site topography generally slopes upwards in a north-easterly direction. This is shown in Figure 2.

1.4 The redline application boundary area for the proposed development is approximately 7,280m^2 (0.728ha) and appears to be mostly impermeable, apart from the existing tennis courts (680m^2), the gate house (80m^2), car parking and driveway. The proposed development will increase the total impermeable area on site.

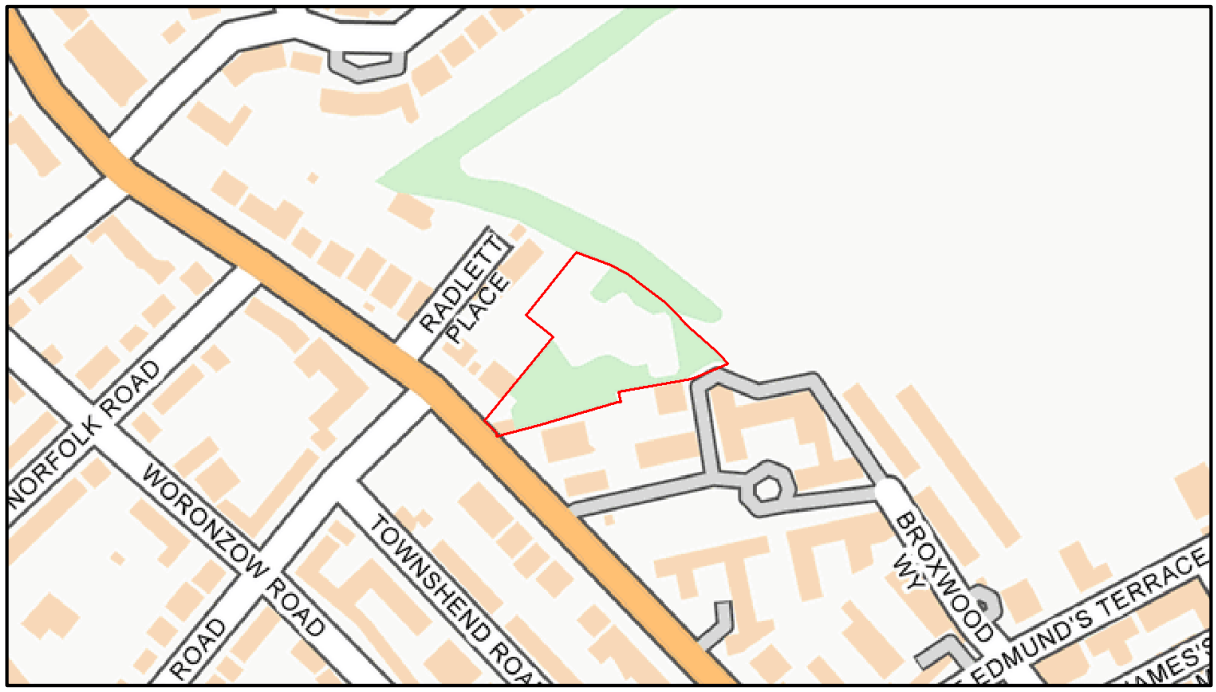


Figure 1 Location Map, identifying the location of the redline application boundary(Source: OS)

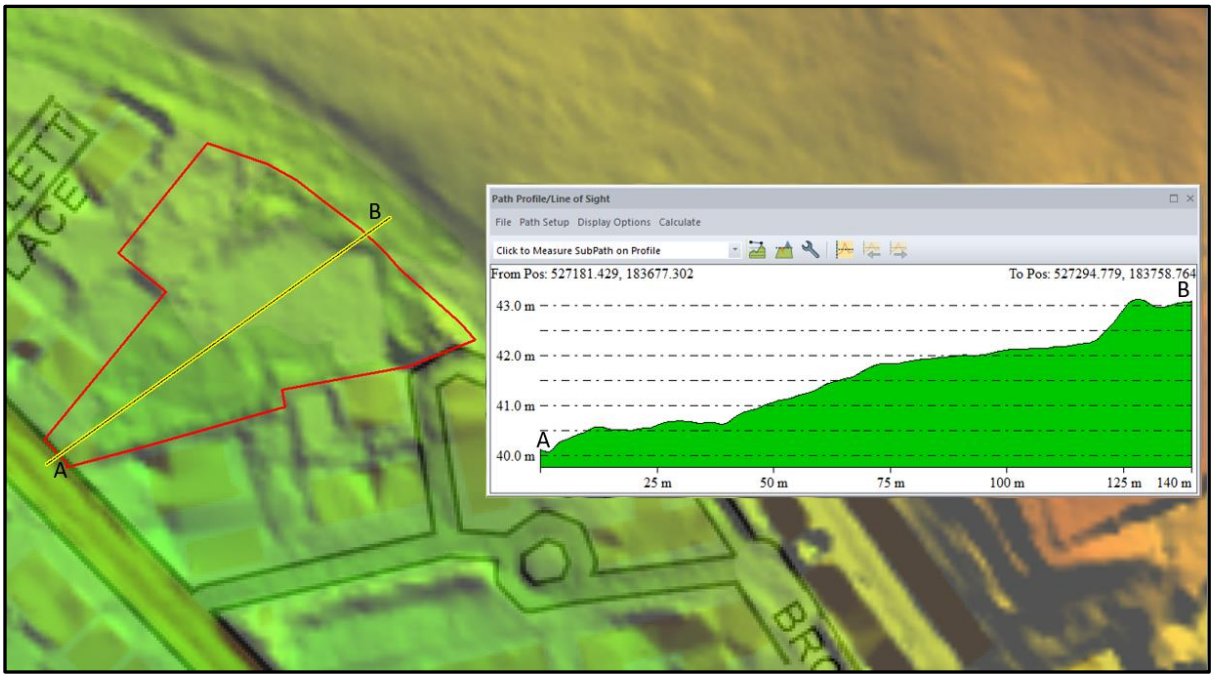


Figure 2 Topography of site using EA 2m LiDAR data. Cross-section indicated as yellow line, showing increase in slope in north-east direction (from A to B)

1.5 The purpose of this assessment is to demonstrate that the development proposal outlined above can be satisfactorily accommodated without increasing flood risk for the area and without placing the development itself at risk of flooding, as per National guidance provided within the National Planning Policy Framework (NPPF) 2019, the National Planning Practice Guidance (NPPG), DEFRA's National Standards for Sustainable Drainage, and Local guidance provided within London Plan Policy 5.13 and SPG.

Existing Drainage Infrastructure and Watercourses

1.6 The Grand Union Canal is located approximately 400m south-east of the redline site boundary.

Geology and Infiltration Potential

1.7 According to the British Geological Survey (BGS) online service mapping, the bedrock underlying the site is London Clay, comprising of clay, silt and sand. Analysis of nearby borehole logs (reference TQ28SE733) indicates that the topsoil deposits are predominantly clay mixed with stones. See Appendix III.

1.8 The Soilscapes website indicates the soils at the site to have impeded drainage.

1.9 Source protection zones are defined around large potable groundwater abstraction sites and indicate the risk of contamination from activities in the vicinity of the abstraction site. The site is within a Zone II - Outer Protection Zone (Figure 3). There is a predicted travel-time of 400 days for pollutants below the water table to reach the abstraction point.

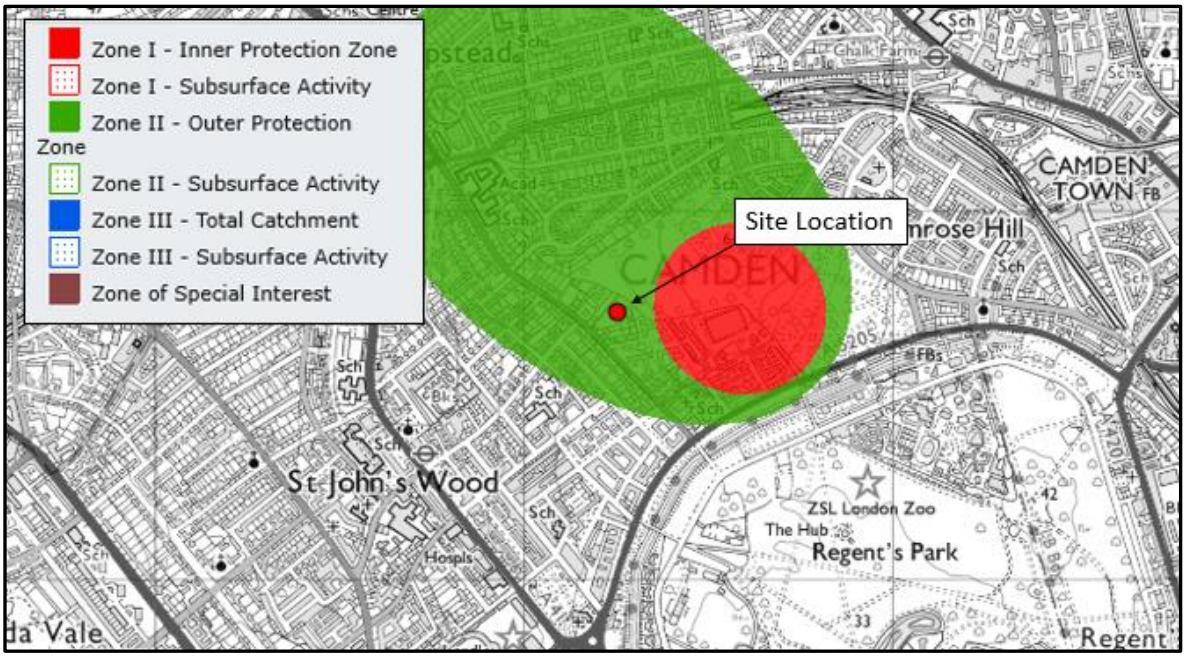


Figure 3 Groundwater Source Protection Zone mapping, indicating location of site (Source: MagicMap online)

2. Flood Risk

Vulnerability Classification

2.1 The EA Flood Map for Planning (Figure 4) has been produced in part using a relatively coarse, national scale flood modelling strategy, and in part by detailed modelling. It is important to note that only the potential floodplain is modelled; the mitigating effects of any flood defences currently in place are not considered. For reference, the definition of the NPPF flood risk zones is included below (Table 1).

Zone	Description
1	**Low Probability.** This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).
2	**Medium Probability.** This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.
3a	**High Probability.** This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
3b	**The Functional Floodplain.** This zone comprises land where water has to flow or be stored in times of flood. SFRA's should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the EA, including water conveyance routes).

Table 1 Definition of the NPPF Flood Zones. (Source: EA)

2.2 The EA Flood Map for Planning demonstrates that the proposed development lies wholly within Flood Zone 1. Land within Flood Zone 1 is defined as having a low probability of less than 1 in 1,000 (0.1%) of river or sea flooding in any year.

2.3 The site currently contains a dilapidated tennis court and parking area, with most of the site consisting of grassland and trees. As such, the existing site would be considered 'Water Compatible' under Table 2 of the Flood Risk and Coastal Change Planning Policy Guidance (PPG), due to its use as *'amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms*'. It is understood that the proposed development is for the construction of a 2-storey house (indoor swimming pool at basement level and total 10 No. bedrooms on first and second floor), with associated single-storey tennis pavilion, single-storey pool house, pool area, as well as soft landscaping for the driveway. Subsequently, the proposed development would be considered as 'More Vulnerable', due to its residential use, and will result in an increase in the vulnerability classification.

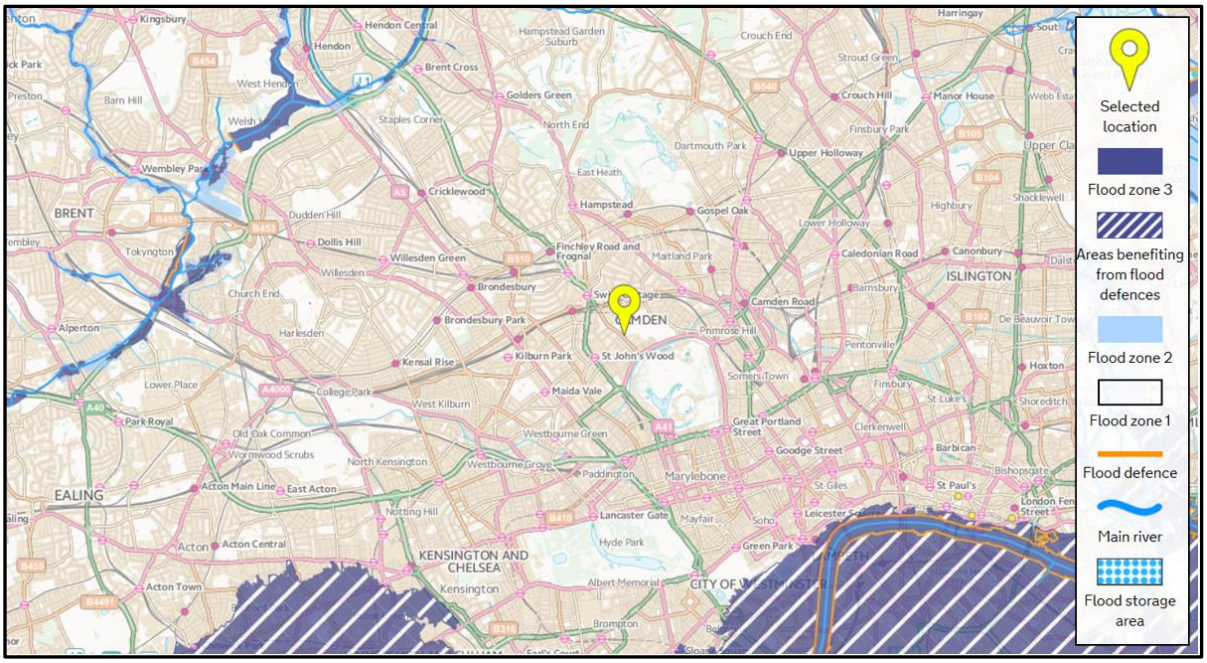


Figure 4 EA Flood Map for Planning (Source: EA)

Sequential Test/Exception Test

2.4 Under the NPPF, all new planning applications should undergo a *Sequential Test*. This test should be implemented by local planning authorities with a view to locating particularly vulnerable new developments (e.g. residential, hospitals, mobile homes etc.) outside of the floodplain.

2.5 The NPPF *Sequential Test: Flood Risk Vulnerability and Flood Zone 'Compatibility' Table* is reproduced below;

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	**Zone 1**	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test Required	✓	✓
	Zone 3a	Exception Test Required	✓	×	Exception Test Required	✓
	Zone 3b ***Functional Floodplain***	Exception Test Required	✓	×	×	×

Table 2 The Sequential Test: Flood Risk Vulnerability and Flood Zone 'Compatibility' Table as specified by NPPF. Please note: ✓means development is appropriate; ×means the development should not be permitted.

2.6 Using the principles of the Sequential Test outlined above, the proposed development is 'More Vulnerable'. The site is sequentially located within Flood Zone 1 (as defined by the EA) and therefore, under the NPPF, does not require the application of the Exception Test and is appropriate for development for this flood zone.

2.7 The proposed development has been identified as being located within a Critical Drainage Area inside Flood Zone 1. As such, the planning application for this development is required to be accompanied by an FRA which shows that development can be achieved in a sustainable manner, with an overall reduction of flood risk to the site and surrounding area.

Sources of Flooding

2.8 The proposed development is located within Flood Zone 1 (low risk of flooding) and is considered to be 'More Vulnerable' according to NPPF guidelines. Table summarises the potential sources of flooding to the site:

Source	Description
Fluvial/Tidal	Flood Zone 1
Surface	CDA Group 3_005; low risk on site
Groundwater	Low in local area
Sewer	Low in local area

Table 3 Summary of flood sources.

Fluvial/Tidal

2.9 The EA Flood Map for Planning (Figure 4) demonstrates the site to be located within Flood Zone 1, with a low probability of less than 1 in 1,000 (0.1%) of river flooding in any year.

2.10 The Grand Union Canal is located approximately 400m south-east of the redline site boundary.

2.11 Given that the site lies in Flood Zone 1, no modelled fluvial/tidal flood levels and depths were available from the Environment Agency for this area at the time of writing.

2.12 Topographic levels within the redline application boundary vary between approximately 40.26mAOD and 44.56mAOD. Analysis of the LiDAR data indicates that the site topography generally slopes upwards in a north-easterly direction. This is shown in Figure 2.

2.13 As such, the risk of fluvial/tidal flooding to the proposed site is considered to be **low.**

Surface Water (Pluvial)

2.14 With reference to the London Borough of Camden Surface Water Management Strategy (SWMP, 2014), the proposed development is located within Critical Drainage Area (CDA) Group 3_005, as indicated in Figure 5. It is not located in a Local Flood Risk Zone.

2.15 The SWMP defines a Critical Drainage Area as:

'a discrete geographic area and usually a hydrological catchment, where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more Local Flood Risk Zones.

Local Flood Risk Zones (LFRZs) are discrete areas/extents of predicted surface water flooding; these are in general shown as dark blue areas of deep flooding in the in 1 in 100 year Rainfall Event Flood Depth Map or the dark orange areas in the corresponding Hazard Map'.

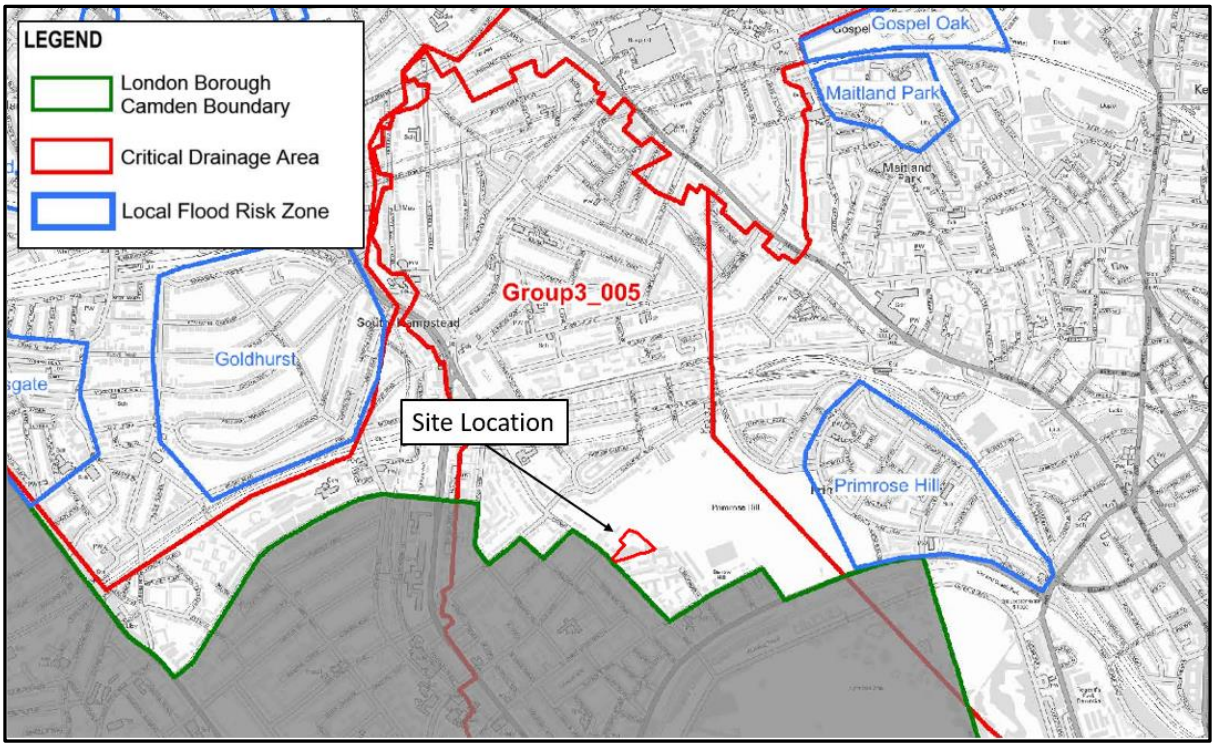


Figure 5 Critical Drainage Areas and Local Flood Risk Zones, indicating location of site (Source: Camden SWMP 2014)

2.16 The Environment Agency Flood Risk from Surface Water map (Figure 6) shows the redline application boundary to be within an area of 'Low' risk of flooding from surface water. However, Figure 6 also demonstrates that Avenue Road, which lies at the entrance to the site and provides access/egress, is at 'High' risk of flooding from surface water. Areas identified to be at 'High' risk have a greater than 3.3% annual risk of flooding from this source.

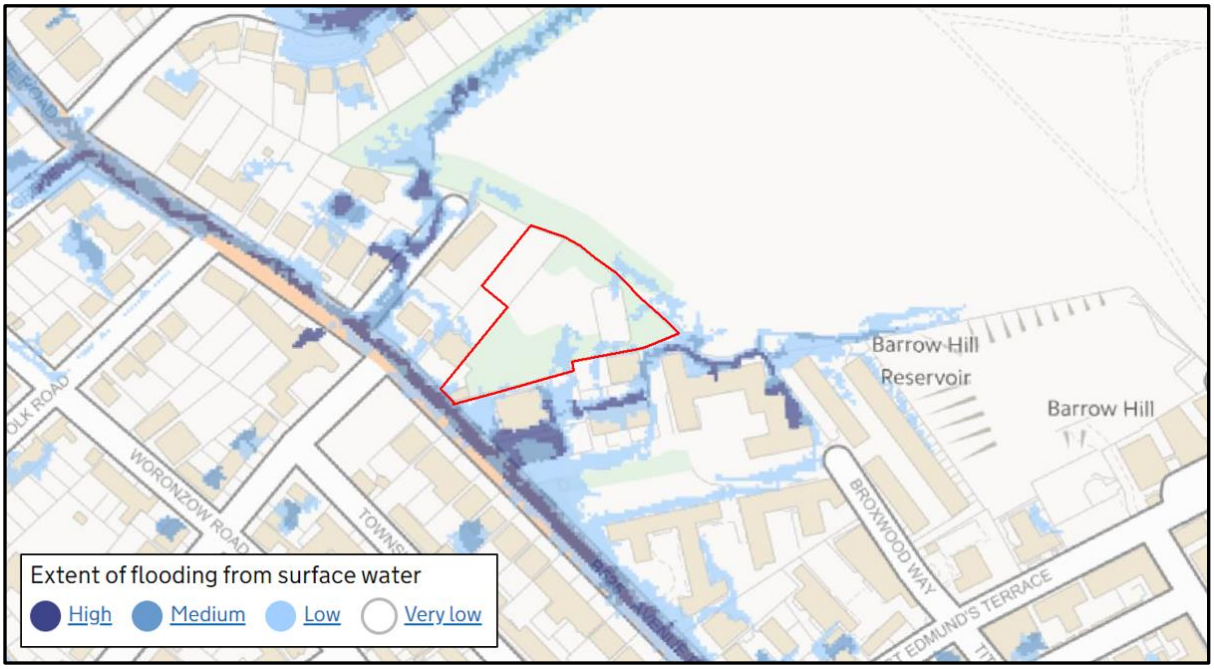


Figure 6 EA Surface Water Flood Risk map, indicating redline application boundary (Source: EA)

2.17 The EA's Risk of Flooding from Surface Water (RoFSW) dataset indicates that the redline site boundary remains unaffected by flooding during the modelled 1 in 30 year (Figure 7) and 1 in 100 year (Figure 8) pluvial events. However, Avenue Road located at the entrance of the site, to the south-west, is shown to

be affected by flood depths mostly up to 0.30m in the 1 in 30 year and up to 0.60m in the 1 in 100 year event.

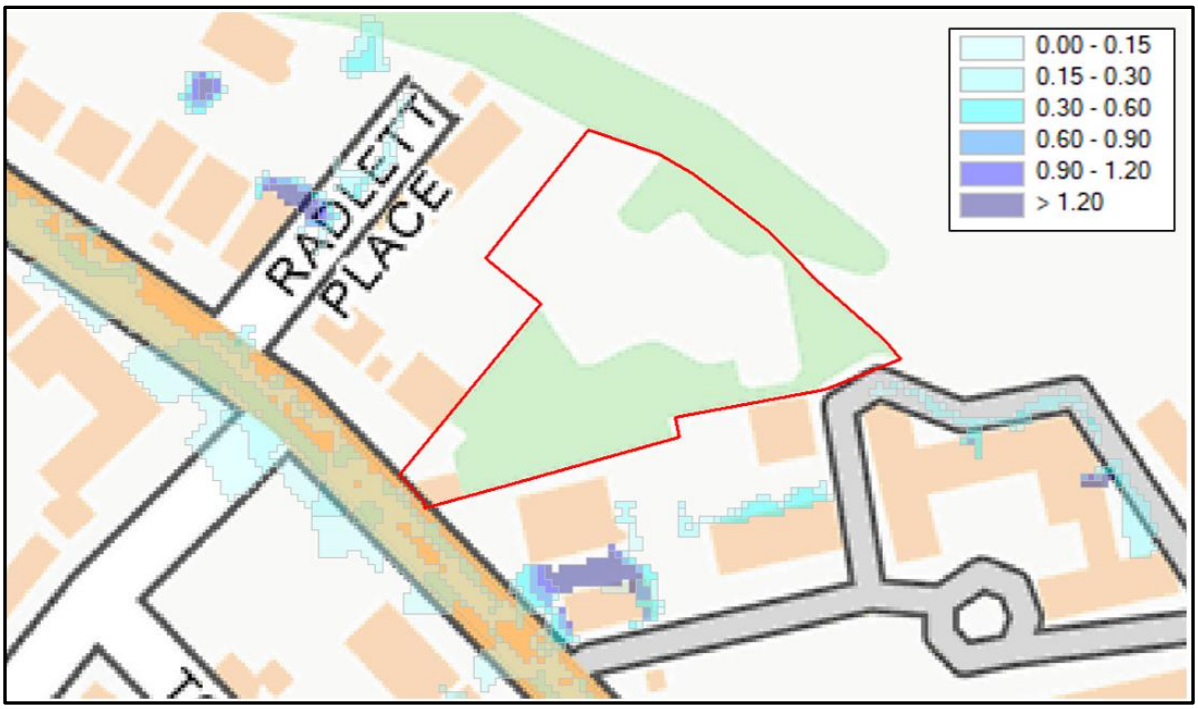


Figure 7 EA RoFSW 1 in 30 year pluvial event, indicating redline application boundary (Source: EA)

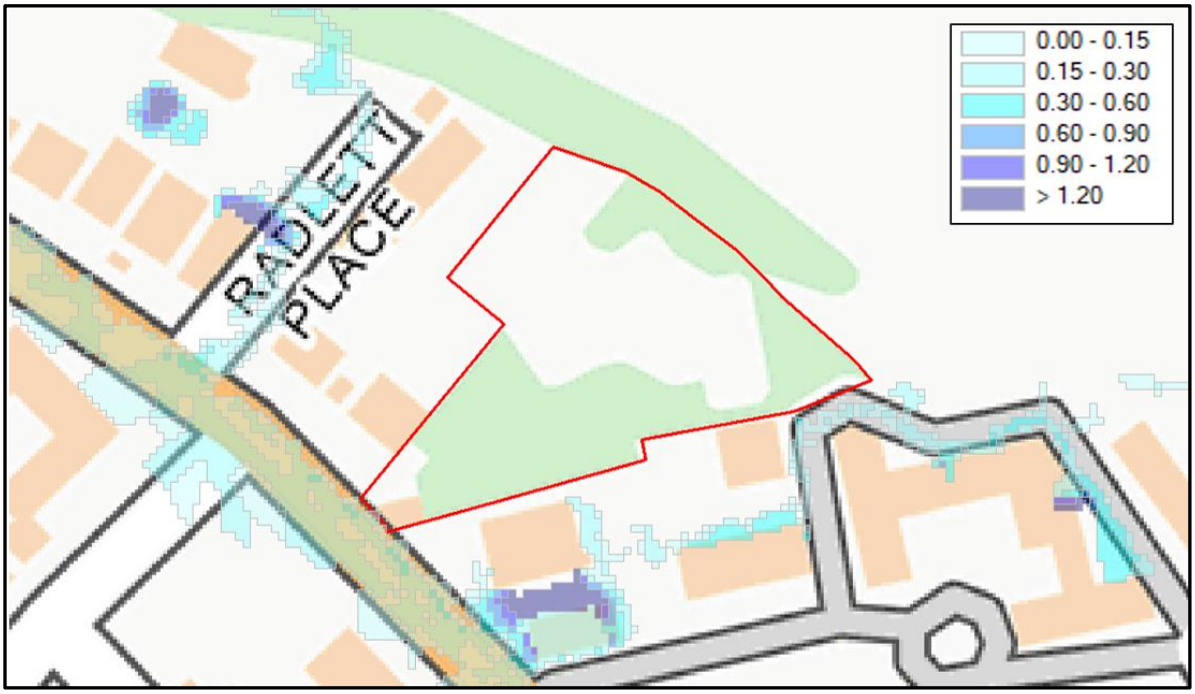


Figure 8 EA RoFSW 1 in 100 year pluvial event, indicating redline application boundary (Source: EA)

2.18 The RoFSW modelled 1 in 1,000 year pluvial event, as shown in Figure 9, demonstrates that the majority of the proposed site should remain unaffected during this event. Figure 9 also shows that some areas within the site could be affected by flood depths up to approximately 0.30m. Avenue Road is also shown to be affected by flood depths up to approximately 0.60m during this event. It should be noted that there is a low probability of this event occurring.

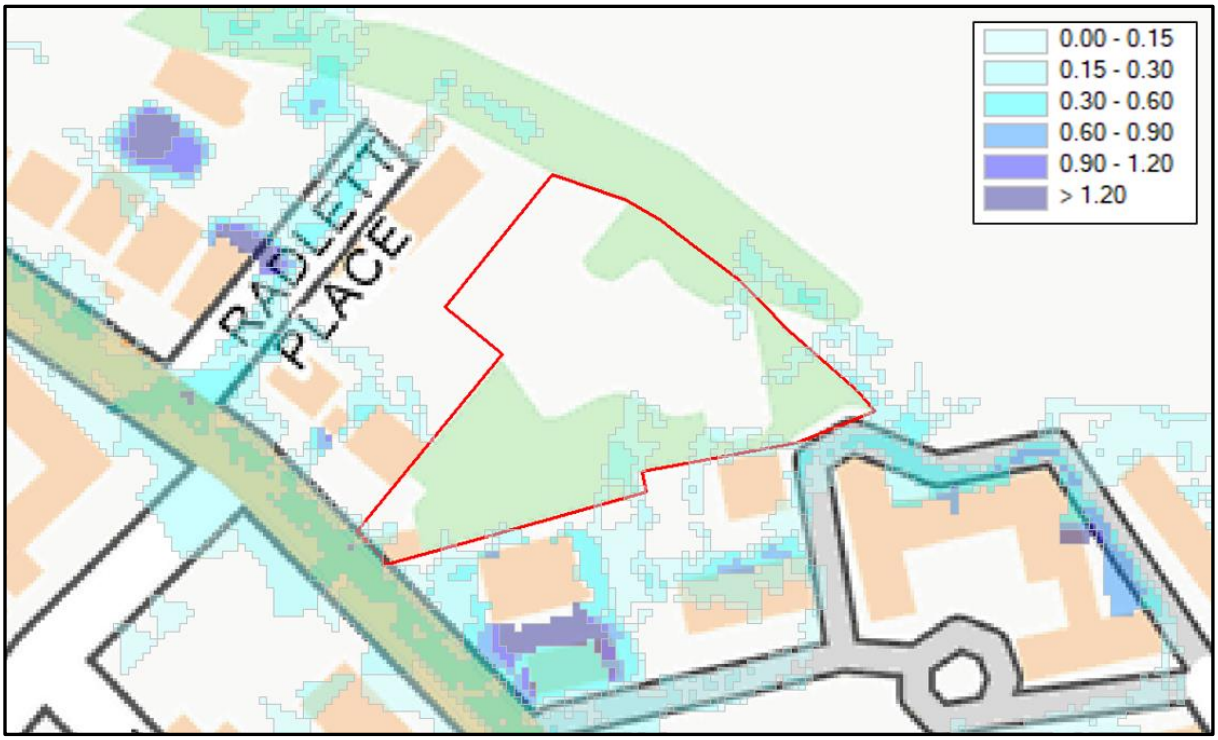


Figure 9 EA RoFSW 1 in 1,000 year pluvial event, indicating redline application boundary (Source: EA)

2.19 As such, the risk of flooding from surface water sources to the proposed development site could be considered low. Access to and from the site could be affected during a surface water event, as the road at the entrance of the site is at high risk of pluvial flooding.

Groundwater

2.20 The BGS Groundwater Susceptibility Mapping demonstrates the proposed site to be located in an area which is unaffected by groundwater flood risk (Figure 10).

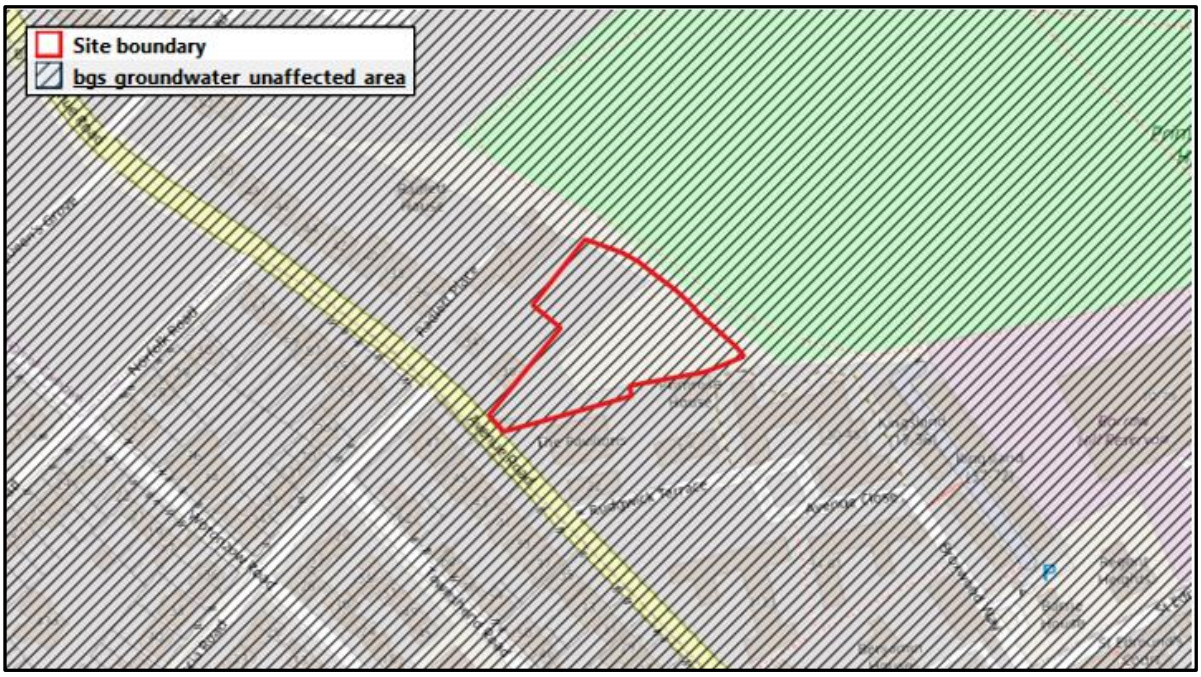


Figure 10 BGS Groundwater Susceptibility map (Source: BGS)

2.21 As indicated by the site plans provided by the client, the proposed development includes the construction of a basement. Given that the proposed site is located in an area shown to be unaffected by groundwater flood risk, it could be considered that the basement should not be at risk of flooding from this source.

2.22 It should be noted that there is a residual risk of flooding from perched groundwater at the site. As such, during basement excavation, safe practices should be employed.

2.23 Source protection zones are defined around large potable groundwater abstraction sites and indicate the risk of contamination from activities in the vicinity of the abstraction site. The site is within a Zone II - Outer Protection Zone (Figure 3). There is a predicted travel-time of 400 days for pollutants below the water table to reach the abstraction point.

Sewer

2.24 The Camden SFRA (2014) states that records of internal sewer flooding of properties from the TWUL (Thames Water Utilities Ltd) DG5 flood records is mainly concentrated in the north of the borough. The proposed development is located in the south of the borough, so could be considered to be at low risk of flooding from sewer sources.

Records of Historical Flooding

2.25 There is no indication from the EA or the Camden SFRA (2014) that the proposed site or the local area has been affected by flooding in the past.

Residual Risks

2.26 Residual risks are those remaining after applying the sequential approach to the location of development and taking mitigating actions. Examples of residual flood risk include:

- the failure of flood management infrastructure such as a breach of a raised flood defence, blockage of a surface water conveyance system, overtopping of an upstream storage area, or failure of a pumped drainage system;
- failure of a reservoir; or,
- a severe flood event that exceeds a flood management design standard, such as a flood that overtops a raised flood defence, or an intense rainfall event which the drainage system cannot cope with.

Defence Breach

2.27 The proposed development is not located in an area benefitting from flood defences, so it is considered that there is no residual risk of flooding from breach or overtopping of flood defences.

Reservoir Failure

2.28 The EA Risk from Reservoir Flooding Map (Figure 11) demonstrates that the site is outside flood extents in the event of reservoir flooding.

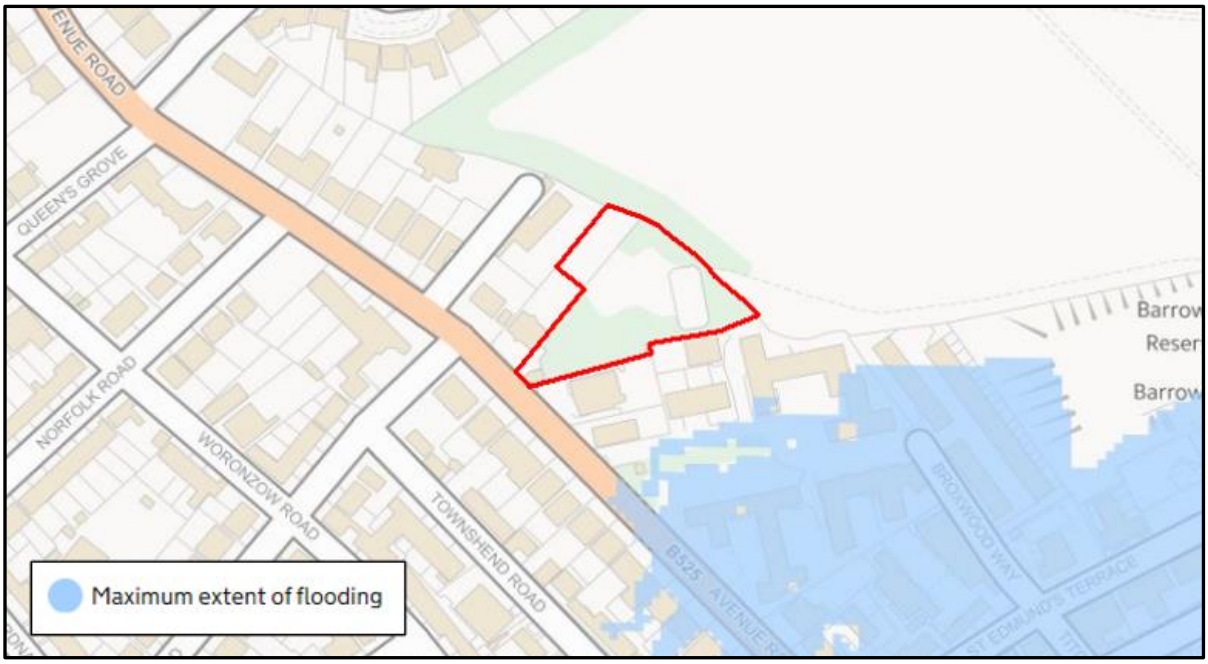


Figure 11 EA Risk from Reservoir Flooding map showing maximum flood extent and indicating site as redline boundary (Source: EA)

Drainage Exceedance

2.29 In the event of drainage failure/exceedance, overland flows would be dictated by site topography.

2.30 Topographic levels within the redline application boundary vary between approximately 40.26mAOD and 44.56mAOD. Analysis of the LiDAR data indicates that the site topography generally slopes upwards in a north-easterly direction. The site is also shown to be topographically higher than the main access road to the site at the south-western side of the site, B525 / Avenue Road. Therefore, it is expected that any overland flows would be directed towards the road in a surface water event.

3. Flood Risk Management Measures

3.1 With reference to the EA Flood Map for Planning, the proposed development is in Flood Zone 1, so is considered as being at low risk of fluvial flooding. However, the site is shown to be located within Critical Drainage Area (CDA) Group 3_005.

3.2 Analysis within the report demonstrates that the risk of flooding from fluvial/tidal, pluvial, groundwater and sewer sources to the proposed development could be considered low.

3.3 Given the risk of flooding there are no specific mitigation measures that are required. However, the site is located within a Critical Drainage Area so additional flood resilience measures should be incorporated into the development as set out in 'Improving the Flood Performance of New Buildings' Flood Resilient Construction (2007) and waterproofing of below ground structures should be undertaken as described in British Standard BS8102-2009. A summary of additional mitigation measures is detailed below.

3.4 Where kitchens, bathrooms or other water related installations are planned at basement level, that mitigation measures in the form of provision of a pumped solutions or 'active drainage devices' incorporating non-return valves are installed to prevent surcharge flooding from the sewer system during intense storm events.

3.5 Basements which are to be used for habitable accommodation are required to be constructed to Grade 3 (No water penetration or dampness is permitted). As such, a 'type C' drain protection system with internal drained cavity protection with a sump and pump for removal of water is recommended - in line with British Standards BS8102-2009.

3.6 The provision of a sump and small capacity automatic pump at a low point in the basement is proposed. This system will help the draining process and speed up drying. The dimensions of the sump and its operational procedure would be calculated and agreed with a specialist.

3.7 Non-return valves are to be installed on the new drainage systems throughout the basement level. It is also recommended that these valves are retrofitted on to any existing sewer connections to prevent back-flow of diluted sewage. Maintenance of these valves is important to ensure their continued effectiveness so should be maintained in line with manufacturers recommendations.

3.8 Damp Proof Membranes (d.p.m.) should be included in any design to minimise the passage of water through ground floors. Impermeable polythene membranes should be at least 1200 gauge to minimise ripping. Effective methods of joining membrane sections are overlaps of 300mm, and also taping (mastic tape with an overlap of 50mm minimum).

3.9 The development will be constructed to reduce the use of water throughout. Residential water consumption will be managed through dual flush toilets, highly efficient aerated taps and aerated low flow shower heads throughout the development.

Flood Warning Service and Evacuation Plan

3.10 The EA operates a 24-hour telephone service on 0345 988 1188 that provides frequently updated flood warnings and associated floodplain information. Further information can be found on www.environment-agency.gov.uk/floodline. Floodline Warnings Direct is a free service operated by the EA that provides flood warnings direct to occupants by telephone, mobile phone, fax or pager.

3.11 The proposed development site lies in Flood Zone 1 and thus it is deemed unlikely that the site would be affected by fluvial flooding. As such, the proposed development is not located within an EA Flood Warning Service Area.

3.12 However, given that the site lies within a CDA, it is advised that site users pay attention to 5-day weather forecasts during extreme events.

Off Site Impacts

3.13 The EA Flood Map for Planning demonstrates that the proposed development lies wholly within Flood Zone 1. Land within Flood Zone 1 is defined as having a low probability of less than 1 in 1,000 (0.1%) of river or sea flooding in any year.

3.14 At its closest proximity, the extent of Flood Zone 2 and 3 is located approximately 4.4km south-east of the site. Therefore, the site will likely remain at a low risk of fluvial/tidal flooding over its lifetime and, as a result, should not increase flood risk to others.

3.15 The proposed development is located within a Critical Drainage Area (CDA Group 3_005), indicating that there is a high risk of surface water flooding in the wider area of the proposed site. Section 3 onwards compares various sustainable drainage systems (SuDS) and recommends a drainage strategy for managing runoff on site to manage the risk of surface water flooding to the development and others.

4. SUDS Assessment

4.1 In accordance with the SuDS management train approach as detailed in the CIRIA 753 'The SUDS Manual', Section 3.2.3, the use of various SuDS measures to reduce and control surface water flows have been considered in detail for the development.

4.2 The management of surface water has been considered in respect to the SuDS hierarchy (below) :

SuDS Drainage Hierarchy				
			Suitability	Comment
↓	1.	Infiltration	-	The proposed garden areas will infiltrate as existing.
	2.	Discharge to Surface Waters	x	No surface water ditches/watercourses to discharge to
	3.	Discharge to Surface Water Sewer, Highway Drain or another Drainage System	✓	There is a surface water sewer in close proximity to the site which the permeable paving will drain to.
	4.	Discharge to Combined Sewer	-	
	5.	Discharge to a foul sewer (should not be considered as a possible option)	-	

Table 4: SuDS Hierarchy

4.3 The existing site is currently greenfield with a tennis court and drains via a combination of infiltration and surface water sewers. The proposed drainage strategy will utilise a combination of infiltration and surface water sewers via an attenuation tank.

Suitability of SuDS Components		
SuDS Component	**Description**	**Suitability**
Infiltrating SuDS	Infiltration can contribute to reducing runoff rates and volumes while supporting baseflow and groundwater recharge processes. The suitability and infiltration rate depends on the permeability of the surrounding soils.	x
Permeable Pavement	Pervious surfaces can be used in combination with aggregate sub-base and/or geocellular/modular storage to attenuate and/or infiltrate runoff from surrounding surfaces and roofs. Liners can be used where ground conditions are not suitable for infiltration.	✓
Green / Blue Roofs	Green Roofs provide areas of visual benefit, ecological value, enhanced building performance and the reduction of surface water runoff. They are generally more costly to install and maintain than conventional roofs but can provide many long-term benefits and reduce the on-site storage volumes. Blue roofs provide additional attenuation by storing the rainwater in crates located in the roof structure. Runoff from these structures can be reduced significantly using small orifice devices due to the low risk of blockage.	✓
Rainwater Harvesting	Rainwater Harvesting is the collection of rainwater runoff for use. It can be collected form roofs or other impermeable area, stored, treated (where required) and then used as a supply of water for domestic, commercial and industrial properties.	x
Swales	Swales are designed to convey, treat and attenuate surface water runoff and provide aesthetic and biodiversity benefits. They can replace conventional pipework as a means of conveying runoff, however space constraints of some sites can make it difficult incorporating them into the design.	x

Rills and Channels	Rills and Channels keep runoff on the surface and convey runoff along the surface to downstream SuDS components. They can be incorporated into the design to provide a visually appealing method of conveyance, they also provide effectiveness in pre-treatment removal of silts.	✓
Bioretention Systems	Bioretention systems can reduce runoff rates and volumes and treat pollution through the use of engineer soils and vegetation. They are particularly effective in delivering interception, but can also be an attractive landscape feature whilst providing habitat and biodiversity.	x
Retention Ponds and Wetlands	Ponds and Wetlands are features with a permanent pool of water that provide both attenuation and treatment of surface water runoff. They enhance treatment processes and have great amenity and biodiversity benefits. Often a flow control system at the outfall controls the rates of discharge for a range of water levels during storm events.	x
Detention Basins	Detention Basins are landscaped depressions that are usually dry except during and immediately following storm events, and can be used as a recreational or other amenity facility. They generally appropriate to manage high volumes of surface water from larger sites such as neighbourhoods.	x
Geocellular Systems	Attenuation storage tanks are used to create a below-ground void space for the temporary storage of surface water before infiltration, controlled release or use. The inherent flexibility in size and shape means they can be tailored to suit the specific characteristics and requirements of any site.	✓
Proprietary Treatment Systems	Proprietary treatment systems are manufactured products that remove specific pollutants from surface water runoff. They are especially useful where site constraints preclude the use of other methods and can be useful in reducing the maintenance requirements of downstream SuDS.	x
Filter Drains and Filter Strips	Filter drains are shallow trenches filled with stone, gravel that cerate temporary subsurface storage for the attenuation, conveyance and filtration of surface water runoff. Filter strips are uniformly graded and gently sloping strips of grass or dense vegetation, designed to treat runoff from adjacent impermeable areas by promoting sedimentation, filtration and infiltration.	x

Table 5 - Suitability of SuDS Components Table

Geocellular System

4.4 Geocellular Systems are generally built by placing together (e.g. stacking) cuboid plastic structures with very high void ratios (90-95%). The formed volume is then surrounded by a permeable geomembrane and backfilled with the excavated soil to form the infiltration device. Within the proposed SuDS scheme the Geocellular tanks are used to provide the storage volume requirement. They are proposed to be located within the southern garden area, however the exact layout is to be determined at the detailed design stage.

Permeable Pavement

4.5 Permeable paving is a method of paving vehicle and pedestrian pathways to enable infiltration of stormwater runoff. Permeable pavement surfaces typically include pervious concrete, porous asphalt, paving stones and interlocking pavers. Unlike traditional impervious paving materials, permeable paving systems allow stormwater to percolate and infiltrate through the pavement and into the aggregate layers and/or soil below. In addition to reducing surface runoff, permeable paving systems can trap suspended solids, thereby filtering pollutants from stormwater. The goal is to control stormwater at the source, reduce runoff and improve water quality by filtering pollutants in the subsurface layers.

London Borough of Camden – Advice note on contents of a Surface Water Drainage Statement

4.6 This section of the report relays relevant information from the above document.

4.7 Within Camden, SuDS systems must be designed in accordance with the London Plan Policy 5.13. This requires that developments should utilise sustainable urban drainage systems (SuDS) unless there are

practical reasons for not doing so, and 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 a porous surface in non-clay areas
- Attenuate rainwater in ponds or open water features for gradual release
- Attenuate rainwater by storing in tanks or sealed water features for gradual release
- Discharge rainwater direct to a watercourse
- Discharge rainwater to a surface water sewer/drain
- Discharge rainwater to the combined sewer

4.8 Camden Development Policy 23 (Water) requires developments to reduce pressure on combined sewer network and the risk of flooding by limiting the rate of run-off through sustainable urban drainage systems.

4.9 Camden Planning Guidance 3 (CPG3) requires developments to achieve a greenfield run-off rate once SuDS have been installed. Where it can be demonstrated that this is not feasible, a minimum 50% reduction in run off rate across the development is required. Further guidance on how to reduce the risk of flooding can be found in CPG3 paragraphs 11.4-11.8.

5. Surface Water Drainage Strategy

5.1 In order to mitigate flood risk posed by the development, adequate control measures are required to be considered. This will ensure that surface water runoff is dealt with at source and the flood risk on/off site is not increased over the lifetime of the development.

5.2 It is understood that the proposed development is for the construction of a 2-storey residential house, with a total of 10 bedrooms across the first and second floors and an outdoor pool at ground floor level. The proposal is also for the construction of a single-storey tennis pavilion as well as soft landscaping for the driveway and parking area. The existing tennis court (although resurfaced) and gate house at the current site will remain post-development.

5.3 The proposed development will have a gross site area of approximately 0.716ha (7155.3m^2).

5.4 The **existing** hardstanding area consists of a tennis court and gatehouse (668.9m^2 + 76.8m^2 = 745.7m^2).

5.5 The **proposed** hardstanding area (2614.2m^2) consists of:

- Main building: 724m^2
- Hardstanding area surrounding main building: 427.2m^2
- Swimming pool (including hardstanding) + pool house: 208.14m^2
- Driveway: 554m^2 (North section: 434.72m^2 / South section: 119.2m^2)
- Tennis pavilion: 29.75m^2 – Green roof to be installed
- Tennis court: 669m^2 (although existing, will be resurfaced)

5.6 The remaining greenfield area will equal approximately 4541.1m^2 (Gross site area – (proposed hardstanding + gatehouse)).

5.7 The design life of a residential dwelling is 100 years, and an allowance for climate change should be considered in accordance with published guidance within the NPPF 2018. The proposed surface water drainage system should therefore be designed to accommodate the 1:100 year + 40%CC storm event on site.

5.8 Ambiental has utilised Causeway software to calculate the runoff associated with the new hardstanding areas.

5.9 Infiltration SuDS have been dismissed due to the site lying on London Clay (poor infiltration).

5.10 An attenuation tank measuring 80m^2 with 800mm depth will provide the 60.9m^3 storage needed during the 1:100 year +40% Climate Change storm event (Appendix II).

5.11 The northern section of the driveway will be constructed using Type C permeable paving (430m^2 with 0.4m depth) and will provide the 60.72m^3 of storage necessary during the 1:100 year +40% Climate Change storm event (Appendix II).

5.12 According to LiDAR data, topographic levels within the redline boundary vary between approximately 40.26mAOD and 44.56mAOD. According to the asset plan (appendix I), the existing surface water manhole on site is at the following levels – CL: 41.72mAOD & IL: 40.81mAOD. Location and condition of existing surface water pipe pending a topographic survey and detailed connection survey. The tank/permeable paving could be redesigned to suit at a later detailed design stage.

5.13 The existing tennis court is to be resurfaced as per the proposed plans. It is proposed the tennis court is built with a central ridge (appendix I). The eastern half with drain as existing while the western half will drain to the attenuation tank via gullies.

5.14 As such, for calculation purposes within Causeway, the area of hardstanding (using 50% of the tennis court area) that will generate surface water runoff to be stored in the tank and the permeable paving is approximately 1911m^2.

5.15 Surface water will be collected from the house via rainwater pipes conveying it to the public sewer connection via permeable paving and an attenuation tank (to be used during severe storm events) at 1.1 l/s as per the calculations within the appendix II.

5.16 A hydrobrake is proposed to limit flow from the development to 1.1l/s whilst complying with sewers for adoption 8 which states flow controls must have a minimum diameter aperture of 50mm.

Runoff rates

5.17 Greenfield runoff rates have been calculated using the HR Wallingford Tool and by applying the Institute of Hydrology Report 124 methodology (Marshall and Bayliss, 1994), as recommended in the CIRIA 753 'The SUDS Manual' for calculating the greenfield runoff rates. Calculations are included in appendix 3.

SURFACE WATER DISCHARGE RATES SUMMARY					
	Area (ha)	Discharge Rates (l/s)			
		1 year	2 year/Q_{BAR}	30 year	100 year*
Greenfield Rates	1	3.61	4.25	9.78	13.56
Site Greenfield Rates	0.262	0.95	1.11	2.56	3.55
Proposed Site (+40% CC)	0.262	**0.8**	**-**	**1.0**	**1.1**

*Table 4: Runoff rates; *- 40% climate change allowance added to 100 year event*

Water Quality

5.18 Adequate water treatment must be delivered to the water runoff to remove pollutants through SuDS devices, which are able to provide pollution mitigation. Pollution Hazards and the SuDS Mitigation have been indexed in the specialised literature CIRIA 753 'The SUDS Manual'.

5.19 The Pollution Hazard Indices are summarised in Table 5 below (reference: Table 26.3.CIRIA SuDS Manual 2015).

POLLUTION HAZARD INDICES FOR DIFFERENT LAND USE CLASSIFICATIONS				
LAND USE	**Pollution Hazard Level**	**Total suspended Solids (TSS)**	**Metals**	**Hydro-carbons**
Residential Roofs	Very Low	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads i.e. < 300 traffic movements/day	Low	0.5	0.4	0.4

Table 5: Summary of Pollution hazard Indices for different Land Use

5.20 The runoff from the driveway and the patio is to be treated through permeable pavement. The Mitigation Indices of the proposed SuDS techniques are summarized in Table 6 below. It can be seen the water treatment provided by the permeable pavement is enough to remove the pollutants. This would

additionally provide the filtration required in order to minimise the risk of blockage for the flow control device.

5.21 Runoff from roof areas is considered to generally be uncontaminated. However, to prevent any potential sediment from impacting on the storage structure and the flow control device, sediment traps with filters (e.g. Marley UG60 with Marley UG61) are proposed for the connections from the rainwater pipes prior to entering the permeable paving.

INDICATIVE SuDS MITIGATION INDICES FOR DISCHARGES TO SURFACE WATER			
SuDS Component	**Total suspended Solids (TSS)**	**Metals**	**Hydrocarbons**
Permeable Pavement	0.7	0.6	0.7
Standard to be achieved	0.5	0.4	0.4
System is compliant?	Yes	Yes	Yes

Table 6: Indicative SuDS Mitigation Indices

Adoption and Maintenance

All onsite SuDS and drainage systems will be privately maintained. A long-term maintenance regime should be agreed with the site owners before adoption. In addition to a long-term maintenance regime, it is recommended that all drainage elements implemented on site should be inspected following the first rainfall event post-construction and monthly for the first quarter following construction, see Appendix IV.

TYPICAL KEY SUDS COMPONENTS OPERATION AND MAINTENANCE ACITIVIES													
Operation and Maintenance Activity	**SuDS Component**												
	Pond	**Wetlands**	**Detention Basin**	**Infiltration Basin**	**Soakaway**	**Infiltration Trench**	**Filter Drain**	**Modular Storage**	**Pervious pavement**	**Swale/Bioretention**	**Filter Strip**	**Green Roofs**	**Proprietary Treatment**
Regular Maintenance													
Inspection	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Litter/debris removal	✓	✓	✓	✓	-	✓	✓	-	✓	✓	✓	x	-
Grass cutting	✓	✓	✓	✓	-	✓	✓	-	-	✓	✓	x	x
Weed/invasive plant control	-	-	-	-	x	-	-	x	-	x	-	✓	x
Shrub management	-	-	-	-	x	x	x	x	-	-	-	x	x
Shoreline vegetation management	✓	✓	-	x	x	x	x	x	x	x	x	x	x
Aquatic vegetation management	✓	✓	-	x	x	x	x	x	x	x	x	x	x
Occasional Maintenance													
Sediment management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Vegetation replacement	-	-	-	-	x	x	x	x	x	-	-	✓	x
Vacuum sweeping and brushing	x	x	x	x	x	x	x	x	✓	x	x	x	x
Remedial Maintenance													
Structure rehabilitation/repair	-	-	-	-	-	-	-	-	-	-	-	-	x
Infiltration surface reconditioning	x	x	x	-	-	-	-	x	-	-	-	x	x
Key:													
Will be Required	✓	May be Required					-	Not Normally Required					x

6. Conclusion

6.1 Ambiental Environmental Assessment have completed a Flood Risk Assessment (FRA) and Surface Water Drainage Strategy (SWDS) for the proposed development at 28 Avenue Road, Primrose Hill, London, NW8 6BU.

6.2 The existing site comprises of open green space (grass and trees), with a dilapidated tennis court, car parking area and gate house at the entrance to the property. It is understood that the proposed development is for the construction of a 2-storey residential house, with a total of 10 bedrooms across the first and second floors and an outdoor pool at ground floor level. The proposal is also for the construction of a single-storey tennis pavilion as well as soft landscaping for the driveway and parking area. The existing tennis court (although resurfaced) and gate house at the current site will remain post-development.

6.3 With reference to the EA Flood Map for Planning, the proposed development is in Flood Zone 1, so is considered as being at low risk of fluvial flooding. However, the site is shown to be located within a Critical Drainage Area (CDA) Group 3_005.

6.4 The existing site is considered as 'Water Compatible' under the PPG, and the proposed development is considered to be 'More Vulnerable' (residential).

6.5 The site is sequentially located in Flood Zone 1, so does not require the application of the Exception Test. Given that the site is located within a Critical Drainage Area, an FRA is required to be submitted alongside the planning application.

6.6 The following table provides a summary of flood risk to the site:

Source	**Description**	**Level of risk**
Fluvial/Tidal	EA Flood Map for Planning shows that site is located in Flood Zone 1 (low risk). No modelled data available for sites in FZ1.	Low risk
Surface Water	Site is located in Critical Drainage Area (CDA) Group 3_005 according to Camden SWMP 2014. Review of EA surface water mapping shows existing site is at low risk of flooding; however, main access road is at high risk.	Low risk at site High risk at main access road, Avenue Road
Groundwater	BGS Groundwater Susceptibility map shows entire site to remain unaffected by groundwater flooding. Safe practices should be employed when excavating site for construction of basement. Site is within a Zone II – Outer Protection Zone.	Low
Sewer	No records of flooding available in SFRA.	Low risk

Table 8: Summary of flood risk at proposed site

6.7 Analysis within the report demonstrates that the risk of flooding from fluvial/tidal, pluvial, groundwater and sewer sources to the proposed development could be considered low.

6.8 The design life of a residential dwelling is 100 years, and an allowance for climate change should be considered in accordance with published guidance within the NPPF 2018. The proposed surface water drainage system should therefore be designed to accommodate the 1:100 year + 40%CC storm event on site.

6.9 Ambiental has utilised Causeway software to calculate the runoff associated with the new hardstanding areas.

6.10 Infiltration SuDS have been dismissed due to the site lying on London Clay (poor infiltration).

6.11 An attenuation tank measuring 80m^2 with 800mm depth will provide the 60.9m^3 storage needed during the 1:100 year +40% Climate Change storm event (Appendix II).

6.12 The northern section of the driveway will be constructed using Type C permeable paving (430m^2 with 0.4m depth) and will provide the 60.72m^3 of storage necessary during the 1:100 year +40% Climate Change storm event (Appendix II).

6.13 According to LiDAR data, topographic levels within the redline boundary vary between approximately 40.26mAOD and 44.56mAOD. According to the asset plan (appendix I), the existing surface water manhole on site is at the following levels – CL: 41.72mAOD & IL: 40.81mAOD. Location and condition of existing surface water pipe pending a topographic survey and detailed connection survey. The tank/permeable paving could be redesigned to suit at a later detailed design stage.

6.14 The existing tennis court is to be resurfaced as per the proposed plans. It is proposed the tennis court is built with a central ridge (appendix I). The eastern half with drain as existing while the western half will drain to the attenuation tank via gullies.

6.15 As such, for calculation purposes within Causeway, the area of hardstanding (using 50% of the tennis court area and 50% of northern section of driveway) that will generate surface water runoff to be stored in the tank and the permeable paving is approximately 1911m^2.

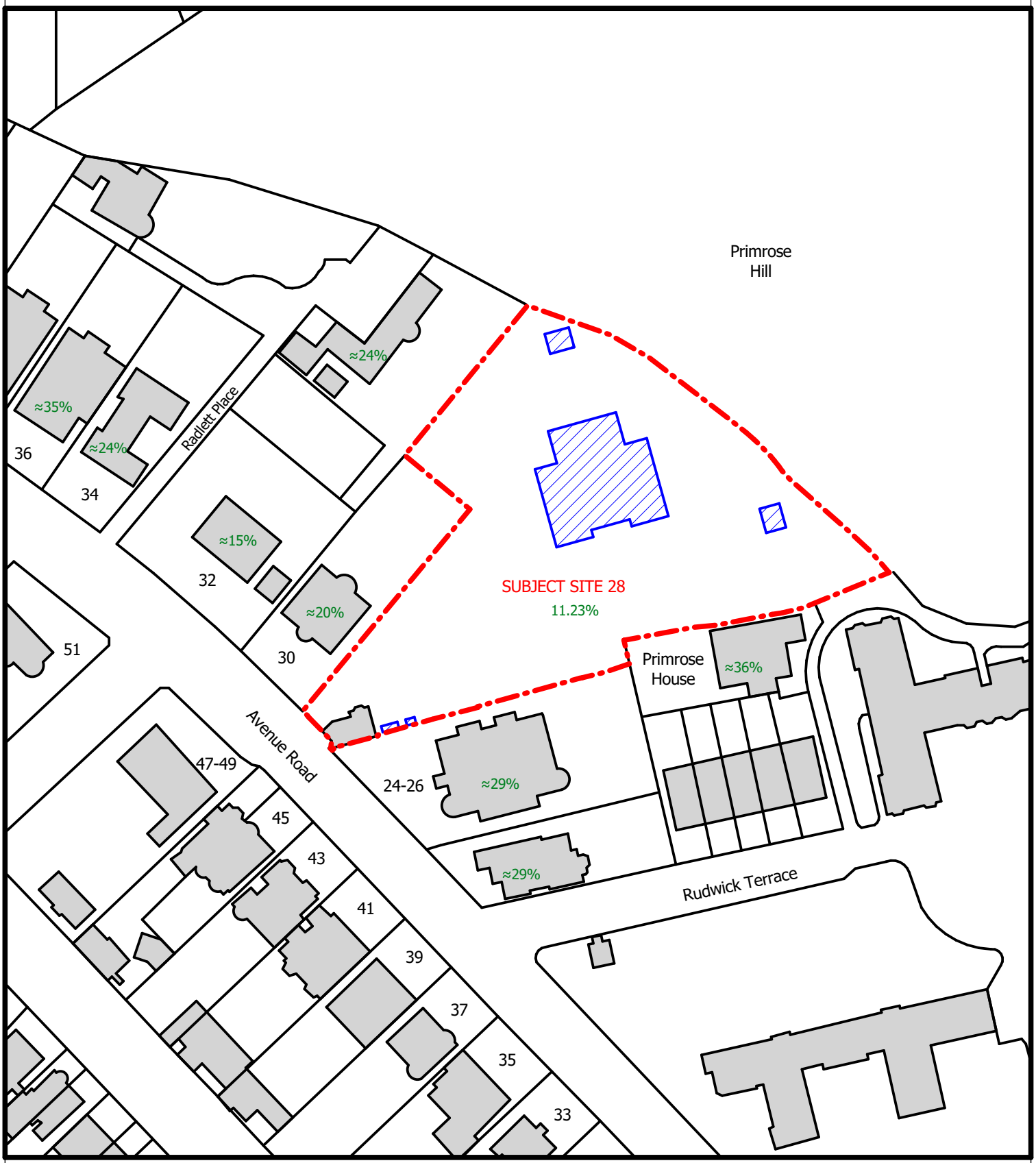
6.16 Surface water will be collected from the house via rainwater pipes conveying it to the public sewer connection via permeable paving and an attenuation tank (to be used during severe storm events) at 1.1 l/s as per the calculations within the appendix II.

6.17 A hydrobrake is proposed to limit flow from the development to 1.1l/s whilst complying with sewers for adoption 8 which states flow controls must have a minimum diameter of 50mm.

6.18 The findings and recommendations of this report are for the use of the client who commissioned the assessment, and no responsibility or liability can be accepted for the use of the report or its findings by any other person or for any other purpose.

Appendix I - Site Plans

Ambiental Environmental Assessment
Sussex Innovation Centre,
Science Park Square,
Brighton, BN1 9SB



1 SCALE 1:1250 @ A4

SITE COVERAGE MAP

DO NOT SCALE FROM THIS DRAWING
Figured dimensions only are to be taken from this drawing. All dimensions are to be checked on site before any work is put in hand.
If in doubt, ask.

Legends & Notes:
Proposed Building Footprint
Existing Building Footprint

shh
Architecture & Interior Design
1 Vencourt Place, Ravenscourt Park, Hammersmith, London W6 9NU
Phone **+44 (0) 20 8600 4171**
Email **info@shh.co.uk**
shh.co.uk
RIBA Chartered Practice
MEMBER

Project:
28 Avenue Road
28 Avenue Road
London, NW8 6BU

Client:
Private Client

Drawing Title:
Site Coverage

(Project number)DWG number_Revision
(860)001.1_PL01

2 storey
+mansard roof

**1
RADLETT
PLACE**

SIGNIFICANT TREE TO
BE RETAINED

SIGNIFICANT TREE TO
BE RETAINED

SIGNIFICANT TREE
TO BE RETAINED

**PRIMROSE
HILL**

DILAPIDATED
TENNIS COURT

SITE BOUNDARY

SIGNIFICANT TREE TO
BE RETAINED

SIGNIFICANT TREES TO
BE RETAINED

2 storey +
mansard roof

**32
AVENUE
ROAD**

**30
AVENUE
ROAD**

DIRT DRIVEWAY

EXISTING CROSSOVER

EXISTING CROSSOVER

EXISTING CROSSOVER

1 2 3 4 5 6 7 8 9 10

2 storey + roof

4 storey
+ roof

**PRIMROSE
HOUSE**

4 storey + roof

**AVENUE
ROAD**

OUTLINE OF EXISTING GATE
HOUSE

**24-26
AVENUE
ROAD**

2 storey + roof

1 SCALE 1:200 @ A1

EXISTING - SITE PLAN

DO NOT SCALE FROM THIS DRAWING
Figured dimensions only are to be taken from this drawing. All dimensions are to be checked on site before any work is put in hand.
If in doubt, ask.

SCALE 1:250 @ A1, 1:500 @ A3
0 5 10 15m

Rev	Date	Descriptor	Athr.
PL03	xx.xx.2020	Planning submission	AK

Legends & Notes:

- Trees that need to be retained
- Trees that could be removed (subject to approval)
- Trees unsuitable for retention
- Trees to be removed

shh
Architecture & Interior Design
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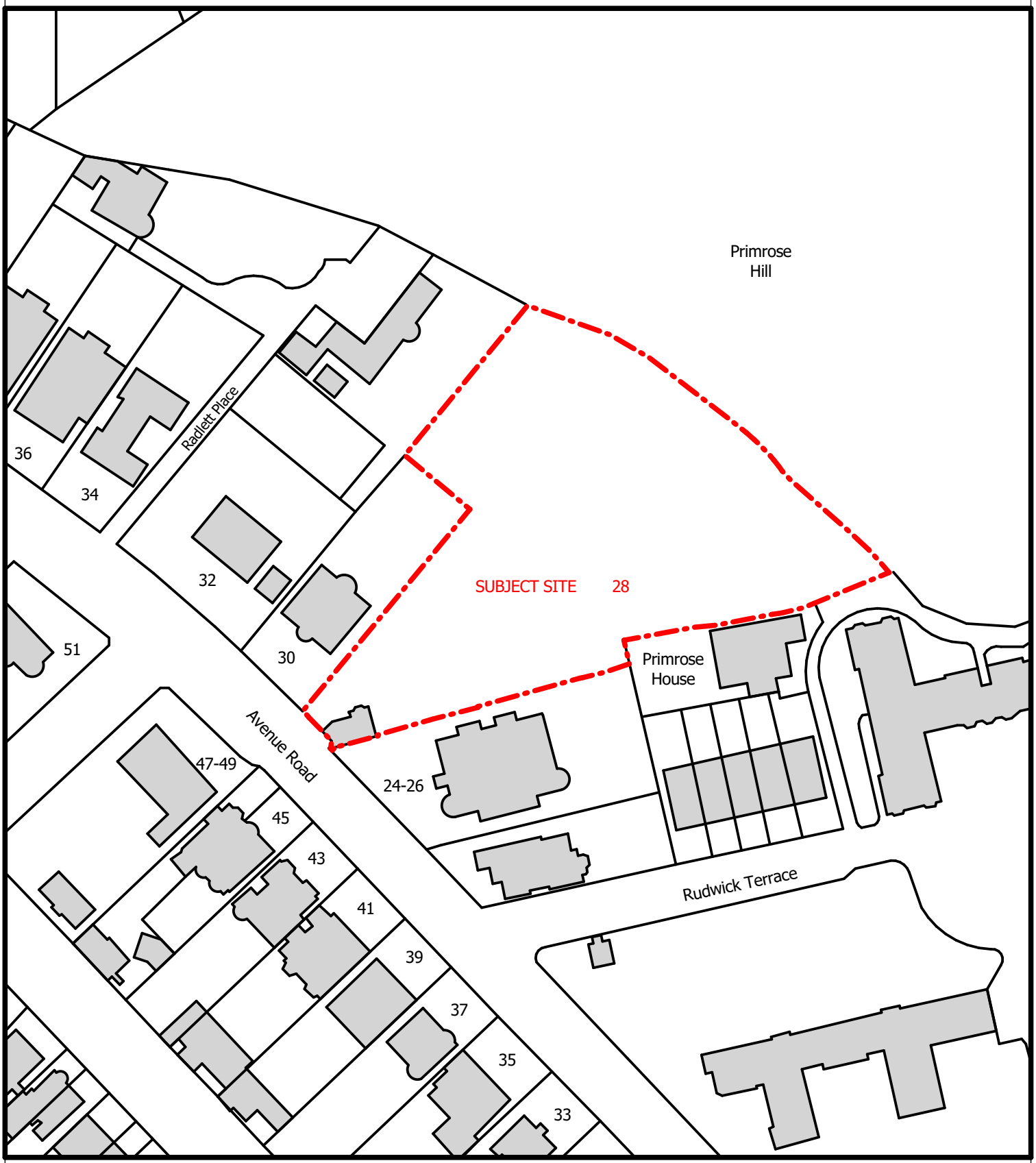
RIBA Chartered Practice
MEMBER

Project:
28 Avenue Road
28 Avenue Road
London, NW8 6BU

Client:
Private Client

Drawing Title:
Site Plan - Existing

{Project number}DWG number_Revision
(860)003_PL03



1

SCALE 1:1250 @ A4

ORDNANCE SURVEY

DO NOT SCALE FROM THIS DRAWING
Figured dimensions only are to be taken from this drawing. All dimensions are to be checked on site before any work is put in hand.
If in doubt, ask.

Legends & Notes:

shh
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RIBA Chartered Practice
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Project:
28 Avenue Road
28 Avenue Road
London, NW8 6BU

Client:
Private Client

Drawing Title:
OS Location Map

(Project number)DWG number_Revision
(860)001_PL02

1

SCALE 1:250 @ A1, 1:500 @ A3

AERIAL

DO NOT SCALE FROM THIS DRAWING

Figured dimensions only are to be taken from this drawing. All dimensions are to be checked on site before any work is put in hand.

If in doubt, ask.

SCALE 1:250 @ A1, 1:500 @ A3

0 5 10 15m

Rev	Date	Descriptor	Athr.
PL02	09.08.2019	Pre-application submission	AK
PL01	19.10.2017	Pre-application submission	JH

Legends & Notes:

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Architecture & Interior Design

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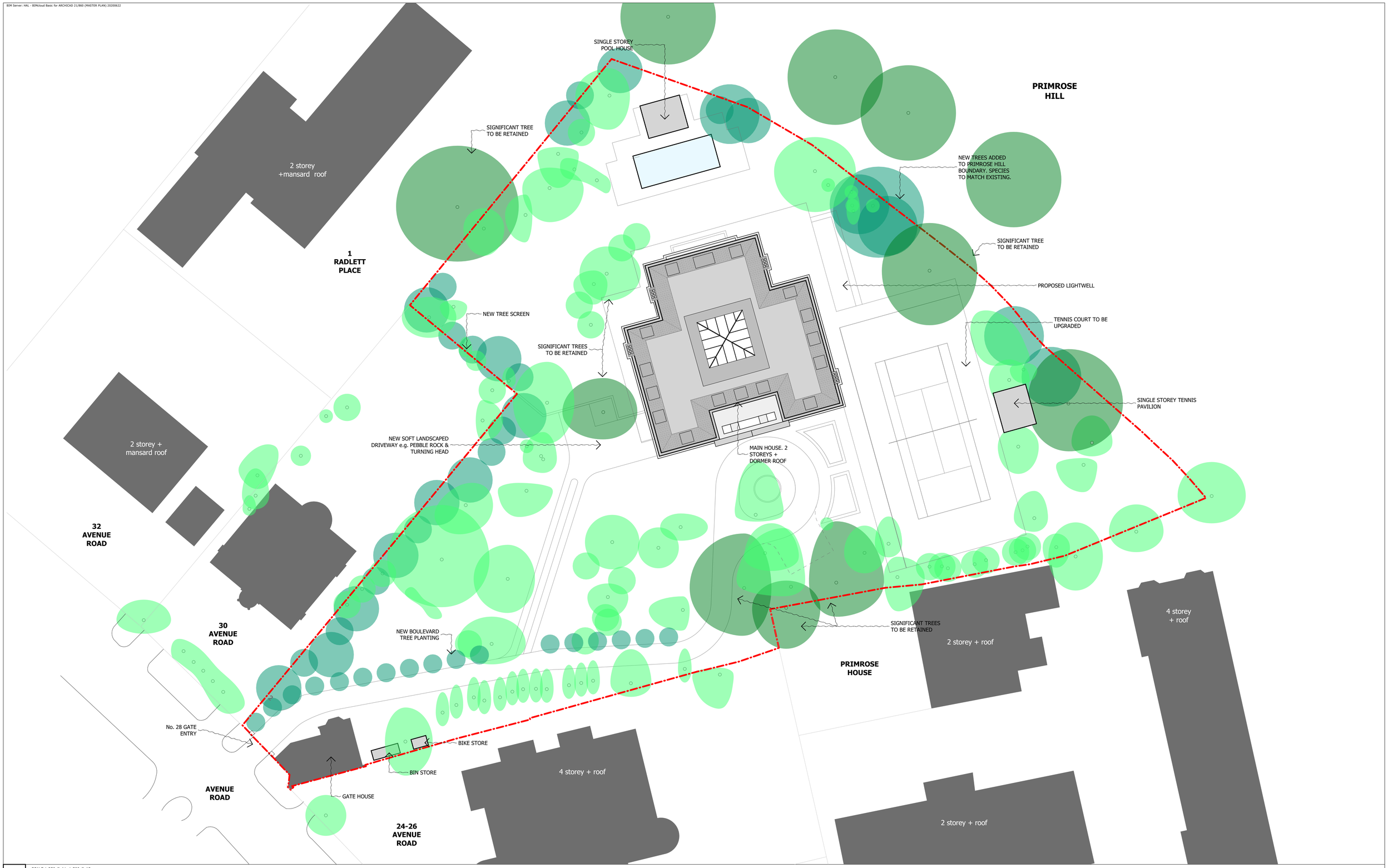
MEMBER

Project:
28 Avenue Road
28 Avenue Road
London, NW8 6BU

Client:
Private Client

Drawing Title:
Aerial

{Project number}DWG number_Revision
(860)002_PL02



1

SCALE 1:250 @ A1, 1:500 @ A3

PROPOSED - SITE PLAN

DO NOT SCALE FROM THIS DRAWING
Figured dimensions only are to be taken from this drawing. All dimensions are to be checked on site before any work is put in hand.
If in doubt, ask.

SCALE 1:250 @ A1, 1:500 @ A3
0 5 10 15m

Rev	Date	Descriptor	
PL03	xx.xx.2020	Planning submission	AK

Legends & Notes:

- Trees that need to be retained
- Trees that could be removed (subject to approval)
- New trees to be planted

Areas:

GIA

Basement + G + 1st + 2nd floors =	26,043 sft
Pool House =	226 sft
Tennis Pavilion =	226 sft
Gate House (existing) =	711 sft
Total built-up area =	**27,206 sft**
Building footprint areas =	8,646 sft
Site Area =	77,019 sft
Site Coverage Ratio =	**11.23%**

GEA

Basement + G + 1st + 2nd floors =	29,887 sft
Pool House =	280 sft
Tennis Pavilion =	280 sft
Bin & Cycle store =	99 sft
Gate House (existing) =	827 sft
Total built-up area =	**31,373 sft**

Previous Scheme

GIA

Basement + G + 1st + 2nd floors =	32,732 sft

GEA

Basement + G + 1st + 2nd floors =	37,188 sft

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shh.co.uk
RIBA Chartered Practice
MEMBER

Project:
28 Avenue Road
28 Avenue Road
London, NW8 6BU

Client:
Private Client

Drawing Title:
Site Plan - Proposed

(Project number)DWG number_Revision
(860)004_PL03

POOL DRAINAGE TO BE CONFIRMED BY SPECIALIST

DRAINAGE WILL NEED TO BE REVIEWED PENDING RELATIVE LEVELS OF POOL AND THAMES WATER SEWER TO ASCERTAIN WHETHER PUMP IS NEEDED OR GRAVITY WILL SUFFICE

POOL SURROUNDING AREA TO DRAIN TO SURFACE WATER DRAIN VIA GULLY

TENNIS COURT TO BE CONSTRUCTED WITH A CENTRAL RIDGE RIGHT HAND SIDE OF TENNIS COURT TO DRAIN AS EXISTING LEFT HAND SIDE TO DRAIN TO GULLY THEREFORE 50% OF TENNIS COURT AREA TO GO TO ATTENUATION TANK

GREEN ROOF

ATTENUATION TANK
L 10m x W 8m x D 0.8m
VOLUME DURING 1:100 YEAR + 40% STORM EVENT: 60.9M^3
HYDRAULIC DEPTH: 0.851M
FINAL LOCATION TBC AT DETAILED DESIGN STAGE
PENDING A TOPOGRAPHIC SURVEY

DEPTH MAY BE INCREASED AND AREA DECREASED PENDING CONNECTION SURVEY AND INCREASED/DECREASED USE OF PERMEABLE PAVING WITHIN DRIVEWAY

SOUTH SECTION OF DRIVEWAY TO DRAIN AS EXISTING

DESIGN BASED ON THE PRINCIPLES SET IN THE FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY (REPORT NO: 5258 FRA/SWDS).

DESIGN BASED ON POOR INFILTRATION (LONDON CLAY) AND SITE WITHIN CDA (CRITICAL DRAINAGE AREA).

ALL NEW HARDSTANDING AREA TO BE DRAINED TO EXISTING PUBLIC SEWER VIA ATTENUATION TANK AND PERMEABLE PAVING.

ACCORDING TO LIDAR DATA, TOPOGRAPHIC LEVELS WITHIN THE REDLINE APPLICATION BOUNDARY VARY BETWEEN APPROX. 40.26MAOD AND 44.56MAOD.
PENDING A TOPOGRAPHIC AND CONNECTION SURVEY, THE TANK/PERMEABLE PAVING COULD BE REDESINGED TO SUIT AT A LATER DETAILED DESIGN STAGE.

TENNIS COURT TO BE CONSTRUCTED WITH A CENTRAL RIDGE RIGHT HAND SIDE OF TENNIS COURT TO DRAIN AS EXISTING LEFT HAND SIDE TO DRAIN TO GULLY THEREFORE 50% OF TENNIS COURT AREA TO GO TO ATTENUATION TANK

RWP LOCATIONS SHOWN INDICATIVELY - TO BE CONFIRMED WITH ARCHITECT.

ALL NEW SURFACE WATER DRAINS TO BE 150mm DIAMETER PLASTIC PIPES WITH GRADIANT NO FLATTER THAN 1:100.

HYDROBRAKE TO LIMIT OUTFLOW TO 1.1L/S COMPLYING WITH A MINIMUM OUTFLOW CONTROL DIAMETER OF 50MM AS PER SEWERS FOR ADOPTION 8.
FINAL LOCATION TBC AT DETAILED DESIGN STAGE PENDING A TOPOGRAPHIC AND CONNECTION SURVEY

CONNECTION TO PUBLIC SEWER TO BE CONFIRMED AT A LATER DETAILED DESIGN STAGE

NORTH SECTION OF DRIVEWAY TO BE CONSTRUCTED USING PERMEABLE PAVING
AREA: 430M^2
DEPTH: 0.4M
VOLUME DURING 1:100 YEAR + 40% STORM EVENT: 60.72M^3

FLOW CONTROL HYDROBRAKE TO LIMIT OUTFLOW TO 1.1L/S AS DETAILED IN AMBIENTALS REPORT

MAX FLOW WILL BE 1.1L/S DURING THE 100 YEAR RAINFALL EVENT PLUS CLIMATE CHANGE

FINAL LOCATION TBC AT DETAILED DESIGN STAGE PENDING A TOPOGRAPHIC AND CONNECTION SURVEY

EXISTING SURFACE WATER PIPE AS SHOWN ON ASSET PLAN TO BE UTILISED
LOCATION AND CONDITION TO BE CONFIRMED VIA SURVEY BEFORE CONSTRUCTION

EXISTING MANHOLE
TYPE OF INSPECTION CHAMBER/MANHOLE EXISTING IS UNKNOWN
MANHOLE REFERENCE: 2701
COVER LEVEL: 41.72mAOD
INVERT LEVEL: 40.81mAOD

1. GENERAL
a. THIS DRAWING IS NOT TO BE SCALED, WORK TO FIGURED DIMENSIONS ONLY, CONFIRMED ON SITE.
b. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTURAL DRAWINGS, DETAILED SPECIFICATIONS WHERE APPLICABLE AND ALL ASSOCIATED DRAWINGS IN THIS SERIES.
c. ANY DISCREPANCY ON THIS DRAWING IS TO BE REPORTED IMMEDIATELY TO THE PARTNERSHIP FOR CLARIFICATION.
d. THE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY WORKS AND FOR THE STABILITY OF THE WORKS IN PROGRESS.
e. CDM REGULATIONS 2015: ALL CURRENT DRAWINGS AND SPECIFICATIONS MUST BE READ IN CONJUNCTION WITH THE DESIGNER'S HAZARD RISK AND ENVIRONMENT ASSESSMENT RECORD. DESIGN HAS BEEN PRODUCED BASED ON INFORMATION PROVIDED BY THE CLIENT/PRINCIPLE DESIGNER AVAILABLE AT TIME OF ISSUE. CONTRACTOR TO REVIEW DRAWING AND SPECIFICATION IN CONTEXT WITH THE WIDER SITE AND SPECIFIC SITE INVESTIGATION, CONTAMINATION ASSESSMENT, ASBESTOS SURVEY, ENVIRONMENTAL SURVEY, UXO SURVEY AND ANY OTHER RELEVANT INFORMATION AND MANAGE RISKS RELATING TO THE WORKS OUTLINED IN THE DRAWINGS AND SPECIFICATION. PRINCIPLE CONTRACTOR TO MAKE DESIGNER AND CLIENT AWARE OF SITE SPECIFIC RISKS THAT MAY AFFECT THE DRAWING AND SPECIFICATION.
f. CDM REGULATIONS 2015. FOR GENERIC MAINTENANCE AND MANAGEMENT RISKS REFER TO CHAPTER 36 OF CIRIA 752 SUDS MANUAL. FOR PROPRIETARY SYSTEMS SEE MANUFACTURER'S MANAGEMENT AND MAINTENANCE DETAILS AND RISK ASSESSMENT WITH REGARDS TO MAINTENANCE OF PROPRIETARY SYSTEMS.

2. CONSTRUCTION NOTE
a. THE MAIN CONTRACTOR IS RESPONSIBLE FOR THE DESIGN OF ALL TEMPORARY WORKS, AND IS ALSO RESPONSIBLE FOR THE SAFE MAINTENANCE AND STABILITY OF EXISTING BUILDINGS AT ALL TIMES.
b. THE MAIN CONTRACTOR IS RESPONSIBLE FOR ALL OCCURRENCES OF GROUND WATER DURING THE CONSTRUCTION PERIOD.
c. ANY INFORMATION GIVEN REGARDING EXISTING UNDERGROUND SERVICES IS GIVEN IN GOOD FAITH AFTER CONSULTATION WITH THE RELEVANT AUTHORITY, HOWEVER ACCURACY IS NOT CERTAIN. THE MAIN CONTRACTOR IS RESPONSIBLE FOR CHECKING ALL INFORMATION ON SITE PRIOR TO WORK COMMENCING AND TAKING DUE CARE AND ATTENTION WHILST UNDERTAKING THE WORKS.
d. THE CONTRACTOR MUST COMPLY WITH ALL CURRENT LEGISLATION RELATING TO HEALTH & SAFETY.
e. ALL PRODUCTS SPECIFIED SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS AND INSTRUCTIONS. IF THERE ARE DISCREPANCIES BETWEEN THAT INFORMATION AND THE DETAILS ON ANY AMBIENTAL DRAWINGS, THE MANUFACTURERS INSTRUCTIONS MUST BE USED

3. BELOW GROUND DRAINAGE
a. PIPEWORK TO BE UPVC-U PIPES TO BS 4660 : 2000 AND INSPECTION CHAMBERS TO BS 7158 : 2001.
b. ALL ADOPTABLE DRAINAGE TO BE CONSTRUCTED IN ACCORDANCE WITH 'SEWERS FOR ADOPTION' 7TH EDITION AND THE RELEVANT COUNCIL DESIGN GUIDE.
c. ALL PRIVATE SURFACE WATER SEWERS TO BE LAID AT 1 IN 100 UNLESS OTHERWISE STATED ON THE DRAWING.
d. ALL PRIVATE FOUL WATER SEWERS TO BE LAID AT 1 IN 40 AT THE HEAD OF PIPE RUNS AND 1 IN 80 ELSEWHERE UNLESS OTHERWISE STATED.
e. ALL PRIVATE FOUL SEWER PIPES TO BE 150MM DIAMETER UNLESS OTHERWISE STATED ON THE DRAWING. ALL PRIVATE SURFACE WATER SEWER PIPES TO BE 100MM DIAMETER FROM DOWNPIPES AND 150MM DIAMETER ELSEWHERE UNLESS OTHERWISE STATED ON THE DRAWING.
f. ALLOW FOR RODDING ACCESS ABOVE GROUND WHERE RAINWATER DOWNPIPES DO NOT HAVE A DIRECT CONNECTION TO AN INSPECTION CHAMBER. EXISTING SEWER PIPE TO BE RE-USED TO BE SURVEYED AND LEVELLED PRIOR TO COMMENCEMENT OF THE DRAINAGE WORKS AND REFURBISHED IF NECESSARY.
g. CONNECTIONS TO AN ADOPTED SEWER ONLY TO BE MADE FOLLOWING APPROVAL FROM THE RELEVANT ADOPTING AUTHORITY.
h. ALL DRAINS, SEWER PIPES AND MANHOLES TO BE CLEANED AND TESTED FOR WATER TIGHTNESS ON COMPLETION OF CONSTRUCTION.

4. MANHOLE COVERS AND FRAMES
a. MANHOLE COVERS TO BE CLASS D400 IN HIGHWAYS, CLASS B125 IN FOOTWAYS AND VERGES, CLASS A15 IN NON-TRAFFICKED AREAS.
b. MANHOLE COVER AND FRAME TO BE BEDDED AND SURROUNDED IN 1:3 MORTAR.

LEGEND

- PRIVATE SURFACE WATER DRAIN
- PERFORATED SURFACE WATER DRAIN
- PUBLIC SURFACE WATER DRAIN
- EXISTING SURFACE WATER DRAIN
- HIGHWAY DRAIN
- SLOT/CHANNEL DRAIN
- HYDROBRAKE MANHOLE
- TYPE 3 INSPECTION CHAMBER
- TYPE 4 INSPECTION CHAMBER
- RE RODDING EYE
- RWP RAIN WATER PIPE
- ROAD GULLY
- BOTTLE GULLY
- PERMEABLE PAVING
- ATTENUATION SYSTEM
- OVERLAND FLOW
- FLOW DIRECTION

REV	DATE	BY	CKD	APP	DESCRIPTION
##	XX.XX.XX	--	--	--	--

PRELIMINARY DRAWING
FOR INFORMATION ONLY. NOT FOR CONSTRUCTION.

Client
ME7 Ltd

AMBIENTAL
ENVIRONMENTAL ASSESSMENT
a company of Royal HaskoningDHV

Project
28-30 AVENUE ROAD PRIMROSE HILL
LONDON NW8 6BU

Drawing
SITE LAYOUT
SURFACE WATER DRAINAGE STRATEGY

Drawn by: SL Date: 27/01/2021

Drawing No. 5258_DR01 Revision 2

Drawing Scale: 1:250 @ A1
0 2.5m 5m 7.5m 10m 12.5m

Drawing No: C:\Users\Sam.\1Box\WAT-DW-AEA General\PROJECTS\5258_ME7_LondonSWDS\CAD\5258_Drawing_4_NEWPLANS.dwg

Appendix II - Calculations

Ambiental Environmental Assessment
Sussex Innovation Centre,
Science Park Square,
Brighton, BN1 9SB

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Sam Lee
Site name:	28-30 Avenue Road
Site location:	NW8 6BU

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.53801° N
Longitude:	0.16734° W
Reference:	2411344645
Date:	Apr 07 2020 13:59

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 0.246

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	628	628
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

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

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

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

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	1.05	1.05
1 in 1 year (l/s):	0.89	0.89
1 in 30 years (l/s):	2.41	2.41
1 in 100 year (l/s):	3.34	3.34
1 in 200 years (l/s):	3.91	3.91

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	40	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.500
Ratio-R	0.400	Preferred Cover Depth (m)	0.600
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Circular Link Type

Shape Circular | Barrels 1 | Auto Increment (mm) 75 | Follow Ground x

Available Diameters (mm)

100 | 150

Nodes

	Name	Area (ha)	T of E (mins)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Depth (m)
✓	Hardstanding Areas	0.148	4.00	1.000	Manhole	Adoptable	1200	0.825
✓	Underground Tank			1.000	Junction			0.887
✓	2			1.000	Manhole	Adoptable	1200	0.949
✓	Depth/Area 1	0.043	4.00	1.000	Junction			0.750

Links

	Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)
✓	1.001	Underground Tank	2	5.000	0.600	Colebrook-White	0.113	0.051	0.062	80.0	225	Circular	4.13	50.0
✓	1.000	Depth/Area 1	Underground Tank	5.000	0.600	Colebrook-White	0.250	0.188	0.062	80.0	150	Circular	4.07	50.0
✓	2.000	Hardstanding Areas	Underground Tank	5.000	0.600	Colebrook-White	0.175	0.113	0.062	80.0	225	Circular	4.06	50.0

	Name	US Node	DS Node	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Minimum Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
✓	1.001	Underground Tank	2	1.463	58.2	36.2	0.662	0.724	0.662	0.724	0.191	0.0	129	1.540
✓	1.000	Depth/Area 1	Underground Tank	1.125	19.9	8.2	0.600	0.662	0.600	0.662	0.043	0.0	67	1.071
✓	2.000	Hardstanding Areas	Underground Tank	1.463	58.2	28.1	0.600	0.662	0.600	0.662	0.148	0.0	110	1.451

Simulation Settings

Rainfall Methodology	FSR	Summer CV	0.750	Drain Down Time (mins)	240
FSR Region	England and Wales	Winter CV	0.840	Additional Storage (m³/ha)	20.0
M5-60 (mm)	20.000	Analysis Speed	Normal	Check Discharge Rate(s)	x
Ratio-R	0.400	Skip Steady State	x	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	40	0	0	30	40	0	0
2	40	0	0	100	40	0	0

Node Underground Tank Online Hydro-Brake® Control

Flap Valve	x	Design Flow (l/s)	0.8
Downstream Link	1.001	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	0.113	Product Number	CTL-SHE-0050-8000-0400-8000
Design Depth (m)	0.400	Min Outlet Diameter (m)	0.075

Node Underground Tank Online Hydro-Brake® Control

Min Node Diameter (mm) 1200

Node Underground Tank Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	0.113
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	80.0	0.0	0.800	80.0	0.0	0.801	0.0	0.0

Node Depth/Area 1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	10.000	Depth (m)	0.400
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	0.250	Length (m)	43.000	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)		Slope (1:X)	100.0		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year +40% CC 15 minute summer	153.330	43.387	1 year +40% CC 360 minute winter	12.894	5.105
1 year +40% CC 15 minute winter	107.600	43.387	1 year +40% CC 480 minute summer	15.659	4.138
1 year +40% CC 30 minute summer	100.014	28.301	1 year +40% CC 480 minute winter	10.403	4.138
1 year +40% CC 30 minute winter	70.186	28.301	1 year +40% CC 600 minute summer	12.855	3.516
1 year +40% CC 60 minute summer	67.809	17.920	1 year +40% CC 600 minute winter	8.783	3.516
1 year +40% CC 60 minute winter	45.051	17.920	1 year +40% CC 720 minute summer	11.484	3.078
1 year +40% CC 120 minute summer	42.074	11.119	1 year +40% CC 720 minute winter	7.718	3.078
1 year +40% CC 120 minute winter	27.953	11.119	1 year +40% CC 960 minute summer	9.475	2.495
1 year +40% CC 180 minute summer	32.526	8.370	1 year +40% CC 960 minute winter	6.277	2.495
1 year +40% CC 180 minute winter	21.143	8.370	1 year +40% CC 1440 minute summer	6.928	1.857
1 year +40% CC 240 minute summer	25.865	6.835	1 year +40% CC 1440 minute winter	4.656	1.857
1 year +40% CC 240 minute winter	17.184	6.835	2 year +40% CC 15 minute summer	198.193	56.082
1 year +40% CC 360 minute summer	19.836	5.105	2 year +40% CC 15 minute winter	139.083	56.082

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year +40% CC 30 minute summer	128.454	36.348
2 year +40% CC 30 minute winter	90.143	36.348
2 year +40% CC 60 minute summer	85.821	22.680
2 year +40% CC 60 minute winter	57.018	22.680
2 year +40% CC 120 minute summer	52.428	13.855
2 year +40% CC 120 minute winter	34.832	13.855
2 year +40% CC 180 minute summer	40.141	10.330
2 year +40% CC 180 minute winter	26.092	10.330
2 year +40% CC 240 minute summer	31.691	8.375
2 year +40% CC 240 minute winter	21.055	8.375
2 year +40% CC 360 minute summer	24.129	6.209
2 year +40% CC 360 minute winter	15.684	6.209
2 year +40% CC 480 minute summer	18.971	5.013
2 year +40% CC 480 minute winter	12.604	5.013
2 year +40% CC 600 minute summer	15.523	4.246
2 year +40% CC 600 minute winter	10.606	4.246
2 year +40% CC 720 minute summer	13.829	3.706
2 year +40% CC 720 minute winter	9.294	3.706
2 year +40% CC 960 minute summer	11.358	2.991
2 year +40% CC 960 minute winter	7.524	2.991
2 year +40% CC 1440 minute summer	8.247	2.210
2 year +40% CC 1440 minute winter	5.543	2.210
30 year +40% CC 15 minute summer	376.189	106.449
30 year +40% CC 15 minute winter	263.992	106.449
30 year +40% CC 30 minute summer	244.900	69.298
30 year +40% CC 30 minute winter	171.860	69.298
30 year +40% CC 60 minute summer	163.225	43.136
30 year +40% CC 60 minute winter	108.443	43.136
30 year +40% CC 120 minute summer	98.613	26.061
30 year +40% CC 120 minute winter	65.516	26.061
30 year +40% CC 180 minute summer	74.617	19.202
30 year +40% CC 180 minute winter	48.503	19.202
30 year +40% CC 240 minute summer	58.245	15.393
30 year +40% CC 240 minute winter	38.697	15.393
30 year +40% CC 360 minute summer	43.710	11.248
30 year +40% CC 360 minute winter	28.413	11.248
30 year +40% CC 480 minute summer	34.053	8.999
30 year +40% CC 480 minute winter	22.624	8.999
30 year +40% CC 600 minute summer	27.658	7.565
30 year +40% CC 600 minute winter	18.898	7.565
30 year +40% CC 720 minute summer	24.485	6.562
30 year +40% CC 720 minute winter	16.456	6.562
30 year +40% CC 960 minute summer	19.901	5.240
30 year +40% CC 960 minute winter	13.183	5.240
30 year +40% CC 1440 minute summer	14.225	3.812
30 year +40% CC 1440 minute winter	9.560	3.812
100 year +40% CC 15 minute summer	488.233	138.153
100 year +40% CC 15 minute winter	342.620	138.153
100 year +40% CC 30 minute summer	320.551	90.705
100 year +40% CC 30 minute winter	224.948	90.705
100 year +40% CC 60 minute summer	214.603	56.713
100 year +40% CC 60 minute winter	142.577	56.713
100 year +40% CC 120 minute summer	129.587	34.246
100 year +40% CC 120 minute winter	86.094	34.246
100 year +40% CC 180 minute summer	97.729	25.149
100 year +40% CC 180 minute winter	63.526	25.149
100 year +40% CC 240 minute summer	75.977	20.078
100 year +40% CC 240 minute winter	50.477	20.078
100 year +40% CC 360 minute summer	56.677	14.585
100 year +40% CC 360 minute winter	36.841	14.585
100 year +40% CC 480 minute summer	43.979	11.622
100 year +40% CC 480 minute winter	29.219	11.622
100 year +40% CC 600 minute summer	35.604	9.738
100 year +40% CC 600 minute winter	24.327	9.738

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +40% CC 720 minute summer	31.433	8.424	100 year +40% CC 960 minute winter	16.847	6.697
100 year +40% CC 720 minute winter	21.125	8.424	100 year +40% CC 1440 minute summer	18.055	4.839
100 year +40% CC 960 minute summer	25.432	6.697	100 year +40% CC 1440 minute winter	12.134	4.839

Results for 1 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	Hardstanding Areas	344	0.474	0.299	7.9	1.4090	0.0000	SURCHARGED
360 minute winter	Underground Tank	344	0.474	0.361	8.6	27.4031	0.0000	SURCHARGED
15 minute summer	2	1	0.051	0.000	0.8	0.0000	0.0000	OK
360 minute winter	Depth/Area 1	344	0.474	0.224	2.2	7.2478	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	Hardstanding Areas	2.000	Underground Tank	7.5	0.858	0.129	0.1989	
360 minute winter	Underground Tank	Hydro-Brake®	2	0.8				23.5
360 minute winter	Depth/Area 1	1.000	Underground Tank	2.9	0.525	0.147	0.0880	

Results for 2 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	Hardstanding Areas	352	0.539	0.364	8.0	1.7157	0.0000	SURCHARGED
360 minute winter	Underground Tank	352	0.539	0.426	11.9	32.3432	0.0000	SURCHARGED
15 minute summer	2	1	0.051	0.000	0.8	0.0000	0.0000	OK
360 minute winter	Depth/Area 1	352	0.539	0.289	2.2	11.9704	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	Hardstanding Areas	2.000	Underground Tank	9.5	0.885	0.163	0.1989	
360 minute winter	Underground Tank	Hydro-Brake®	2	0.8				25.4
360 minute winter	Depth/Area 1	1.000	Underground Tank	2.4	0.525	0.119	0.0880	

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	Hardstanding Areas	585	0.784	0.609	6.5	2.8761	0.0000	FLOOD RISK
600 minute winter	Underground Tank	585	0.784	0.671	10.9	51.0306	0.0000	FLOOD RISK
15 minute summer	2	1	0.051	0.000	0.8	0.0000	0.0000	OK
600 minute winter	Depth/Area 1	585	0.784	0.534	4.0	38.9707	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
600 minute winter	Hardstanding Areas	2.000	Underground Tank	7.8	0.788	0.134	0.1989	
600 minute winter	Underground Tank	Hydro-Brake®	2	1.0				42.3
600 minute winter	Depth/Area 1	1.000	Underground Tank	3.1	0.447	0.158	0.0880	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	Hardstanding Areas	690	0.964	0.789	7.3	3.7234	0.0000	FLOOD RISK
720 minute winter	Underground Tank	690	0.964	0.851	7.1	60.8380	0.0000	FLOOD RISK
15 minute summer	2	1	0.051	0.000	0.8	0.0000	0.0000	OK
720 minute winter	Depth/Area 1	690	0.964	0.714	5.0	60.7202	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
720 minute winter	Hardstanding Areas	2.000	Underground Tank	7.1	0.806	0.122	0.1989	
720 minute winter	Underground Tank	Hydro-Brake®	2	1.1				52.4
720 minute winter	Depth/Area 1	1.000	Underground Tank	-2.9	0.447	-0.148	0.0880	

Appendix III - Asset Plan

Ambiental Environmental Assessment
Sussex Innovation Centre,
Science Park Square,
Brighton, BN1 9SB

Asset location search

Property Searches

Ambiental
Sussex Innovation Centre
Science Park Square
BRIGHTON
BN1 9SB

Search address supplied 28-30
Avenue Road
London
NW8 6BU

Your reference 5258

Our reference ALS/ALS Standard/2020_4157255

Search date 19 February 2020

Knowledge of features below the surface is essential for every development

The benefits of this knowledge not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility of any development.

Did you know that Thames Water Property Searches can also provide a variety of utility searches including a more comprehensive view of utility providers' assets (across up to 35-45 different providers), as well as more focused searches relating to specific major utility companies such as National Grid (gas and electric).

Contact us to find out more.

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

Asset location search

Property Searches

Search address supplied: 28-30, Avenue Road, London, NW8 6BU

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

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.

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

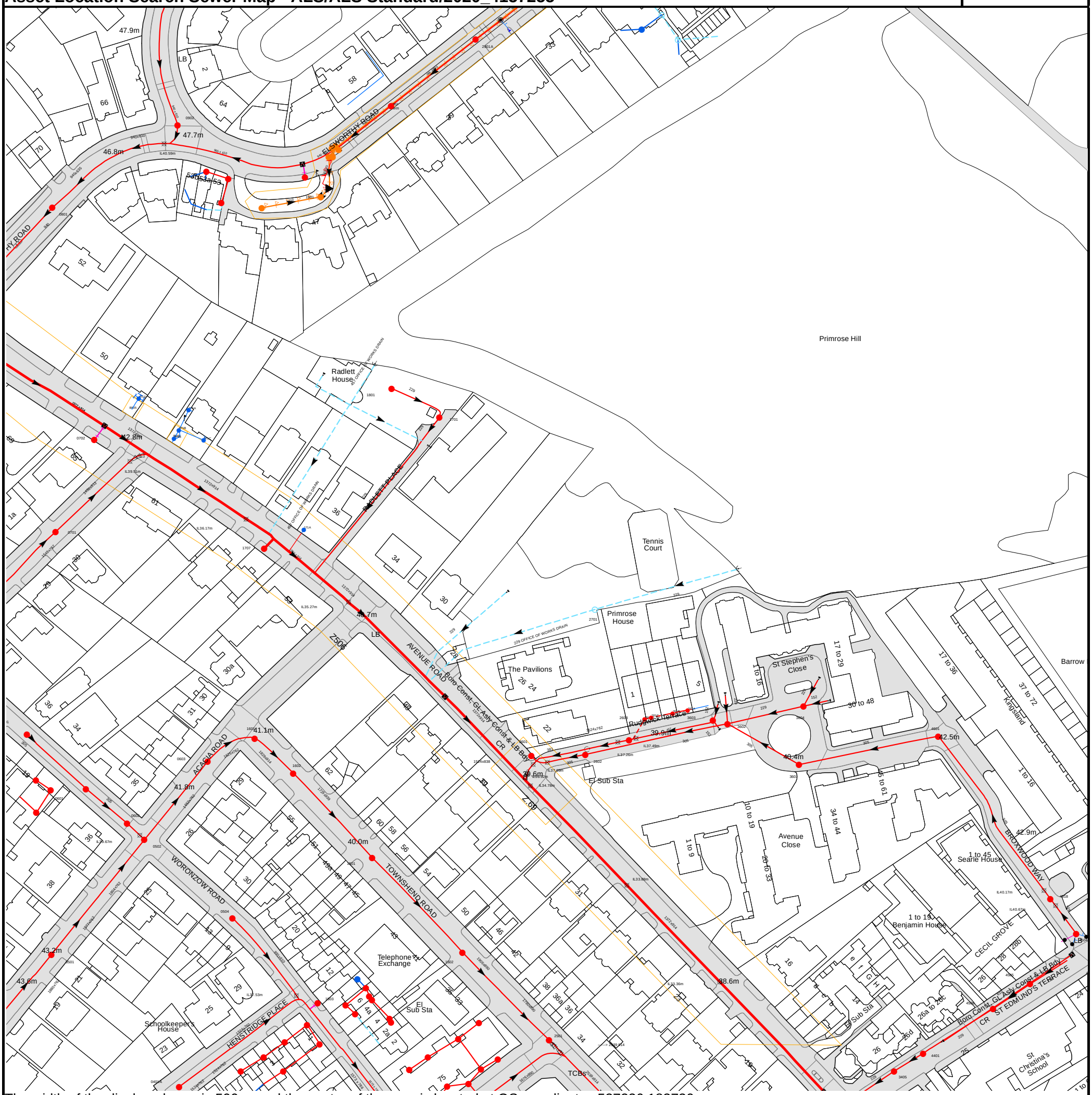
Clean Water queries

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/2020_4157255



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 527236,183730

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
4506	39.76	38.52
4505	40.57	39.27
4518	43.1	n/a
4504	42.26	40.95
3405	38.37	37.29
4401	38.74	37.71
3601	40.52	38.01
4601	42.87	38.62
3604	41.85	38.07
29CA	n/a	n/a
29BG	n/a	n/a
29BF	n/a	n/a
2901A	46.01	42.41
n/a	n/a	n/a
0801	46.29	40.07
08BB	n/a	n/a
n/a	n/a	n/a
08AJ	n/a	n/a
1901	n/a	n/a
09BA	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
0902	n/a	n/a
1902	45.86	41.75
15CD	n/a	n/a
1502	39.4	36.82
0504	41.37	38.57
1501	40.1	37.49
0502	42.43	39.24
1602	40.79	38.02
0603	41.67	38.63
2601	n/a	n/a
2602	39.7	37.37
2603	39.83	n/a
1601	41.09	38.28
3602	40.48	37.66
3603	40.4	39.27
261D	n/a	n/a
261C	n/a	n/a
261B	n/a	n/a
261A	n/a	n/a
2701	41.72	40.81
1707	n/a	n/a
171A	n/a	n/a
071C	42.76	40.86
071E	42.69	39.54
071B	42.78	n/a
1701	42.07	40.36
071A	42.73	40.86
071D	43.64	41.23
1801	42.06	41.12
9601	43.79	40.77
06AH	n/a	n/a
96AI	n/a	n/a
06AG	n/a	n/a
0501	43.36	40.16
0701	43.42	40.37
0601	43.08	40.17
0702	n/a	n/a
0602	42.62	39.92
0401A	41.52	38.5
14BI	n/a	n/a
14BG	n/a	n/a
04AE	n/a	n/a
14AH	n/a	n/a
14BE	n/a	n/a
24AH	n/a	n/a
24AI	n/a	n/a
14BD	n/a	n/a
14BF	n/a	n/a
15AE	n/a	n/a
15AJ	n/a	n/a
2501	38.9	36.24
15BB	n/a	n/a
15AH	n/a	n/a
25AC	n/a	n/a
15BI	n/a	n/a
15BJ	n/a	n/a
15CF	n/a	n/a
15CE	n/a	n/a
1503	40.51	n/a
15CA	n/a	n/a
15CB	n/a	n/a
15CC	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

Gulley

Culverted Watercourse

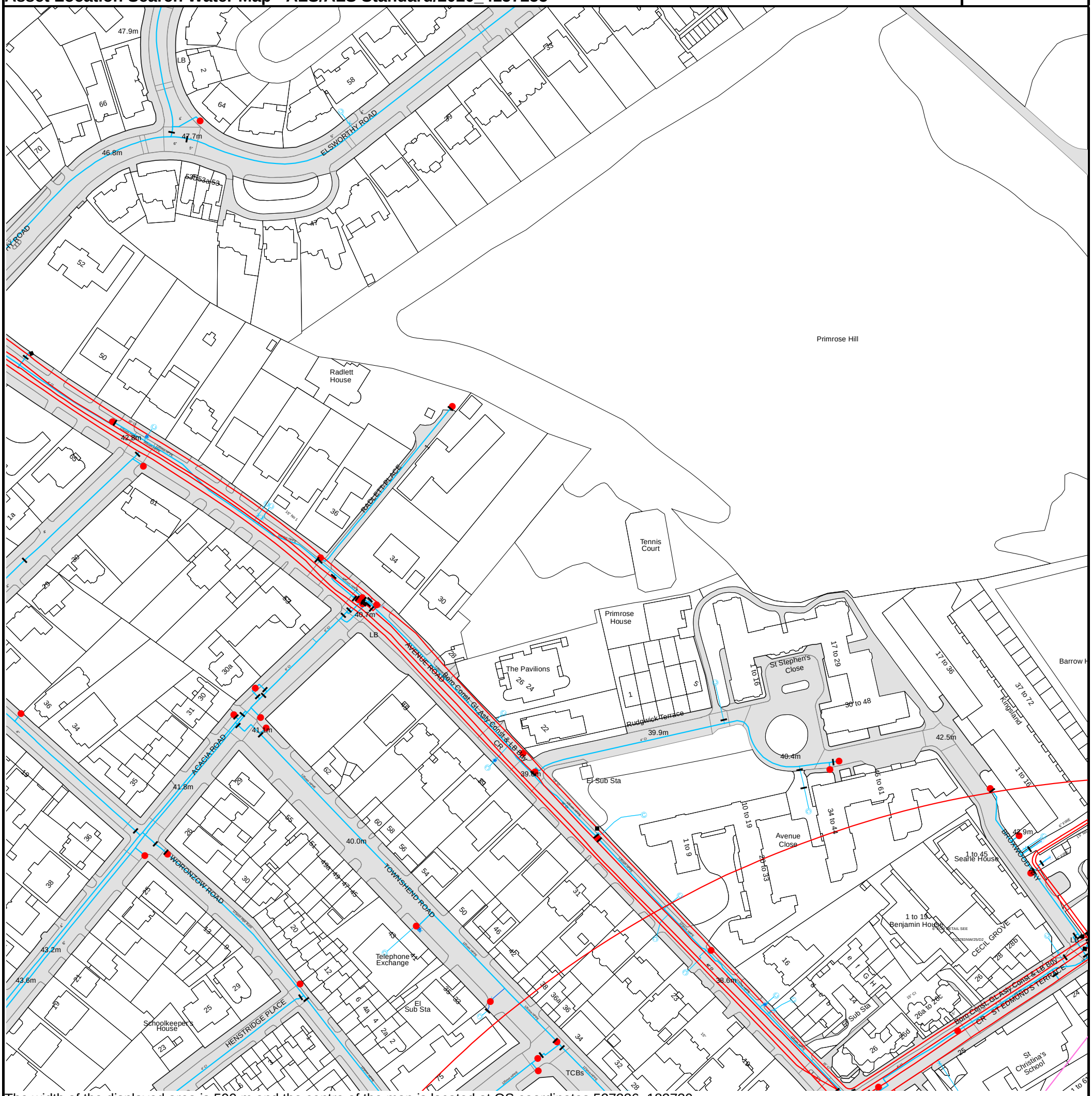
Proposed

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/2020_4157255



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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 her 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 / OSS	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**

Appendix IV - Maintenance

GULLIES, PIPEWORK, INSPECTION CHAMBERS AND CONTROLS	
Required Action	**Frequency**
Regular Maintenance	
Remove cover and inspect chambers and pipework ensuring water is flowing freely and that the exit route for water is unobstructed.	Annually
Undertake inspection after leaf fall in autumn, remove leaves from gullies, chambers and pipes	Every autumn
Inspect silt traps and clear of silt	Every 6 months or as required
Inspect catchpits and clear of silt	Every 6 months or as required
Remedial work	
Remove debris, silt and leaves from inspection chambers and flow control chambers.	As required
Remove debris and silt from pipework through high pressure jet washing.	As required
Repair physical damage if necessary	As required
Monitoring	
CCTV survey to establish condition of pipe runs. Cleansing or repair of physical damage to be conducted if necessary	Every 5 years or as required
PERMEABLE AND POROUS SURFACES	
Required Action	**Frequency**
Regular Maintenance	
Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional Tasks	
Stabilise and mow contributing and adjacent areas	As required

Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required
Remedial Work	
Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material.	As required
Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required
If efficiency of water percolating to the sub-base drops, jet washing and suction cleaning could substantially reinstate paving to 90% efficiency (as per recent experience).	As required
Monitoring	
Initial inspection	Monthly for three months after installation
Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48h after large storms in first six months
Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
Monitor inspection chambers	Annually
GEOCELLULAR TANK SYSTEM	
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 – all runoff entering the tank will need to have been routed through a catchpit with sediment filter.	Annually or as required
Remedial	
Repair/rehabilitate inlets, outlets and vents	As required

Monitoring	
Inspect/check all inlets, outlets and vents to ensure that they are in good condition and operating as designed	Annually
If product allows for internal inspection, CCTV survey inside of tank for sediment build-up and remove if necessary (this could be through the Polystorm Access product suitable for the Polystorm Xtra crate system). **Manufacturer's specific recommendation to be followed**.	Every 5 years or as required