FLOOD RISK ASSESSMENT AT 4 THE GROVE, HIGHGATE, LONDON N6 6JU

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EXECUTIVE SUMMARY

The proposed development would be expected to remain dry in all but the most extreme conditions. Providing the recommendations made in this FRA are instigated, flood risk from all sources would be minimised, the consequences of flooding are acceptable and the development would be in accordance with the requirements of the NPPF.

This FRA demonstrates that the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of the NPPF. The development should not therefore be precluded on the grounds of flood risk.

1. INTRODUCTION

Tier Environmental were commissioned by SODA Studio to undertake a Flood Risk Assessment, for or a property located at 4 The Grove, Highgate, London N6 6JU. (Hereinafter referred to as "Site").

It is understood that the client is looking to refurbish and continue using the existing building for residential purposes.

This report aims to outline the potential flood risks associated with the proposed development and provide recommendations for mitigation measures to reduce flooding impacts to the site and surrounding area.

1.1. Scope of Works

The agreed scope of work for this assessment was:

- Acquiring flood information from the Environment Agency, Local Authority, Water Utility Providers and other relevant bodies and interrogation of online databases.
- Interpreting the site location, history, geological, hydrogeological and hydrological site setting.
- Undertaking a site walkover by a suitably experienced Tier Engineer involving the inspection of the site and the surrounding area for indications of flood risks and other flooding related issues.
- Provide information relating to the site vulnerability, potential flooding hazards and probability, potential climate change impacts, development proposals, potential flood risk management measures, off-site impacts, and residual risks.

1.2. Background

This Flood Risk Assessment (FRA) has been carried out in accordance with guidance contained in the National Planning Policy Framework (NPPF), associated National Planning Practice Guidance (NPPG) and the NPPG 'Site-specific flood risk assessment checklist' (para 068 Reference ID: 7-068-20140306). This FRA identifies and assesses the risks of all forms of flooding to and from the development and demonstrates how these flood risks will be managed so that the development remains safe throughout the lifetime, taking climate change into account.

It is recognised that developments which are designed without regard to flood risk may endanger lives, damage property, cause disruption to the wider community, damage the environment, be difficult to insure and require additional expense on remedial works. The development design should be such that future users will not have difficulty obtaining insurance or mortgage finance, or in selling all or part of the development, as a result of flood risk issues.

1.3. National Planning Policy Framework (NPPF)

One of the key aims of the NPPF is to ensure that flood risk is taken into account at all stages of the planning process; to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk. It advises that where new development is exceptionally necessary in areas of higher risk, this should be safe, without increasing flood risk elsewhere, and where possible, reduce flood risk overall.

A risk-based approach is adopted at stages of the planning process, applying a source pathway receptor model to planning and flood risk. To demonstrate this, an FRA is required and should include:

- whether a proposed development is likely to be affected by current or future flooding from all sources;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate;
- if necessary, provide the evidence to the Local Planning Authority (LPA) that the Sequential Test can be applied; and,
- whether the development will be safe and pass part c) of the Exception Test if this is appropriate.

1.4. Report Structure

This FRA has the following report structure:

- Section 2 details the sources of information that have been consulted;
- Section 3 describes the location area and the existing and proposed development;
- Section 4 outlines the flood risk to the existing and proposed development;
- Section 5 provides details of the impact of the proposed development on flood risk;
- Section 6 details the proposed surface water drainage for the site;
- Section 7 describes the risk management methods used to mitigate all sources of flood risk; and,
- Section 8 presents a summary and conclusions.

2. SOURCES OF INFORMATION

2.1. Discussion with Regulators

Consultation and discussions with the relevant regulators have been undertaken during this FRA including the Environment Agency, the Local Planning Authority (LPA), the Lead Local Flood Authority (LLFA) and Sewerage Undertakers.

2.2. Environment Agency

The Flood and Water Management Act 2010 gives the Environment Agency (EA) a strategic overview role for all forms of flooding and coastal erosion. They also have direct responsibility for preventing, mitigating and remediating flood damage for main rivers and coastal areas. The EA is the statutory consultee with regards to flood risk and planning. Information regarding the current flood risk at the application site, local flood defences and flood risk has been obtained from the EA.

2.3. London Borough of Camden

The London Borough of Camden (LBC) is the Local Planning Authority (LPA) controlling flood risk and water environment issues through policies and guidance presented in their Strategic Flood Risk Assessment (SFRA) July 2014.

Under the Flood and Water Management Act 2010, The London Brough of Camden has new powers and responsibilities for co-ordinating local flood risk management. They are the Lead Local Flood Authority (LLFA) unless assigned or shared with another Authority and have a responsibility to work with local partners to better manage local flooding issues across the Borough's catchment area.

2.4. Thames Water

Thames Water is responsible for the disposal of wastewater and supply of clean water for this area. Information with regards to sewer and water main flooding contained within the LBC SFRA Level 1 and 2. All Water Companies have a statutory obligation to maintain a register of properties/areas which are at risk of flooding from the public sewerage system, and this is shown on the DG5 Flood Register.

2.5. Previous Reports

A ground investigation, by Tier Environmental, has previously been completed for the site and a Flood Risk Assessment for the adjoining property (No. 5) was previously conducted by Hull Raiser Ltd. These reports should be read in conjunction with this report, which includes pertinent information from these reports, which are referenced:

- 'Ground Investigation Report, 4 The Grove, Highgate, London N6 6JU', Tier Environmental, Ref: TE1723-TE-00XX-RP-GE-001-V01, dated 29 March 2023.
- 'Flood Risk Assessment, 5 The Grove, Highgate Village, London N6 6JU', Hull Raiser Ltd, Ref: 230821, dated September 2021.

3. LOCATION & DESCRIPTION

3.1. Site Location

The site is located at 4 The Grove, Highgate, London, N6 6JU (see Drawing No. TE1723-TE-00-XX-DR-001-V01 included in Appendix A), within Highgate village in the London Borough of Camden. The National Grid Reference (NGR) for the site is E: 528130, N: 187270.

3.2. Site Description

Roughly rectangular in plan, the site is relatively flat, multi-levelled and covers approximately 0.17 hectares. The site currently includes a three-storey red brick Grade II* listed semi-detached property, with a basement that dominates its eastern quarter. The front garden, to the east, is flat and brick paved. Steps lead from the front garden along the property's northern edge to the rear garden, which comprises a small paved patio leading to grass covered lawns that have been formed into two terraces. A red brick retaining wall separates the lower terraced rear garden from the upper part. A greenhouse is situated on the southern boundary to the lower western terrace of the rear garden, which contains raised flower beds in the northwest corner and is also partly tree covered. Borders line the northern and southern boundaries to the upper terraced part of the rear garden.

The site is accessed via a gate from The Grove on the eastern boundary and the front garden is delineated with red brick wall, metal rail fencing and trees. Delineating the rear garden are a vegetated red brick wall, hedging and trees.

Private terraced gardens bound the site to the north and south and the grounds to Witanhurst Mansion bound it to the west. The Grove and trees bound the site to the east, beyond which are Highgate West Hill and private residences.

The existing and proposed site layout is shown on drawing TE1723-TE-00-XX-DR-002-V01 included in Appendix A. A topographic survey for the site is included in Appendix B.

3.3. Proposed Development

Under current proposals the development will include extending the existing basement under the front garden and replacing a greenhouse, in the lower rear garden, with a summerhouse and above ground swimming pool. The proposed summerhouse will likely be a lightweight timber structure clad in wood and glass and the swimming pool will potentially be around 2.00m deep.

The existing and proposed site layout is shown on drawing TE1723-TE-00-XX-DR-002-V01, in Appendix A.

3.4. Site History

The existing property and gardens were constructed around 1688 and have remained relatively unchanged since this time.

3.5. Ground Levels

The site is situated on elevated ground, above 125m Above Ordnance Datum (m AOD) forming Highgate Hill. Surrounding ground elevations slope towards the southwest to around 70m AOD at Highgate Ponds (located at roughly 600m to the southwest).

Ground surface elevations at the front (eastern side) of the house are at approximately 128.6m AOD and fall to around 126.7m AOD, on the patio area, to rear (western side) of the house. The rear garden generally falls from the patio area towards the west with the lower terraced rear garden sloping from around 122.7m AOD (in the east) to 119.1m AOD (in the west)..

3.6. Geology and Ground Conditions

The published British Geological Survey (BGS) map Sheet 256, "North London", dated 2006 and recent ground investigation works show the site to be devoid of superficial deposits and covered with a granular and clay rich Made Ground and Made Ground/Topsoil layer to between 1.50m and 2.70m depth. Topsoil is also anticipated to cover other areas within the rear gardens. The underlying bedrock is predominantly clay rich strata with granular pockets / horizons, which have been interpreted as belonging to the Bagshot Formation and was recorded to the full investigation depth at 6.45m. Underlying this stratum is clay rich strata belonging to the Claygate Member (part of the London Clay Formation), which historical BGS borehole records indicate can reach to between 127m and 129m depth (126m to 128m thick). The Thanet Sands (17m to 18m thick) underlie the Claygate Member and have been recorded, by historical BGS boreholes, to be at around 144m and 147m depth.

During the investigation works, perched groundwater was recorded at around 5.00m depth (WS101) and a seepage was recorded at 3.70m depth (WS02), which was generally confined within granular pockets/horizons associated with the Bagshot Formation.

A plan (Drawing TE1723-TE-00-XX-DR-003-V01), showing the geology underlying the site is included in Appendix A.

3.7. Hydrogeology

The site is situated on elevated ground at between roughly 127m AOD and 122m AOD, with ground elevations sloping towards the southwest. Topographic and geological information indicate that groundwater is likely to occur at depth and within the Thanet Sands that underlie the London Clay Formation. Perched groundwater is anticipated to be present within granular pockets and horizons associated with the Bagshot Formation.

Both the Bagshot Formation and Claygate Members have been designated by the Environment Agency as Secondary A Aquifers.

3.8. Hydrology

The site is situated on elevated ground with on-site ground surfaces sloping very gently towards the west. The front garden area is currently paved with brick hardstanding. Surface water drainage in this area of the property is expected to be via downpipes leading from the roof and to occur as overground flow to existing drainage networks.

The rear garden area is predominantly covered with grassy terraced lawns with an existing greenhouse on the lower western terrace. Surface water drainage within the rear garden area is expected to be predominantly directed into the ground where it will migrate vertically downwards before encountering the underlying clay rich bedrock. A small surface water volume will drain directly from the existing greenhouse area into the surrounding soils. On encountering the clay rich bedrock, surface water will continue to drain as through flow down the topographic gradient which falls gently towards the west.

There are no surface watercourses within 250m of the site. A covered, below ground reservoir, is the nearest surface water feature to the site, located approximately 90m to the northeast. Various minor water courses and the 'Highgate Ponds' are located downslope and over 300m to the southwest, which are anticipated to be features sat on top of the underlying clay strata belonging to the Claygate Member.

3.9. Catchment Characteristics

The site is situated on the eastern periphery of the Highgate Ponds Catchment, which covers approximately 1.02km^2 (see drawing TE1723-TE-00-XX-DR-GE-004-V01 in Appendix A). No surface watercourses are shown flowing into the catchment from the site and it is expected that drainage into the catchment is as throughflow in near surface/shallow soils.

The Standard Percentage Runoff, derived using the UK Hydrology of Soil Types (SPRHOST), is low to moderate in a UK context at 26.77% with a relatively low revised Baseflow Index, derived using the UK Hydrology of Soil Types released in

2019 (BFIHOST19), of 0.566. This is confirmed on the Cranfield Soil and Agrifood Institute Soilscapes website (www.landis.org.uk/soilscapes), which indicates that shallow near surface soils, i.e. Topsoil and Made Ground/Topsoil or Made Ground, underlying the site and catchment are classed as 'Freely draining slightly acid loamy soils' (see drawing TE1723-TE-00-XX-DR-GE-005-V01). The catchment is very lightly urbanised with an URBEXT2000 of around 0.2%. The relevant descriptors for the Highgate Ponds Catchment, taken from the UK Centre for Ecology & Hydrology (UK CEH) Flood estimation Handbook Web Service website (www.ceh.ac.uk/flood-estimation-handbook-feh-web-service), are presented in Table 3.1 below.

Table 3.1 – UK Centre for Ecology and Hydrology Catchment Descriptors for the Highgate Ponds Catchment

	Location:	**Highgate Ponds Catchment**
	NGR	**TQ 27700, 86900**
AREA	Catchment Area (km^2)	1.02
ALTBAR	Mean Elevation (m)	104
ASPBAR	Mean Aspect	154
ASPVAR	Variance of Aspect	0.33
BFIHOST	Base Flow Index	0.697
BFIHOST19	Base Flow Index (2019)	0.566
DPLBAR	Mean Drainage Path Length (km)	0.78
DPSBAR	Mean Drainage Path Slope	69
FARL	Index of Lakes	0.779
FPEXT	Prop. of Catchment in1% FP	0.0098
FPDBAR	Mean Flood Depth (Catchment)	0.088
FPLOC	Average Distance of FP to Outlet	0.533
LDP	Longest Drainage Path (km)	1.59
PROPWET	Proportion of Time Soil is Wet	0.29
RMED -1H	Median 1 Hour Rainfall (mm)	11.4
RMED -1D	Median 1 Day Rainfall (mm)	33.9
RMED -2D	Median 2 Day Rainfall (mm)	43.6
SAAR6190	Average Annual Rainfall 1961-1990(mm)	682
SAAR4170	Ditto for 1941-1970 (mm)	669
SPRHOST	Percentage Runoff	26.77
URBEXT1990	Urban Extent 1990	0.1446
URBEXT2000	Urban Extent 2000	0.2255

3.10. Rainfall Data

Rainfall data for all UK wide catchments is available from the UK Centre for Ecology & Hydrology (UK CEH) Flood estimation Handbook Web Service website.

Standard Average Annual Rainfall (SAAR) for the period 1961 to 1990 for the catchment is 682mm. The peak rainfall intensity for a 1:100 year event is 105.09mm.

4. FLOOD RISK

4.1. Sources of Flooding

All sources of flooding have been considered, including: fluvial (river) flooding, tidal (coastal) flooding, groundwater flooding, surface water (pluvial) flooding, sewer flooding and flooding from artificial drainage systems/infrastructure failure.

4.2. Historic Flooding

Correspondence with the Environment Agency indicates that due to the designated Flood Zone, in which the site sits, they do not hold any records for historic flooding from rivers or sea for the site. They point out however, this does not mean that flooding has not occurred at the site in the past. According to Thames Water Property Searches, their records show that there have been no flooding incidents recorded for the site as a result of surcharging public sewers.

4.3. Existing and Planned Flood Defence Measures

The site is not located near any major watercourses and there are no existing or planned flood defences associated with the site.

4.4. Environment Agency Flood Zones

A review of the Environment Agency's flood map (www.flood-map-for-planning.service.gov.uk), indicates that the site is located within Flood Zone 1 and therefore has a 'low probability' of fluvial flooding as shown in Drawing TE1723-TE-00-XX-DR-GE-006-V01, included in Appendix A.

Flood Zone 1 has a less than 1 in 1,000 annual probability of river flooding in any year. The LBC SFRA confirms that the site is located within Flood Zone 1. However, the SFRA indicates that whilst the risk of flooding from fluvial sources is negligible within LBC, there is a potential risk of flooding from other sources including surface water, groundwater, sewers and artificial sources such as reservoirs and canals.

The Flood Zones are the current best information on the extent of the extremes of flooding from rivers or the sea that would occur without the presence of flood defences, because these can be breached, overtopped and may not be in existence for the lifetime of the development. The Environment Agency Flood Zones and acceptable development types are explained in Table 4.1, which shows that all development types are generally acceptable in a Flood Zone 1.

Table 4.1 – Environment Agency Flood Zones and Appropriate Land Use

Flood Zone	Probability	Explanation	Appropriate Land Use
Zone 1	Low	Less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%).	All development types generally acceptable.
Zone 2	Medium	Between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% 0.1%) in any year.	Most development type are generally acceptable.
Zone 3a	High	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.	Some development types not acceptable.
Zone 3b	'Functional Floodplain'	Land where water has to be flow or be stored in times of flood. SFRAs should identify this 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 Environment Agency, including water conveyance routes).	Some development types not acceptable.

4.5. Site Sensitivity and Flood Risk Vulnerability

In the Planning Practice Guidance to the NPPF (Table 1) appropriate uses have been identified for each Flood Zone designation.

The proposed development will include extending the existing basement beneath the front garden area to provide a additional living space. In accordance with Table 2 of the Planning Practice Guidance to the NPPF, this will class the existing and proposed development as 'highly vulnerable'. Table 4.2 below summarises the development types coming under a "Highly Vulnerable" flood risk vulnerability classification according to the NPPF: Technical Guidance Table 2.

Table 4.2 – Flood Risk Vulnerability Classification

Highly Vulnerable
Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding.
Emergency dispersal points.
Basement dwellings.
Caravans, mobile homes and park homes intended for permanent residential use.
Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as "essential infrastructure")

Applying the Flood Risk Vulnerability Classification in Table 4.2 and Table 4.3 below (taken from Table 3 of the Planning Practice Guidance to the NPPF) 'Highly Vulnerable' uses are appropriate within Flood Zone 1.

Table 4.3 – Flood Risk Vulnerability and Flood Zone 'Compatibility' as identified in Table 3 of the Planning Practice Guidance to the NPPF

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

Key: ✓: Development is appropriate, X: Development should not be permitted.

4.6. Fluvial (River) and Tidal (Coastal) Flooding

The site lies within a Flood Zone 1 where there is little or no risk of flooding from rivers or the sea, therefore, the EA do not hold and detailed flood modelling data that would impact the site.

The LBC SFRA indicates that all main rivers historically located within the borough have been culverted and incorporated into the Thames Water Utilities Ltd (TWUL) sewer network. Therefore, there is no fluvial flood risk within LBC.

Given the above, the elevation of the proposed development, that there are no nearby surface water courses within 250m and the site is not near to the sea, it is considered that the risk of flooding from fluvial or coastal sources is negligible.

4.7. Groundwater Flooding

Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded. Groundwater flooding tends to occur sporadically in both location and time. When groundwater flooding does occur, it tends to mostly affect low-lying areas, below surface infrastructure and buildings (for example, tunnels, basements and car parks) underlain by permeable rocks (aquifers).

The site is situated on elevated ground at roughly between 119m AOD and 127m AOD. Recent investigation works recorded clay rich strata with granular pockets/horizons underlying the site to at least 6.45m depth that have been interpreted as the Bagshot Sands/Claygate Member. Information contained within the LBC SFRA indicates that the encountered soils may represent the upper parts of the underlying Claygate Member (London Clay Formation), which is identified as sand silt and clay. Perched groundwater was identified associated with granular pockets/horizons within this stratum and the LBC SFRA indicates isolated perched groundwater bodies are present within the London Clay. The London Clay is identified as having low permeability, which would be expected given its clay rich nature.

The LBC SFRA indicates that for areas underlain by bedrock within the borough, expected water table depths are likely to occur at either >5m throughout the year or <3m for part of the year. The London Clay strata have been recorded in historical BGS boreholes down to depths around 144m and 147m where they are underlain by the Thanet Sands. Given the impermeable nature of the London Clay, groundwater is anticipated to occur at depth within the Thanet Sand strata and therefore, the risks posed to the proposed development from groundwater flooding are considered negligible.

4.8. Surface Water (Pluvial) Flooding

Surface water is defined as rainwater falling onto a property or the ground that is drained away via a watercourse or public sewer. The EA defines surface water flooding as what happens when heavy rain cannot drain away. This is difficult to predict as it is dependent on rainfall volume and location. Surface water flooding can occur up hills, away from rivers and other water bodies, and is more widespread in areas with harder surfaces like concrete.

The proposed development will include extending the existing basement beneath the front garden area, at the eastern end of the site, which is currently brick paved. No change to existing site levels is proposed. Surface water drainage from the front garden area is currently transferred via downpipes, at the front of the property, and is expected to also occur as surface runoff (over the brick paved surface) to local drainage networks. The nature of the proposed development is not expected to change the volume of surface water or how it currently drains from the front garden area. Therefore, it is not expected to pose a significant flooding risk. It is understood from third party CCTV surveys that surface water draining from the front garden area feeds into the Thames Water sewer system that runs along The Grove and is below the level of the existing basement.

The rear garden area predominantly comprises grass covered terraced lawns with a small, paved patio adjacent to the house and an existing greenhouse on the lower, west end terrace. It is proposed to replace the greenhouse with a summer house and associated above ground swimming pool, which will cover the existing greenhouse footprint and there will be no significant changes to the rear garden area. Shallow near surface soils, i.e. Topsoil and Made Ground/Topsoil or Made Ground, underlying the rear garden area is classed as ‘Freely draining slightly acid loamy soils’. Therefore, surface water drainage within the rear garden area will predominantly be directly into the ground where it

will migrate vertically downwards before encountering the underlying clay rich bedrock. A small surface water volume will drain directly from the existing patio and greenhouse areas into the surrounding soils. On encountering the clay rich bedrock, surface water will continue to drain as through flow down topographic gradient towards the west and into the Highgate Ponds Catchment. Constructing the proposed summerhouse and swimming pool is not expected to change the existing surface water volumes or drainage patterns into the Highgate Ponds Catchment.

Surface water flooding tends to occur sporadically in both location and time and will tend to be confined to the streets around the development site. EA surface water flood risk information (see Drawing TE1723-TE-00-XX-DR-GE-007-V01) confirms that the site has a very low risk of surface water flooding with a chance of flooding of less than 1 in 1000 years (0.1%). The LBC SFRA indicates that the site is located within a Critical Drainage Area (CDA), despite the risk from surface water flooding being very low. However, this designation is generally based on the larger north Camden Borough area. More site-specific localised information shows that there are no issues relating to the site and surface water flooding. Therefore, the potential flooding risk from surface water sources is considered negligible. Given this, it is considered that no specific management or mitigation measures are required to reduce the risks of surface water flooding, however, consideration should be given to what happens during more extreme events.

4.9. Sewer Flooding

Sewer flooding occurs when urban drainage networks become overwhelmed and maximum capacity is reached. This can occur if there is a blockage in the network causing water to back up behind it or if the sheer volume of water draining into the system is too great to be handled. Sewer flooding tends to occur sporadically in both location and time such flood flows would tend to be confined to the streets around the development.

An asset property search from Thames Water shows a mains sewer running north to south along The Grove and a CCTV survey from third party sources shows that the property benefits from connection to the local sewer in the Grove. Plans provided by Thames Water and included in Appendix B, show the sewer to be combined, which is usual for an area of this age in London.

Existing public sewers are likely to have limited capacity and in extreme conditions, surcharges can lead to flooding. Burst water mains can also lead to flooding but will tend to be restricted with much lower water volumes than weather generated events and have been discounted for the purposes of this assessment. Given the design parameters normally used for drainage design, in recent times, and allowing for some deterioration in the installed system performance, which is likely to have been in place for many years, an appropriate flood risk probability for the existing sewer could be assumed to have a return period between 1 in 10 to 1 in 30 years. Thames Water flooding records indicate that there have been no incidents of flooding in the requested area as a result of surcharging from public sewers.

Invert levels for the existing sewer are shown for No. 3 The Grove, to the south, at 119.34m AOD and Fitzroy Park, to the north, at 120.49m AOD. It is understood that the proposed basement extension will sit at no more than 4.00m depth below existing ground levels. The existing ground elevation within the front garden area is around 128m AOD. Therefore, the floor of the proposed basement extension is anticipated to sit at around 124m AOD. This elevation is well above the invert levels for the existing sewer beneath The Grove. Therefore, it is considered that the risk of flooding from public sewers affecting the proposed development is negligible.

4.10. Flooding from Artificial Drainage Systems/Infrastructure Failure

A covered, below ground reservoir is located approximately 90m to the northeast of the site, to the east of The Grove. The Environment Agency Reservoir flood map (see Drawing TE1723-TE-00-XX-DR-GE-008-V01) shows that the site is not at risk from reservoir flooding. Reservoir flooding is extremely unlikely; reservoirs in the UK have a very good safety record. There has been no loss of life in the UK from reservoir flooding since 1925.

Since then, reservoir safety legislation has been introduced to make sure reservoirs are well maintained. The hazard is well managed through effective legislation, and it is unlikely that the impact zone downstream of the reservoirs should preclude the proposed development. There are no other nearby artificial water bodies, water channels and artificial drainage systems that could be considered a flood risk to the site. The risk of flooding from nearby artificial water bodies, water channels and artificial drainage systems is considered to be negligible.

4.11. Effects of Development on Flood Risk

There will be no loss of floodplain storage capacity and the proposed development will have no impact on the movement of water.

4.12. Site Specific Flood Risk Assessment Summary

A summary of the sources of flooding and a review of the risk posed by each source at the site is shown in Table 4.4, below.

Table 4.4 - Sources of Flooding and Potential Risk Posed

Sources of Flooding	Potential Flood Risk	Potential Source	Probability/Significance
Fluvial (River) Flooding	No	None Reported.	Negligible
Tidal (Coastal) Flooding	No	None Reported.	Negligible
Groundwater Flooding	No	None Reported.	Negligible
Surface Water (Pluvial) Flooding	No	The site is free draining to the west and drains directly into the existing sewer in the east. No changes to existing surface water volumes or drainage patterns will occur as part of the proposed development.	Negligible
Sewer Flooding	No	Thames Water have indicated no surcharge within their network locally.	Negligible
Flooding from Artificial Drainage Systems/Infrastructure Failure	No	None Reported.	Negligible

There are no recorded major or minor watercourses recorded within 250m of the site, which is located within a Flood Zone 1 and not situated near to a coastal location. Groundwater is expected to occur in more granular bedrock, the Thanet Sands at around 140m depth. Therefore, the risk from flooding associated with fluvial, coastal and groundwater sources is considered to be negligible.

Surface water from the front garden area, which is brick paved, currently drains via down pipes and/or occurs as overgrown flow into local drainage networks that feed into the existing Thames Water sewer running along The Grove. Extending the existing basement beneath this area will not impact the surface water volumes discharging from the front garden nor will it alter the existing drainage patterns from this area.

The rear garden area comprises terraced lawns with a very gentle dip towards the west and into the Highgate Ponds Catchment. Surface water currently falling on this area predominantly percolates directly into freely draining near surface/shallow soils before meeting the underlying clay rich bedrock and draining as throughflow down the topographic gradient to the west. Some minor surface water drainage from the existing patio and greenhouse will occur as overground flow but drain directly into the shallow/near surface soils. As with the front garden area, constructing the proposed summerhouse and swimming pool will not impact the surface water volumes discharging from this area nor will it alter existing drainage patterns. Therefore, it is considered that the potential risk from surface water flooding at the site is negligible.

Thames Water have recorded no surcharges within their local network associated with the sewer running along the Grove, which is well below the proposed basement extension floor level, and there is no significant threat posed to the site from artificial drainage systems/infrastructure failure. Therefore, the potential flooding risk associated with sewers and artificial drainage systems/infrastructure failure is considered negligible.

5. SEQUENTIAL APPROACH

5.1. Sequential Test

The Sequential Test, in accordance with the NPPF, aims to steer new developments to areas with the lowest flooding probability (Flood Zone 1), where there is a less than 1 in 1,000 (<0.1%) annual probability of flooding from rivers or the sea.

The proposed development includes extending the existing property and replacing an existing greenhouse with a summerhouse and swimming pool. The site is located within a Flood Zone 1, on elevated ground with negligible risk of flooding from fluvial or coastal sources. Therefore, it is considered that the requirements of the Sequential Test have been met.

5.2. Exception Test

Applications located within Flood Zone 1 are not subject to the Exception Test as confirmed within Table 4.2 of this report and Table 3 of the Planning Practice Guidance to the NPPF.

6. SURFACE WATER MANAGEMENT

6.1. Surface Water Drainage Overview

It is recognised that consideration of flood issues should not be confined to the floodplain. The alteration of natural surface water flow patterns through development can lead to problems elsewhere in the catchment, particularly flooding downstream. For example, replacing vegetated areas with roofs, roads and other paved areas can increase both the total and the peak flow of surface water runoff from development sites. Changes of land use on previously developed land can also have significant downstream impacts where the existing drainage system may not have sufficient capacity for the additional drainage.

An assessment of the surface water runoff rates has been undertaken, in order to determine the surface water options and attenuation requirements for the site. The assessment considers the impact of the development compared to current conditions. Therefore, the surface water attenuation requirement for the developed site can be determined and reviewed against existing arrangements.

The requirement for managing surface water runoff from developments depends on the pre-developed nature of the site. In the case of brownfield sites, drainage proposals will be measured against the existing performance of the site. The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development unless specific off-site arrangements are made and result in the same net effect.

It should be acknowledged that the satisfactory collection, control and discharge of surface water runoff are now a principal planning and design consideration. It is necessary to demonstrate that the surface water from the proposed development can be discharged safety and sustainably.

6.2. Climate Change

EA projections of future climate change, in the UK, indicate more frequent, short-duration, high intensity rainfall and more frequent periods of long duration rainfall. Guidance included within the NPPF recommends that the effects of climate change are incorporated into FRAs. Recommended precautionary sensitivity ranges for peak rainfall intensities and peak river flows are outlined in the associated Planning Practice Guidance to the NPPF.

The site is at negligible risk from flooding by fluvial sources and will not be impacted by peak river flows due to climate change.

When considering flooding from surface water, the NPPF and EA require an allowance to be added to peak rainfall intensity, in order to account for climate change impacts. In order to account for climate change impacts on surface water flooding, the EA has derived allowances for peak rainfall intensity in small and urban catchments. Peak rainfall allowances from the EA guidance for the London Management Catchment are given in Table 6.1 below.

Table 6.1 – London Management Catchment Peak Rainfall Allowances.

	Allowance Category	2050s (Lifetime up to 2060)	2070s (Lifetime Between 2061 and 2125)
London Management Catchment	Central Allowance	20%	40%
	Upper End Allowance	25%	40%

EA guidance recommends that for a residential development, a lifetime of 100 years should be considered which would take the proposed development beyond 2100. For a 1% AEP the upper end allowance (2070s) of 40% should be used for a worst-case scenario. For a peak rainfall intensity of 105.09mm, this equates to an additional 42mm giving a total peak rainfall of 147.13mm.

6.3. Discharge of Surface Water

Surface water runoff is predominantly restricted to the accommodation and the brick paved front garden area. There are three possible options to discharge the surface water runoff in accordance with the requirements the Defra non-statutory technical standards for SUDS. The Runoff Destination is (in order of preference):

- Infiltration devices;
- To a surface watercourse;
- To a sewer.

It is necessary to identify the most appropriate method of controlling and discharging surface water.

Some surface water overground flow will occur from the patio area and greenhouse within the rear garden area, but this is anticipated to be very minor and drain away through shallow/near surface freely draining soils.

6.4. Infiltration Systems

During the Tier Environmental investigation works, *in situ* falling head permeability tests were undertaken in boreholes located in the front and rear garden areas that targeted the underlying natural bedrock strata. The results returned

poor infiltration rates, between 1.06 x 10^{-5}m/s to 9.01 x 10^{-8}m/s, for the underlying bedrock strata which was to be expected given their predominantly clay rich nature and anticipated low permeability.

Therefore, it is considered that the disposal of surface water via infiltration devices, such as soakaways, will not be feasible at this site.

6.5. Watercourse

No major or minor watercourses are recorded within 250m of the site and, therefore, surface water disposal to such features is not feasible.

6.6. Sewer

Surface water disposal from the front garden area is currently via on-site drainage networks feeding into the combined Thames Water sewer that runs along The Grove. Since discharging surface water to infiltration devices and watercourses is unsuitable for this site, then disposal to the existing sewer remains the only feasible option.

6.7. Surface Water Runoff Rates

The site area is 1,700m^2 and the brick paved front garden area is approximately 75m^2, which equates to around 4.4% of the total site area. Extending the existing basement underneath the front garden will not alter the impermeable surface area nor change the volume of surface water discharging from the area. An estimation of surface water runoff is required to permit effective site surface water management and prevent any increase in flood risk to off-site receptors. In accordance with The SUDs Manual, the runoff rates from the site have been calculated using the FEH Method for the whole site using the HR Wallingford Greenfield Runoff Rate Estimation website (www.uksuds.com). For the hardstanding area the total runoff will be roughly 4.4% of the Greenfield runoff rates calculated for the whole site.

The results are summarised in Table 6.2 below and a calculation sheet is included in Appendix C.

Table 6.2 – Runoff Rates (l/s) from Existing Hardstanding

Return Period (Yrs)	Greenfield (whole site)	Existing Hardstanding	Post Development	Difference (existing – post development
Qbar	0.64	N/A	N/A	N/A
1:1	0.54	0.024	0.024	0.00
1:30	1.47	0.065	0.024	0.00
1:100	2.04	0.090	0.090	0.00
1:100 (+40%)	N/A	N/A	0.126	N/A

6.8. Proposed Surface Water Drainage Scheme

The proposed development involves less than 10 dwellings, has an area less than 1ha and floor space less than 1,000m^2, is not in an area at risk from flooding and will not result in an increase in impermeable areas. Therefore, a formal surface water drainage strategy is not required.

There will be no increase in the volume or runoff rate of surface water from the site and therefore, no increase in flooding to people or property off-site as a result of the development.

The front garden area is currently paved with brick hardstanding and surface water runoff drains to local drainage networks and the existing Thames water sewer running along The Grove. The basement extension design, beneath this area, will need to consider employing measures, i.e. a free draining layer over geotextile or hardstanding to finished ground levels, that allows surface water to drain to the edges and not pool or pond above the finished structure.

Surface water falling onto the rear garden area will continue to drain naturally through the free draining near surface/ shallow soils down topographic gradient to the west.

6.9. Designing for Local Drainage System failure/Design Exceedance

When considering residual risk, it is necessary to make predictions as to the impacts of a storm event that exceeds the design event, or the impact of a failure of the local drainage system. The Surface Water Drainage Scheme applies a safe and sustainable approach to discharging rainfall runoff from the site and this reduces the risk of flooding however, it is not possible to completely remove the risk. This section of the FRA is therefore associated with the way the residual risk is managed.

A Surface Water Drainage Scheme is not required for the site, however, it must be demonstrated that the flooding of property would not occur in the event of local drainage system failure and/or design exceedance. It is not economically

viable or sustainable to build a drainage system that can accommodate the most extreme events. Consequently, the capacity of the drainage system may be exceeded on rare occasions, with excess water flowing above ground.

There will be no extensive sewerage network on the proposed development site and any potential exceedance flooding would be from the existing sewer and lateral drains connecting the properties to the underground storage areas. It is very unlikely that a catastrophic failure would occur. An exceedance or blockage event associated with the existing sewer along The Grove would not affect the proposed basement extension because the finished floor level will be above the level of the sewer. Also, the sewer is confined with clay rich bedrock that will inhibit lateral water movement through the ground.

It is expected that should exceedance flooding occur, this will be restricted to the highways located off-site and to the east. Flows associated with exceedance flooding would be directed southwards, down gradient, and away from the development site.

Surface water runoff, on and off-site, would be directed to local drainage networks via drainage gullies located around the perimeter of the buildings and through contouring of the hardstanding areas. It is not considered that there is an increased risk to the properties on the site or located adjacent to the site.

When considering the impacts of a storm event that exceeds the 1 in 100 year (+40%) event, there is safety factor for attenuation storage, even under the design event conditions. Consequently, if this event were to be exceeded there is additional capacity with the system to accommodate this. If this freeboard was to be exceeded the consequences would be similar, if not less than for the local drainage system failure. Drainage gullies, manholes and pipework will provide additional water storage and provide betterment. Consequently, the impact of an exceedance event is not considered to represent any significant flood hazard.

The above manages and mitigates the flood risk from surface water runoff to the proposed properties from surface water runoff generated by the site development and to offsite locations as well the risk from surface water runoff generated off-site.

7. RISK MANAGEMENT

7.1. Introduction

The flood risk at this location is considered suitable for the proposed development in line with the NPPF. In this flood zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout, form of the development and the use of flood mitigation measures including SuDS techniques. The flooding sources will have to be mitigated on the site by using a number of techniques, and mitigation strategies to manage and reduce the overall flood risk at the site. These will be used to ensure the development will be safe and there is:

- Minimal risk to life;
- Minimal disruption to people living and working in the area;
- Minimal potential damage to property;
- Minimal impact of the proposed development on flood risk generally; and,
- Minimal disruption to natural heritage

7.2. Finished/Minimum Floor Level

There is no minimum floor level proposed as a result of flooding for this site and it would be impractical to raise the floor level for the proposed basement extension.

7.3. Flood Resilience and Resistance

The development of the layout should always consider that the site is potentially at risk from an extreme event and as such the implementation of flood resilience and resistance methods should be assessed. Relatively simple measures such as raising utility entry points, using first floor or ceiling down electrical circuits and sloping landscaping away from properties can be easily and economically incorporated into the development of the site.

7.4. Safe Access and Egress Routes

The site and surrounding area is located within Flood Zone 1 therefore a permanently safe and dry access can be maintained.

7.5. Flooding Consequences

The mitigation measures detailed above show that the flood risk can be effectively managed and therefore the consequences of flooding are acceptable.

8. SUMMARY AND CONCLUSIONS

8.1. Introduction

This report presents an FRA in accordance with the NPPF for the proposed development at 4 The Grove, Highgate, London, N6 6JU. This FRA identifies and assesses the risks of all forms of flooding to and from the development and demonstrates how these flood risks will need to be managed so that the development remains safe throughout the lifetime, taking climate change into account.

8.2. Flood Risk

The site is at negligible risk of flooding from a major source (e.g. fluvial and/or tidal). The site has a 'low probability' of fluvial flooding as the site is located within Flood Zone 1 with less than a 1 in 1,000 annual probability of river flooding in any year (<0.1%).

Whilst flooding from secondary sources, such as surface water and sewers could potentially pose a risk under extreme conditions, the risk of flooding from all sources is considered to be not significant. Extreme flooding would only inundate the site to a relatively low water depth and water velocity and last for a short duration and not impact the whole property.

The proposed development is classified as 'highly vulnerable', and appropriate within Flood Zone 1 after the completion of a satisfactory FRA. The flood risk at the site, will be further managed and mitigated by using a number of risk management techniques, and mitigation strategies to manage and reduce the overall flood risk at the site.

In conclusion, the flood risk to the site can be considered to be limited; the site is situated in Flood Zone 1, with a low annual probability of flooding and from all sources. The site is unlikely to flood except in very extreme conditions.

8.3. Sequential and Exception Tests

The development proposals should be considered by the LPA to satisfy the Sequential and Exception Tests as set out in the NPPF.

8.4. Surface Water Drainage Scheme

A formal surface water drainage strategy is not required for this site. There will be no increase in the volume or runoff rate of surface water runoff from the site and therefore, no increase in flooding to people or property off-site as a result of the development.

The front garden area is currently paved with brick hardstanding and surface water runoff drains to local drainage networks and the existing Thames water sewer running along the Grove. The basement extension design, beneath this area, will need to consider employing measures, i.e. a free draining layer over geotextile or hardstanding to finished ground levels, that allows surface water to drain to the edges and not pool or pond above the finished structure.

Surface water falling onto the rear garden area will continue to drain naturally through the free draining near surface/ shallow soils down topographic gradient to the west.

8.5. Risk Management

Flooding sources will be managed on the site using a number of mitigation strategies to manage and reduce the overall flood risk at the site and will ensure the development will be safe. Measures used:

Minimum Floor Level - There is no minimum finished floor level proposed.

Flood Resilience and Resistance - The development of the layout should always consider that the site is potentially at risk from an extreme event and as such the implementation of flood resilience and resistance methods should be assessed.

Access and Egress - The site and surrounding area is located within Flood Zone 1 therefore a permanently safe and dry access can be maintained.

8.6. Conclusion

In conclusion, the site would be expected to remain dry in all but the most extreme conditions. Providing the recommendations made in this FRA are instigated, flood risk from all sources would be minimised, the consequences of flooding are acceptable, and the development would be in accordance with the requirements of the NPPF.

This FRA demonstrates that the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of the NPPF. The development should not therefore be precluded on the grounds of flood risk.

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9. REFERENCES

British Geological Survey (BGS) map Sheet 256, "North London", Solid and Drift, 1:50,000 Series, dated 2006

BGS Geology of Britain Viewer http://mapapps.bgs.ac.uk/geologyofbritain/home.html.

CIRIA (2006) Designing for exceedance in urban drainage – good practice

CIRIA (2015) CIRIA C753 The SuDs Manual

Communities and Local Government (2014) Planning Practice Guidance - Flood Risk and Coastal Change

Department for Communities and Local Government (2014) Planning Practice Guidance - Flood Risk and Coastal Change

'Flood Risk Assessment, 5 The Grove, Highgate Village, London N6 6JU', Hull Raiser Ltd, Ref: 230821, dated September 2021.

'Ground Investigation Report, 4 The Grove, Highgate, London N6 6JU', Tier Environmental, Ref: TE1723-TE-00XX-RP-GE-001-V01, dated 29 March 2023.

https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#high-allowances.

https://fehweb.ceh.ac.uk/

https://nrfa.ceh.ac.uk/

https://www.landis.org.uk/soilscapes/

https://flood-map-for-planning.service.gov.uk/

https://www.uksuds.com/tools/greenfield-runoff-rate-estimation

Ministry of Housing, Communities and Local Government (2019) National Planning Policy Framework.

National Soil Resources Institute (NSRI) 2013. The Soils Guide. Available: www.landis.org.uk. Cranfield University, UK. Last accessed 15/05/2020.

APPENDIX A - DRAWINGS

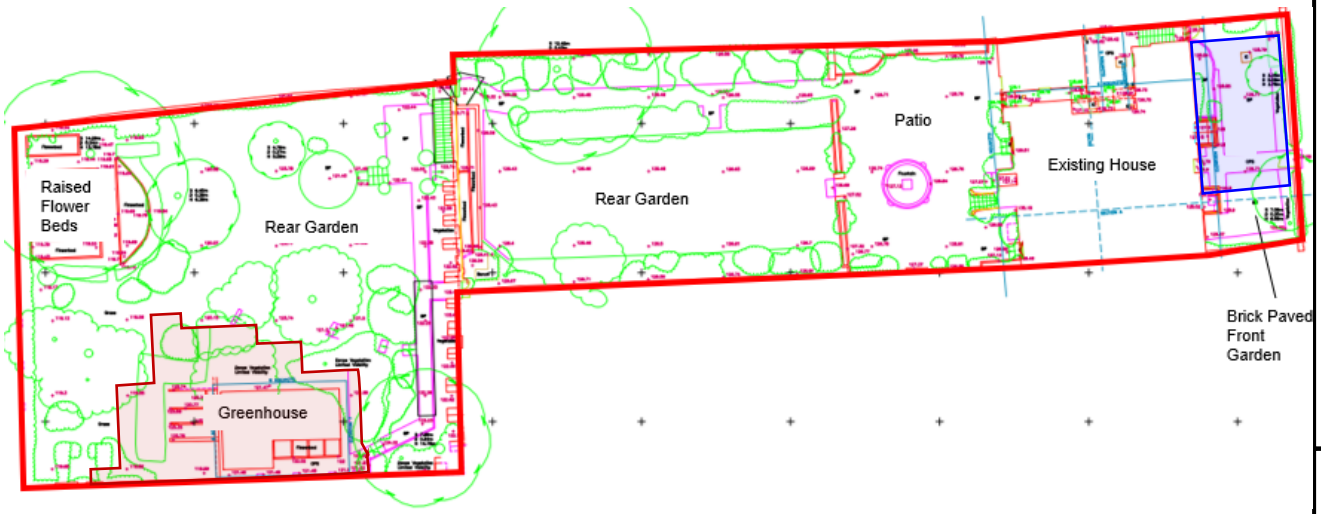
KEY:

Site Location

0 500m

Approximate Scale

PROJECT	4 The Grove, Highgate, London N6 6JU.
CLIENT	SODA Studio
TITLE	Site Location
PROJECT REF	TE1723
DRAWING NO	TE1723-TE-00-XX-DR-GE-001-V01
SCALE	NTS@A3
DATE	May 2023



KEY:

- Site Boundary.
- Proposed Basement Extension.
- Proposed Summer House and Swimming Pool.

0 20m

Approximate Scale

Extract taken from Corstorphine & Wright drawing 2174-202, dated 11.03.2022.

4 The Grove, Highgate, London N6 6JU. PROJECT

CLIENT
SODA Studio

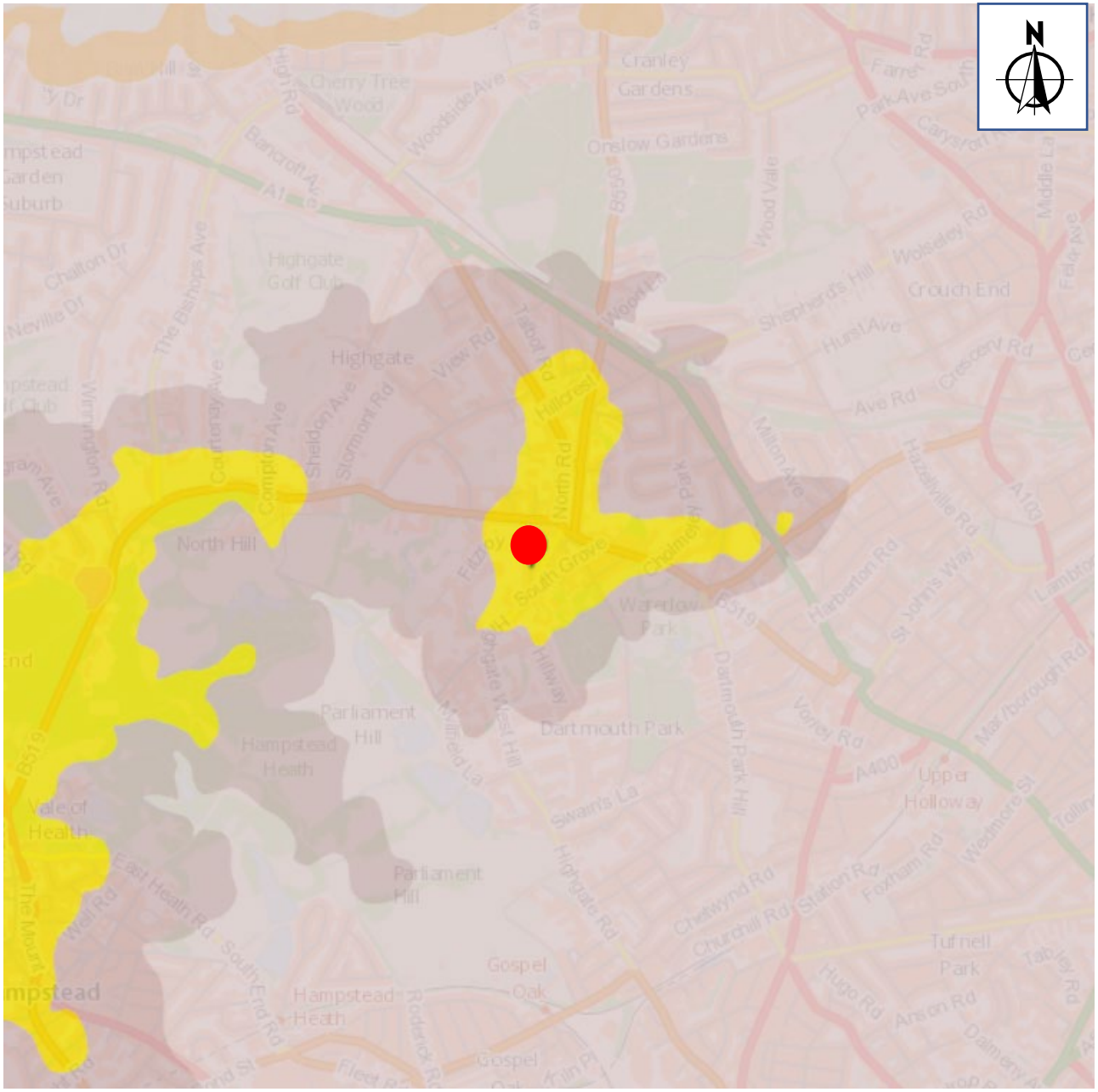
TITLE
Existing & Proposed Site Layout

PROJECT REF
TE1723

DRAWING NO
TE1723-TE-00-XX-DR-GE-002-V01

SCALE
NTS@A3

DATE
May 2023

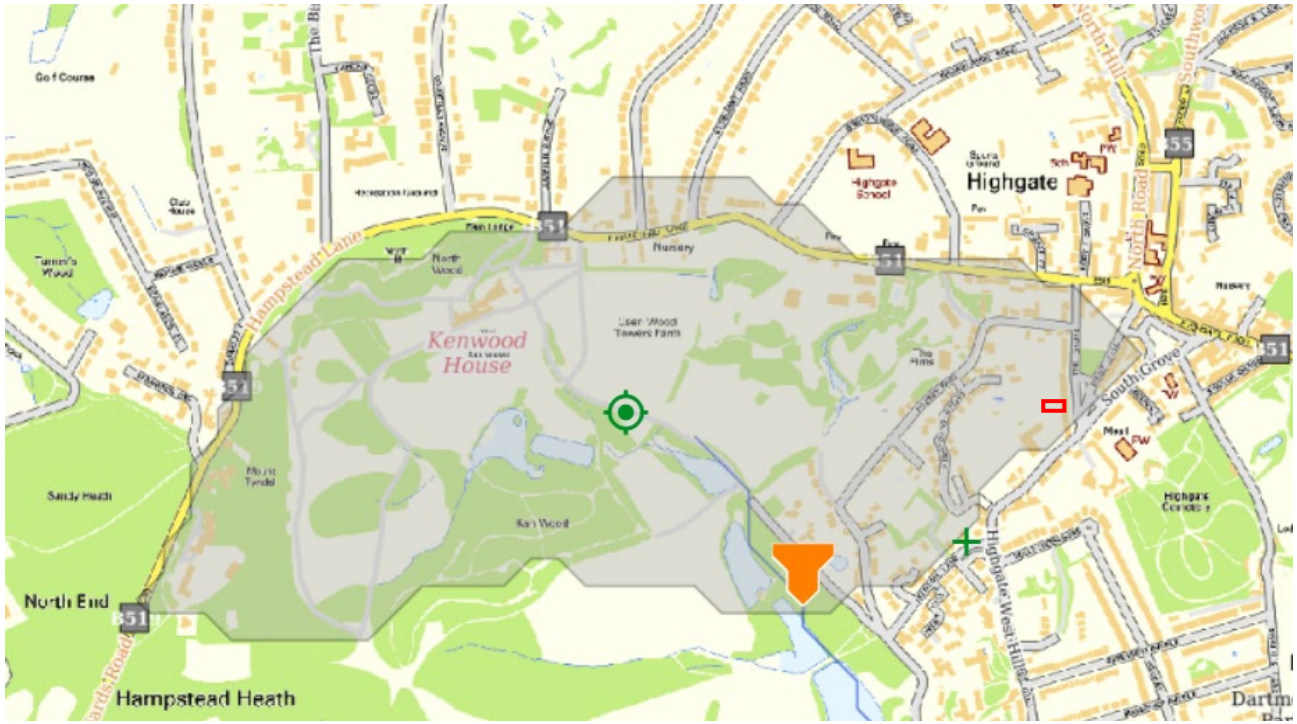


KEY:

- Site Location
- Bagshot Sand (Sand)
- Claygate Member (Clay, Silt & Sand).
- London Clay Formation (Clay, Silt & Sand)

Extract taken from the British Geological Survey GeoIndex website (www.mapapps2.bgs.ac.uk/geoindex).

PROJECT	4 The Grove, Highgate, London N6 6JU.
CLIENT	SODA Studio
TITLE	Geological Plan
PROJECT REF	TE1723
DRAWING NO	TE1723-TE-00-XX-DR-GE-003-V01
SCALE	NTS@A3
DATE	May 2023



KEY:

Site Location.

0 200m

Approximate Scale

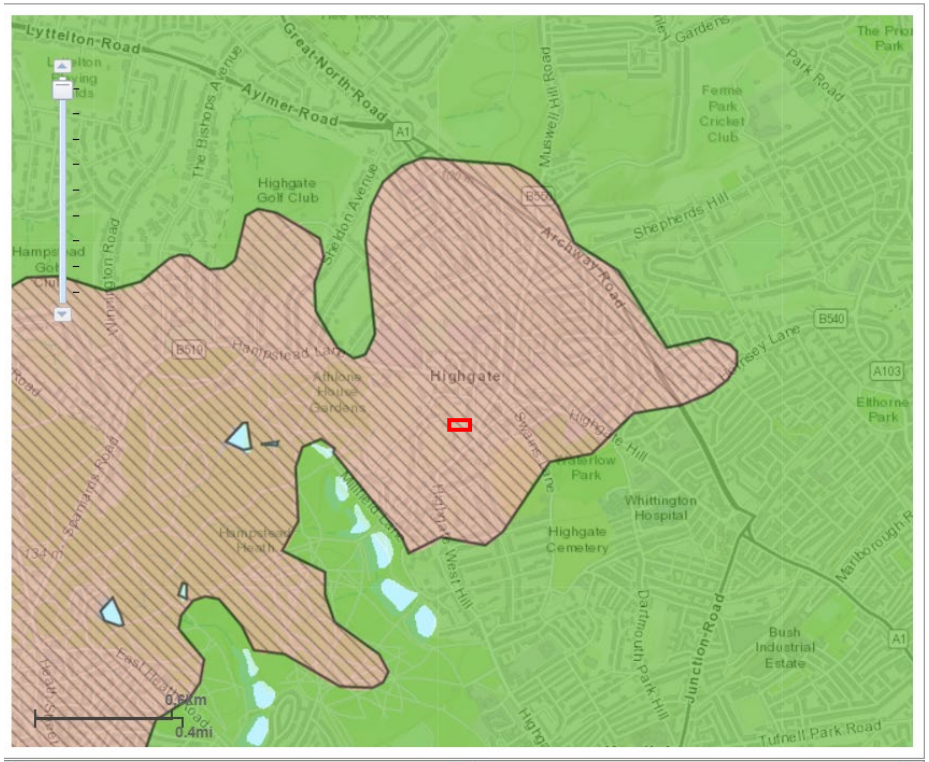
Extract taken from the UK Centre for Ecology and Hydrology – Flood Estimation Handbook Web Service (www.fehweb.ceh.ac.uk/Map)

PROJECT	4 The Grove, Highgate, London N6 6JU.
CLIENT	SODA Studio
TITLE	Highgate Ponds Catchment Characteristics
PROJECT REF	TE1723
DRAWING NO	TE1723-TE-00-XX-DR-GE-004-V01
SCALE	NTS@A3
DATE	May 2023

KEY:

Site Location.

Soilscapes map | Soil descriptions | Help | Search | Contact | About | LandIS



Adjust transparency

Legend

Search

Soil information

Soilscape 6:
Freely draining slightly acid loamy soils

Texture:
Loamy

Coverage:
England: 15.5% Wales: 24.4%
England & Wales: 16.7%

Selected area:
6.6km^2

Drainage:
Freely draining

Fertility:
Low

Habitats:
Neutral and acid pastures and deciduous woodlands; acid communities such as bracken and gorse in the uplands

Landcover:
Arable and grassland

Carbon:
Low

Drains to:
Local groundwater and rivers

Developed by Cranfield University and sponsored by DEFRA
For more detailed soil information visit Soil Site Reporter For soils education visit soil-net.com

TIER CONSULT

0 200m

Approximate Scale

Extract taken from the Cranfield Soil and Agrifood Institute Soilscapes website (www.landis.org.uk/soilscapes).

4 The Grove, Highgate, London N6 6JU. PROJECT

SODA Studio CLIENT

Soil Data TITLE

TE1723 PROJECT REF

TE1723-TE-00-XX-DR-GE-005-V01 DRAWING NO

NTS@A3 SCALE

May 2023 DATE

KEY:

- Site Location
- Flood Zone 3
- Flood Zone 2
- Flood Zone 1

0 80m

Approximate Scale

Extract taken from the Environment Agency Flood Map for Planning website (www.flood-map-for-planning.service.gov.uk)

PROJECT
4 The Grove, Highgate, London N6 6JU.

CLIENT
SODA Studio

TITLE
Environment Agency Flood Zones

PROJECT REF
TE1723

DRAWING NO
TE1723-TE-00-XX-DR-GE-006-V01

SCALE
NTS@A3

DATE
May 2023

KEY:

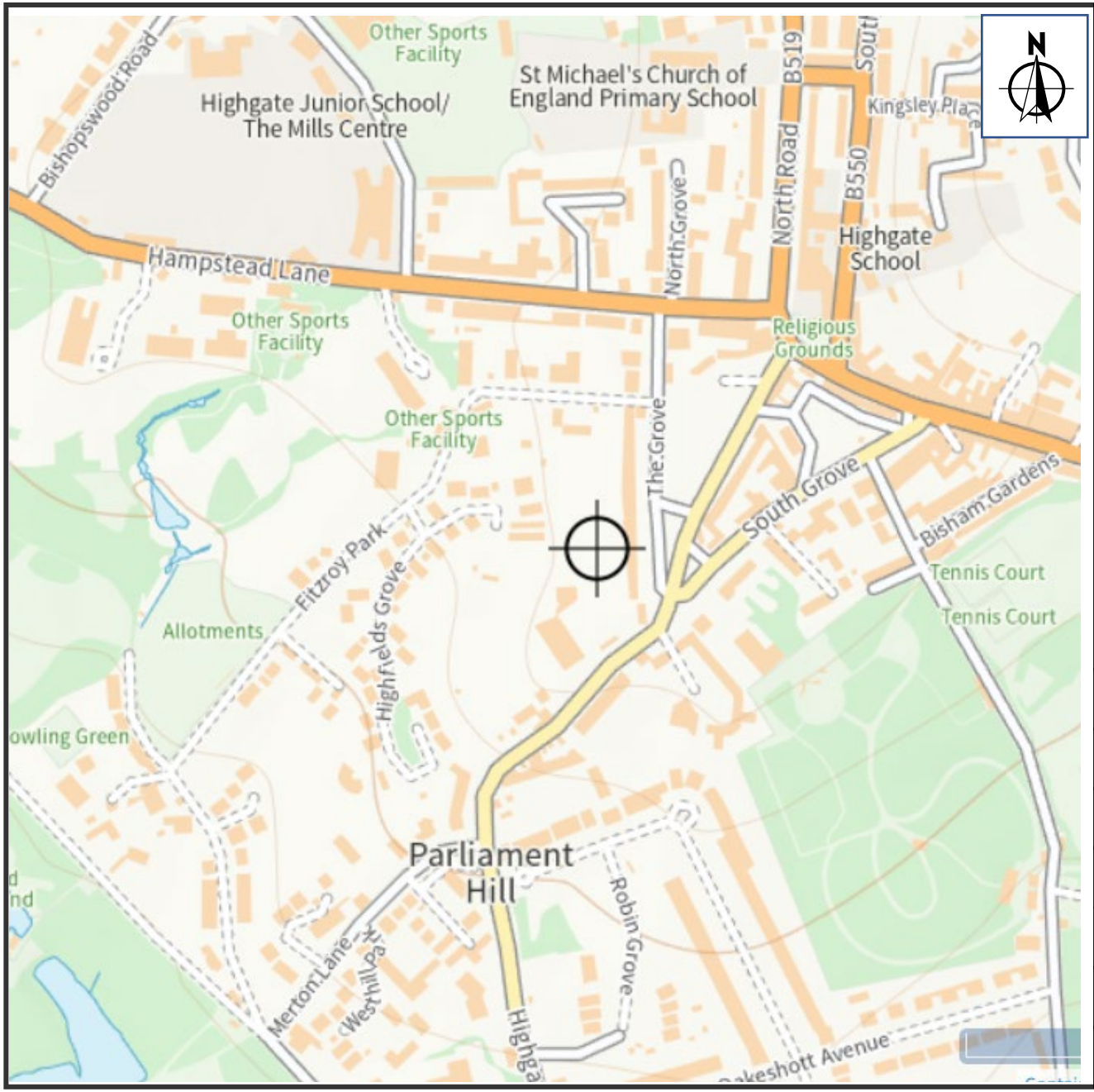
- High
- Medium
- Low
- Very Low
- Site Location

0 — 200m

Approximate Scale

Extract taken from the Environment Agency Flood Map for Planning website (www.flood-map-for-planning.service.gov.uk)

PROJECT	**4 The Grove, Highgate, London N6 6JU.**
CLIENT	**SODA Studio**
TITLE	**Environment Agency Surface Water Flood Risk Map**
PROJECT REF	**TE1723**
DRAWING NO	**TE1723-TE-00-XX-DR-GE-007-V01**
SCALE	**NTS@A3**
DATE	**May 2023**



KEY:

When river Levels are normal.

When there is also flooding from rivers.

Site Location.

TIER CONSULT

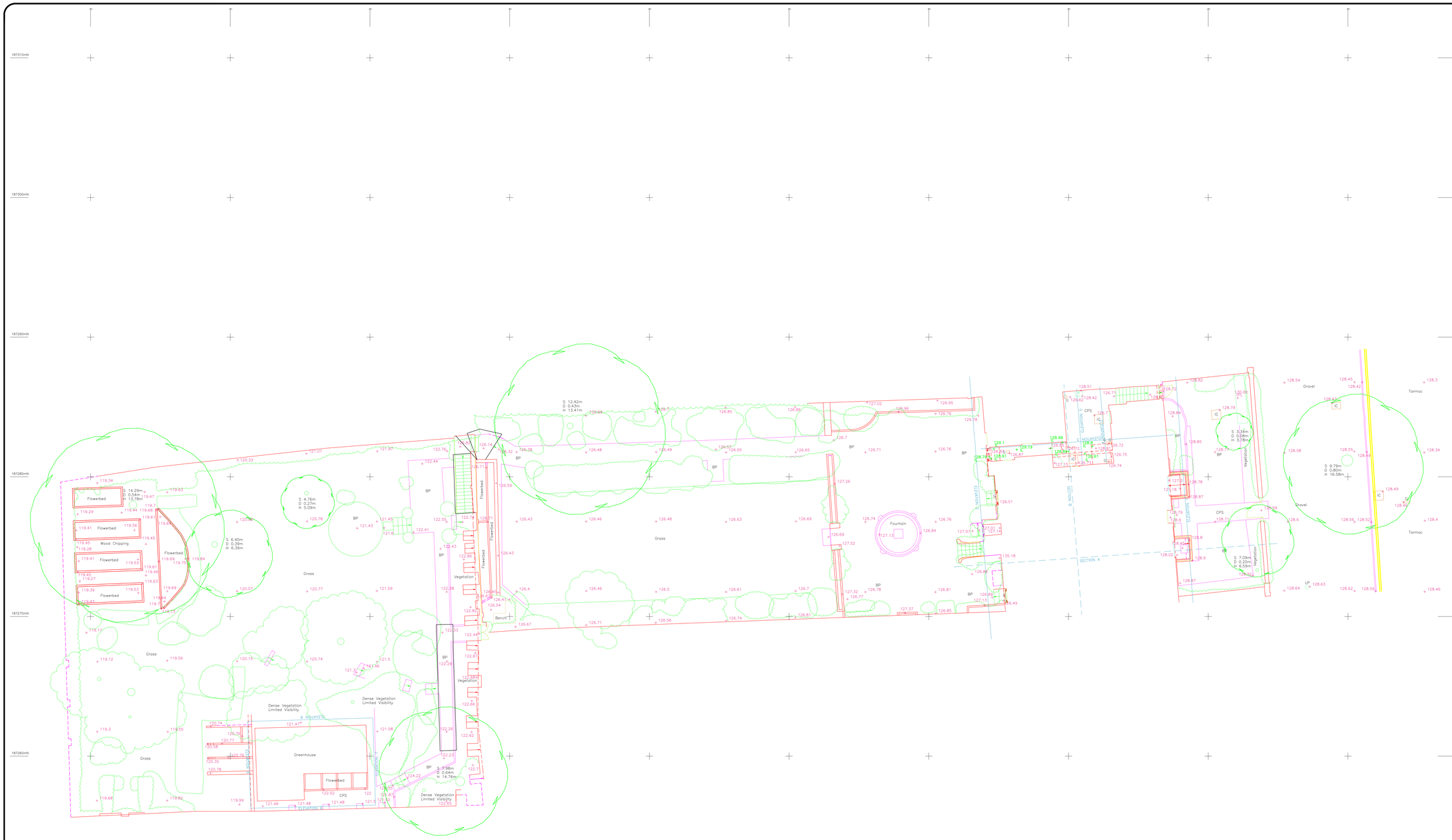
0 200m

Approximate Scale

Extract taken from the Environment Agency Flood Map for Planning website (www.flood-map-for-planning.service.gov.uk)

4 The Grove, Highgate, London N6 6JU.	PROJECT
SODA Studio	CLIENT
Environment Agency Reservoir Flood Risk Map	TITLE
TE1723	PROJECT REF
TE1723-TE-00-XX-DR-GE-008-V01	DRAWING NO
NTS@A3	SCALE
May 2023	DATE

APPENDIX B – THAMES WATER & TOPO SURVEY DRAWINGS



STANDARD ABBREVIATIONS

A/C	AIR CON UNIT	O/H	OVERHEAD
AH	ACCESS HATCH	OBF	OPEN BOARDED FENCE
B	BOLLARD	P	POST/POLE
BB	BRUSHAW BEACON	PB	POST BOX
BKW	BRICK WALL	PFC	PANEL FENCE-CONC
BP	BRICK PAVING	PFW	PANEL FENCE-WOOD
BS	BUS STOP	PL	PAVEMENT LIGHT
BWF	BARBED WIRE FENCE	PWF	POST & RAIL FENCE
CATV	CABLE TV IC	PWF	POST & WIRE FENCE
CB	CRASH BARRIER	(R)	FROM RECORDS
CBF	CLOSE BOARD FENCE	RAD	RADIATOR
CL	COVER LEVEL	RL	RIDGE LEVEL
CLF	CHAIN LINK FENCE	RS	ROAD SIGN
COL	COLUMN	RTW	RETAINING WALL
CONC	CONCRETE	RWP	RAIN WATER PIPE
CPS	CONC PAVING SLAB	SAPL	SAPLING
(disp)	DILAPIDATED	SB	SIGN BOARD
(dis)	DISUSED	SCL	SLOPING CEILING
DCH	DRAINAGE CHANNEL	SKL	SKYLIGHT
DK	DROP KERB	SL	SOFFIT LEVEL
DMR	DORMER WINDOW	SO	SMOKE OUTLET
EL	EAVE LEVEL	SUSP	SUSPENDED CEILING
ELIC	ELECTRIC IC	SV	STOP VALVE
ER	EARTHING ROD	SVP	SOIL VENT PIPE
FB	FLOWER BED	T	TELEPHONE (MISC.)
FH	FIRE HYDRANT	TCB	TELEPHONE CALL BOX
FL	FLOOR LEVEL	TIC	TELECOMS IC
FP	FLAG POLE	TL	TRAFFIC LIGHT
G	GULLY	TP	TELEGRAPH POLE
GV	GAS VALVE	TPL	TOP LEVEL
HT	HEIGHT	TPV	TACTILE PAVING
IC	INSPECTION COVER	(U)	UNIDENTIFIED
IL	INVERT LEVEL	(UTL)	UNABLE TO LIFT
IRF	IRON RAILING FENCE	VP	VENT PIPE
JB	JUNCTION BOX	W	WATER
KO	KERB OUTLET	WM	WATER METER
LB	LETTER BOX	WV	WATER VALVE
LP	LAMP POST		
MH	MAN HOLE		
MKR	MARKER		

TREE (Diameter (trunk) Height Spread (radius))
SINGLE DOOR
DOUBLE DOORS
GATE
SLOPE SYMBOL (Bottom–Top)
3333A SURVEY STATION
+ 26.34 SPOT LEVEL
2.50 CLEARANCE HEIGHT & TAG
FS 1.00 FLOOR TO SILL HEIGHT
SH 1.50 SILL TO HEAD HEIGHT
BA 1.50 FLOOR TO BOTTOM OF ARCH
TA 2.50 FLOOR TO TOP OF ARCH

SERVICE TRACING LEGEND AND NOTES

DRAINAGE & Flow Direction
WATER
GAS
Caution: Tracing of uPVC Gas Pipes Not possible, Gas Lines May Have Also Been Shown From Utility Records ONLY.
ELECTRICITY
TELECOM
CABLE TV
UNDERGROUND CHAMBER

Note:
All Pipe sizes in millimeters unless stated otherwise

CAUTIONARY NOTES

ELECTRO–DETECTION TECHNIQUES HAVE BEEN USED TO OBTAIN THE LOCATION OF UNDERGROUND SERVICES. THE RESULTS ARE NOT INFALLIBLE AND TRIAL EXCAVATIONS MUST BE CARRIED OUT TO CONFIRM SERVICE IDENTIFICATION, POSITIONS AND PARTICULARLY DEPTHS, ALTHOUGH ALL REASONABLE EFFORT HAS BEEN MADE IN SEARCHING AVAILABLE RECORD DRAWINGS, THE COMPLETENESS OF THE UNDERGROUND SERVICE INFORMATION CANNOT BE GUARANTEED.

Layout Plan

General Notes
All units are Metric.

Co-ordinate System
This survey is produced on:
A localised version of the Ordnance Survey National Grid with scale factor removed, derived from multiple GPS measurements.

Survey Accuracy
This survey has been carried out to an accuracy consistent with a scale presentation of that listed in title below. Interrogated dimensions will be within the tolerance associated with this and smaller scales only.

Bench Mark Details
Levels are related to:
The Ordnance Survey Level Datum via multiple GPS observations.

Rev	Date	By	Revision Details

Client
SODA Studio
1Bourchier Street
London
W1D 4HX

Title
4 The Grove
London
N6 6JU

Topographic Survey

Scale	1:100	Date	07/10/22
File	4TGAMSA-XX-XX-D-Y-00001	Check/ Approved	DB | B | A0
Sheet Number	1 OF 1	Job No.	5764

msa
msasurvey.com
Unit 15C
Oakcroft Road
Chessington
Surrey
KT9 1RH
T 020 8770 3390
F 020 8770 3391
msa@msasurvey.com
www.msasurvey.com

Drawing No.	S. Code	Rev.
5764-T	S1	P01

Asset location search

Property Searches

Tier Environmental
22St John Street
BROMSGROVE
B61 9QY

Search address supplied

4
The Grove
Highgate
London
N6 6JU

Your reference x

Our reference ALS/ALS Standard/2023_4817078

Search date 21 April 2023

Notification of Price Changes

From 1st April 2023 Thames water Property Searches will be increasing the prices of its CON29DW, CommercialDW Drainage & Water Enquiries and Asset Location Searches. Historically costs would rise in line with RPI but as this currently sits at 14.2%, we are capping it at 10%.

Customers will be emailed with the new prices by January 1st 2023.

Any orders received with a higher payment prior to the 1st April 2023 will be non-refundable. For further details on the price increase please visit our website at www.thameswater-propertysearches.co.uk

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

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

0800 009 4540

Asset location search

Property Searches

Search address supplied: 4, The Grove, Highgate, London, N6 6JU

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 0800 009 4540, or use the address below:

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

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Asset location search

Thames Water Property Searches

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

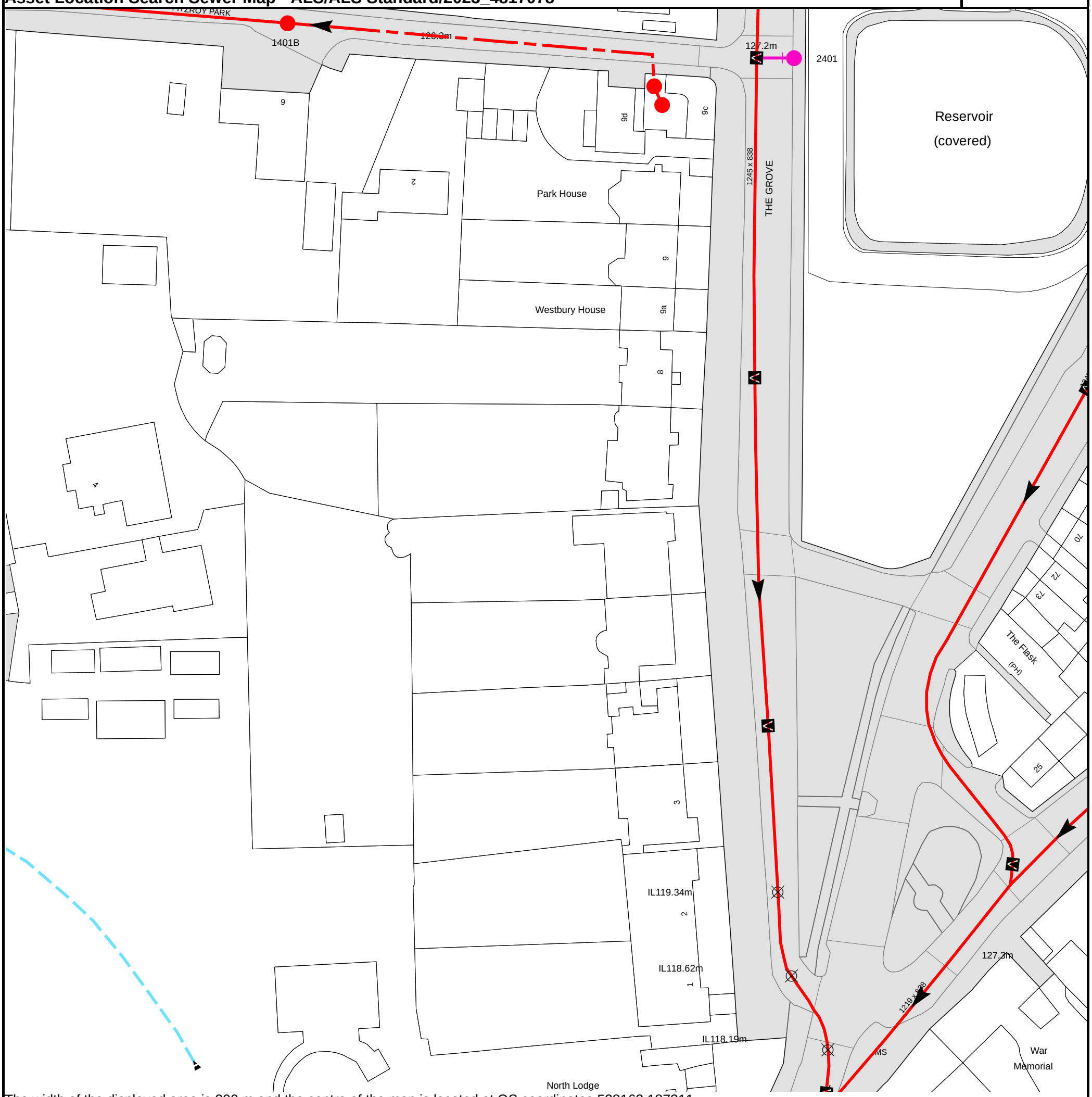
Clean Water queries

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/2023_4817078



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 528163,187311

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

Based on the Ordnance Survey Map (2020) with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

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

Manhole Reference	Manhole Cover Level	Manhole Invert Level
1401B	124.05	120.49
1302	n/a	n/a
1301	n/a	n/a
2401	n/a	n/a

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

Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

Foul Sewer: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water Sewer: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined Sewer: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

- Storm Sewer
- Sludge Sewer
- Foul Trunk Sewer
- Surface Trunk Sewer
- Combined Trunk Sewer
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Vacuum
- Thames Water Proposed
- Vent Pipe
- Gallery

Other Sewer Types (Not operated and maintained by Thames Water)

- Sewer
- Culverted Watercourse
- Proposed
- Decommissioned Sewer
- Content of this drainage network is currently unknown
- Ownership of this drainage network is currently unknown

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
- Meter
- Dam Chase
- Vent
- Fitting

Operational Controls

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

- Ancillary
- Drop Pipe
- Control Valve
- 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.

- Inlet
- Outfall
- Undefined End

Other Symbols

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

- Change of Characteristic Indicator
- Public / Private Pumping Station
- Invert Level
- Summit

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Chamber
- Operational Site

Ducts or Crossings

- Casement

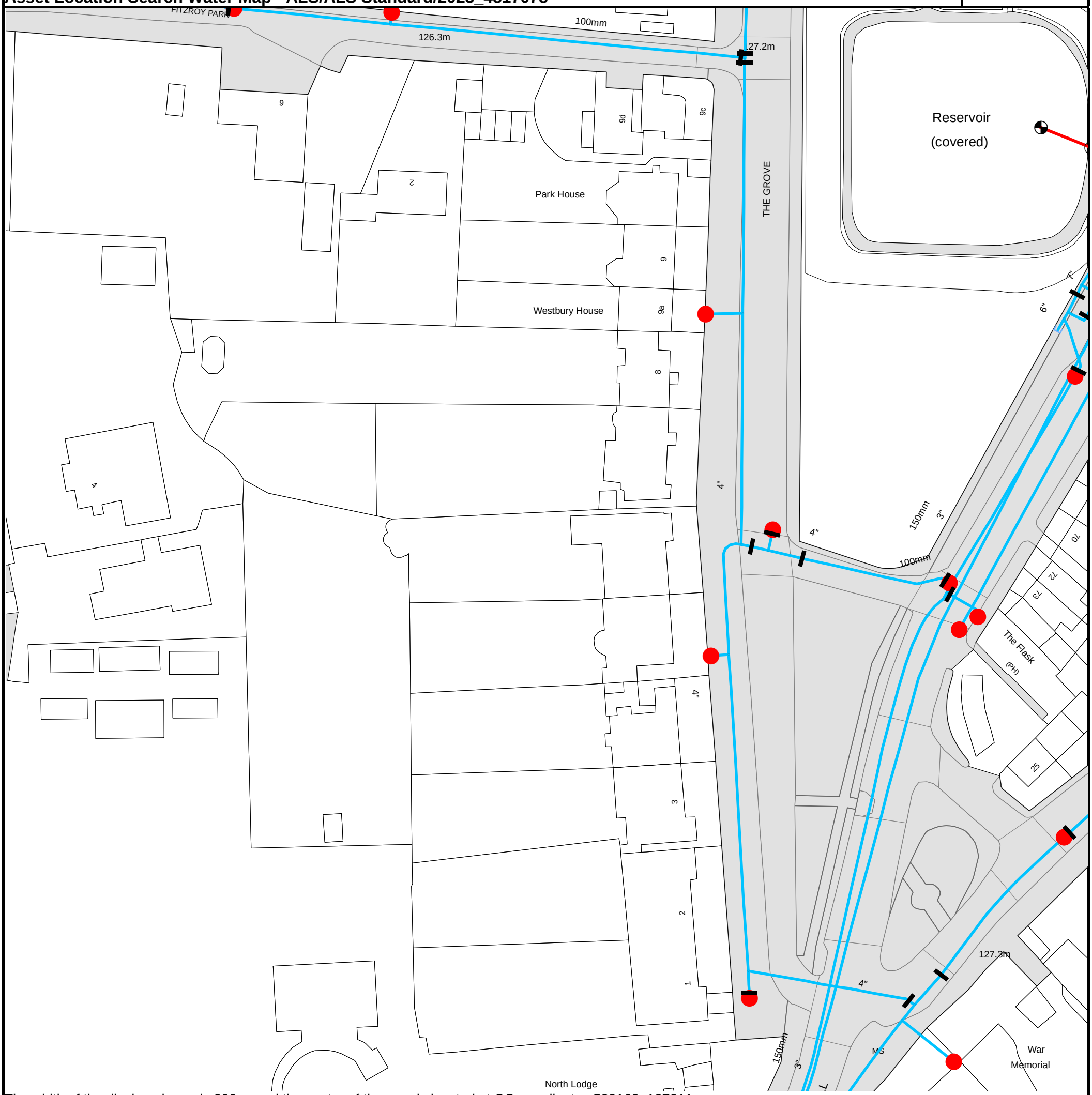
Ducts may contain high voltage cables. Please check with Thames Water.

- Conduit Bridge
- Subway
- Tunnel

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plan are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the 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 indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. 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, please contact Property Searches on 0800 009 4540.

Asset Location Search Water Map - ALS/ALS Standard/2023_4817078



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 528163, 187311.

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.

Asset Location Search - Water Key

Water Pipes (Operated & Maintained by Thames Water)

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

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

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

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

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

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

Valves

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

Hydrants

- Single Hydrant

Meters

- Meter

End Items

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

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

Operational Sites

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

Other Symbols

- Data Logger

Casement: Ducts may contain high voltage cables. Please check with Thames Water.

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.

Payment 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 within 14 days of the 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. 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'.
5. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
6. 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 still not satisfied with the outcome provided, we will refer the matter to a Senior Manager for resolution who will provide you with a response.

If you are still dissatisfied with our final response, and in certain circumstances such as you are buying a residential property or commercial property within certain parameters, The Property Ombudsman will investigate your case and give an independent view. The Ombudsman can award compensation of up to £25,000 to you if he finds that you have suffered actual financial loss and/or aggravation, distress, or inconvenience because of your search not keeping to the Code. Further information can be obtained by visiting www.tpos.co.uk or by sending an email to admin@tpos.co.uk.

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 0300 034 2222 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**
Please Call **0800 009 4540** quoting your invoice number starting CBA or ADS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number

Sewer Flooding
History Enquiry

Property Searches

Tier Environmental

St John Street

Search address supplied	4 The Grove Highgate London N6 6JU
Your reference	x
Our reference	SFH/SFH Standard/2023_4817077
Received date	**21 April 2023**
Search date	**21 April 2023**

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

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

0800 009 4540

Sewer Flooding
History Enquiry

Property Searches

Search address supplied: 4,The Grove,Highgate,London,N6 6JU

This search is recommended to check for any sewer flooding in a specific address or area

TWUL, trading as Property Searches, are responsible in respect of the following:-

(i) any negligent or incorrect entry in the records searched;

(ii) any negligent or incorrect interpretation of the records searched;

(iii) and any negligent or incorrect recording of that interpretation in the search report

(iv) compensation payments

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

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

0800 009 4540

Sewer Flooding
History Enquiry

Thames Water Property Searches

History of Sewer Flooding

Is the requested address or area at risk of flooding due to overloaded public sewers?

The flooding records held by Thames Water indicate that there have been no incidents of flooding in the requested area as a result of surcharging public sewers.

For your guidance:

- A sewer is "overloaded" when the flow from a storm is unable to pass through it due to a permanent problem (e.g. flat gradient, small diameter). Flooding as a result of temporary problems such as blockages, siltation, collapses and equipment or operational failures are excluded.
- "Internal flooding" from public sewers is defined as flooding, which enters a building or passes below a suspended floor. For reporting purposes, buildings are restricted to those normally occupied and used for residential, public, commercial, business or industrial purposes.
- "At Risk" properties are those that the water company is required to include in the Regulatory Register that is presented annually to the Director General of Water Services. These are defined as properties that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system more frequently than the relevant reference period (either once or twice in ten years) as determined by the Company's reporting procedure.
- Flooding as a result of storm events proven to be exceptional and beyond the reference period of one in ten years are not included on the At Risk Register.
- Properties may be at risk of flooding but not included on the Register where flooding incidents have not been reported to the Company.
- Public Sewers are defined as those for which the Company holds statutory responsibility under the Water Industry Act 1991.
- It should be noted that flooding can occur from private sewers and drains which are not the responsibility of the Company. This report excludes flooding from private sewers and drains and the Company makes no comment upon this matter.
- For further information please contact Thames Water on Tel: 0800 316 9800 or website www.thameswater.co.uk

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

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

0800 009 4540

APPENDIX C - GREENFIELD SURFACE WATER RUNOFF RATES

hr wallingford

Greenfield runoff
estimation for s

www.uksuds.com | Greenfield runc

Calculated by:	Andrew Harrison
Site name:	4 The Grove
Site location:	Camden

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:	51.56978°
Longitude:	0.15171°
Reference:	24131953
Date:	May 17 2023 16:

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha):	0.17

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Calculate from dominant HOST
HOST class:	6
BFI / BFIHOST:	0.402
Q_{MED} (l/s):	0.56
Q_{BAR} / Q_{MED} factor:	1.14

Hydrological characteristics

	Default	Edited
SAAR (mm):	661	662
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):	0.64	0.64
1 in 1 year (l/s):	0.54	0.54
1 in 30 years (l/s):	1.46	1.47
1 in 100 year (l/s):	2.03	2.04
1 in 200 years (l/s):	2.38	2.39

Project No. TE1723
Project Name: 4 The Grove, Camden
Date 22/05/2023

Greenfield Runoff Rates from hardstnding areas

Site Area 1700 m^2
Hardstanding Area 75 m^2 (Equal to approximately 4.4% of the total site area).

Return Period (Years)	Greenfield*	Existing	Post Development	Difference
Qbar	0.64	N/A	N/A	N/A
1 in 1	0.54	0.024	0.024	0.000
1 in 30	1.47	0.065	0.065	0.000
1 in 100	2.04	0.090	0.090	0.000
1 in 100 (+40%)	N/A	N/A	0.126	N/A

* Calculated from the HR Wallingford website.