Flood Risk Assessment and Surface Water Drainage Strategy for Planning

Prepared for:
Doyle Design LLP

Location:
28 Cranfield Gardens,
London
NW6 3LA

September 2020

Our reference:
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Unda Consulting Limited, Southpoint, Old Brighton Road, Gatwick, West Sussex, RH11 0PR
+44 (0) 1293 214 444
enquiries@unda.co.uk

Document Issue Record

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Application:	Construction of a basement extension				
Prepared for:	Doyle Design LLP				
Title:	Flood Risk Assessment and Surface Water Drainage Strategy for Planning				
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Written By:	P. Gander, A. Rousou BSc (Hons)	**Checked By:**	E. Bouet, BSc (Hons), E. Jeffery, MSc (Hons)	**Authorised By:**	E. Bouet, BSc (Hons)

1. Introduction

1.1. This Flood Risk Assessment and Surface Water Drainage Strategy has been prepared by Unda Consulting Limited on behalf of Doyle Design LLP, in support of a planning application for a basement extension at the site of 28 Canfield Gardens, London NW6 3LA. This report assesses the flood risk assessment and surface water drainage strategy for the proposed development.

1.2. The proposed planning application is for a basement extension to 28 Canfield Gardens, London. Post development, the internal layout of the basement will be reconfigured. The majority of the new floor space will be created beneath the existing building however a small extension will be constructed at the front and rear of the property to create additional lightwells. Overall, post development, the newly introduced built footprint will cover approximately 125m².

1.3. In order to mitigate flood risk posed by post development runoff, adequate control measures will be required within the site. This will ensure that surface water runoff is dealt with at source and the flood risk off site is not increased.

Figure 1: Site location (Source: Google Earth)

2. Existing Site:

2.1. The proposed development site is currently an existing four storey (including basement) mid-terraced residential town house. The overall plot is approximately 230m², however the existing impermeable areas of the site covers some 206m², which is 90% of the total site area. The existing site is predominantly brownfield with associated garden/yard areas to both the front and rear.

2.2. The Proposed Ground Floor Plan provided by the client is to an arbitrary datum and indicates that levels on site range between 49.19mAOD at the front of the property and 50.10mAOD in the rear garden.

Existing Ground Conditions:

2.3. No site investigation has been undertaken at this stage.

2.4. The bedrock geology taken from BGS records is London Clay Formation – Clay, Silt and Sand. Sedimentary Bedrock formed approximately 48 to 56 million years ago in the Ypresian Age.

2.5. No superficial geological deposits are recorded.

2.6. The soil type taken from the UK soils website shows deep prequaternary marine/estuarine sand and silt, with a clay to silt texture.

2.7. The published Environment Agency Groundwater Vulnerability map shows the site to be located outside of an area classified as a Groundwater Source Protection Zone.

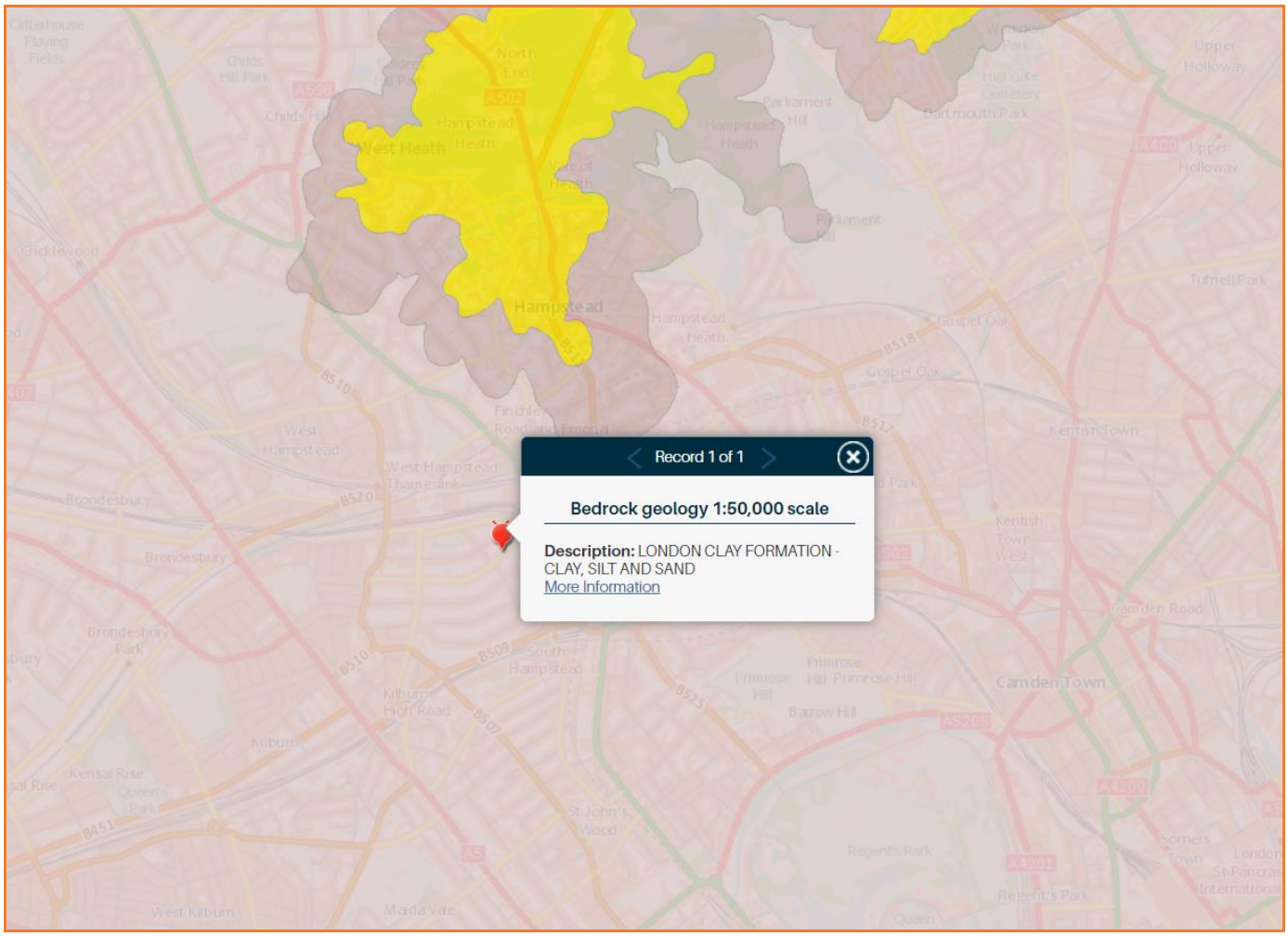


Figure 2: BGS Bedrock Geology (Source: BGS)

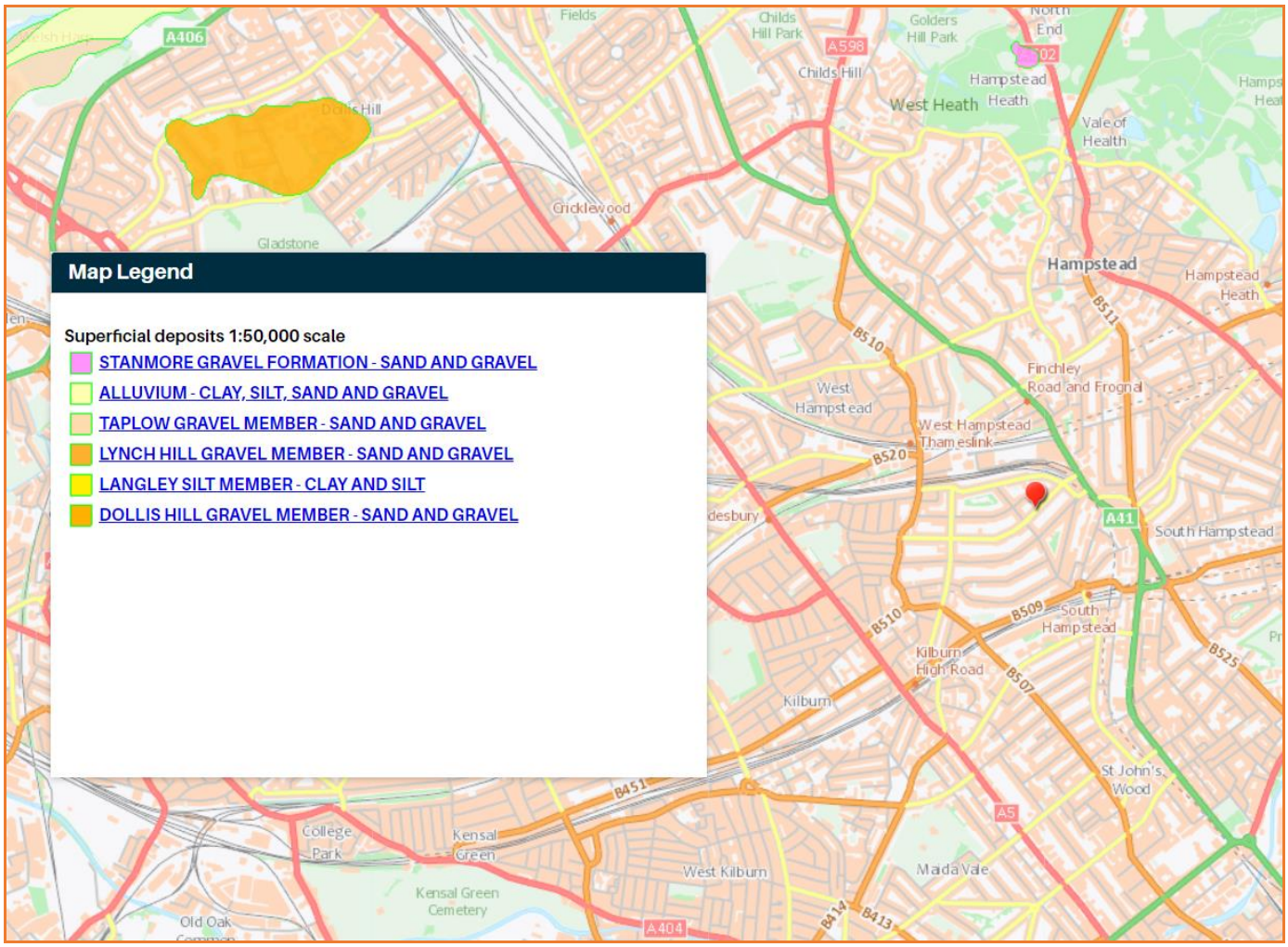


Figure 3: BGS Superficial Deposits (Source: BGS)

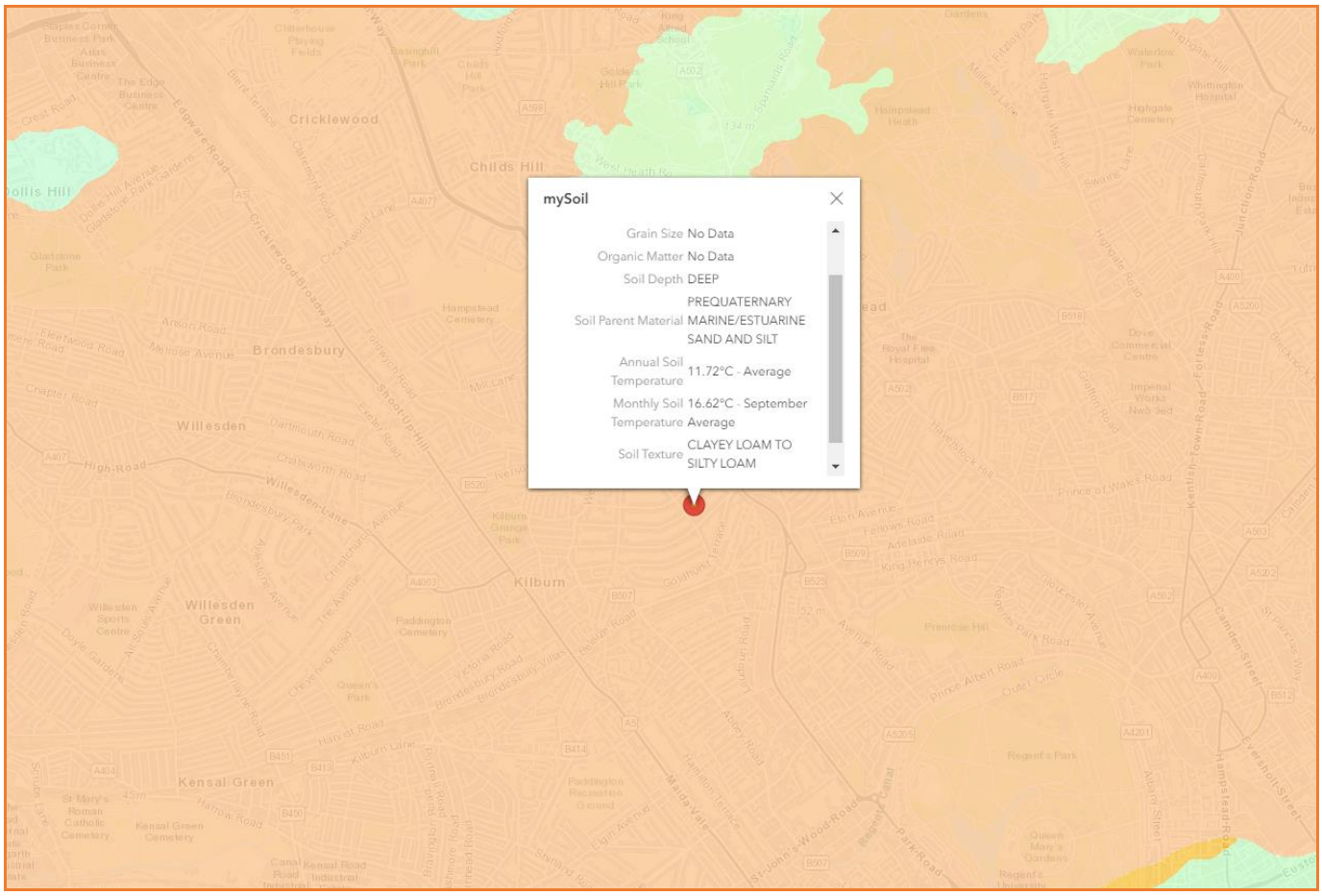


Figure 4: Soil Map (Source: UK Soils, BGS)

Nearby Watercourses / Drainage Features:

2.8. The closest watercourses to the site are drains that are likely to ultimately flow into the Thames, which is classified as an Environment Agency 'Main River' approximately 7.0km to the south east of the site. There are no drains / ditches located on site.

2.9. According to the Basement impact assessment (Site Analytical Services Ltd):

> 'With reference to Camden Geological, Hydrogeological and Hydrological Study (1999), Talling (2011) and Barton (1992) a tributary of the 'lost rivers' River Westbourne was located approximately within 5m of the site.'

Existing Drainage:

2.10. Asset records obtained from Thames Water Utilities Ltd (TWU) indicate the presence of a 940mm x 635mm combined water sewer flowing from north east to south west beneath Canfield Gardens.

2.11. It is assumed that surface water generated within the existing site currently discharges to ground or to the existing public combined sewer.

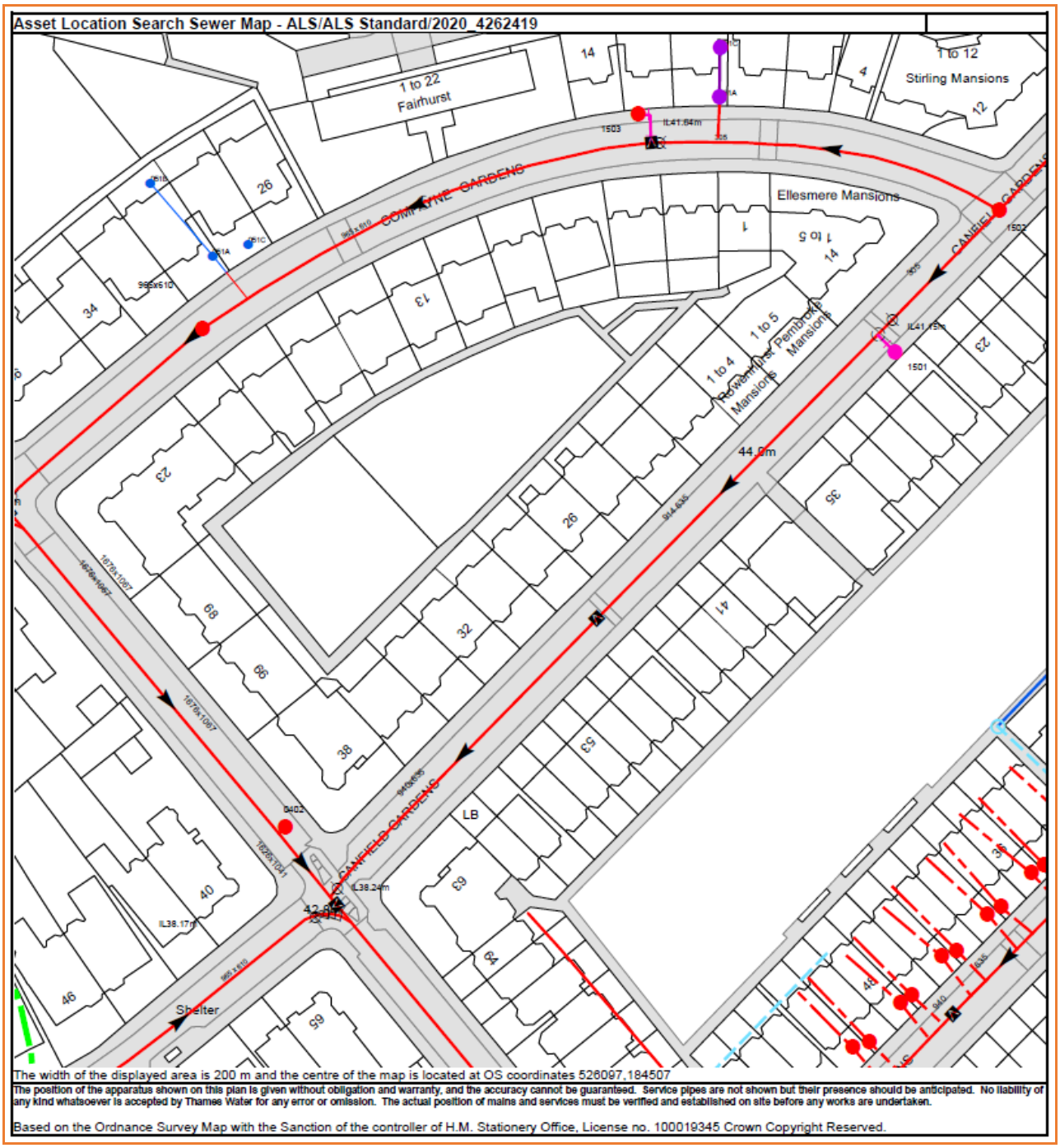


Figure 5: Existing Public Sewers (Source: Thames Water Asset Records)

3. Development Proposals:

Proposed Development:

3.1. The proposed planning application is for a basement front and rear extension to 28 Canfield Gardens, London NW6 3LA.

3.2. Post development, the internal layout of the basement will be reconfigured. The majority of the new floor space will be created beneath the existing building however a small extension will be constructed at the front and rear of the property to create additional lightwells.

3.3. Overall, post development, the built footprint will increase by approximately 17m² from 108m² to 125m², due to the provision of lightwells.

3.4. Despite this, attenuation sizing within the strategy has been based upon Policy CPG3 and will reduce runoff rates from the entire site by 50% thus provide significant betterment post development.

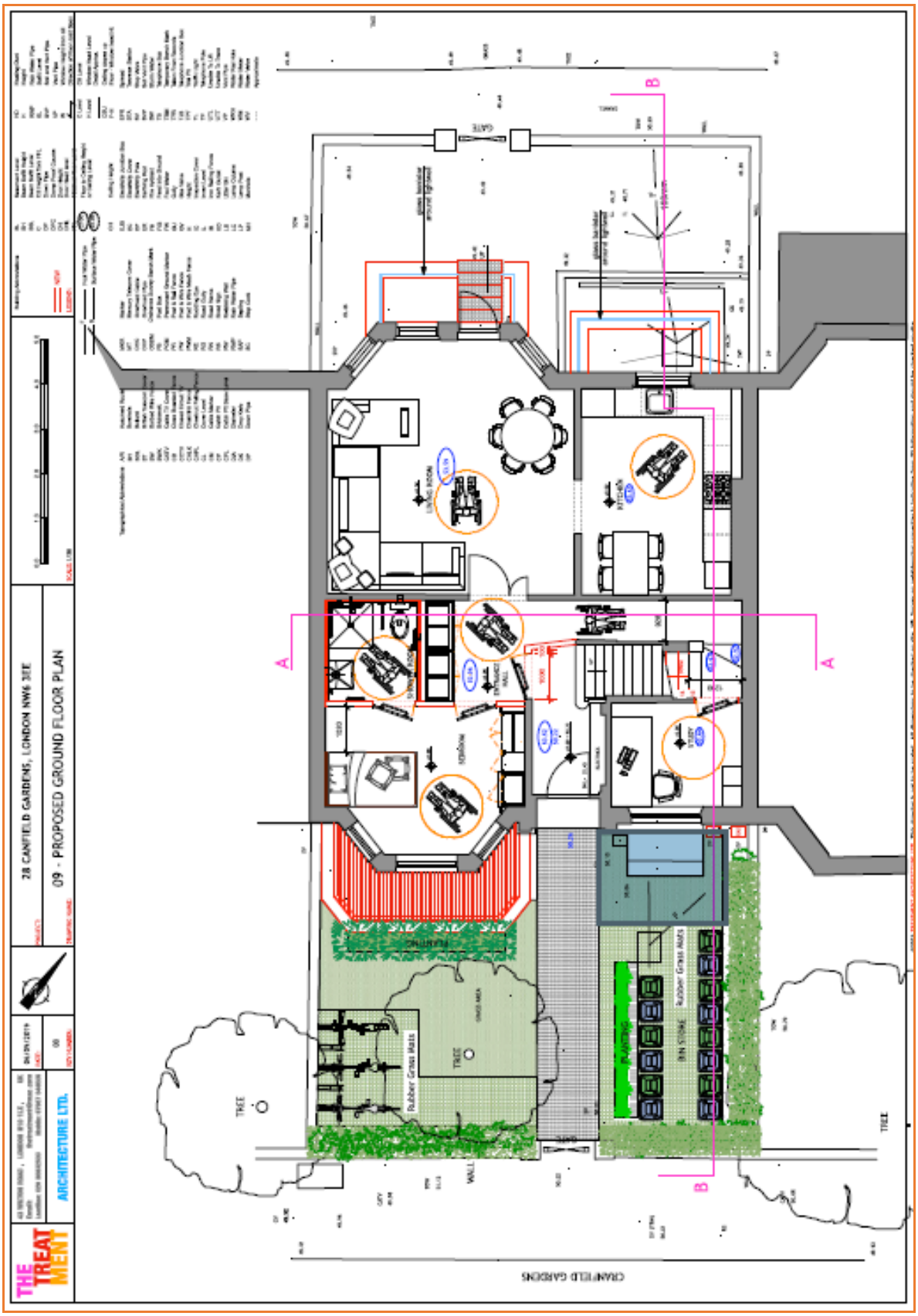


Figure 6: Proposed Ground Floor Layout (Source: The Treatment Architecture Limited)

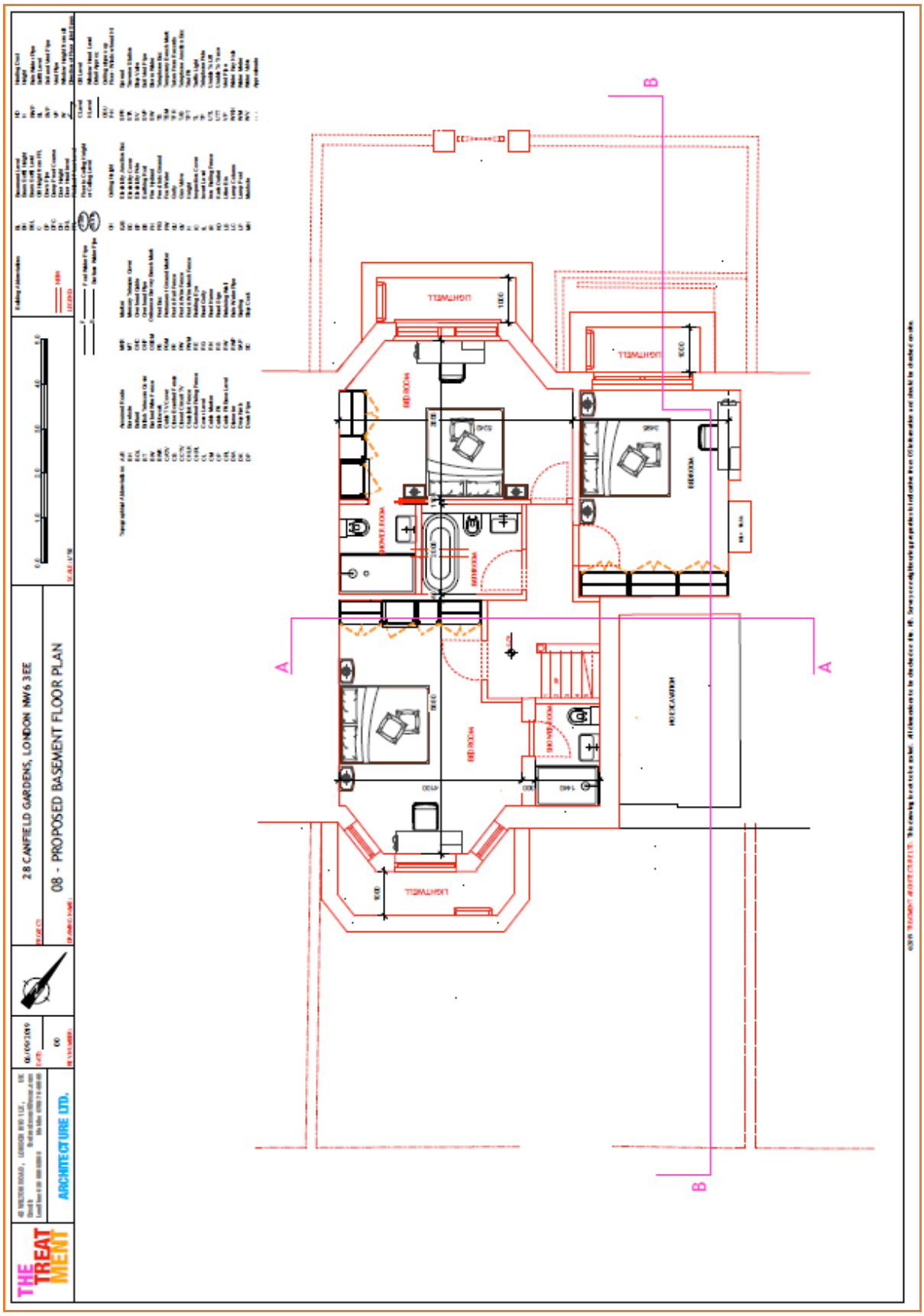


Figure 7: Proposed Basement Layout (Source: The Treatment Architecture Limited)

Vulnerability to flooding:

3.5. The NPPF classifies property usage by vulnerability to flooding. The existing site is currently classified as "more vulnerable" under the NPPF and will remain "more vulnerable" as the application is for the construction of a replacement residential dwelling.

3.6. Accordingly, it is considered that the vulnerability of the site as a whole will remain the same, post development.

4. Flood Risk Assessment:

Flood Zones:

4.1. Within planning, Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences. They are shown on the Environment Agency's Flood Map for Planning (Rivers and Sea), available on the Environment Agency's website.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

Table 1: Environment Agency Flood Map for Planning (Rivers and Sea) (Source: EA)

4.2. The Flood Zones shown on the Environment Agency's Flood Map for Planning (Rivers and Sea) do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding. Further investigation is therefore not required.

4.3. The existing and proposed dwelling footprints are located within Flood Zone 1 (Low Probability) which means it is defined as land having a less than 1:1000 annual probability of fluvial flooding.

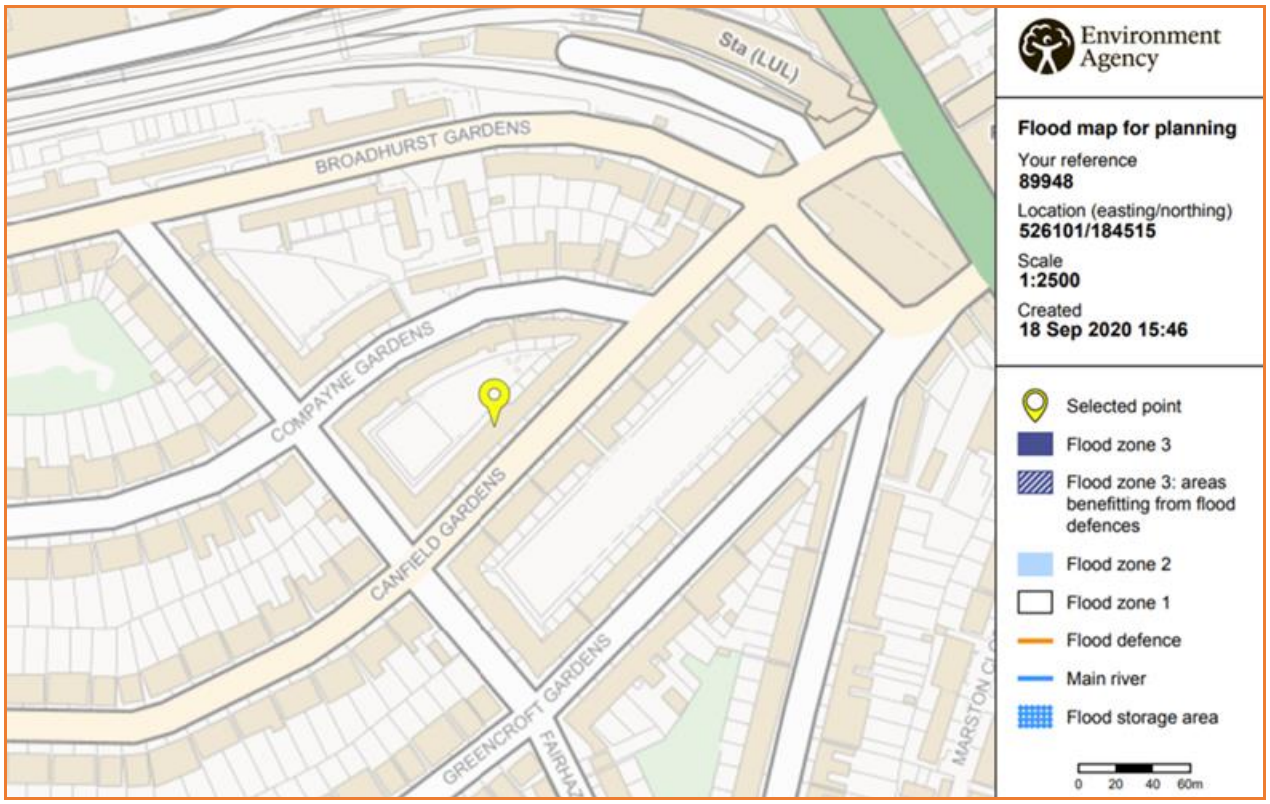


Figure 8: Environment Agency Flood Map for Planning (Rivers and Sea) (Source: EA)

Historical flood events:

4.4. The site is not located in an area that that has previously flooded according to the EA.

Pluvial:

4.5. Pluvial (surface water) flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but instead it lies on or flows over the ground instead.

4.6. In 2013 the EA, working with Lead Local Flood Authorities (LLFAs), produced an updated Flood Map for Surface Water. It is considered to represent a significant improvement on the previous surface water flood maps available, both in terms of method and representation of the risk of flooding. The modelling techniques and data used are considerably improved, and also incorporated locally produced mapping where this is available to represent features best modelled at a local scale.

4.7. The Flood Map for Surface Water assesses flooding scenarios as a result of rainfall with the following chance of occurring in any given year (annual probability of flooding is shown in brackets):

- 1 in 30 (3.3%)
- 1 in 100 (1%)
- 1 in 1000 (0.1%)

4.8. The mapping below shows the Risk of Flooding from Surface Water centred on the site. Please note that the EA to not consider this information suitable to be used to identify the risk to individual properties or sites. It is useful to raise awareness in areas which may be at risk and may require additional investigation.

4.9. The EA Risk of Flooding from Surface Water Map suggests that the majority of the site lies within an area of "Very Low" risk of flooding from surface water.

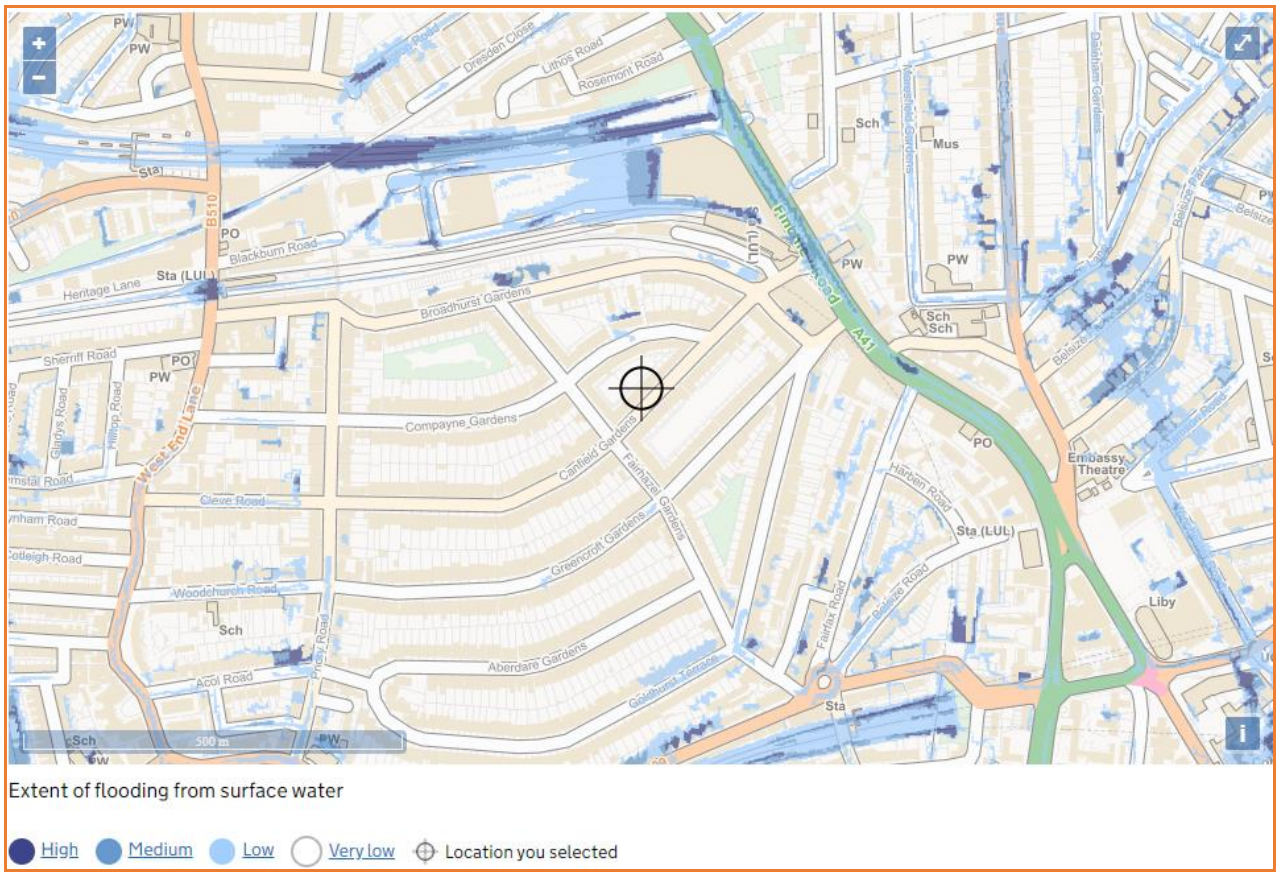


Figure 9: Extract from Environment Agency RoFSW map (Source: EA)

Groundwater:

4.10. Groundwater flooding occurs as a result of water rising up from the underlying rocks or from water flowing from abnormal springs. This tends to occur after much longer periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. Groundwater tends to flow from areas where the ground level is high, to areas where the ground level is low. In low-lying areas, the water table is usually at shallower depths anyway, but during very wet periods, with all the additional groundwater flowing towards these areas, the water table can rise to the surface causing groundwater flooding

4.11. Groundwater flooding is most likely to occur in low-lying areas underlain by permeable rocks (aquifers). These may be extensive, regional aquifers, such as chalk or sandstone, or may be localised sands or river gravels in valley bottoms underlain by less permeable rocks. Groundwater flooding takes longer to dissipate because groundwater moves much more slowly than surface water and will take time to flow away underground.

4.12. The London Borough of Camden SFRA indicates that the site lays within an area where 8 properties have been affected by groundwater flooding. The site is also located close to an EA groundwater flooding incident. However, the site is not located within an area of increased susceptibility to elevated groundwater.

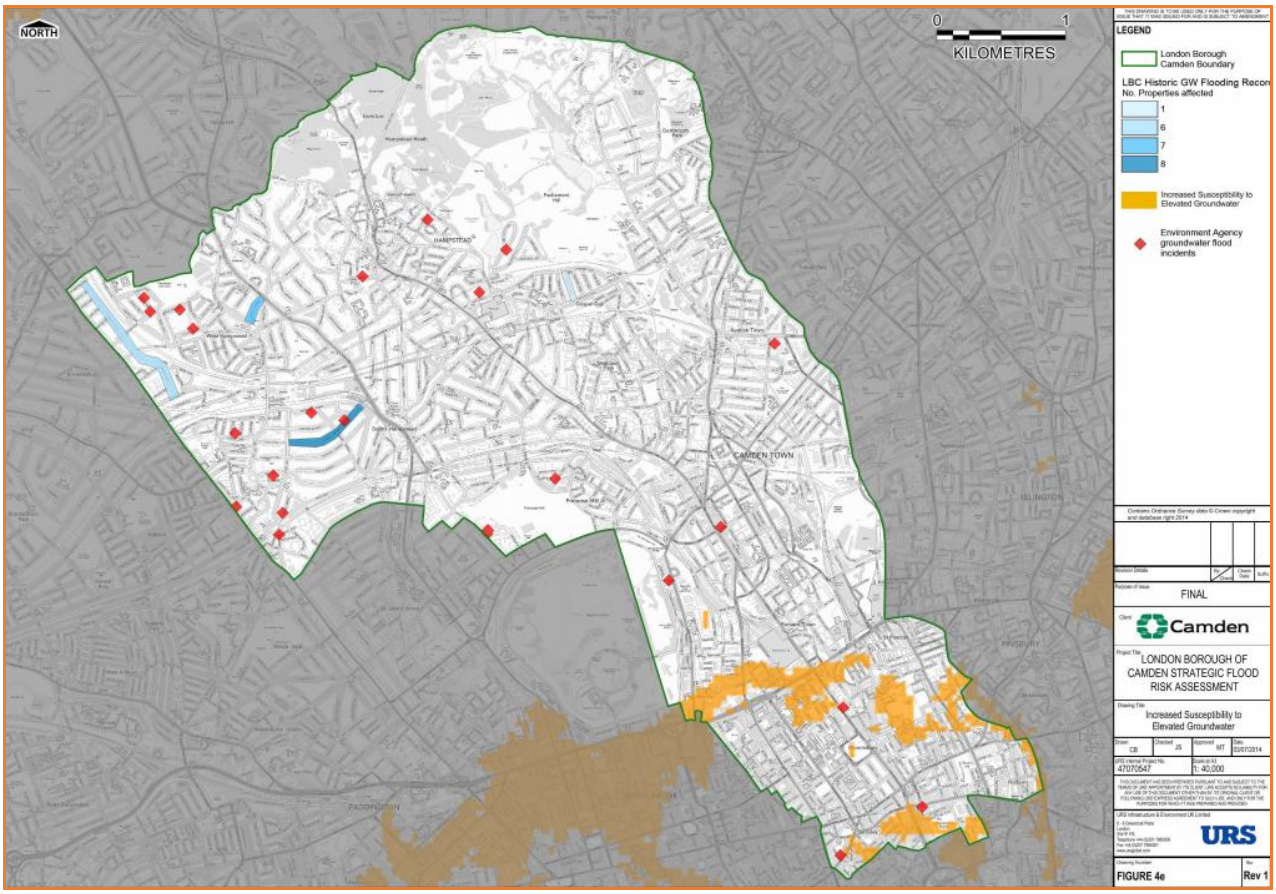


Figure 10: Increased Susceptibility to Elevated Groundwater (Source: London Borough of Camden SFRA)

4.13. No further information has been provided to suggest that the site has flooded from groundwater flooding previously.

Sewer:

4.14. Sewer flooding occurs when the sewer network cannot cope with the volume of water that is entering it. It is often experienced during times of heavy rainfall when large amounts of surface water overwhelm the sewer network causing flooding. Temporary problems such as blockages, siltation, collapses and equipment or operational failures can also result in sewer flooding.

4.15. All Water Companies have a statutory obligation to maintain a register of properties/areas which have reported records of flooding from the public sewerage system, and this is shown on the DG5 Flood Register. This includes records of flooding from foul sewers, combined sewers and surface water sewers which are deemed to be public and therefore maintained by the Water Company. The DG5 register records of flood incidents resulting in both internal property flooding and external flooding incidents. Once a property is identified on the DG5 register, water companies can typically put funding in place to address the issues and hence enable the property to be removed from the register. It should be noted that flooding from land drainage, highway drainage, rivers/watercourses and private sewers is not recorded within the register.

4.16. The London Borough of Camden SFRA indicates that the sites postcode of NW63 lies within an area where 18 properties have been affected by exterior sewer flooding and 8 properties that have been affected by internal sewer flooding.

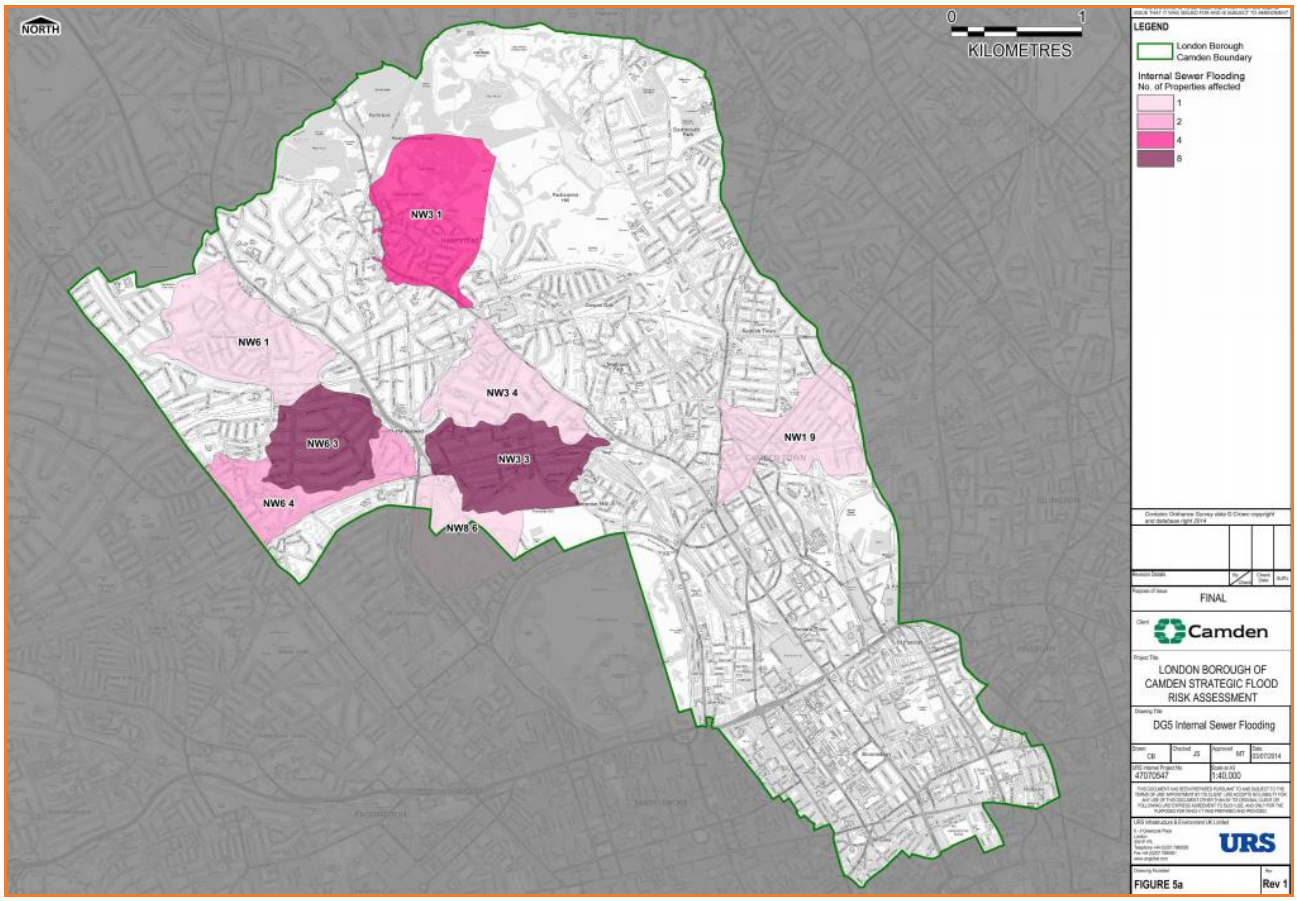


Figure 11: BG5 Internal Sewer Flooding (Source: London Borough of Camden SFRA)

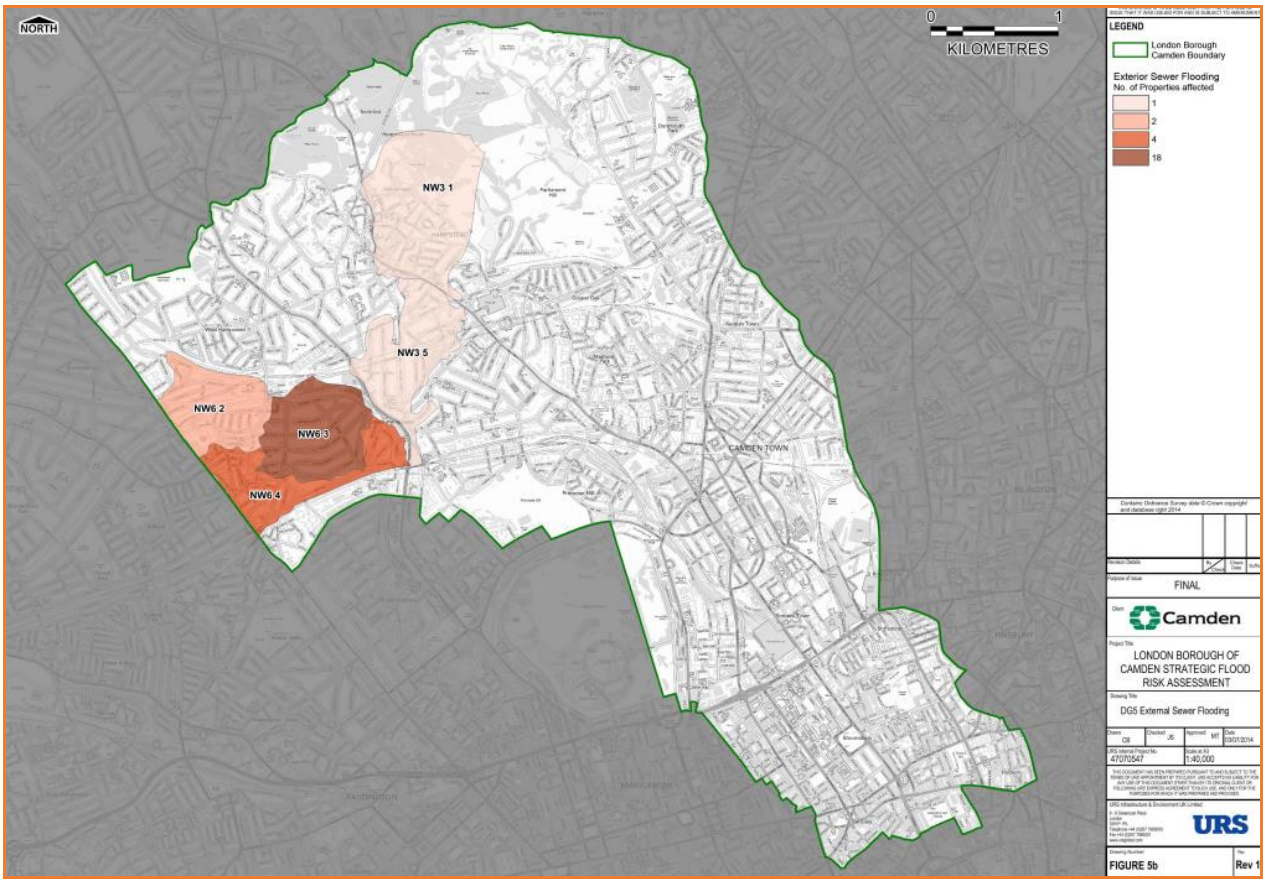


Figure 12: BG5 External Sewer Flooding (Source: London Borough of Camden SFRA)

4.17. No information has been provided to suggest that the site has flooded from sewer surcharge flooding previously.

Other Sources:

4.18. The EA Risk of Flooding from Reservoirs Map suggests that the site lies outside of the "Maximum extent of flooding" from reservoir failure, therefore, the EA advise on their website that reservoir flooding is extremely unlikely. The risk to the site from reservoir flooding is therefore minimal and is far lower than that relating to the potential for fluvial flooding to occur.

4.19. No further information has been provided to suggest the site is susceptible to from the failure of reservoirs, canals or other artificial infrastructure from the risk of flooding.

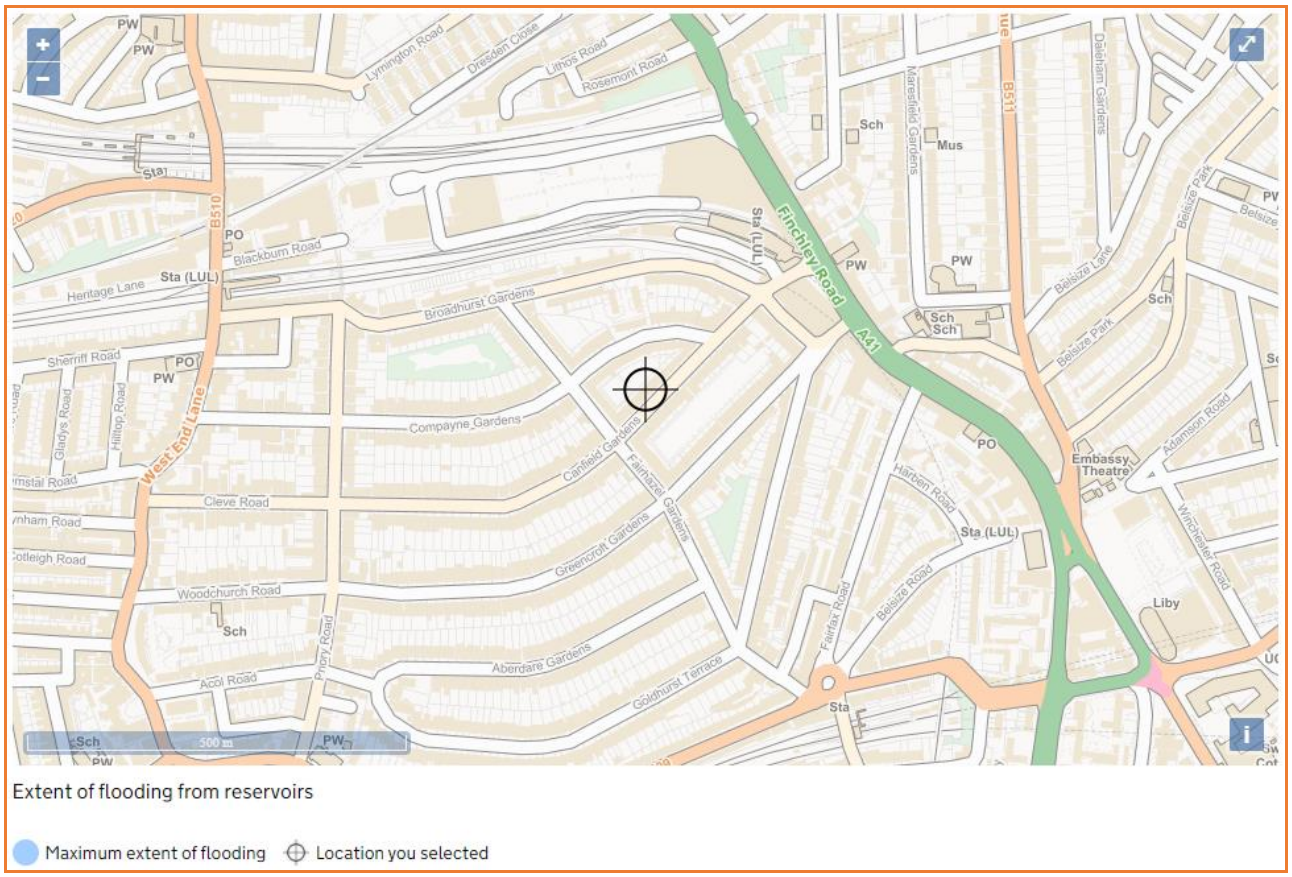


Figure 13: Extract from Environment Agency Reservoir Flooding map (Source: EA)

5. Surface Water Drainage Strategy:

5.1. In order to mitigate flood risk posed by post development runoff, adequate control measures will need to be considered within the site. This will ensure that surface water runoff is dealt with at source and flood risk is not increased elsewhere.

Drainage Hierarchy:

5.2. The drainage strategy for the site has been prepared according to the drainage discharge hierarchy from CIRIA C753 The Suds Manual, as follows:

- Infiltration to the maximum extent that is practical;
- Discharge to surface waters;
- Discharge to surface water sewer.

Infiltration Potential:

5.3. An intrusive site investigation has not been undertaken. BGS records indicate the site is underlain by London Clay Formation – Clay, Silt and Sand. No superficial geological deposits are recorded.

5.4. Due to the likely low infiltration rate, infiltration is considered inappropriate and an attenuation based drainage strategy has been proposed for the site, connecting to the existing drainage discharge arrangement.

Existing Discharge rates

5.5. The total area of the site is some 230m². This comprises of 108m² of roof area, 98m² of impermeable garden/yard, and 24m² of gravel/stone garden. Existing greenfield runoff rates for the site have been calculated as 0.0l/s for the 1:1 annual runoff event, 0.1l/s for the 1:30 year event and 0.1l/s for the 1:100 year event. Due to the very low greenfield runoff rate, we will be discharging both sets of cellular storage at a rate of 0.1 l/s combining to make a site discharge rate of 0.2 l/s.

Attenuation SuDS – Cellular Storage:

5.6. Roof runoff from the downpipes at the front of the house (54m²) and water that falls in the front lightwell (7.5m^2) will be collected and stored in a rainwater harvesting tank located beneath the bin area in the front garden. This will reduce the use of water and minimise current and future flood risk.

5.7. In Order to comply with CIRIA C753 The SuDS Manual, a 10% allowance will be added to the impermeable areas to take into account future urban creep. Applying a 10% allowance to the new front impermeable surfaces (61.5m^2) gives a value of 68m^2. Therefore, all drainage calculations within this assessment have been made based on a total impermeable area of 68m^2.

5.8. Roof runoff from the downpipes at the front of the house (54m²) and water that falls in the rear lightwells (9.5m^2) will be collected and stored in a rainwater harvesting tank located beneath the concrete paving slabs in the rear garden. This will reduce the use of water and minimise current and future flood risk.

5.9. In Order to comply with CIRIA C753 The SuDS Maunual, a 10% allowance will be added to the impermeable areas to take into account future urban creep. Applying a 10% allowance to the new rear impermeable surfaces (64.5m^2) gives a value of 71m^2. Therefore, all drainage calculations within this assessment have been made based on a total impermeable area of 71m^2.

5.10. Tank/attenuation sizing within the strategy has been based upon Policy CPG3 and will reduce runoff rates from the entire site by 50% thus provide significant betterment post development.

5.11. MicroDrainage software has been used to estimate the tank size requirement to provide adequate surface water run-off management (see Appendix).

5.12. The proposed total increase in impermeable surfacing will have a total area of 17m² to the house footprint. There is however a reduction of the front impermeable area meaning there is a total post development impermeable reduction of 32m^2.

Front Garden

5.13. Preliminary calculations indicate that sufficient storage required to attenuate runoff from the proposed impermeable areas (68m^2) arising from the critical 1:100 year + 40% climate change event can be provided within an attenuation storage tank of dimensions 6m^2 x 0.66m deep x 0.95 (voids).

5.14. Preliminary calculations indicate that approximately 3.76m^3 of storage is required to attenuate the runoff for all storms up to and including the 1:100 year + 40% climate change event. A pump would be proposed as the outlet control, restricting the maximum flow rate to 0.1l/s.

5.15. All preliminary surface water drainage calculations have been undertaken using MicroDrainage software. Refer to the appendix.

Rear Garden

5.16. Preliminary calculations indicate that sufficient storage required to attenuate runoff from the proposed impermeable areas (71m^2) arising from the critical 1:100 year + 40% climate change event can be provided within an attenuation storage tank of dimensions 6m^2 x 0.66m deep x 0.95 (voids).

5.17. Preliminary calculations indicate that approximately 3.76m^3 of storage is required to attenuate the runoff for all storms up to and including the 1:100 year + 40% climate change event. A pump would be proposed as the outlet control, restricting the maximum flow rate to 0.1l/s.

5.18. All preliminary surface water drainage calculations have been undertaken using MicroDrainage software. Refer to the appendix.

5.19. This system will manage the entire proposed additional roof area, proving significant betterment over the existing run off situation.

Water Quality:

5.20. Water quality has been assessed in line with the Simple Index approach from Chapter 26 of CIRIA C753 The SuDS Manual:

Step 1 – Allocate suitable pollution hazard indices for the proposed land use.

Step 2 – Select SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index.

5.21. The highest pollution hazard level for the proposed land use is Very Low (residential roofs). The pollution hazard indices for this land use are shown in Table 1 below.

Total suspended solids (TSS)	Metals	Hydrocarbons
0.2	0.2	0.05

Table 1: Pollution Hazard Indices for the proposed site (from Table 26.2 of CIRIA C753 The SuDS Manual)

5.22. Runoff from roof areas is considered to be uncontaminated and does not warrant any form of treatment process to improve water quality prior to discharge to the public sewer.

Design Exceedance:

5.23. Should the onsite drainage system fail under extreme rainfall events or blockage, flooding may occur within the site. In the event of the drainage system failure, the runoff flow can be managed through detailing the new external levels to direct water away from structures.

Adoption and Maintenance:

5.24. It is proposed that all SuDS facilities will be maintained privately by the end user.

A draft Maintenance Schedule is outlined in the Table below.

Cellular Storage:

5.27. It is not envisaged that silt build up within the cellular crate systems will require a rigorous maintenance regime so long as silt is removed from upstream catch pits and inspection chambers on a regular basis. Notwithstanding this, a suitable maintenance regime for the systems will comprise of routine inspection and silt removal (as necessary). Inspection should be undertaken using CCTV equipment offered up the inspection tunnels located within the crate system. Camera access can be gained via inspection chambers and inlet pipework located at each end of the tunnels.

5.28. Silt removal can be achieved by jetting the inspection tunnels. Jetting should be undertaken in accordance with current jetting guidelines, in particular the Code of Practice for Sewer Jetting published by The Water Research Centre. Jetting at 150bar at 300l/min should be more than adequate in removing any build-up of material within the tunnel. The crate system will take higher pressures. However, unlike regular jetting which relies heavily on high pressure to remove hardened deposits on the inner bore of pipes, effective cleansing of a crate system relies more on the delivery flow rate to flush solids back through the system.

5.29. A standard jet head with rear facing nozzles should be used. The head should be fed to the far end of the crate tunnel via the nearest inspection chamber, activated and retracted. As the nozzle is removed, debris will be swept back into the inspection chamber where it can then be removed with the use of a standard gully sucker. This method will ensure the effective removal of gross solids (carrier bags, cans, leaf litter etc.) from the system. Whilst 100% removal cannot be guaranteed, it has been shown that this jetting method will also remove an element of finer material which would otherwise be 'lost' within the system.

Pipework and Catchpits:

5.30. It is not envisaged that silt build up within the pipework systems will require a rigorous maintenance regime so long as silt is removed from upstream catch pits on a regular basis. Notwithstanding this, a suitable maintenance regime for the systems will comprise of routine inspection (every three months) and silt removal (as necessary).

Pumps:

5.31. The proposed pumps should be maintained in strict accordance with the manufacturer's instructions.

Drainage Element	Maintenance Requirement	Frequency
Gutters & Downpipes	Inspect and remove silt/ debris	To be inspected every three months and silt/ debris removed as necessary.
Catchpits and Inspection Chambers	Inspect and remove silt	To be inspected every three months and silt/ debris removed as necessary. Flow control to be checked for blockages.
Cellular Storage	Inspect and remove debris	CCTCV inspection following first storm event. Monthly CCTV inspections for first 3 months. 6 monthly CCTV inspections thereafter. Jetting to remove silt as necessary.
Flow Controls	Inspected for blockage and blockage / debris build up removed	Every six months

Table 6: Suggested Maintenance Regime for Elements of the Drainage Infrastructure

Note: In addition to the above maintenance requirements, it is recommended that all drainage elements are inspected:

- Following the first storm event
- Monthly for the first 3 months following commissioning

6. Flood Risk Mitigation:

Physical Design Measures:

6.1. The NPPF requires residential finished floor levels to be 300mm above the modelled 1:100-year flood level with allowance for Climate Change.

6.2. However, the proposed development area lies within Flood Zones 1 according to the EA Flood Map for planning (Rivers and the Sea).

6.3. To help protect against flooding during extreme events, the application has agreed to implement flood resistant design measures into the new properties, in consultation with the Local Authority building control department. These measures can include the following:

- Solid concrete ground floor slab, with waterproof membrane;
- Waterproof screed used on floors;
- Closed-cell foam used in wall cavities;
- Waterproof ground floor internal render;
- External walls rendered resistant to flooding to first floor level;
- Exterior ventilation outlets, utility points and air bricks fitted with removable waterproof covers;
- Ground floor electrical main ring run from first floor level; and on separately switched circuit from first floor;
- Electrical incomer and meter situated at first floor level or above;
- Boilers, control and water storage / immersion installed at first floor level or above;
- Gas meter installed at first floor level or above;
- Plumbing insulation of closed-cell design;
- Non-return valves fitted to all drain and sewer outlets;
- Manhole covers secured;
- Anti-syphon fitted to all toilets;
- Kitchen units of solid, water resistant material;
- Use of MDF carpentry (i.e. skirting, architrave, built-in storage) avoided at ground floor level;
- Stairs of solid hardwood construction with wood faces treated to resist water penetration.

6.4. The applicant should also consider the use of demountable flood defence barriers to defend ground level doorways and low windows.

Safe Escape:

6.5. The NPPF requires a route of safe escape for all residents and uses to be provided from residential properties in Flood Zone 3. Safe escape is usually defined as being though slow-moving flood water no deeper than 25cm.

6.6. Safe escape can be provided to an area entirely within Flood Zone 1.

Flood Warning:

6.7. The EA is responsible for issuing flood warnings. Flood warnings are issued to the emergency services and local authorities. Both private individuals and organisations can sign-up to receive warnings via phone, text or email. This system of receiving warnings is currently voluntary.

6.8. Advice regarding severe flood warnings will generally be given during weather forecasts on local radio and TV. In the case of extreme events, warnings can also be disseminated via door to door visits by the police or locally appointed flood wardens.

6.9. The EA issue flood warnings to specific areas when flooding is expected. It is recommended that the applicant registers online with the free Environment Agency Floodline Warnings/Alert Direct service at https://fwd.environment-agency.gov.uk/app/olr/register to receive flood warnings by phone, text or email.

6.10. The flood warning service has three types of warnings that will help you prepare for flooding and take action:

Flood Warning	Flood Alert	Flood Warning	Severe Flood Warning
			
What it means?	Flooding is possible. Be prepared.	Flooding is expected. Immediate action required.	Severe flooding. Danger to life.
When it's used?	Two hours to two days in advance of flooding.	Half an hour to one day in advance of flooding.	When flooding poses a significant threat to life.
What to do?	Be prepared to act on your flood plan. Prepare a flood kit of essential items. Monitor local water levels and the flood forecast on our website.	Move family, pets and valuables to a safe place. Turn off gas, electricity and water supplies if safe to do so. Put flood protection equipment in place.	Stay in a safe place with a means of escape. Be ready should you need to evacuate from your home. Co-operate with the emergency services. Call 999 if you are in immediate danger.

Table 7: Flood Warnings

Flood Plan:

6.11. It is recommended that the applicant and future owners, occupiers and Landlords of the property prepare a flood plan to protect life and property during a flood event:

Before a flood:

- Find out if you are at risk of flooding.
- Find out if you can receive flood warnings.
- Prepare and keep a list of all your important contacts to hand or save them on your mobile phone.
- Think about what items you can move now and what you would want to move to safety during a flood such as pets, cars, furniture, and electrical equipment.
- Know how to turn off gas, electricity and water supplies.
- Prepare a flood kit of essential items and keep it handy. It can include copies of important documents, a torch, a battery-powered or wind-up radio, blankets and warm clothing, waterproofs, rubber gloves and a first aid kit including all essential medication.
- Consider buying flood protection products such as flood boards and airbrick covers to help reduce flood water getting into your property.

During a flood:

- Tune into your local radio station on a battery or wind-up radio.
- Fill jugs and saucepans with water.
- Grab your flood kit - if you have prepared one.
- Collect blankets, torch, first aid kit, medication and food.
- Move important documents, personal items, valuables, and lightweight belongings upstairs or to high shelves.
- Raise large items of furniture or put them in large bags if you have them.
- Move people, outdoor belongings, cars and pets to higher ground.
- Switch off water, gas and electricity at mains when water is about to enter your home. Do not touch sources of electricity when standing in water.

- Fit flood protection products, if you have them, for example flood boards, airbrick covers, sandbags.
- Put plugs in sinks and baths. Weigh them down with a pillowcase or plastic bag filled with soil.
- If you do not have non-return valves fitted, plug water inlet pipes with towels or cloths.
- Move your family and pets upstairs or to a high place with a means of escape.
- Listen to the advice of the emergency service and evacuate if told to do so.
- Avoid walking or driving through flood water. Six inches of fast-flowing water can knock over an adult and two feet of water can move a car.

After a flood:

- If you have flooded, contact your insurance company as soon as possible.
- Take photographs and videos of your damaged property as a record for your insurance company.
- If you do not have insurance, contact your local authority for information on grants and charities that may help you.
- Flood water can contain sewage, chemicals and animal waste. Always wear waterproof outerwear, including gloves, wellington boots and a face mask.
- Have your electrics, central heating and water checked by qualified engineers before switching them back on.

7. Discussion and Conclusions:

7.1. This Flood Risk Assessment and Surface Water Drainage Strategy has been prepared by Unda Consulting Limited on behalf of Doyle Design LLP, in support of a planning application for a basement extension at the site of 28 Canfield Gardens, London NW6 3LA. This report assesses the flood risk assessment and surface water drainage strategy for the proposed development.

7.2. The proposed planning application is for a basement extension to 28 Canfield Gardens, London. Post development, the internal layout of the basement will be reconfigured. The majority of the new floor space will be created beneath the existing building however a small extension will be constructed at the front and rear of the property to create additional lightwells. Overall, post development, the newly introduced built footprint will cover approximately 125m².

7.3. The proposed development site is currently an existing four storey (including basement) mid-terraced residential town house. The overall plot is approximately 230m², however the existing impermeable areas of the site covers some 206m², which is 90% of the total site area. The existing site is predominantly brownfield with associated garden/yard areas to both the front and rear.

7.4. Asset records obtained from Thames Water Utilities Ltd (TWU) indicate the presence of a 940mm x 635mm combined water sewer flowing from north east to south west beneath Canfield Gardens.

7.5. It is assumed that surface water generated within the existing site currently discharges to ground or to the existing public combined sewer.

7.6. The Proposed Ground Floor Plan provided by the client indicates that levels on site range between 49.19mAOD at the front of the property and 50.10mAOD in the rear garden.

7.7. Overall, post development, the built footprint will increase by approximately 17m² from 108m² to 125m², due to the provision of lightwells.

7.8. The bedrock geology taken from BGS records is London Clay Formation – Clay, Silt and Sand. Sedimentary Bedrock formed approximately 48 to 56 million years ago in the Ypresian Age. BGS mapping indicates that there are no superficial deposits.

7.9. The soil type taken from the UK soils website shows deep prequaternary marine/estuarine sand and silt, with a clay to silt texture.

7.10. The published Environment Agency Groundwater Vulnerability map shows the site to be located outside of an area classified as a Groundwater Source Protection Zone.

7.11. There are no watercourses within the immediate vicinity of the property.

Flood Risk Discussion

7.12. The existing and proposed dwelling footprints are located within Flood Zone 1 (Low Probability) which means it is defined as land having a less than 1:1000 annual probability of fluvial flooding.

7.13. To help protect against flooding during extreme events, the applicant has agreed to implement flood resistant design measures as outlined on page 22.

7.14. The EA Risk of Flooding from Surface Water Map suggests that the site lies within an area of “Very Low” risk of flooding from surface water.

7.15. The London Borough of Camden SFRA indicates that the site lays within an area where 8 properties have been affected by groundwater flooding. The site is also located close to an EA groundwater flooding incident. However, the site is not located within an area of increased susceptibility to elevated groundwater.

7.16. The London Borough of Camden SFRA indicates that the sites postcode of NW63 lies within an area where 18 properties have been affected by exterior sewer flooding and 8 properties that have been affected by internal sewer flooding.

7.17. No further information has been provided to suggest that the site has flooded from sewer surcharge or groundwater flooding previously.

Surface Water Drainage Strategy Discussion

7.18. An intrusive site investigation has not been undertaken. BGS records indicate the site is underlain by London Clay Formation – Clay, Silt and Sand. No superficial geological deposits are recorded.

7.19. Due to the likely low infiltration rate, infiltration is considered inappropriate and an attenuation based drainage strategy has been proposed for the site, connecting to the existing drainage discharge arrangement.

7.20. The total area of the site is some 230m². This comprises of 108m² of roof area, 98m² of impermeable garden/yard, and 24m² of gravel/stone garden. Existing greenfield runoff rates for the site have been calculated as 0.0l/s for the 1:1 annual runoff event, 0.1l/s for the 1:30 year event and 0.1l/s for the 1:100 year event. Due to the very low greenfield runoff rate, we will be discharging both sets of cellular storage at a rate of 0.1 l/s combining to make a site discharge rate of 0.2 l/s.

7.21. Roof runoff from the downpipes at the front of the house (54m²) and water that falls in the front lightwell (7.5m²) will be collected and stored in a rainwater harvesting tank located beneath the bin area in the front garden. This will reduce the use of water and minimise current and future flood risk.

7.22. In Order to comply with CIRIA C753 The SuDS Maunual, a 10% allowance will be added to the impermeable areas to take into account future urban creep. Applying a 10% allowance to the new front impermeable surfaces (61.5m²) gives a value of 68m². Therefore, all drainage calculations within this assessment have been made based on a total impermeable area of 68m².

7.23. Roof runoff from the downpipes at the front of the house (54m²) and water that falls in the rear lightwells (9.5m²) will be collected and stored in a rainwater harvesting tank located beneath the concrete paving slabs in the rear garden. This will reduce the use of water and minimise current and future flood risk.

7.24. In Order to comply with CIRIA C753 The SuDS Maunual, a 10% allowance will be added to the impermeable areas to take into account future urban creep. Applying a 10% allowance to the new rear impermeable surfaces (64.5m²) gives a value of 71m². Therefore, all drainage calculations within this assessment have been made based on a total impermeable area of 71m².

7.25. Tank/attenuation sizing within the strategy has been based upon Policy CPG3 and will reduce runoff rates from the entire site by 50% thus provide significant betterment post development.

7.26. MicroDrainage software has been used to estimate the tank size requirement to provide adequate surface water run-off management (see Appendix).

7.27. The proposed total increase in impermeable surfacing will have a total area of 17m². There is however a reduction of the front impermeable area meaning there is a total post development impermeable reduction of 32m².

Front Garden

7.28. Preliminary calculations indicate that sufficient storage required to attenuate runoff from the proposed impermeable areas (68m²) arising from the critical 1:100 year + 40% climate change event can be provided within an attenuation storage tank of dimensions 6m² x 0.66m deep x 0.95 (voids).

7.29. Preliminary calculations indicated that approximately 3.76m³ of storage is required to attenuate the runoff for all storms up to and including the 1:100 year + 40% climate change event. A pump would be proposed as the outlet control, restricting the maximum flow rate to 0.1l/s.

7.30. All preliminary surface water drainage calculations have been undertaken using MicroDrainage software. Refer to the appendix.

Rear Garden

7.31. Preliminary calculations indicate that sufficient storage required to attenuate runoff from the proposed impermeable areas (71m²) arising from the critical 1:100 year + 40% climate change event can be provided within an attenuation storage tank of dimensions 6m² x 0.66m deep x 0.95 (voids).

7.32. Preliminary calculations indicate that approximately 3.76m³ of storage is required to attenuate the runoff for all storms up to and including the 1:100 year + 40% climate change event. A pump would be proposed as the outlet control, restricting the maximum flow rate to 0.1l/s.

7.33. All preliminary surface water drainage calculations have been undertaken using MicroDrainage software. Refer to the appendix.

7.34. This system will manage the entire proposed additional roof area, proving significant betterment over the existing run off situation.

7.32. Runoff from roof areas is considered to be uncontaminated and does not warrant any form of treatment process to improve water quality. Nevertheless, it is suggested to include debris / sediment traps on any new drainage.

7.33. Should the onsite drainage system fail under extreme rainfall events or blockage, flooding may occur within the site. In the event of the drainage system failure, the runoff flow can be managed through detailing the new external levels to direct water away from structures.

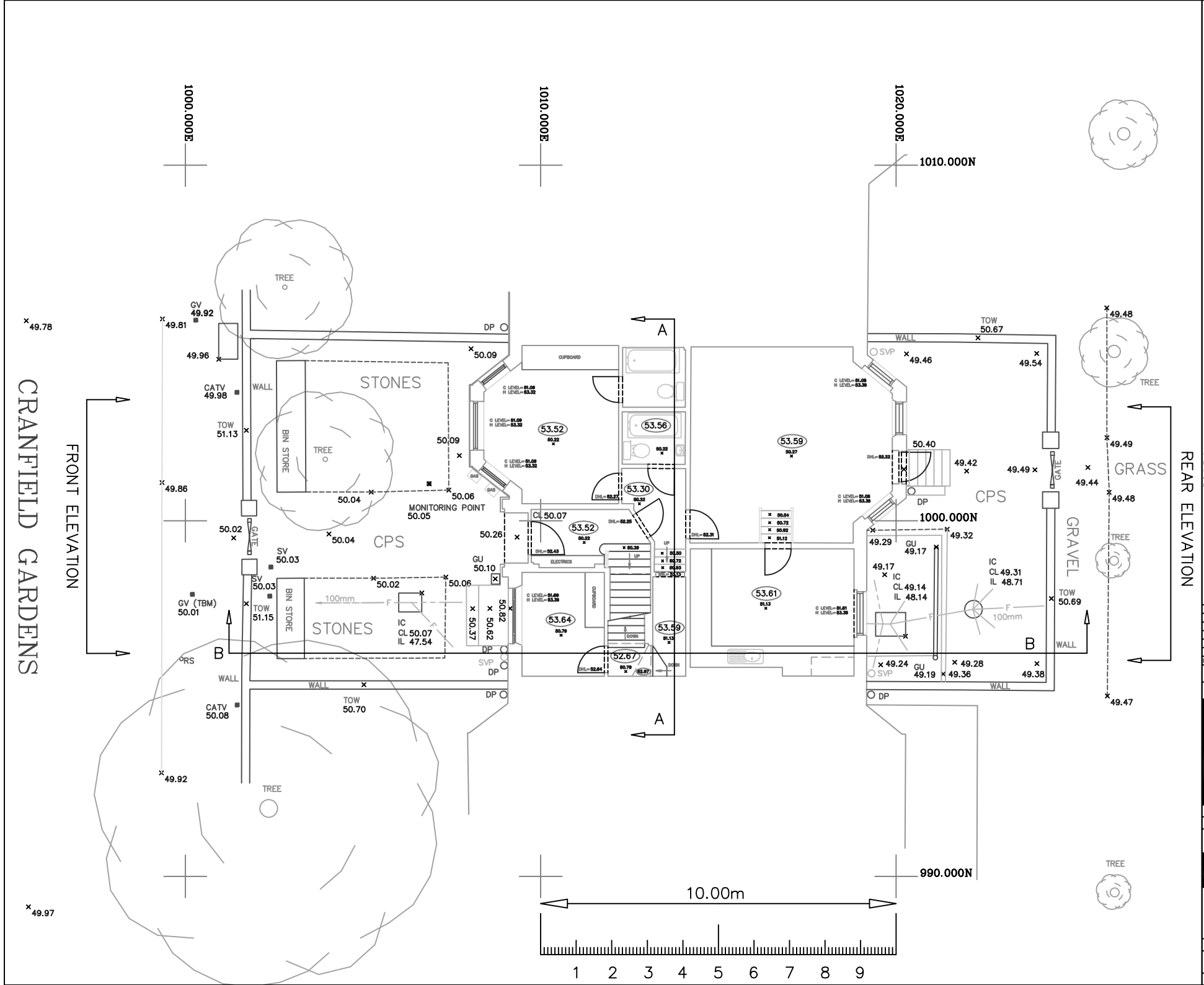
7.34. This drainage strategy has been undertaken in accordance with the principles set out in NPPF. We can conclude that providing the development adheres to the conditions advised above, the said development proposals can be accommodated without increasing flood risk within the locality in accordance with objectives set by Central Government and the EA.

Unda Consulting Limited

September 2020

8. Appendix

- Existing and proposed plans;
- Proposed Drainage Plan;
- Greenfield Runoff Calculations;
- Cellular storage Calculations;
- Thames Water Sewer Records.



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Building Abbreviations

BL	Basement Level	HD	Heating Duct
BH	Beam Soffit Height	H	Height
BSL	Beam Soffit Level	RWP	Rain Water Pipe
C	Cill Height from FFL	SL	Soffit Level
DP	Down Pipe	SVP	Soil and Vent Pipe
DPC	Damp Proof Course	VP	Vent Pipe
DH	Door Height	W	Window Height from cill
DHL	Door Head level		Direction of Fllor Joist Span
FFL	Finished Floor Level	C Level	Cill Level
2100	Floor to Ceiling Height or Ceiling Level	H Level	Window Head Level
2.5m			Detail Approx.
		CSU	Ceiling slopes up
CH	Ceiling Height	F-H	Floor - Window head Ht

Topographical Abbreviations

A/R	Assumed Route	MKR	Marker
BH	Borehole	MT	Mercury Telecom Cover
BOL	Bollard	OHC	Overhead Cable
BT	British Telecom Cover	OHP	Overhead Pipe
BW	Barbed Wire Fence	OSBM	Ordnance Survey Bench Mark
BWK	Brickwork	PB	Post Box
CATV	Cable TV Cover	PGM	Permanent Ground Marker
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CHLK	Chainlink Fence	PWM	Post & Wire Mesh Fence
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CL	Cover Level	RG	Road Gully
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MH	Manhole	WV	Water Valve
		- - -	Approximate

Legend

F — Foul Water Pipe
S — Surface Water Pipe

Notes

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SURVEYED BY
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HEAD OFFICE
16 St NICHOLAS DRIVE
SHEPPERTON
MIDDX
TW17 9LD
TEL 01932 221358
E-MAIL info@reedgeomatics.com
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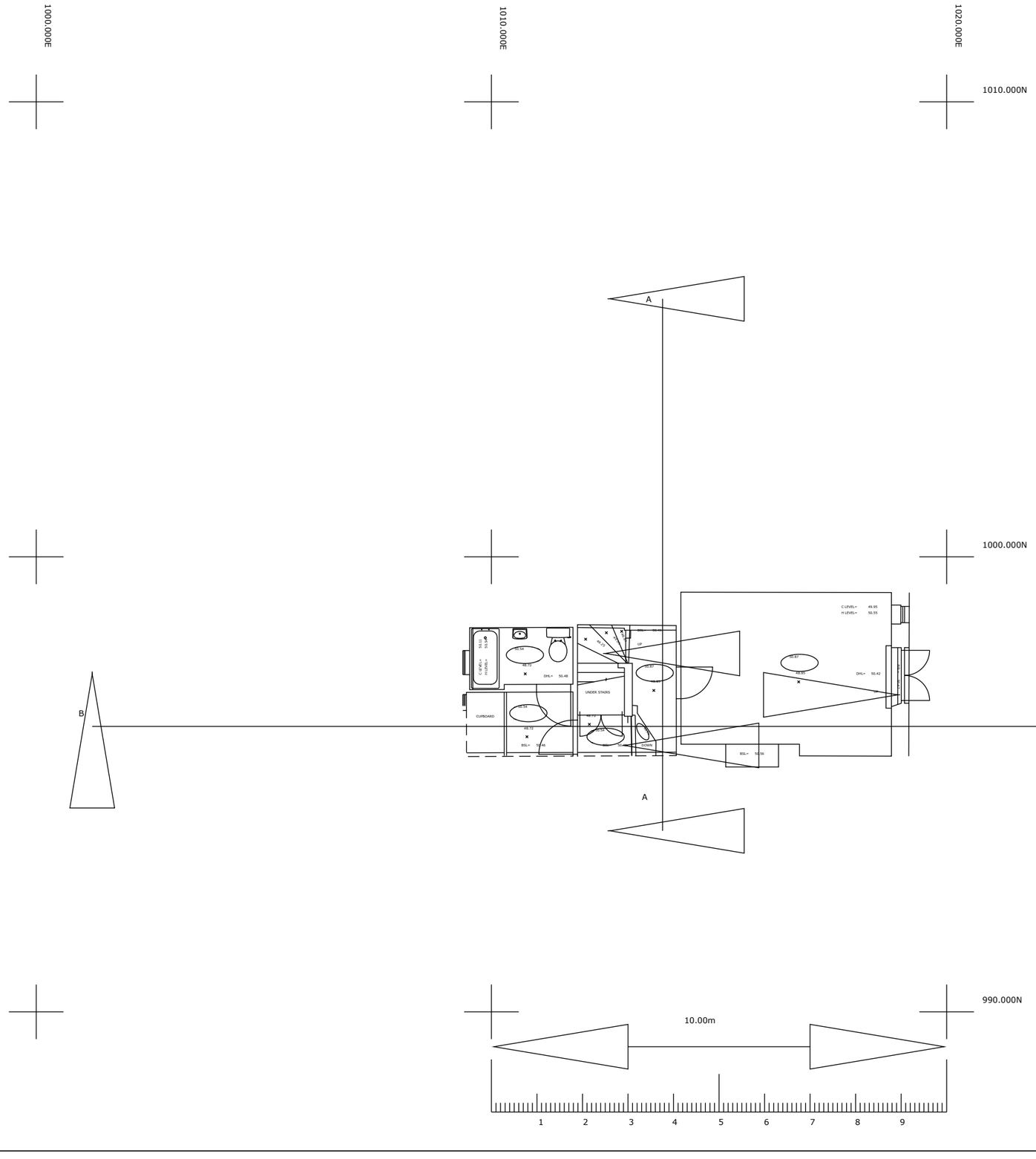

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CHPL	Chestnut Paling Fence	RE	Rodding Eye
CL	Cover Level	RG	Road Gully
CM	Cable Marker	RN	Road Name
CP	Catch Pit	RS	Road Sign
CPL	Catch Pit Base Level	RW	Retaining Wall
DIA	Diameter	RWP	Rain Water Pipe
DK	Drop Kerb	SAP	Sapling
DP	Down Pipe	SC	Stop Cock
EJB	Electricity Junction Box	SPR	Spread
EC	Electricity Cover	STA	Traverse Station
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			Approximate

Legend

Foul Water Pipe

Surface Water Pipe

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SHEPPERTON
MIDDX
TW17 8LD

TEL 01932 221358
E-MAIL info@reedgeomatics.com

BRANCH OFFICE
BRANDONS VENNS GATE
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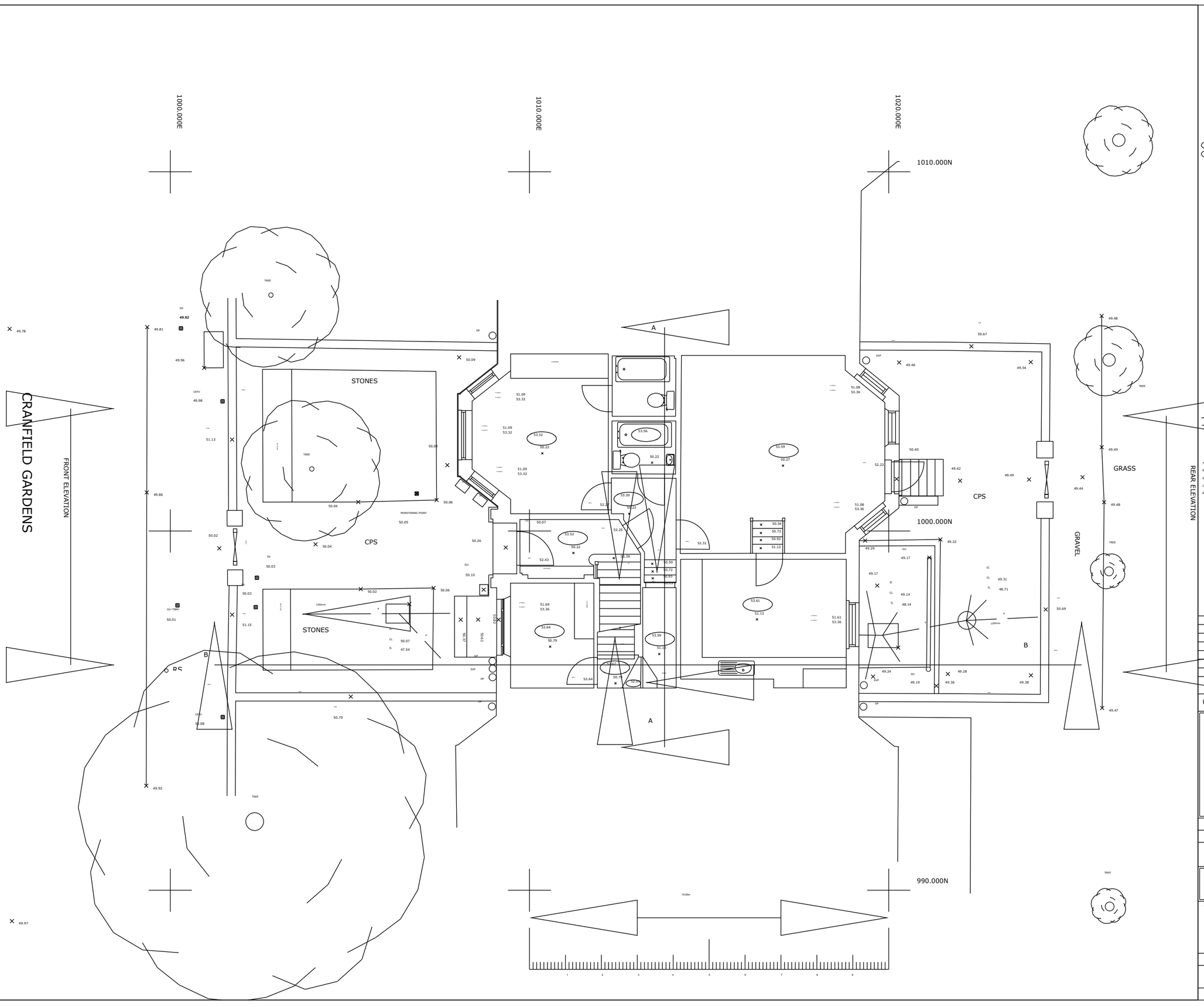

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ADJACENT PROPERTY

OUTLINE ONLY

ADJACENT PROPERTY

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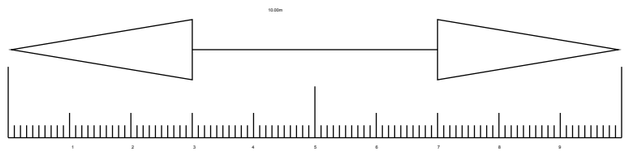

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ADJACENT PROPERTY

OUTLINE ONLY

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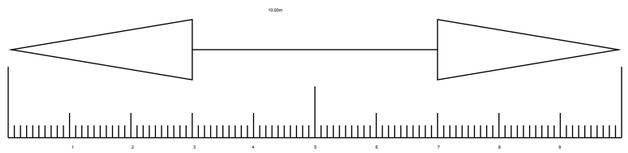

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TEL 01932 221358
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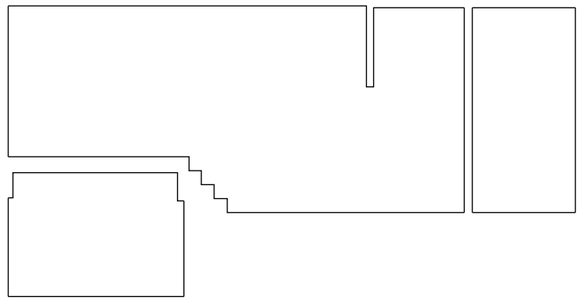

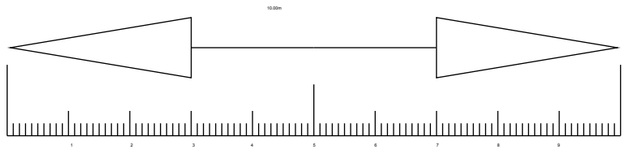

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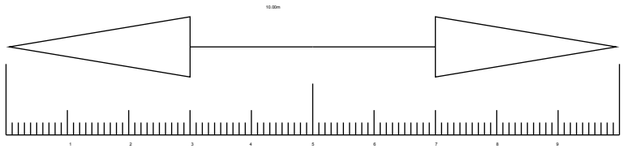

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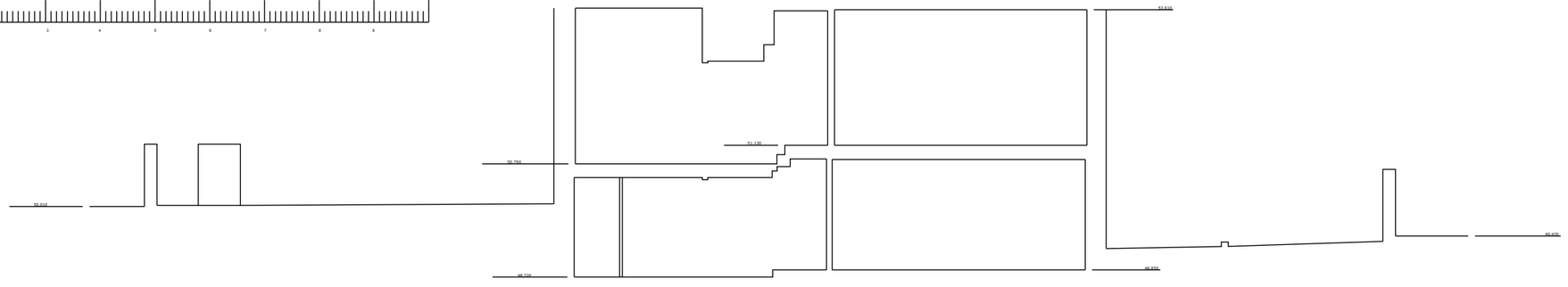

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TEL 01932 221358
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ELEVATIONS / SECTIONS

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LONDON

NW6 3LA

JOB No	DRAWING NUMBER
RG19 1963	03C

A2 Sheet

THE TREATMENT ARCHITECTURE LTD.
43 WILTON ROAD , LONDON N10 1LX , UK
Email: thetreatment@mac.com
Landline: 020 88832503 Mobile: 07887 646505

DATE: 06/09/2019

REV NUMBER: 00

PROJECT: **28 CANFIELD GARDENS, LONDON NW6 3EE**

DRAWING NAME: **08 - PROPOSED BASEMENT FLOOR PLAN**

SCALE: 1/50

0.0 1.0 2.0 3.0 4.0 5.0

LEGEND: NEW

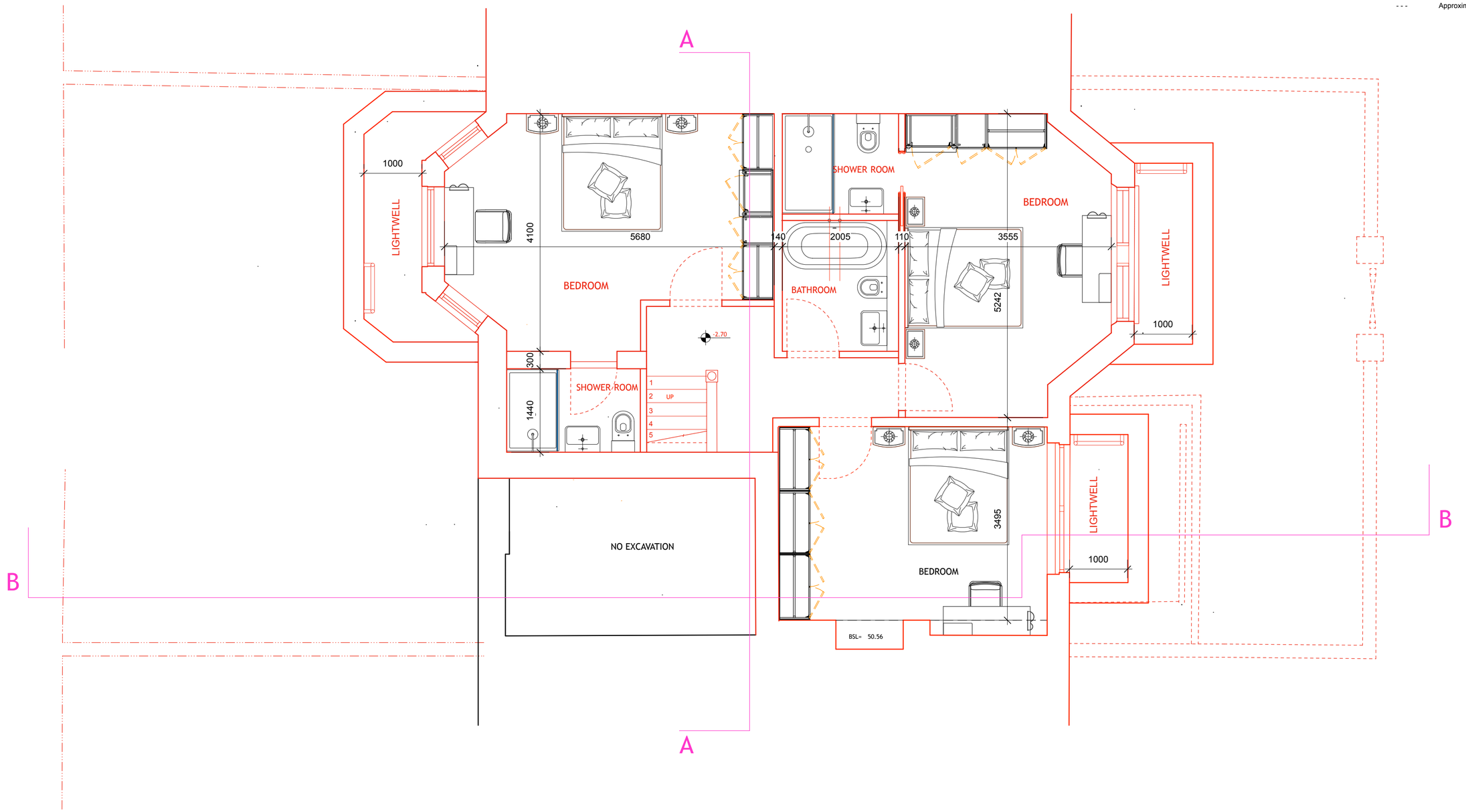
F Foul Water Pipe
S Surface Water Pipe

Building Abbreviations

BL	Basement Level	HD	Heating Duct
BH	Beam Soffit Height	H	Height
BSL	Beam Soffit Level	RWP	Rain Water Pipe
C	Cill Height from FFL	SL	Soffit Level
DP	Down Pipe	SVP	Soil and Vent Pipe
DPC	Damp Proof Course	VP	Vent Pipe
DH	Door Height	W	Window Height from cill
DHL	Door Head level		Direction of Floor Joist Span
FFL	Finished Floor Level	C Level	Cill Level
2100	Floor to Ceiling Height or Ceiling Level	H Level	Window Head Level Detail Approx.
25.56		CSU	Ceiling slopes up
CH	Ceiling Height	F-H	Floor - Window head Ht

Topographical Abbreviations

A/R	Assumed Route	MKR	Marker	EJB	Electricity Junction Box	SPR	Spread
BH	Borehole	MT	Mercury Telecom Cover	EC	Electricity Cover	STA	Traverse Station
BOL	Bollard	OHC	Overhead Cable	EP	Electricity Pole	SV	Stop Valve
BT	British Telecom Cover	OHP	Overhead Pipe	ER	Earthing Rod	SVP	Soil Vent Pipe
BW	Barbed Wire Fence	OSBM	Ordnance Survey Bench Mark	FH	Fire Hydrant	SW	Storm Water
BWK	Brickwork	PB	Post Box	FIG	Feed Into Ground	TB	Telephone Box
CATV	Cable TV Cover	PGM	Permanent Ground Marker	FW	Foul Water	TBM	Temporary Bench Mark
CB	Close Boarded Fence	PR	Post & Rail Fence	GU	Gully	TFR	Taken From Records
CCTV	Closed Circuit TV	PW	Post & Wire Fence	GV	Gas Valve	TJB	Telephone Junction Box
CHLK	Chainlink Fence	PWM	Post & Wire Mesh Fence	H	Height	TPT	Trial Pit
CHPL	Chestnut Paling Fence	RE	Rodding Eye	IC	Inspection Cover	TL	Traffic Light
CL	Cover Level	RG	Road Gully	IL	Invert Level	TP	Telephone Pole
CM	Cable Marker	RN	Road Name	IR	Iron Railing Fence	UTL	Unable To Lift
CP	Catch Pit	RS	Road Sign	KO	Kerb Outlet	UTT	Unable To Trace
CPL	Catch Pit Base Level	RW	Retaining Wall	LB	Litter Bin	VP	Vent Pipe
DIA	Diameter	RWP	Rain Water Pipe	LC	Lamp Column	WKH	Water Key Hole
DK	Drop Kerb	SAP	Sapling	LP	Lamp Post	WM	Water Meter
DP	Down Pipe	SC	Stop Cock	MH	Manhole	WV	Water Valve
						- - -	Approximate



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DATE: 06/09/2019

REV NUMBER: 00

PROJECT: 28 CANFIELD GARDENS, LONDON NW6 3EE

DRAWING NAME: 09 - PROPOSED GROUND FLOOR PLAN

SCALE: 1/50

0.0 1.0 2.0 3.0 4.0 5.0

LEGEND: NEW

Building Abbreviations

BL	Basement Level	HD	Heating Duct	F	Foul Water Pipe
BH	Beam Soffit Height	H	Height	S	Surface Water Pipe
BSL	Beam Soffit Level	RWP	Rain Water Pipe	2100	Floor to Ceiling Height or Ceiling Level
C	Cill Height from FFL	SL	Soffit Level	25.56	
DP	Down Pipe	SVP	Soil and Vent Pipe	CH	Ceiling Height
DPC	Damp Proof Course	VP	Vent Pipe		
DH	Door Height	W	Window Height from cill		
DHL	Door Head level		Direction of Floor Joist Span		
FFL	Finished Floor Level	C Level	Cill Level		
		H Level	Window Head Level Detail Approx.		
		CSU	Ceiling slopes up		
		F-H	Floor - Window head Ht		

Topographical Abbreviations

A/R	Assumed Route	MKR	Marker	EJB	Electricity Junction Box	SPR	Spread
BH	Borehole	MT	Mercury Telecom Cover	EC	Electricity Cover	STA	Traverse Station
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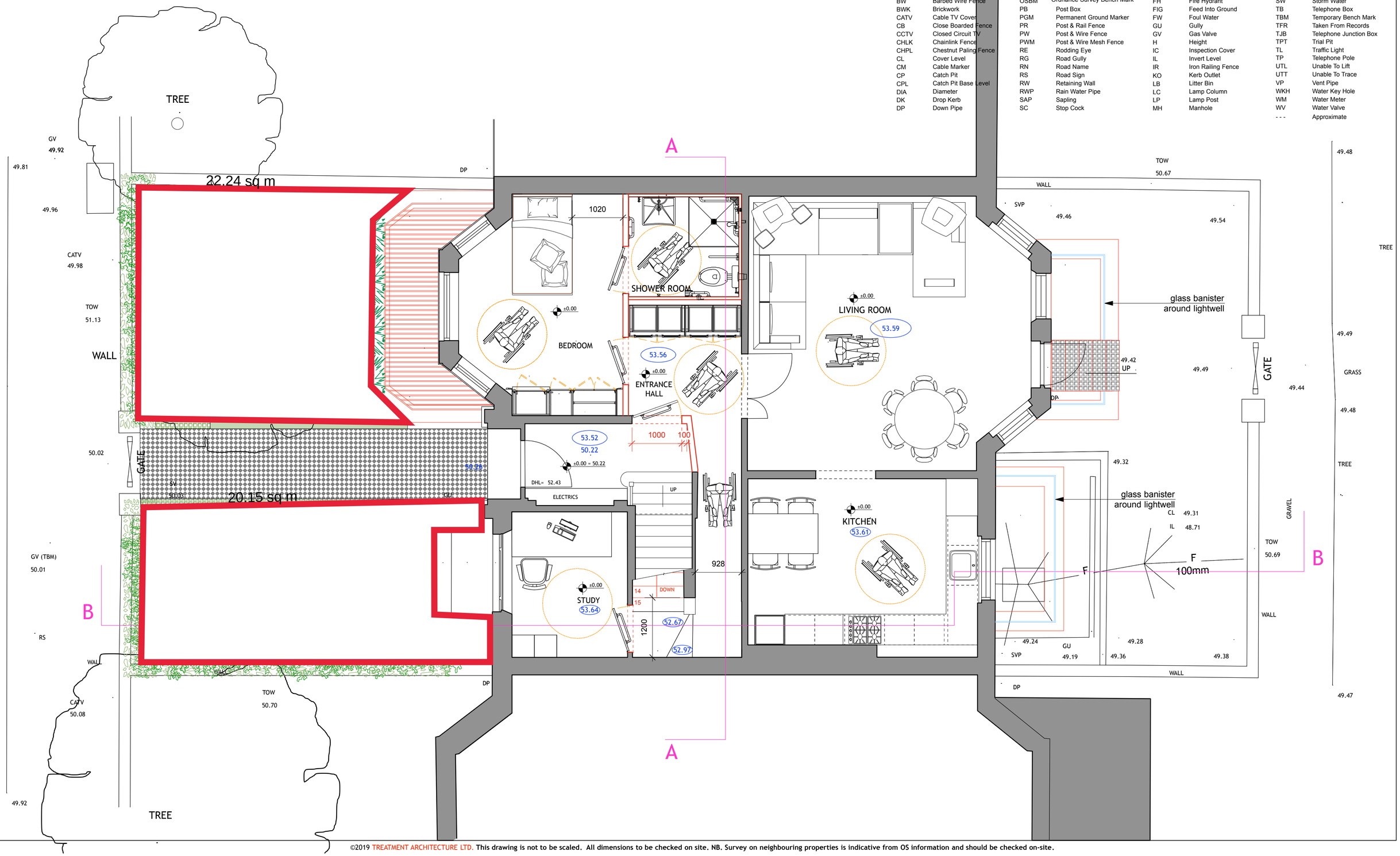
BT	British Telecom Cover	OHP	Overhead Pipe	ER	Earthing Rod	SVP	Soil Vent Pipe
BW	Barbed Wire Fence	OSBM	Ordnance Survey Bench Mark	FH	Fire Hydrant	SW	Storm Water
BWK	Brickwork	PB	Post Box	FIG	Feed Into Ground	TB	Telephone Box
CATV	Cable TV Cover	PGM	Permanent Ground Marker	FW	Foul Water	TBM	Temporary Bench Mark
CB	Close Boarded Fence	PR	Post & Rail Fence	GU	Gully	TFR	Taken From Records
CCTV	Closed Circuit TV	PW	Post & Wire Fence	GV	Gas Valve	TJB	Telephone Junction Box
CHLK	Chainlink Fence	PWM	Post & Wire Mesh Fence	H	Height	TPT	Trial Pit
CHPL	Chestnut Paling Fence	RE	Rodding Eye	IC	Inspection Cover	TL	Traffic Light
CL	Cover Level	RG	Road Gully	IL	Invert Level	TP	Telephone Pole
CM	Cable Marker	RN	Road Name	IR	Iron Railing Fence	UTL	Unable To Lift
CP	Catch Pit	RS	Road Sign	KO	Kerb Outlet	UTT	Unable To Trace
CPL	Catch Pit Base Level	RW	Retaining Wall	LB	Litter Bin	VP	Vent Pipe
DIA	Diameter	RWP	Rain Water Pipe	LC	Lamp Column	WKH	Water Key Hole
DK	Drop Kerb	SAP	Sapling	LP	Lamp Post	WM	Water Meter
DP	Down Pipe	SC	Stop Cock	MH	Manhole	WV	Water Valve
						- - -	Approximate



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DATE: 06/09/2019

REV NUMBER: 00

PROJECT: **28 CANFIELD GARDENS, LONDON NW6 3EE**

DRAWING NAME: **10 - PROPOSED SECTIONS A-A**

SCALE: 1/50

0.0 1.0 2.0 3.0 4.0 5.0

LEGEND: NEW

Building Abbreviations

BL	Basement Level	HD	Heating Duct
BH	Beam Soffit Height	H	Height
BSL	Beam Soffit Level	RWP	Rain Water Pipe
C	Cill Height from FFL	SL	Soffit Level
DP	Down Pipe	SVP	Soil and Vent Pipe
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DH	Door Height	W	Window Height from cill
DHL	Door Head level		Direction of Floor Joist Span
FFL	~~Finished Floor Level~~	C Level	Cill Level
2100	Floor to Ceiling Height or Ceiling Level	H Level	Window Head Level
25.56			Detail Approx.
CH	Ceiling Height	CSU	Ceiling slopes up
		F-H	Floor - Window head Ht

F Foul Water Pipe

S Surface Water Pipe

Topographical Abbreviations

A/R	Assumed Route	MKR	Marker	EJB	Electricity Junction Box	SPR	Spread
BH	Borehole	MT	Mercury Telecom Cover	EC	Electricity Cover	STA	Traverse Station
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BW	Barbed Wire Fence	OSBM	Ordnance Survey Bench Mark	FH	Fire Hydrant	SW	Storm Water
BWK	Brickwork	PB	Post Box	FIG	Feed Into Ground	TB	Telephone Box
CATV	Cable TV Cover	PGM	Permanent Ground Marker	FW	Foul Water	TBM	Temporary Bench Mark
CB	Close Boarded Fence	PR	Post & Rail Fence	GU	Gully	TFR	Taken From Records
CCTV	Closed Circuit TV	PW	Post & Wire Fence	GV	Gas Valve	TJB	Telephone Junction Box
CHLK	Chainlink Fence	PWM	Post & Wire Mesh Fence	H	Height	TPT	Trial Pit
CHPL	Chestnut Paling Fence	RE	Rodding Eye	IC	Inspection Cover	TL	Traffic Light
CL	Cover Level	RG	Road Gully	IL	Invert Level	TP	Telephone Pole
CM	Cable Marker	RN	Road Name	IR	Iron Railing Fence	UTL	Unable To Lift
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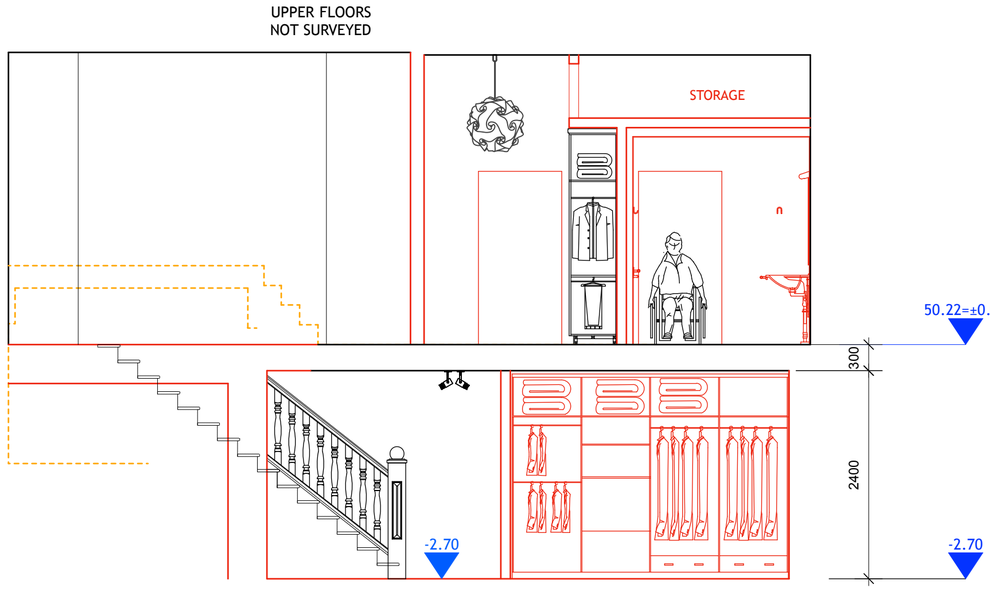

DATUM 46.00m

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06/09/2019 DATE:

00 REV NUMBER:

PROJECT: **28 CANFIELD GARDENS, LONDON NW6 3EE**

DRAWING NAME: **11 - PROPOSED SECTION B-B**

SCALE: 1/50

0.0 1.0 2.0 3.0 4.0 5.0

LEGEND: NEW

Building Abbreviations

BL	Basement Level	HD	Heating Duct
BH	Beam Soffit Height	H	Height
BSL	Beam Soffit Level	RWP	Rain Water Pipe
C	Cill Height from FFL	SL	Soffit Level
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DPC	Damp Proof Course	VP	Vent Pipe
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DHL	Door Head level		Direction of Floor Joist Span
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25.56			Detail Approx.
CH	Ceiling Height	CSU	Ceiling slopes up
		F-H	Floor - Window head Ht

F Foul Water Pipe

S Surface Water Pipe

Topographical Abbreviations

A/R	Assumed Route	MKR	Marker	EJB	Electricity Junction Box	SPR	Spread
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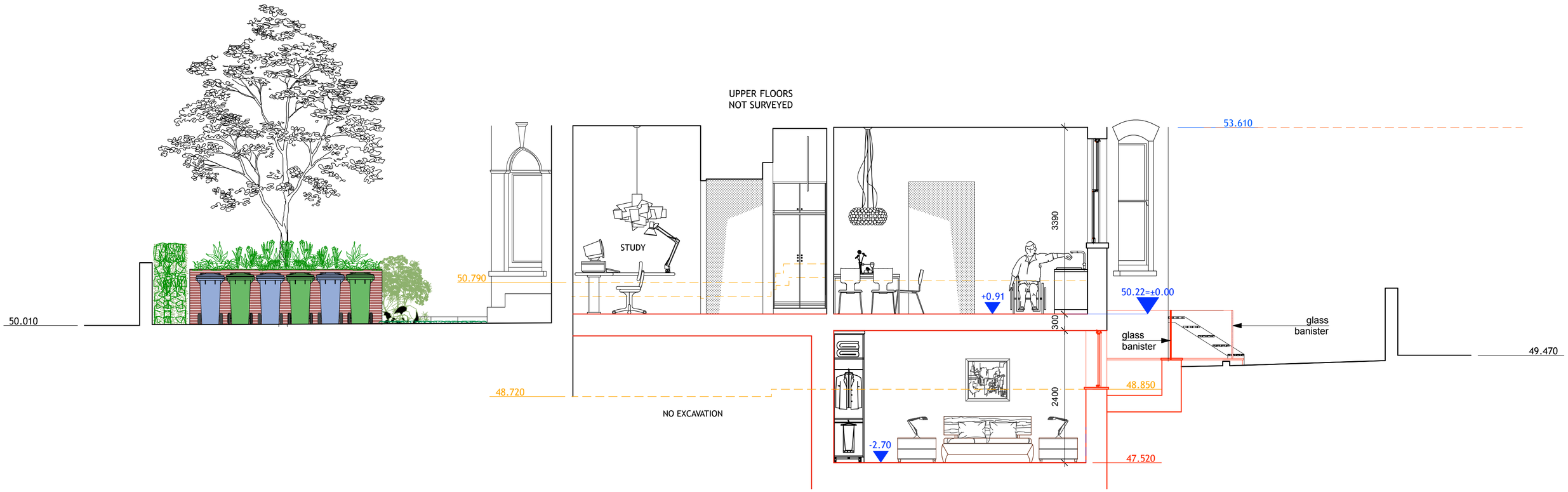


DATUM 46.00m

ICP SUDS Mean Annual Flood

Input

Return Period (years) 100 SAAR (mm) 600 Urban 0.000
Area (ha) 0.023 Soil 0.300 Region Number Region 6

Results l/s

QBAR Rural 0.0
QBAR Urban 0.0

Q100 years 0.1

Q1 year 0.0
Q30 years 0.1
Q100 years 0.1

ICP SUDS Mean Annual Flood

Input

Return Period (years) 100 SAAR (mm) 600 Urban 0.750
Area (ha) 0.023 Soil 0.300 Region Number Region 6

Results l/s

QBAR Rural 0.0
QBAR Urban 0.1

Q100 years 0.3

Q1 year 0.1
Q30 years 0.2
Q100 years 0.3

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 303 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	46.665	0.325	0.0	0.1	0.1	1.9	O K
30 min Summer	46.753	0.413	0.0	0.1	0.1	2.4	Flood Risk
60 min Summer	46.828	0.488	0.0	0.1	0.1	2.8	Flood Risk
120 min Summer	46.879	0.539	0.0	0.1	0.1	3.1	Flood Risk
180 min Summer	46.888	0.548	0.0	0.1	0.1	3.1	Flood Risk
240 min Summer	46.880	0.540	0.0	0.1	0.1	3.1	Flood Risk
360 min Summer	46.858	0.518	0.0	0.1	0.1	3.0	Flood Risk
480 min Summer	46.836	0.496	0.0	0.1	0.1	2.8	Flood Risk
600 min Summer	46.814	0.474	0.0	0.1	0.1	2.7	Flood Risk
720 min Summer	46.792	0.452	0.0	0.1	0.1	2.6	Flood Risk
960 min Summer	46.749	0.409	0.0	0.1	0.1	2.3	Flood Risk
1440 min Summer	46.672	0.332	0.0	0.1	0.1	1.9	O K
2160 min Summer	46.578	0.238	0.0	0.1	0.1	1.4	O K
2880 min Summer	46.509	0.169	0.0	0.1	0.1	1.0	O K
4320 min Summer	46.439	0.099	0.0	0.1	0.1	0.6	O K
5760 min Summer	46.420	0.080	0.0	0.1	0.1	0.5	O K
7200 min Summer	46.408	0.068	0.0	0.1	0.1	0.4	O K
8640 min Summer	46.399	0.059	0.0	0.1	0.1	0.3	O K
10080 min Summer	46.392	0.052	0.0	0.1	0.1	0.3	O K
15 min Winter	46.706	0.366	0.0	0.1	0.1	2.1	Flood Risk
30 min Winter	46.805	0.465	0.0	0.1	0.1	2.6	Flood Risk
60 min Winter	46.892	0.552	0.0	0.1	0.1	3.1	Flood Risk
120 min Winter	46.955	0.615	0.0	0.1	0.1	3.5	Flood Risk
180 min Winter	46.971	0.631	0.0	0.1	0.1	3.6	Flood Risk
240 min Winter	46.967	0.627	0.0	0.1	0.1	3.6	Flood Risk
360 min Winter	46.939	0.599	0.0	0.1	0.1	3.4	Flood Risk
480 min Winter	46.910	0.570	0.0	0.1	0.1	3.3	Flood Risk
600 min Winter	46.880	0.540	0.0	0.1	0.1	3.1	Flood Risk
720 min Winter	46.849	0.509	0.0	0.1	0.1	2.9	Flood Risk
960 min Winter	46.787	0.447	0.0	0.1	0.1	2.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	147.171	0.0	1.9	18
30 min Summer	95.108	0.0	2.5	33
60 min Summer	58.456	0.0	3.1	62
120 min Summer	34.709	0.0	3.6	122
180 min Summer	25.261	0.0	4.0	180
240 min Summer	20.053	0.0	4.2	232
360 min Summer	14.450	0.0	4.5	286
480 min Summer	11.451	0.0	4.8	348
600 min Summer	9.554	0.0	5.0	414
720 min Summer	8.237	0.0	5.2	482
960 min Summer	6.514	0.0	5.5	616
1440 min Summer	4.673	0.0	5.9	880
2160 min Summer	3.347	0.0	6.3	1252
2880 min Summer	2.639	0.0	6.6	1588
4320 min Summer	1.886	0.0	7.1	2208
5760 min Summer	1.485	0.0	7.5	2944
7200 min Summer	1.233	0.0	7.8	3672
8640 min Summer	1.059	0.0	8.0	4408
10080 min Summer	0.931	0.0	8.2	5144
15 min Winter	147.171	0.0	2.2	18
30 min Winter	95.108	0.0	2.8	33
60 min Winter	58.456	0.0	3.4	62
120 min Winter	34.709	0.0	4.1	120
180 min Winter	25.261	0.0	4.5	176
240 min Winter	20.053	0.0	4.7	232
360 min Winter	14.450	0.0	5.1	332
480 min Winter	11.451	0.0	5.4	374
600 min Winter	9.554	0.0	5.6	450
720 min Winter	8.237	0.0	5.8	526
960 min Winter	6.514	0.0	6.1	672

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
1440 min Winter	46.671	0.331	0.0	0.1	0.1	1.9	O K
2160 min Winter	46.533	0.193	0.0	0.1	0.1	1.1	O K
2880 min Winter	46.450	0.110	0.0	0.1	0.1	0.6	O K
4320 min Winter	46.416	0.076	0.0	0.1	0.1	0.4	O K
5760 min Winter	46.401	0.061	0.0	0.1	0.1	0.3	O K
7200 min Winter	46.391	0.051	0.0	0.1	0.1	0.3	O K
8640 min Winter	46.384	0.044	0.0	0.0	0.0	0.2	O K
10080 min Winter	46.378	0.038	0.0	0.0	0.0	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
1440 min Winter	4.673	0.0	6.6	940
2160 min Winter	3.347	0.0	7.1	1296
2880 min Winter	2.639	0.0	7.4	1560
4320 min Winter	1.886	0.0	8.0	2248
5760 min Winter	1.485	0.0	8.4	2944
7200 min Winter	1.233	0.0	8.7	3672
8640 min Winter	1.059	0.0	9.0	4384
10080 min Winter	0.931	0.0	9.2	5144

Rainfall Details

Rainfall Model	FSR	Ratio R	0.437	Cv (Winter)	0.840
Return Period (years)	100	Summer Storms	Yes	Shortest Storm (mins)	15
Region	England and Wales	Winter Storms	Yes	Longest Storm (mins)	10080
M5-60 (mm)	20.600	Cv (Summer)	0.750	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.007

Time (mins) From:	To:	Area (ha)
0	4	0.007

Model Details

Storage is Online Cover Level (m) 47.000

Cellular Storage Structure

Invert Level (m) 46.340 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	6.0	6.0	0.660	6.0	6.0

Pump Outflow Control

Invert Level (m) 46.340

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.1000	0.700	0.1000	1.300	0.0000	1.900	0.0000	2.500	0.0000
0.200	0.1000	0.800	0.0000	1.400	0.0000	2.000	0.0000	2.600	0.0000
0.300	0.1000	0.900	0.0000	1.500	0.0000	2.100	0.0000	2.700	0.0000
0.400	0.1000	1.000	0.0000	1.600	0.0000	2.200	0.0000	2.800	0.0000
0.500	0.1000	1.100	0.0000	1.700	0.0000	2.300	0.0000	2.900	0.0000
0.600	0.1000	1.200	0.0000	1.800	0.0000	2.400	0.0000	3.000	0.0000

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 303 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	46.865	0.325	0.0	0.1	0.1	1.9	O K
30 min Summer	46.953	0.413	0.0	0.1	0.1	2.4	Flood Risk
60 min Summer	47.028	0.488	0.0	0.1	0.1	2.8	Flood Risk
120 min Summer	47.079	0.539	0.0	0.1	0.1	3.1	Flood Risk
180 min Summer	47.088	0.548	0.0	0.1	0.1	3.1	Flood Risk
240 min Summer	47.080	0.540	0.0	0.1	0.1	3.1	Flood Risk
360 min Summer	47.058	0.518	0.0	0.1	0.1	3.0	Flood Risk
480 min Summer	47.036	0.496	0.0	0.1	0.1	2.8	Flood Risk
600 min Summer	47.014	0.474	0.0	0.1	0.1	2.7	Flood Risk
720 min Summer	46.992	0.452	0.0	0.1	0.1	2.6	Flood Risk
960 min Summer	46.949	0.409	0.0	0.1	0.1	2.3	Flood Risk
1440 min Summer	46.872	0.332	0.0	0.1	0.1	1.9	O K
2160 min Summer	46.778	0.238	0.0	0.1	0.1	1.4	O K
2880 min Summer	46.709	0.169	0.0	0.1	0.1	1.0	O K
4320 min Summer	46.639	0.099	0.0	0.1	0.1	0.6	O K
5760 min Summer	46.620	0.080	0.0	0.1	0.1	0.5	O K
7200 min Summer	46.608	0.068	0.0	0.1	0.1	0.4	O K
8640 min Summer	46.599	0.059	0.0	0.1	0.1	0.3	O K
10080 min Summer	46.592	0.052	0.0	0.1	0.1	0.3	O K
15 min Winter	46.906	0.366	0.0	0.1	0.1	2.1	Flood Risk
30 min Winter	47.005	0.465	0.0	0.1	0.1	2.6	Flood Risk
60 min Winter	47.092	0.552	0.0	0.1	0.1	3.1	Flood Risk
120 min Winter	47.155	0.615	0.0	0.1	0.1	3.5	Flood Risk
180 min Winter	47.171	0.631	0.0	0.1	0.1	3.6	Flood Risk
240 min Winter	47.167	0.627	0.0	0.1	0.1	3.6	Flood Risk
360 min Winter	47.139	0.599	0.0	0.1	0.1	3.4	Flood Risk
480 min Winter	47.110	0.570	0.0	0.1	0.1	3.3	Flood Risk
600 min Winter	47.080	0.540	0.0	0.1	0.1	3.1	Flood Risk
720 min Winter	47.049	0.509	0.0	0.1	0.1	2.9	Flood Risk
960 min Winter	46.987	0.447	0.0	0.1	0.1	2.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	147.171	0.0	1.9	18
30 min Summer	95.108	0.0	2.5	33
60 min Summer	58.456	0.0	3.1	62
120 min Summer	34.709	0.0	3.6	122
180 min Summer	25.261	0.0	4.0	180
240 min Summer	20.053	0.0	4.2	232
360 min Summer	14.450	0.0	4.5	286
480 min Summer	11.451	0.0	4.8	348
600 min Summer	9.554	0.0	5.0	414
720 min Summer	8.237	0.0	5.2	482
960 min Summer	6.514	0.0	5.5	616
1440 min Summer	4.673	0.0	5.9	880
2160 min Summer	3.347	0.0	6.3	1252
2880 min Summer	2.639	0.0	6.6	1588
4320 min Summer	1.886	0.0	7.1	2208
5760 min Summer	1.485	0.0	7.5	2944
7200 min Summer	1.233	0.0	7.8	3672
8640 min Summer	1.059	0.0	8.0	4408
10080 min Summer	0.931	0.0	8.2	5144
15 min Winter	147.171	0.0	2.2	18
30 min Winter	95.108	0.0	2.8	33
60 min Winter	58.456	0.0	3.4	62
120 min Winter	34.709	0.0	4.1	120
180 min Winter	25.261	0.0	4.5	176
240 min Winter	20.053	0.0	4.7	232
360 min Winter	14.450	0.0	5.1	332
480 min Winter	11.451	0.0	5.4	374
600 min Winter	9.554	0.0	5.6	450
720 min Winter	8.237	0.0	5.8	526
960 min Winter	6.514	0.0	6.1	672

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
1440 min Winter	46.871	0.331	0.0	0.1	0.1	1.9	O K
2160 min Winter	46.733	0.193	0.0	0.1	0.1	1.1	O K
2880 min Winter	46.650	0.110	0.0	0.1	0.1	0.6	O K
4320 min Winter	46.616	0.076	0.0	0.1	0.1	0.4	O K
5760 min Winter	46.601	0.061	0.0	0.1	0.1	0.3	O K
7200 min Winter	46.591	0.051	0.0	0.1	0.1	0.3	O K
8640 min Winter	46.584	0.044	0.0	0.0	0.0	0.2	O K
10080 min Winter	46.578	0.038	0.0	0.0	0.0	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
1440 min Winter	4.673	0.0	6.6	940
2160 min Winter	3.347	0.0	7.1	1296
2880 min Winter	2.639	0.0	7.4	1560
4320 min Winter	1.886	0.0	8.0	2248
5760 min Winter	1.485	0.0	8.4	2944
7200 min Winter	1.233	0.0	8.7	3672
8640 min Winter	1.059	0.0	9.0	4384
10080 min Winter	0.931	0.0	9.2	5144

Rainfall Details

Rainfall Model	FSR	Ratio R	0.437	Cv (Winter)	0.840
Return Period (years)	100	Summer Storms	Yes	Shortest Storm (mins)	15
Region	England and Wales	Winter Storms	Yes	Longest Storm (mins)	10080
M5-60 (mm)	20.600	Cv (Summer)	0.750	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.007

Time (mins) From:	To:	Area (ha)
0	4	0.007

Model Details

Storage is Online Cover Level (m) 47.200

Cellular Storage Structure

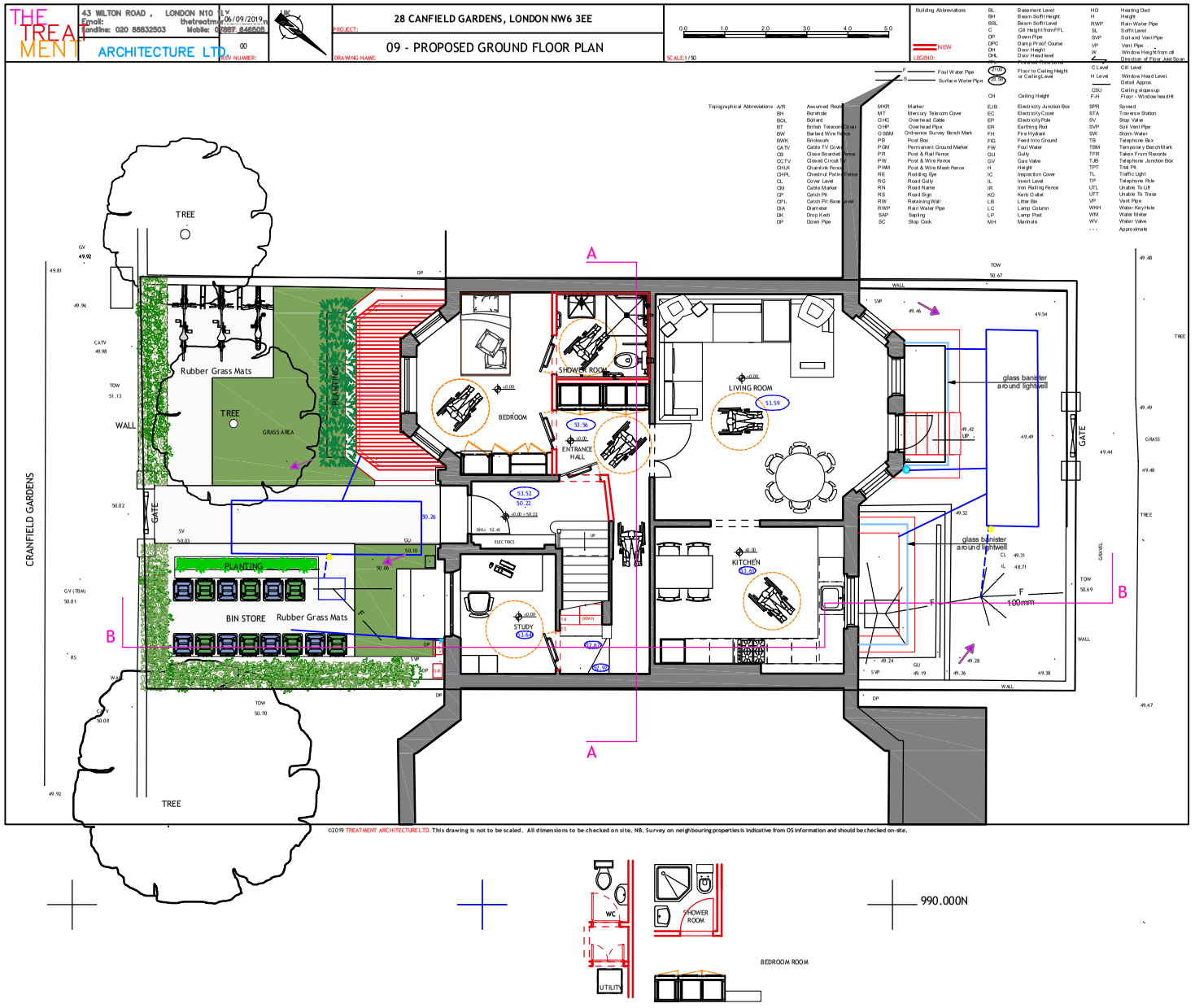
Invert Level (m) 46.540 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	6.0	6.0	0.660	6.0	6.0

Pump Outflow Control

Invert Level (m) 46.540

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.1000	0.700	0.1000	1.300	0.0000	1.900	0.0000	2.500	0.0000
0.200	0.1000	0.800	0.0000	1.400	0.0000	2.000	0.0000	2.600	0.0000
0.300	0.1000	0.900	0.0000	1.500	0.0000	2.100	0.0000	2.700	0.0000
0.400	0.1000	1.000	0.0000	1.600	0.0000	2.200	0.0000	2.800	0.0000
0.500	0.1000	1.100	0.0000	1.700	0.0000	2.300	0.0000	2.900	0.0000
0.600	0.1000	1.200	0.0000	1.800	0.0000	2.400	0.0000	3.000	0.0000



UNDA

Key

- Site Boundary
- Proposed Inspection Chambers
- 37.0 Topographic Site Contour
- Design Exceedance Route
- Proposed Pump
- Proposed Downpipes
- Proposed Gravity Surface Water Pipe
- Proposed Pressure Surface Water Pipe

Notes:

1. Discharge post development surface water runoff from the front and rear of the property will be managed via two cellular storage tanks.
2. All levels are to an assumed datum.

Client:
Doyle Design LLP

Site Address:
Basement Extension,
28 Canfield Gardens,
London
NW6 3LA

Job Reference:	Date:
84813-Doyle-CanfieldGd	21-Oct-20
Drawing Number:	**Revision:**
89948-01	v1.0

Designed by:	Drawn by:	Checked by:
AR	AR	PSG

Scale:
1:75@A2

Disclaimer:
The drawings provided are for planning purposes only.

Unda Consulting Ltd
Southpoint
Old Brighton Road
Gatwick
RH11 0PR

Asset location search

Property Searches

Unda Consulting Limited
Southpoint
GATWICK
RH11 0PR

Search address supplied 28
Canfield Gardens
London
NW6 3LA

Your reference 89948

Our reference ALS/ALS Standard/2020_4262419

Search date 24 September 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, Canfield Gardens, London, NW6 3LA

Dear Sir / Madam

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

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

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

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

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

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

Contact Us

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

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

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

Asset location search

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

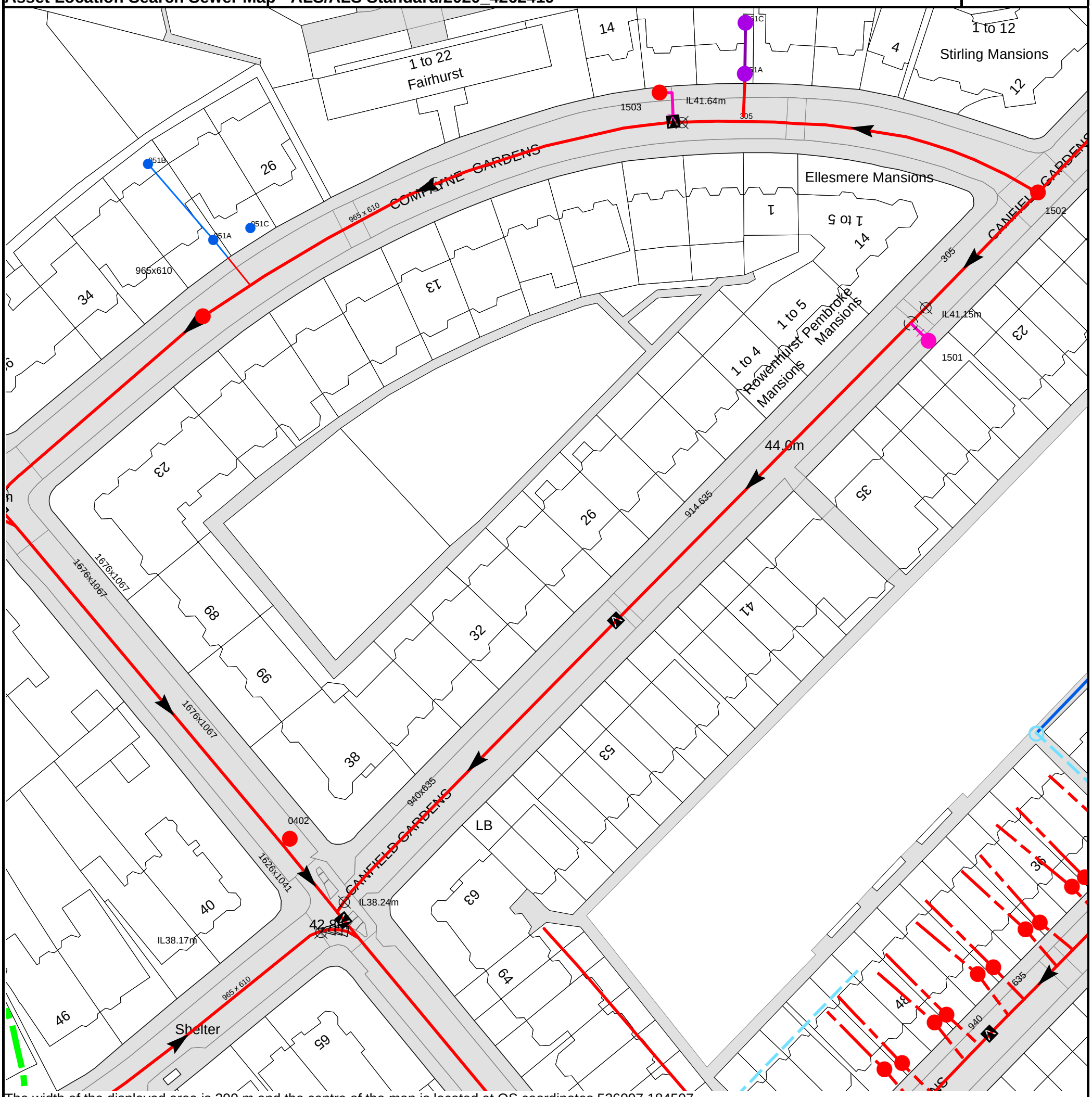
Clean Water queries

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/2020_4262419



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 526097,184507

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

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

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

Manhole Reference	Manhole Cover Level	Manhole Invert Level
1502	46.46	42.31
051B	n/a	n/a
051C	n/a	n/a
1503	n/a	n/a
151A	n/a	n/a
161C	n/a	n/a
1403	n/a	n/a
1404	n/a	n/a
1405	n/a	n/a
1406	n/a	n/a
1407	n/a	n/a
1408	n/a	n/a
1409	n/a	n/a
1410	n/a	n/a
1411	n/a	n/a
1412	n/a	n/a
0402	42.79	n/a
14DD	n/a	n/a
1501	45.13	n/a
auto	n/a	n/a
051A	n/a	n/a

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

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

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

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

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

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

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

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

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

Control Valve

Drop Pipe

Ancillary

Weir

End Items

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

Outfall

Undefined End

Inlet

Other Symbols

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

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

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

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

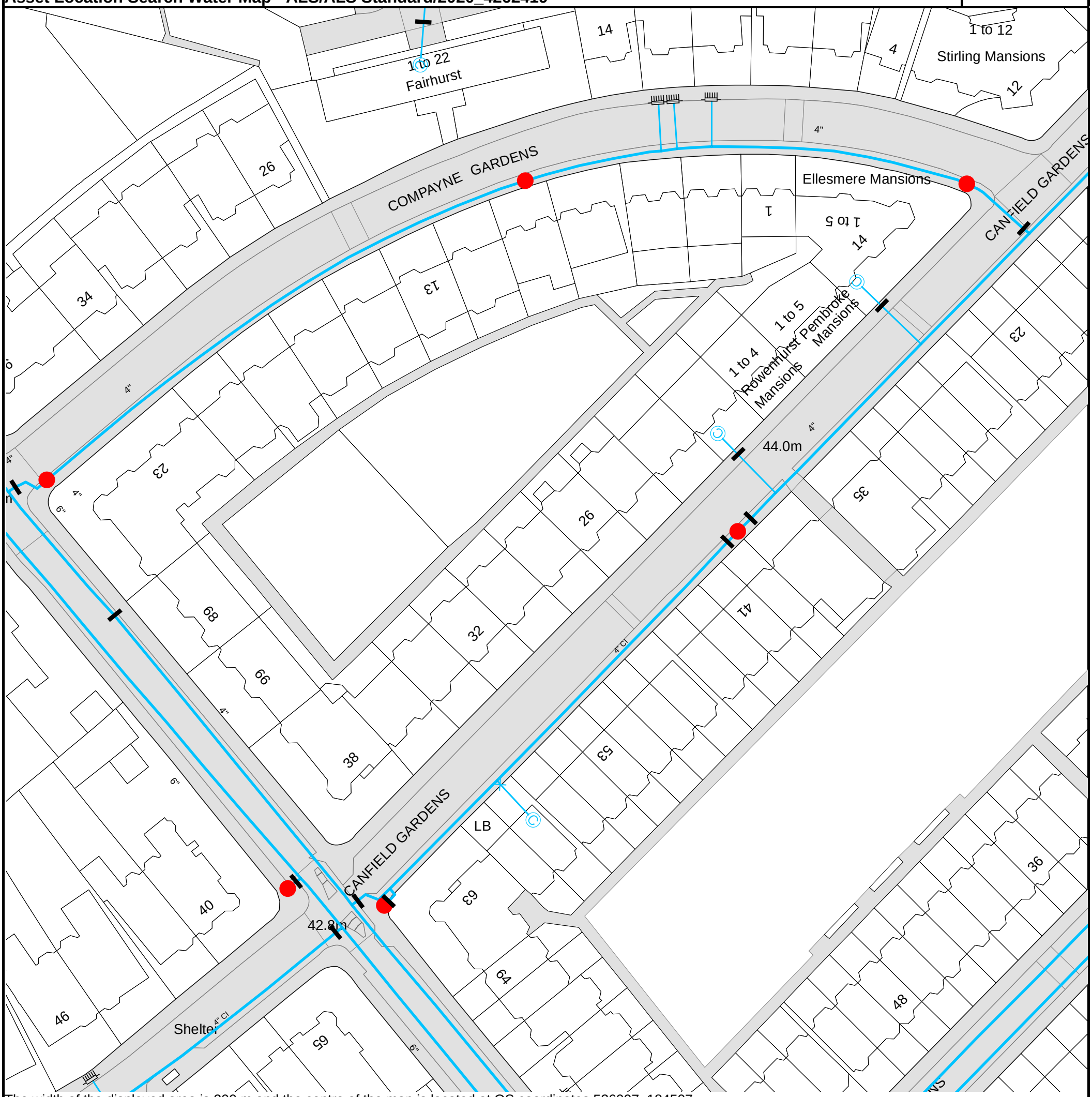
Proposed

Abandoned Sewer

Notes:

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

Asset Location Search Water Map - ALS/ALS Standard/2020_4262419



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 526097, 184507.

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.

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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**

Advice Note on contents of a Surface Water Drainage Statement

London Borough of Camden

1. Introduction

1.1 The Government has strengthened planning policy on the provision of sustainable drainage and new consultation arrangements for 'major' planning applications will come into force from 6 April 2015 as defined in the Written Ministerial Statement (18th Dec 2014).

1.2 The new requirements make Lead Local Flood Authorises statutory consultees with respect to flood risk and SuDS for all major applications. Previously the Environment Agency had that statutory responsibility for sites above 1ha in flood zone 1.

1.3 Therefore all 'major' planning applications submitted from 6 April 2015 are required demonstrate compliance with this policy and we'd encourage this is shown in a **Surface Water Drainage Statement**.

1.4 The purpose of this advice note is to set out what information should be included in such statements.

2. Requirements

2.1 It is essential that the type of Sustainable Drainage System (SuDS) for a site, along with **details of its extent and position**, is identified within the planning application to clearly demonstrate that the proposed SuDS can be accommodated within the development.

2.2 It will now not be acceptable to leave the design of SuDs to a later stage to be dealt with by planning conditions.

2.3 The NPPF paragraph 103 requires that developments do not increase flood risk elsewhere, and gives priority to the use of SuDS. Major developments must include SuDS for the management of run-off, unless demonstrated to be inappropriate. The proposed minimum standards of operation must be appropriate and as such, a **maintenance plan** should be included within the Surface Water Drainage Statement,clearly demonstrating that the SuDS have been designed to ensure that the maintenance and operation requirements are economically proportionate Planning Practice Guidance suggests that this should be considered by reference to the costs that would be incurred by consumers for the use of an effective drainage system connecting directly to a public sewer.

2.4 Camden Council will use planning conditions or obligations to ensure that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

2.5 Within Camden, SuDS systems must be designed in accordance with 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**:

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

2.6 The hierarchy above seeks to ensure that surface water run-off is controlled as near to its source as possible to mimic natural drainage systems and retain water on or near to the site, in contrast to traditional drainage approaches, which tend to pipe water off-site as quickly as possible.

2.7 Before disposal of surface water to the public sewer is considered all other options set out in the drainage hierarchy should be exhausted. When no other practicable alternative exists to dispose of surface water other than the public sewer, the Water Company or its agents should confirm that there is adequate spare capacity in the existing system taking future development requirements into account.

2.8 Best practice guidance within the non-statutory technical standards for the design, maintenance and operation of sustainable drainage systems will also need to be followed. Runoff volumes from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the **greenfield runoff volume** for the same event.

2.9 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. This policy also requires that developments in areas known to be at risk of surface water flooding are designed to cope with being flooded. Camden's SFRA surface water flood maps, updated SFRA figures 6 (LFRZs), and 4e (increased susceptibility to elevated groundwater) , as well as the Environment Agency updated flood maps for surface water (ufmfsw), should be referred to when determining whether developments are in an area at risk of flooding.

2.10 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.

2.11 Where an application is part of a larger site which already has planning permission it is essential that the new proposal does not compromise the drainage scheme already approved.

3. Further information and guidance

3.1 Applicants are strongly advised to discuss their proposals with the Lead Local Flood Authority at the pre-application stage to ensure that an acceptable SuDS scheme is submitted.

3.2 For general clarification of these requirements please Camden's Local Planning Authority or Lead Local Flood Authority

Surface Water Drainage Pro-forma for new developments

This pro-forma accompanies our advice note on surface water drainage. Developers should complete this form and submit it to the Local Planning Authority, referencing from where in their submission documents this information is taken. The pro-forma is supported by the Defra/EA guidance on Rainfall Runoff Management and uses the storage calculator on www.UKsuds.com. This pro-forma is based on current industry best practice and focuses on ensuring surface water drainage proposals meet national and local policy requirements. The pro-forma should be considered alongside other supporting SuDS Guidance.

1. Site Details

Site	28 Cranfield Gardens
Address & post code or LPA reference	28 Canfield Gardens, London, NW6 3LA
Grid reference	526080, 184494
Is the existing site developed or Greenfield?	Developed
Is the development in a LFRZ or in an area known to be at risk of surface or ground water flooding? If yes, please demonstrate how this is managed, in line with DP23?	Refer to Basement Imapct Assessment and FRA
Total Site Area served by drainage system (excluding open space) (Ha)*	0.0108

***** The Greenfield runoff off rate from the development which is to be used for assessing the requirements for limiting discharge flow rates and attenuation storage from a site should be calculated for the area that forms the drainage network for the site whatever size of site and type of drainage technique. Please refer to the Rainfall Runoff Management document or CIRIA manual for detail on this.

2. Impermeable Area

	Existing	Proposed	Difference (Proposed-Existing)	Notes for developers
Impermeable area (ha)	0.0206	0.0174	-0.0032	If the proposed amount of impermeable surface is greater, then runoff rates and volumes will increase. Section 6 must be filled in. If proposed impermeability is equal or less than existing, then section 6 can be skipped and section 7 filled in.
Drainage Method (infiltration/sewer/watercourse)	combined Sewer	llular storage + Combined sew	N/A	If different from the existing, please fill in section 3. If existing drainage is by infiltration and the proposed is not, discharge volumes may increase. Fill in section 6.

3. Proposing to Discharge Surface Water via

	Yes	No	Evidence that this is possible	Notes for developers
Existing and proposed MicroDrainage calculations	Y			Please provide MicroDrainage calculations of existing and proposed run-off rates and volumes in accordance with a recognised methodology or the results of a full infiltration test (see line below) if infiltration is proposed.
Infiltration		N		e.g. soakage tests. Section 6 (infiltration) must be filled in if infiltration is proposed.
To watercourse		N		e.g. Is there a watercourse nearby?
To surface water sewer	Y		Combined sewer	Confirmation from sewer provider that sufficient capacity exists for this connection.
Combination of above		N		e.g. part infiltration part discharge to sewer or watercourse. Provide evidence above.
Has the drainage proposal had regard to the SuDS hierarchy?	Y			Evidence must be provided to demonstrate that the proposed Sustainable Drainage strategy has had regard to the SuDS hierarchy as outlined in Section 2.5 above.
Layout plan showing where the sustainable drainage infrastructure will be located on site.	Y			Please provide plan reference numbers showing the details of the site layout showing where the sustainable drainage infrastructure will be located on the site. If the development is to be constructed in phases this should be shown on a separate plan and confirmation should be provided that the sustainable drainage proposal for each phase can be constructed and can operate independently and is not reliant on any later phase of development.

4. Peak Discharge Rates – This is the maximum flow rate at which storm water runoff leaves the site during a particular storm event.

	Existing Rates (l/s)	Proposed Rates (l/s)	Difference (l/s) (Proposed-Existing)	% Difference (difference /existing x 100)	Notes for developers
Greenfield QBAR	0	N/A	N/A	N/A	QBAR is approx. 1 in 2 storm event. Provide this if Section 6 (QBAR) is proposed.
1 in 1	0	0.2	0.2	N/A	Proposed discharge rates (with mitigation) should aim to be equivalent to greenfield rates for all corresponding storm events. As a minimum, peak discharge rates must be reduced by 50% from the existing sites for all corresponding rainfall events.
1 in 30	0.1	0.2	0.1	100%	
1in 100	0.1	0.2	0.1	100%	
1 in 100 plus climate change	N/A	0.2	N/A	N/A	The proposed 1 in 100 +CC peak discharge rate (with mitigation) should aim to be equivalent to greenfield rates. As a minimum, proposed 1 in 100 +CC peak discharge rate must be reduced by 50% from the existing 1 in 100 runoff rate sites.

5. Calculate additional volumes for storage –The total volume of water leaving the development site. New hard surfaces potentially restrict the amount of stormwater that can go to the ground, so this needs to be controlled so not to make flood risk worse to properties downstream.

	Greenfield runoff volume (m^3)	Existing Volume (m^3)	Proposed Volume (m^3)	Difference (m^3) (Proposed-Existing)	Notes for developers
1 in 1	-	8.6	7.4	-1.2	Proposed discharge volumes (with mitigation) should be constrained to a value as close as is reasonably practicable to the greenfield runoff volume wherever practicable and as a minimum should be no greater than existing volumes for all corresponding storm events. Any increase in volume increases flood risk elsewhere. Where volumes are increased section 6 must be filled in.
1 in 30	-	16	13.7	-2.3	
1in 100 6 hour	-	10.9	9.4	-1.5	
1 in 100 6 hour plus climate change	-	15.3	13.1	-2.2	The proposed 1 in 100 +CC discharge volume should be constrained to a value as close as is reasonably practicable to the greenfield runoff volume wherever practicable. As a minimum, to mitigate for climate change the proposed 1 in 100 +CC volume discharge from site must be no greater than the existing 1 in 100 storm event. If not, flood risk increases under climate change.

6. Calculate attenuation storage – Attenuation storage is provided to enable the rate of runoff from the site into the receiving watercourse to be limited to an acceptable rate to protect against erosion and flooding downstream. The attenuation storage volume is a function of the degree of development relative to the greenfield discharge rate.

		Notes for developers
Storage Attenuation volume (Flow rate control) required to meet greenfield run off rates (m^3)	N/A - to sewer	Volume of water to attenuate on site if discharging at a greenfield run off rate. Can't be used where discharge volumes are increasing
Storage Attenuation volume (Flow rate control) required to reduce rates by 50% (m^3)	N/A - to sewer	Volume of water to attenuate on site if discharging at a 50% reduction from existing rates. Can't be used where discharge volumes are increasing
Storage Attenuation volume (Flow rate control) required to meet [OTHER RUN OFF RATE (as close to greenfield rate as possible] (m^3)	N/A - to sewer	Volume of water to attenuate on site if discharging at a rate different from the above – please state in 1st column what rate this volume corresponds to. On previously developed sites, runoff rates should not be more than three times the calculated greenfield rate. Can't be used where discharge volumes are increasing
Storage Attenuation volume (Flow rate control) required to retain rates as existing (m^3)	N/A - to sewer	Volume of water to attenuate on site if discharging at existing rates. Can't be used where discharge volumes are increasing
Percentage of attenuation volume stored above ground,	0% - due to site constraints and refer to FRA	Percentage of attenuation volume which will be held above ground in swales/ponds/basins/green roofs etc. If 0, please demonstrate why.

7. How is Storm Water stored on site?

Storage is required for the additional volume from site but also for holding back water to slow down the rate from the site. This is known as attenuation storage and long term storage. The idea is that the additional volume does not get into the watercourses, or if it does it is at an exceptionally low rate. You can either infiltrate the stored water back to ground, or if this isn't possible hold it back with on site storage. Firstly, can infiltration work on site?

			Notes for developers
Infiltration	**State the Site's Geology and known Source Protection Zones (SPZ)**	London clay formation. Not in SPZ	Avoid infiltrating in made ground. Infiltration rates are highly variable and refer to Environment Agency website to identify and source protection zones (SPZ)
	Are infiltration rates suitable?	No - located on London Clay	Infiltration rates should be no lower than $1x10^{-6}$ m/s.
	State the distance between a proposed infiltration device base and the ground water (GW) level	N/A	Need 1m (min) between the base of the infiltration device & the water table to protect Groundwater quality & ensure GW doesn't enter infiltration devices. Avoid infiltration where this isn't possible.

	Were infiltration rates obtained by desk study or infiltration test?	N/A	Infiltration rates can be estimated from desk studies at most stages of the planning system if a back up attenuation scheme is provided..
	Is the site contaminated? If yes, consider advice from others on whether infiltration can happen.	N/A	Advice on contaminated Land in Camden can be found on our supporting documents webpage Water should not be infiltrated through land that is contaminated. The Environment Agency may provide bespoke advice in planning consultations for contaminated sites that should be considered.
In light of the above, is infiltration feasible?	**Yes/No? If the answer is No, please identify how the storm water will be stored prior to release**	No - London Clay Formation	If infiltration is not feasible how will the additional volume be stored?. The applicant should then consider the following options in the next section.

Storage requirements

The developer must confirm that either of the two methods for dealing with the amount of water that needs to be stored on site.

Option 1 Simple – Store both the additional volume and attenuation volume in order to make a final discharge from site at the greenfield run off rate. This is preferred if no infiltration can be made on site. This very simply satisfies the runoff rates and volume criteria.

Option 2 Complex – If some of the additional volume of water can be infiltrated back into the ground, the remainder can be discharged at a very low rate of 2 l/sec/hectare. A combined storage calculation using the partial permissible rate of 2 l/sec/hectare and the attenuation rate used to slow the runoff from site.

		Notes for developers
Please confirm what option has been chosen and how much storage is required on site.	Option 1 - Refer to FRA	The developer at this stage should have an idea of the site characteristics and be able to explain what the storage requirements are on site and how it will be achieved.

8. Please confirm

		Notes for developers
Which Drainage Systems measures have been used, including green roofs?	Cellular storage	SUDS can be adapted for most situations even where infiltration isn't feasible e.g. impermeable liners beneath some SUDS devices allows treatment but not infiltration. See CIRIA SUDS Manual C697.
Drainage system can contain in the 1 in 30 storm event without flooding	Yes	This a requirement for sewers for adoption & is good practice even where drainage system is not adopted.
Will the drainage system contain the 1 in 100 +CC storm event? If no please demonstrate how buildings and utility plants will be protected.	Yes	National standards require that the drainage system is designed so that flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.
Any flooding between the 1 in 30 & 1 in 100 plus climate change storm events will be safely contained on site.	N/A	**Safely:** not causing property flooding or posing a hazard to site users i.e. no deeper than 300mm on roads/footpaths. Flood waters must drain away at section 6 rates. Existing rates can be used where runoff volumes are not increased.
How will exceedance events be catered on site without increasing flood risks (both on site and outside the development)?	Levels on site - Refer to FRA	**Safely:** not causing property flooding or posing a hazard to site users i.e. no deeper than 300mm on roads/footpaths. Flood waters must drain away at section 6 rates. Existing rates can be used where runoff volumes are not increased. Exceedance events are defined as those larger than the 1 in 100 +CC event.
How are rates being restricted (vortex control, orifice etc)	Pump	Detail of how the flow control systems have been designed to avoid pipe blockages and ease of maintenance should be provided.
Please confirm the owners/adopters of the entire drainage systems throughout the development. Please list all the owners.	Refer to application	If these are multiple owners then a drawing illustrating exactly what features will be within each owner's remit must be submitted with this Proforma.
How is the entire drainage system to be maintained?	See maintance plan within FRA	If the features are to be maintained directly by the owners as stated in answer to the above question please answer yes to this question and submit the relevant maintenance schedule for each feature. If it is to be maintained by others than above please give details of each feature and the maintenance schedule. Clear details of the maintenance proposals of all elements of the proposed drainage system must be provided. Details must demonstrate that maintenance and operation requirements are economically proportionate. Poorly maintained drainage can lead to increased flooding problems in the future.

9. Evidence Please identify where the details quoted in the sections above were taken from. i.e. Plans, reports etc. Please also provide relevant drawings that need to accompany your proforma, in particular exceedance routes and ownership and location of SuDS (maintenance access strips etc

Pro-forma Section	Document reference where details quoted above are taken from	Page Number
Section 2	FRA	
Section 3	FRA	
Section 4	FRA - Refer to 5.10 for 50% betterment	
Section 5	FRA	
Section 6	FRA	
Section 7	FRA	
Section 8	FRA	

The above form should be completed using evidence from the Flood Risk Assessment and site plans. It should serve as a summary sheet of the drainage proposals and should clearly show that the proposed rate and volume as a result of development will not be increasing. If there is an increase in rate or volume, the rate or volume section should be completed to set out how the additional rate/volume is being dealt with.

This form is completed using factual information from the Flood Risk Assessment and Site Plans and can be used as a summary of the surface water drainage strategy on this site.

Form Completed By Antony Rousou
Qualification of person responsible for signing off this pro-forma Bsc (Hons)

Company Unda Consulting Limited
On behalf of (Client's details) Doyle Design LLP
Date: 23/10/20