FLOOD RISK ASSESSMENT AND SUDS STRATEGY

33 Belsize Avenue

Produced by XCO2 for Vikki Done

December 2017

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	Draft		Final			
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Authorised by	TK	TK	TK			
Date	29/09/2017	10/11/2017	20/12/2017			
Project reference	8.997	8.997	8.997			

EXECUTIVE SUMMARY

This report analyses the flood risk associated with the proposed 33 Belsize Avenue site, arising from natural and artificial sources. The report then presents a detailed drainage assessment, outlining the proposed Sustainable Urban Drainage System strategy suitable for this development site. The strategy is designed in line with the requirements set out by the London Borough of Camden, the London Plan and the National Planning Policy Framework.

A primary Flood Risk Assessment was undertaken for the proposed refurbishment and extension development. The analysis considered flood risk from a number of sources including fluvial and tidal flooding, overland flow, groundwater, sewers and flooding from other artificial sources. The results indicate that the 33 Belsize Avenue site is located within Flood Zone 1, and is not at risk of flooding from any sources.

The proposed drainage system incorporates the use of Sustainable Urban Drainage Systems (SUDS). The SUDS proposed on site includes permeable paving to the rear of the site beneath the patio area, comprising a non-infiltrating stone blanket system underneath the paving, lined with an impermeable geomembrane connecting into the existing onsite drainage network. Further to this, a single raingarden planter is proposed to intercept the run-off from part of the roof before discharging to the existing sewer system.

The proposed development includes a significant reduction in the drained impermeable area and as such the volume of run-off will be reduced compared with the existing site. Additionally, the SUDS strategy will further reduce the surface water leaving the site, and therefore reduce the flood risk at the site and elsewhere in the catchment area. This report has been written to comply with the strategy laid out in the non-statutory Technical Standards for Sustainable Drainage: Practice Guidance, the National Planning Policy Framework, the London Plan (2016) and the London Borough of Camden Flood Risk Management Strategy and Local Plan.

It should be noted that this report has drawn upon data from a number of information sources and while XCO2 believes the trustworthiness of such sources it is unable to guarantee the accuracy of third party data. Despite this, this analysis has utilised the best data and information presently available.

SITE DETAILS

The prosed development comprises an extension to the existing lower ground level to provide a games room, gym an steam room, as well as a full glass façade to the rear ground floor, replacing the current brick structure and bay window. At the front the proposal looks to replace No. 33s portion of the crossover shared with No. 35 with soft landscaping, adding centralised pedestrian access instead.

The approximate location and boundary of the application site is shown in the figure below.

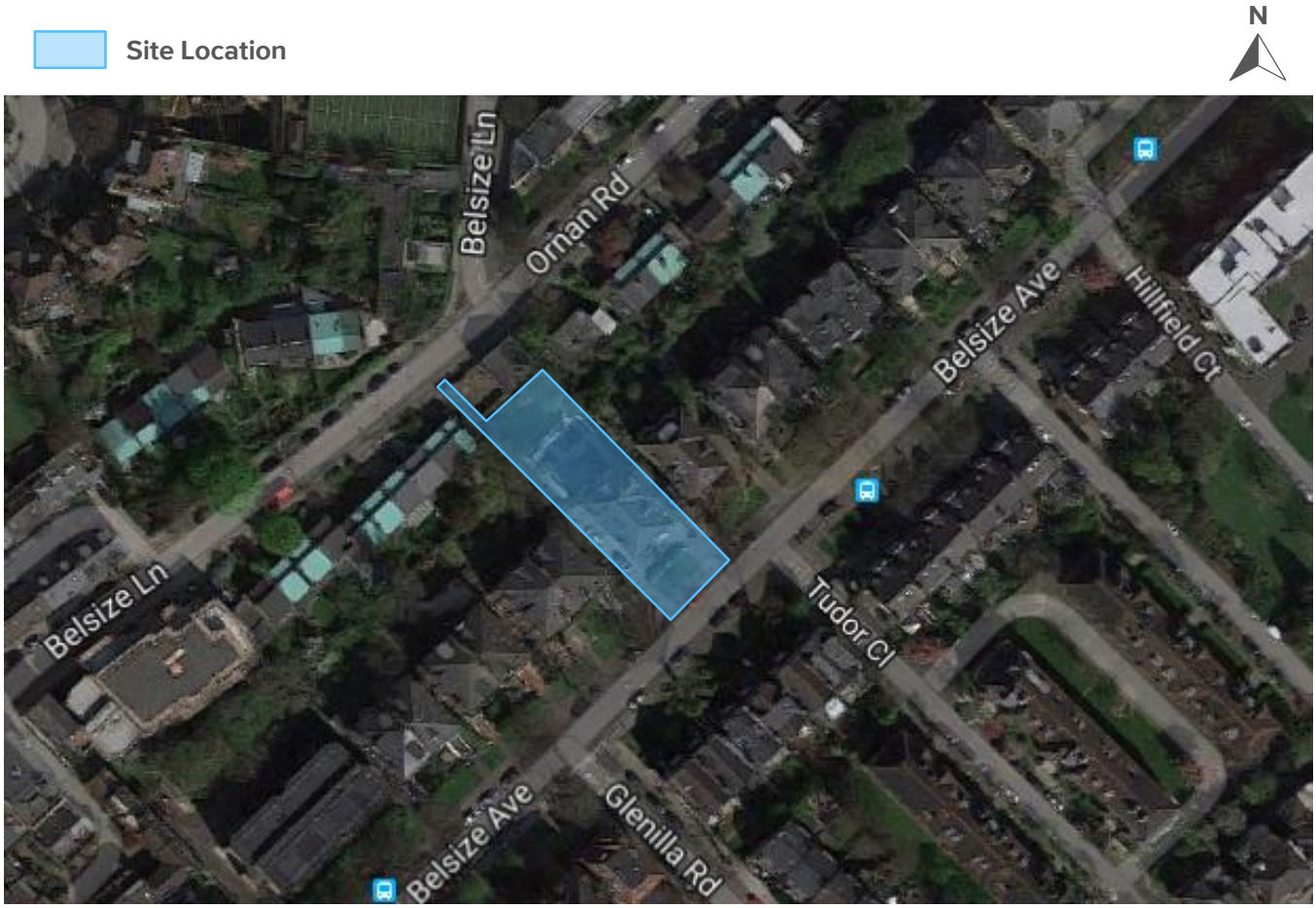


Figure 1. Approximate location of Site

EXISTING SITE DESCRIPTION AND TOPOGRAPHY

The existing site layout is shown on the topographical survey plan as displayed in Appendix A. The existing site currently comprises a mix of hardstanding and soft scape areas with the existing onsite building occupying a large portion of the existing site.

GEOLOGY OF SITE

Geological information for the site was gathered from the British Geological Survey (BGS) 'Geology of Britain Viewer'. The BGS describes the bedrock of the proposed site as London Clay Formation – Clay, Silt and Sand described as comprising "*bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay.*" (summary taken directly from BGS).

The BGS does not contain any information on the superficial deposits at the proposed site location, however, research of borehole data near the development site suggests that the superficial layer is likely to consist of gravelly clay whereby the gravel consists of brick, flint and quartz (made ground).

The BGS Geological Map showing bedrock deposits at the site is displayed in the following image.

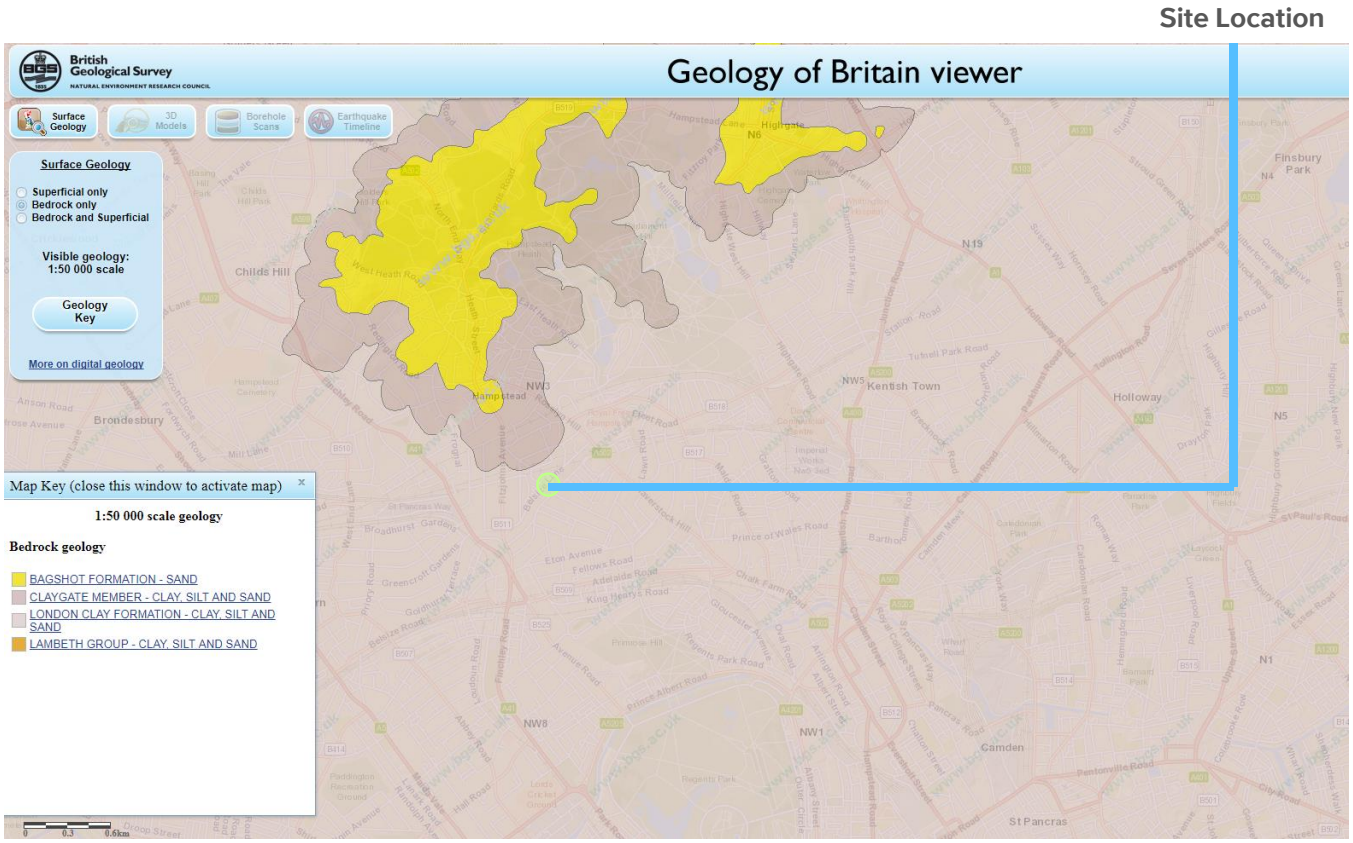


Figure 2. Bedrock geology at the proposed site location (Source: BGS)

PLANNING POLICY

The proposed development has been designed in line with the requirements set out in national policy as well Camden Local Plan (2017). This section highlights the policies applicable to the proposed Standard House development.

NATIONAL PLANNING POLICY FRAMEWORK (MARCH 2015)

National Planning policy sets out the strategy for future development across the UK. It states that;

- *Development in areas at risk of flooding should be avoided, but where development is necessary, making it safe without increasing flood risk elsewhere. Local Plans should be supported by Strategic Flood Risk Assessment and develop policies to manage flood risk from all sources.*
- *Local Plans should apply a sequential, risk-based approach to the location of development to avoid where possible flood risk to people and property, taking account of the impacts of climate change, by: Safeguarding land from development that is required for current and future flood management; using opportunities offered by new development to reduce the cause and impact of flooding.*

THE LONDON PLAN (2016)

The London Plan 2016 is the overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for the development of London over the next 20-25 years. The overarching policy setting out the principles of flood risk associated with construction are incorporated in Policies 5.12 and 5.13.

- **Policy 5.12 Flood risk management:** *Development proposals must comply with the flood risk assessment and management requirements set out in the NPPF and the associated technical Guidance on flood risk over the lifetime of the development and have regard to measures proposed in Thames Estuary 2100 (TE2100 – see paragraph 5.55) and Catchment Flood Management Plans;*
- **Policy 5.13 Sustainable Drainage**: *Development 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*

CAMDEN LOCAL PLAN (2017)

- **Policy CC3 – Water and Flooding** – The Council will seek to ensure that development does not increase flood risk and reduces the risk of flooding where possible. We will require development to:
  a. incorporate water efficiency measures;
  b. avoid harm to the water environment and improve water quality;
  c. consider the impact of development in areas at risk of flooding (including drainage);
  d. incorporate flood resilient measures in areas prone to flooding;
  e. utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible; and
  f. not locate vulnerable development in flood-prone areas.

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

FLOOD RISK

The proposed development is located in Flood Zone 1, with a low risk of flooding from rivers and seas as recommended by the Environment Agency. Assessment of this site has been based upon the Environment Agency's flood map, the topographical site survey and the architect's proposed development layout. The assessment indicates that flood risk at the site from all sources of flooding is considered to be low.

FLOOD VULNERABILITY

Table 1 on the following page, extrapolated from the National Planning Policy Framework (NPPF), summarises the category of vulnerability that various building types and land uses are considered to fall under. Table 2 on the subsequent page furthers this by highlighting what development type is appropriate for each flood zone, as well as summarising the flood risk assessment requirement and policy aim. The grouping of particular building types into vulnerability categories is based partly on a building's need to stay operational during a period of flooding and on DEFRA's research into 'Flood Risk to People'.

Table 1. Flood vulnerability categories

Flood Vulnerability Categories
Essential Infrastructure
• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure, including electricity generating power stations, grids, primary substations and water treatment works that need to remain operational in times of flood.
Highly vulnerable
• Police, Ambulance and Fire stations and command centres, and telecommunications installations required to be operational during flooding. • Emergency dispersal points, basement dwellings, caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substance consent.
More Vulnerable
• Hospitals, residential institutions such as care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling house, student halls of residence, drinking establishments, nightclubs, hotels and sites used for holiday or short-let caravans and camping. • Non-residential uses for health service, nurseries and educational establishments. • Landfill and waste management facilities for hazardous waste.
Less vulnerable
• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops, financial, professional and other services, restaurants and cafes, offices, industry, storage and distribution and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities), mineral workings and processing (except for sand and gravel). • Water treatment plants and sewerage treatment plans (if adequate pollution control measures are in place.)
Water-Compatible Developments
• Flood control infrastructure, water transmission infrastructure sewage transmission infrastructure and pumping stations. • Docks, marinas and wharves, navigational facilities. • MOD defence installations • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterslide location. • Water-based recreation (excluding sleeping accommodation) • Lifeguard and coastguard stations • Amenity open space, nature conservation and sports recreation. • Essential sleeping or residential accommodation for staff required by users in this category, subject to a warning and evacuation plan.

Table 2. Flood zone classification

Flood Zone Classification	Definition of Zone	Appropriate Uses	FRA Requirement	Policy Aims
Zone 1: Low Probability	Land having a less than 1 in 1000 annual probability or river or sea flooding (shown as all land outside zones 2 and 3)	• All development types	Proposals compromising greater than one hectare with a vulnerability to flooding and the potential to increase flood risk elsewhere in the catchment.	Developers/local authorities should aim to reduce overall risk of flooding through layout and form and SUD application
Zone 2: Medium Probability	Land having between a 1 in 100 and 1 in 1000 annual probability of river flooding or between a 1 in 200 greater annual probabilities of sea flooding.	• Water-compatible • Less vulnerable • More vulnerable • Essential infrastructure • Highly vulnerable (only appropriate if exception test applied and passed.	All development proposals should be accompanied by a FRA.	
Zone 3a: High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or a 1 in 200 or greater annual probability of sea flooding.	• Water compatible • Less vulnerable • More vulnerable and essential infrastructure (only appropriate if exception test applied and passed.		Developers/local authorities should aim to reduce overall risk of flooding through layout and form and SUD application, relocate existing development to land in a lower flood zone and restore functional floodplain/safeguarding open space for flood storage.
Zone 3b: The Functional Floodplain	This zone compromises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their strategic Flood Risk Assessments area of functional floodplain and its boundaries accordingly.	• Only the water-compatible uses and the essential infrastructure that has to be there should be permitted.		

FLUVIAL OR TIDAL FLOODING

The Environment Agency have developed a series of flood risk maps which can be used to analyse the relative flood risk for different return periods.

From the map below it can be seen that the development site is located within Flood Zone 1. Areas located within Flood Zone 1 are said to be at low risk of flooding from rivers and seas, with a predicted probability of less than 1 in 1000 of flooding an annual basis. In accordance with Table 2 from the NPPF's technical guidance displayed on Page 11, land within Flood Zone 1 is suitable for any use.

As the site is considered to be located in Flood Zone 1, it can be concluded that there is low risk of either fluvial or tidal flooding.

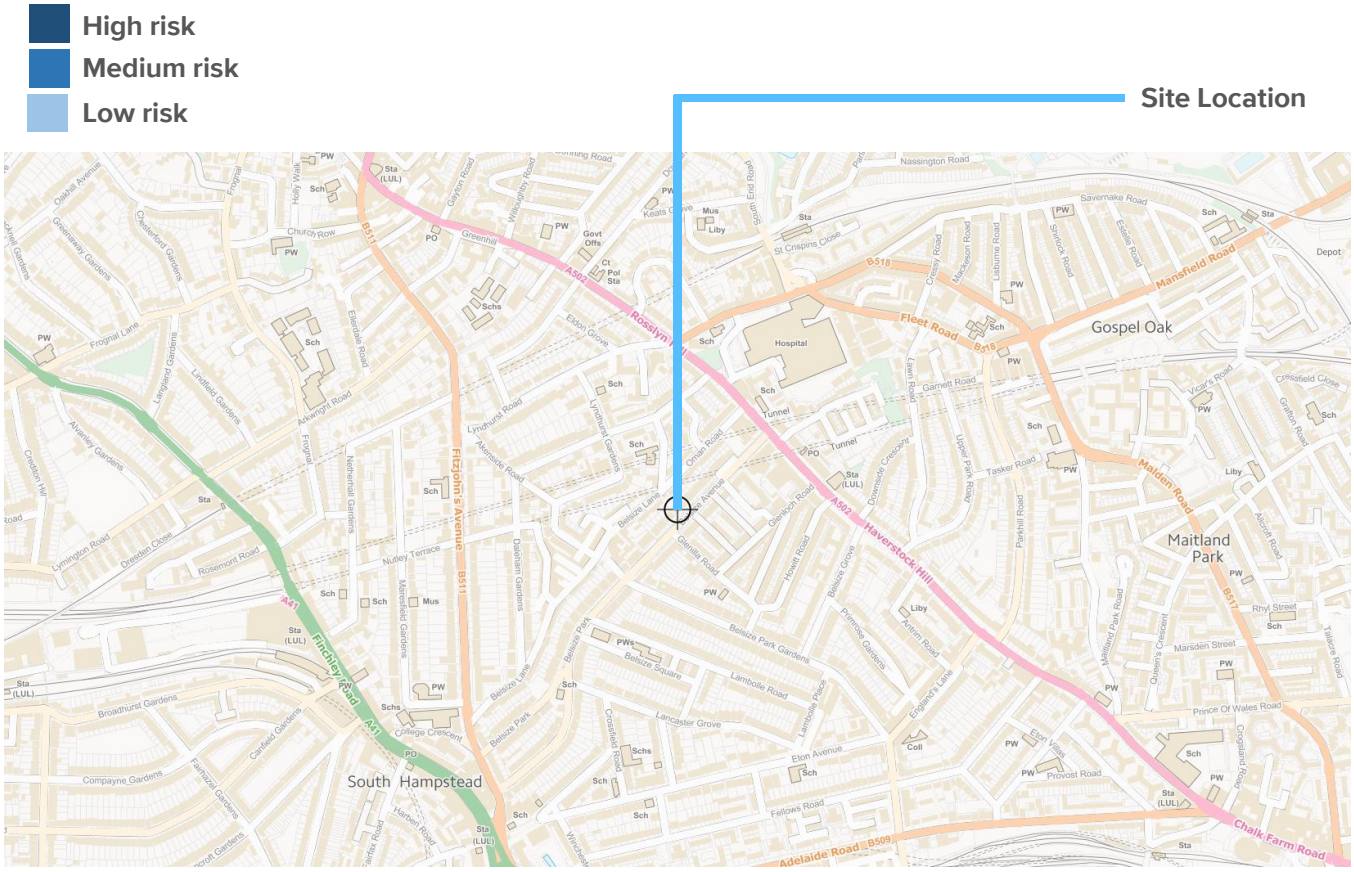


Figure 3. Risk of flooding from rivers and seas (Source: EA Flood Maps)

FLOODING FROM LAND (OVERLAND FLOW)

The image below shows that the development site is located in an area of very low risk of flooding from overland flow. A small portion of the site is located in an area considered to be at low risk, with the remaining site area considered to be at no risk of flooding from overland flow.

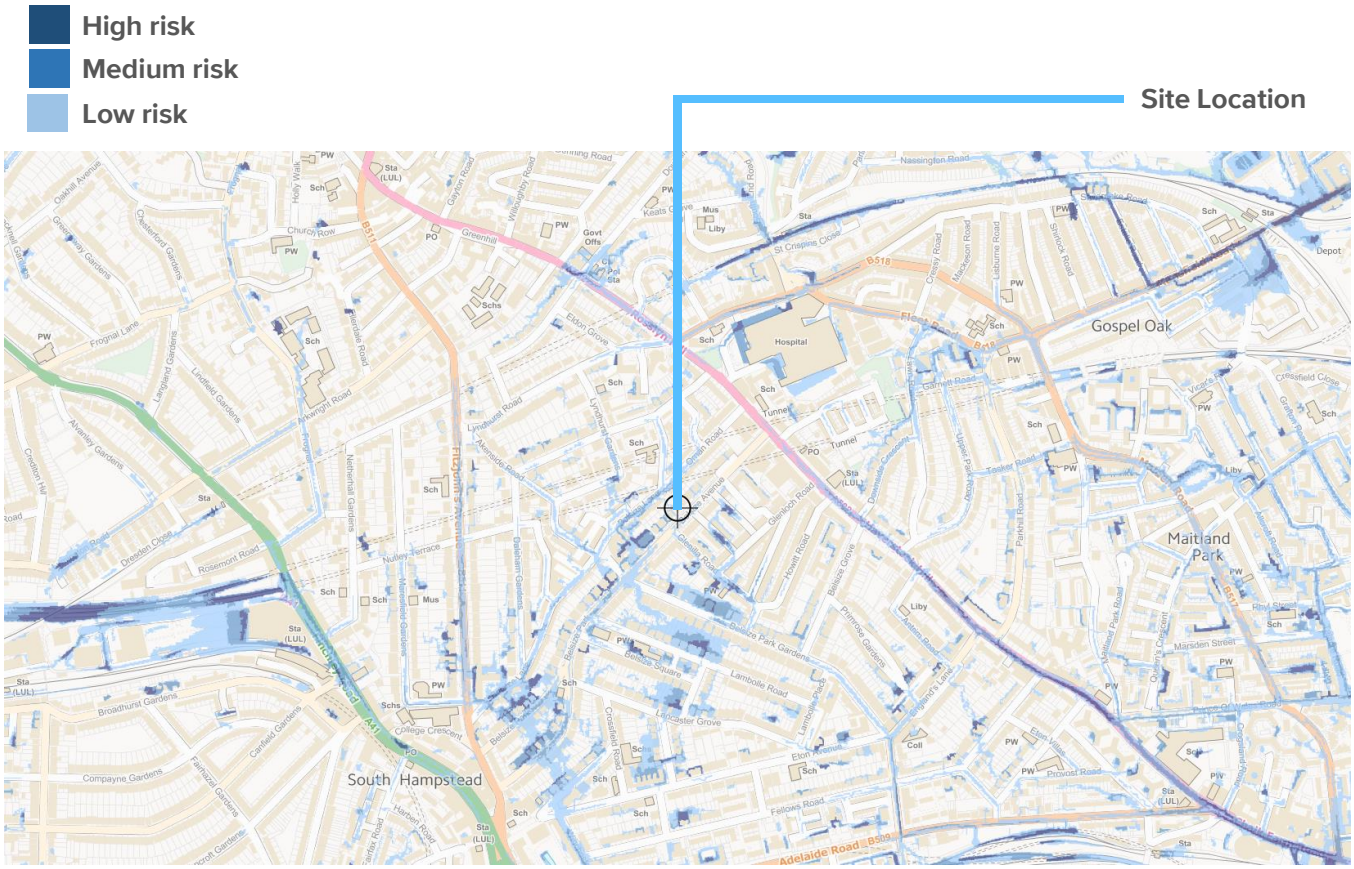


Figure 4. Flooding from overland flow (Source: EA Flood Maps)

FLOODING FROM GROUNDWATER

The map below taken from the London Borough of Camden Flood Risk Management Strategy shows areas believed to be especially vulnerable to groundwater flooding. Records indicate that groundwater is not exclusive to these areas and surveys are recommended for anyone wishing to better understand the groundwater risk in their areas. As can be seen from the image, the site is located in an area outside of the groundwater emergence zone that has previously experienced no incidence of groundwater flooding. For this reason it can be concluded that the proposed development site is not at risk from groundwater flooding.

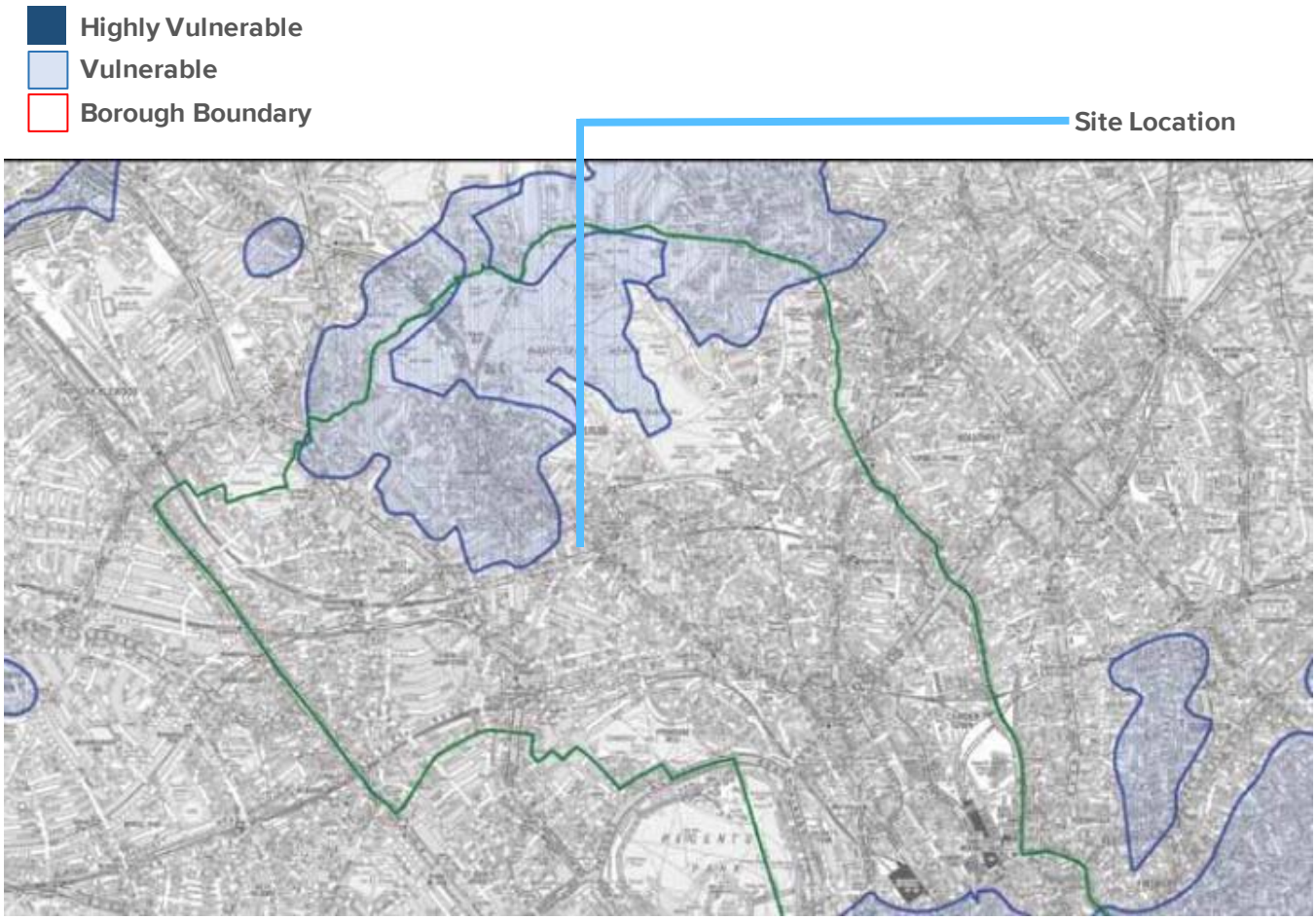


Figure 5. Flood risk from groundwater (Source: London Borough of Camden Flood Risk Management Strategy)

FLOODING FROM SEWERS

Modern sewer systems are typically designed to accommodate rainfall events with a 1 in 30-year return period. The images below display the number of internal and external sewer flood records for the last 10 years within the area surrounding the proposed site. In the area of the proposed site it appears that there has been 1 incident of internal and external sewer flooding, which given the size of the area is very low. As such the risk of flooding from sewers for the proposed development site is considered to be negligible.

The proposed development and associated SUDS strategy is anticipated to reduce the risk of sewer surcharge. The development will reduce the amount of surface water runoff generated from the site. The following section details how the proposed SUDS strategy will reduce the peak rate of runoff leaving the site.

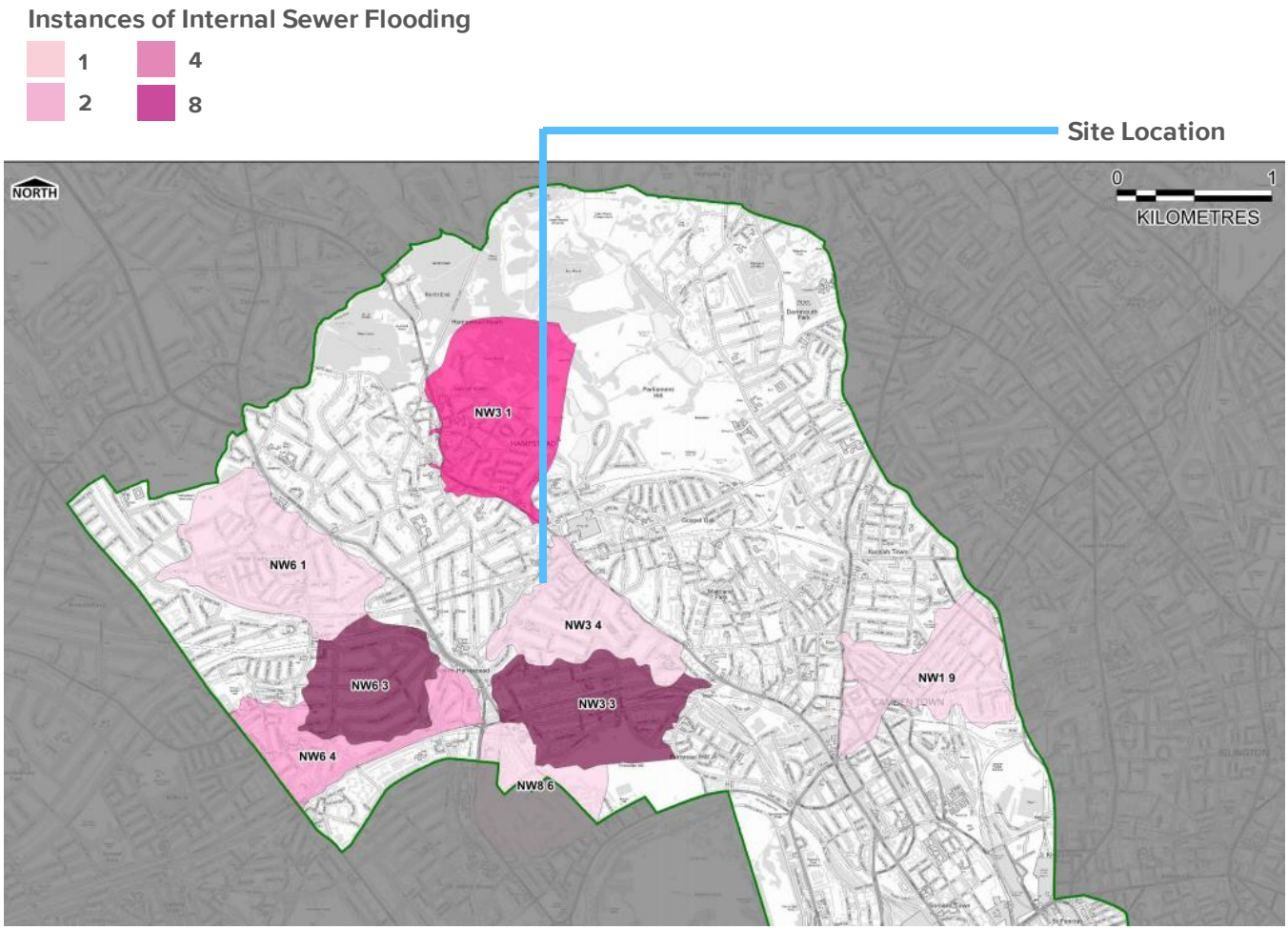


Figure 6. Internal Sewer Flooding risk from sewers (Source: London Borough of Camden Strategic Flood Risk Assessment)

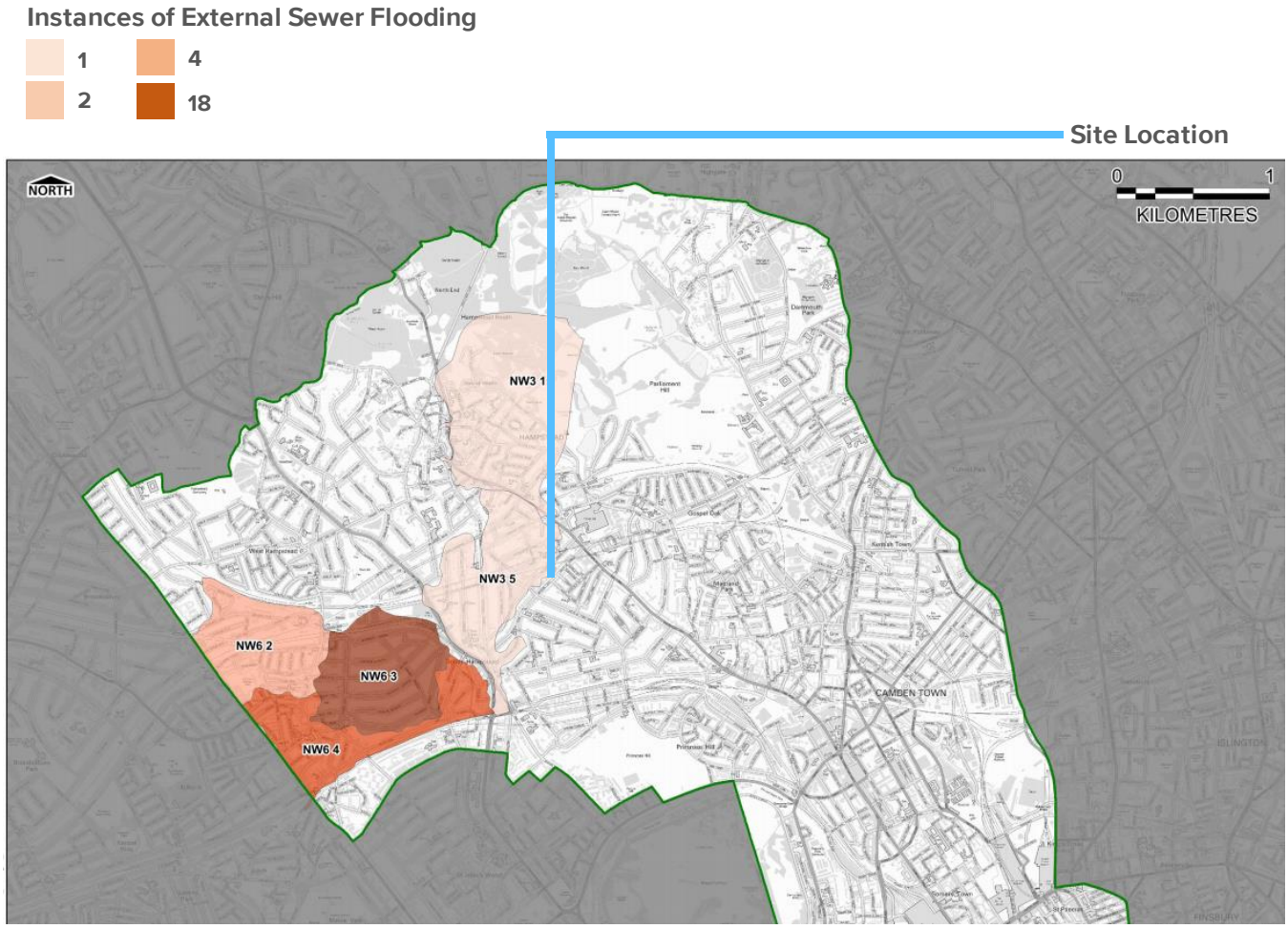


Figure 7. External Sewer Flooding risk from sewers (Source: London Borough of Camden Strategic Flood Risk Assessment)

FLOODING FROM RESERVOIRS, CANALS AND OTHER ARTIFICIAL SOURCES

The image below shows the maximum extent of flooding from reservoirs, canals and other artificial sources. The map shows that no risk of flooding appears to be present in the vicinity of the site.

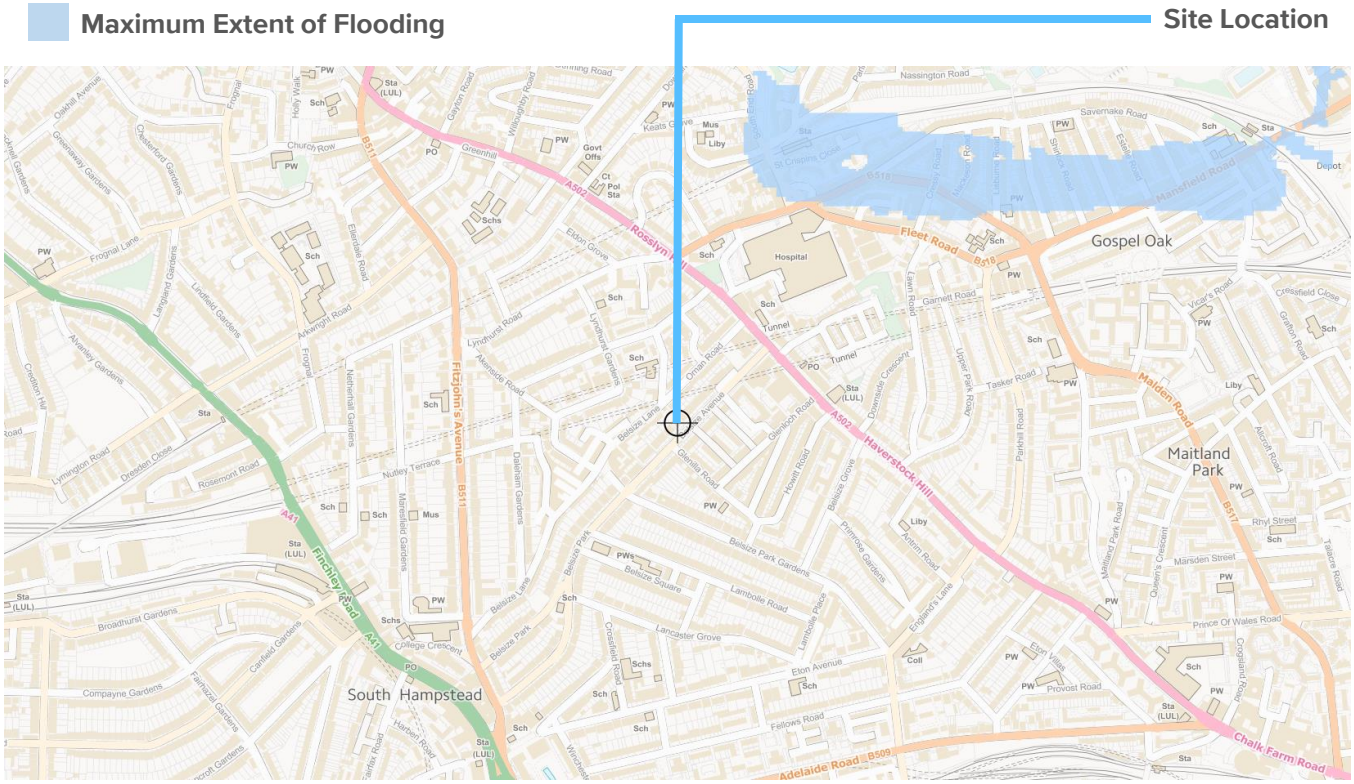


Figure 8. Flood risk from reservoirs, canals and other artificial sources (source: EA Flood Maps)

DRAINAGE SYSTEMS

This section of the report introduces the concept of Sustainable Urban Drainage Systems (SUDS). The proposed solution for the 33 Belsize Avenue site incorporates permeable landscaping solutions to manage ground level surface water runoff and a rain garden planter system to manage roof level runoff.

SUSTAINABLE URBAN DRAINAGE SYSTEMS

The total site area is approximately 875m^2, with a pre-development impermeable area of 569.2m^2. Pre- and post-development surface water runoff calculations showing the peak flow rate leaving the site can be found in Appendix C: Surface Water Calculations.

Following the development, with the addition of extensive permeable landscaped areas, the total impermeable area will decrease to approximately 496.8m^2. This impermeable area comprises the roof space and surrounding driveway/hard landscaping.

The onsite surface water would be managed in a sustainable manner to mimic the pre-development greenfield water flow arising from the site as close as possible. This management strategy should aim to reduce flood risk to the site itself as well as elsewhere in the catchment area while taking the influence of climate change into account.

The most effective way of managing flood risk at urban sites is through reducing the rate of surface water discharge. Historically, traditional piped systems transport surface water through our developments as quickly as possible, however this has proven to cause a number of additional adverse impacts including downstream flooding, reduced ground water levels, dry water flow and surface water contamination through run-off contamination.

SUDS work through utilising the principle of ecosystem services. They are designed to drain developed areas in a more natural way, using the infiltration and storage capacities of semi-natural devices such as infiltration trenches, swales and ponds. There are a number of both environmental and social benefits that arise from SUDS application. These include:

- Habitat creation through the incorporation of urban watercourse.
- Protection and enhancement of water quality – improved water quality leaving site through on-site attenuation, mechanical filtration and biological filtration.
- Amenity space creation through developing open green spaces.

Figure 9: Typical SUDS Solutions

EXISTING DRAINAGE NETWORKS

The Thames Water asset plan in Appendix B shows that there is a surface water sewer located approximately 40m northeast of the development site, on Belsize Avenue near the junction with Tudor Close, with a cover level of 65.8m AOD and an invert level of 61.1m AOD.

PROPOSED SUDS SOLUTION

The suggested SUDS solution aims to treat rainwater at source as far as possible, reducing the burden on existing Thames Water infrastructure. In order to deal with as much of the surface runoff at source, the area of total soft scape landscaping should be maximised as much as reasonably possible.

Policy 5.13 (Sustainable Drainage) of the London Plan and Policy CC3 (Water and Flooding) of the Camden Local Plan states that developments should aim to achieve greenfield runoff rates (calculated at 0.422 l/s for the development site). This target is however not always feasible for refurbishments or extensions to existing developments where drainage is dependent largely on the existing onsite drainage network. For this reason the SUDS strategy described below demonstrates the design team's ambition to reduce runoff rates as far as feasibly possible beyond the existing onsite conditions.

Due to the urban nature, density of the site and underlying geology, the application of many below ground SUDS strategies were considered unrealistic (soakaways, ponds, swales and basins). For this reason, the scheme will aim to utilise rainwater interception to minimise site runoff. As a result of this, it has been suggested that any outflow would be conveyed into a stone blanket system underneath the paving and a rainwater garden system, to intercept the slow the surface water run-off from the ground and roof respectively.

For the proposed 33 Belsize Avenue development site, it is recommended that the rear patio area utilises permeable paving, where runoff infiltrates through the surface permeable laying course into the porous permeable structural layer and foundation. Below this should sit an impermeable geomembrane with water flow facilitated by a perforated drainage pipe that connects directly to the existing onsite drainage system. The closest drainage system is located immediately adjacent to the proposed paving area, identified and displayed with the CCTV drainage survey shown in Appendix A. The system would perform the dual task of intercepting water run-off and providing water filtration benefits.

Further to this, it is proposed that a raingarden planter should be incorporated into the design to collect the runoff from roof level. The roof runoff from a portion of the roof will be conveyed to a raingarden planter system in the light well on the eastern side of the building, and then connecting into the drainage network shown within the CCTV survey (Appendix A). This system would intercept and buffer the roof run-off, slowing the rate at which it is conveyed to the sewer.

This analysis has fully considered the Sustainable Urban Drainage hierarchy. With the information provided it was determined that the post development runoff rate will reduce from pre development rates through an increase in permeable landscaped areas alone. With the addition of the proposed SUDS strategy this runoff rate is anticipated to decrease further, displaying a significant benefit in onsite drainage for a development of this nature. This reduction in runoff rate will limit the burden on existing drainage infrastructure while also minimising flood risk both onsite and elsewhere in the catchment. With the extent of permeable landscaped area maximised, along with the incorporation of a permeable paving system to manage surface water runoff and a rain garden planter system to manage roof level runoff, the total site runoff post development will be significantly reduce beyond pre development levels. There will be a significant reduction from the pre-development runoff rate, achieving the targets set out within the Camden Local Plan.

In the event of system exceedance (caused by greater than a 1 in 100 year rainfall event) or failure of the proposed drainage system, the topography of the site will ensure that rainfall will flow off site and gather at the low point on Belsize Avenue. Therefore, reducing the risk of water ingress into the building and to other vulnerable receptors in the immediate area.

This analysis has fully considered the Sustainable Urban Drainage hierarchy. With the information provided it has been proven facilitating onsite rainwater storage and attenuation can significantly reduce the outflow runoff rate. This will reduce the burden on existing Thames Water infrastructure and reduce the risk of flooding on site and elsewhere in the catchment.

TIMESCALE AND MAINTENANCE

All drainage works shall be completed prior to first occupation and there shall be no adoption of any of the drainage works within the site. The developer/landlord should be responsible for overseeing the long-term maintenance of all communal drains. The following outline maintenance strategy sets out recommended timescales for maintenance of the proposed drainage works, in line with CIRIA SUDS Design Guide

- Regular inspection will comprise the inspection and cleaning of catchment, gutters, filters and tanks to reduce the likelihood of contamination, this is recommended to be carried out every 3 to 6 months.
- General maintenance should be carried out every three months to ensure that weeds, seedlings and any litter is removed.
- Pervious paving must be regularly cleaned of silt and other sediment to preserve its infiltration capacity.

CONCLUSIONS

FLOOD RISK ASSESSMENT

From the flood risk assessment, it can be concluded that the site falls within Flood Zone 1, indicating a low probability of fluvial or tidal flooding. In addition to this, the site is located in an area at low risk of flooding from overland flow, ground water, sewers or other artificial sources.

For this reason, it can be concluded that there is no flood risk associated with the 33 Belsize Avenue proposed development site.

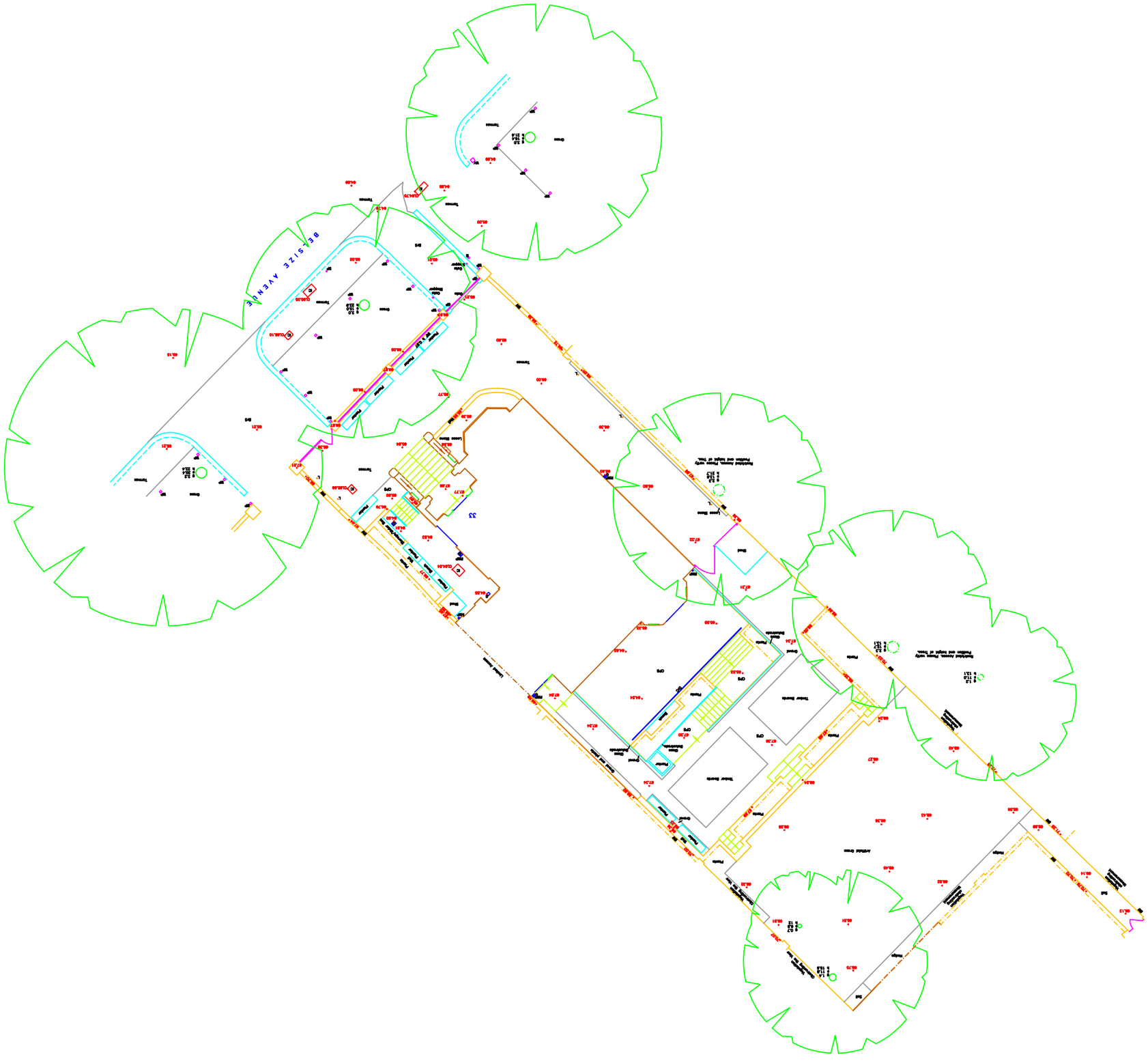
DRAINAGE STRATEGY

In order to ensure site runoff is minimised as far as reasonably possible, it is recommended that the rear patio area utilises permeable paving, where runoff infiltrates through the surface permeable laying course into the porous permeable structural layer and foundation before being discharged to the existing onsite drainage network. Further to this, a single raingarden planter is proposed to intercept the run-off from a portion of the roof.

The incorporation of these SUDS strategies will reduce the total site runoff compared to the pre-development level, displaying a significant improvement and complying with Policy CC3 (Water and Flooding) of the Camden Local Plan.

Overall, the drainage strategy will have no negative impact on flood risk at the site and elsewhere in the catchment. Indeed, the proposed SUDS strategy will greatly reduce the surface water leaving the site, and therefore reduce flood risk at the site and elsewhere in the catchment area.

APPENDIX A: DRAWINGS

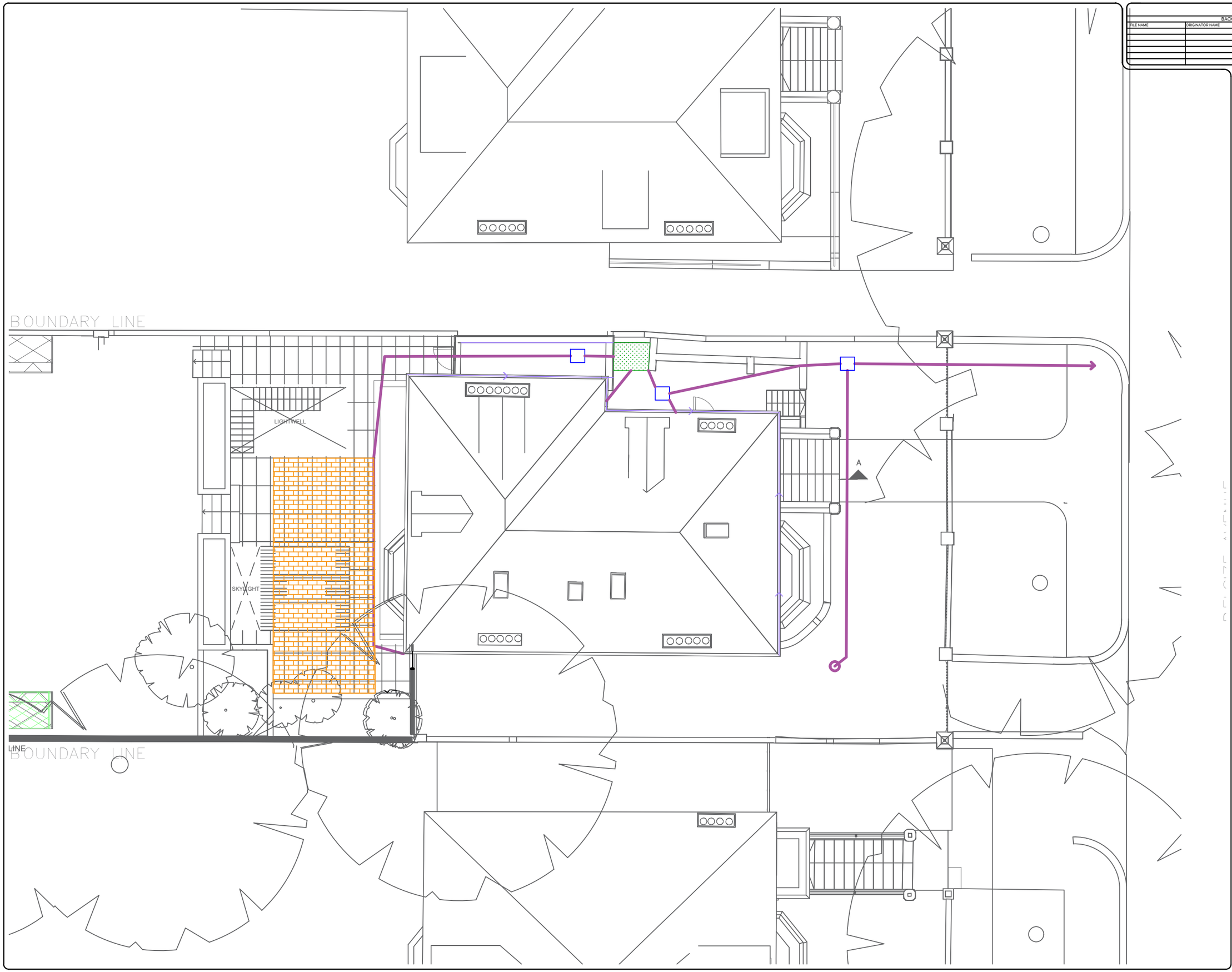


Topographical

DO NOT SCALE

BACKGROUND DRAWING INFORMATION

FILE NAME	ORIGINATOR NAME	DESCRIPTION NAME	REV	DATE RECD



Notes

- Permeable paving
- Rain garden planter
- Drainage pipe
- Manhole
- Direction of water flow

Rev	Date	Description	Chk'd	Appr
XX	00.00.16	XX	XX	XX

Planning Issue

XCO2

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Client: Vikki Done

Architect: KSR Architects

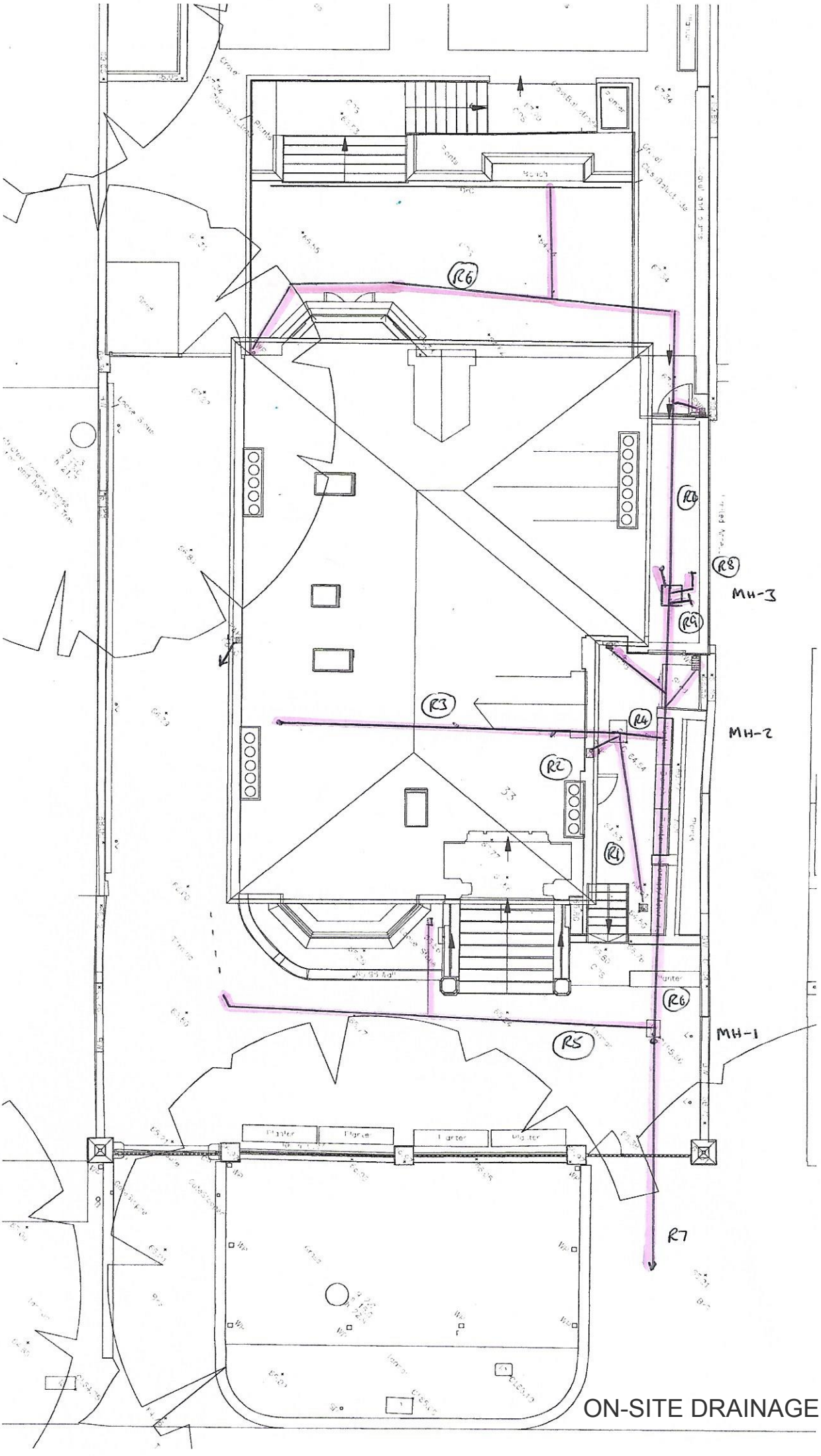
Project: 33 Belsize Avenue

Title: Preliminary SUDS Markup

Scale@A3	Drawn	Checked	Date
N.T.S	SL	JC	20/12/2017

Drawing Number: 8_997_01

Revision: 03



ON-SITE DRAINAGE SURVEY

APPENDIX B: THAMES WATER ASSET PLAN

Asset location search

Property Searches

XCO2 Energy Ltd
56 Sans Walk,

LONDON
EC1R 0LU

Search address supplied	33 Belsize Avenue 33 Belsize Avenue Belsize Park London NW3 4BL
Your reference	9_997
Our reference	ALS/ALS Standard/2017_3653812
Search date	19 September 2017

Keeping you up-to-date

Knowledge of features below the surface is essential in every development. The benefits of this not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility for any commercial or residential project.

An asset location search provides information on the location of known Thames Water clean and/or wastewater assets, including details of pipe sizes, direction of flow and depth. Please note that information on cover and invert levels will only be provided where the data is available.

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

searchcode

Asset location search

Search address supplied: 33 Belsize Avenue, 33, Belsize Avenue, Belsize Park, London, NW3 4BL

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

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.

Asset location search

Property Searches

For your guidance:

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

Payment for this Search

A charge will be added to your suppliers account.

Asset location search

Property Searches

Further contacts:

Waste Water queries

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

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

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

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

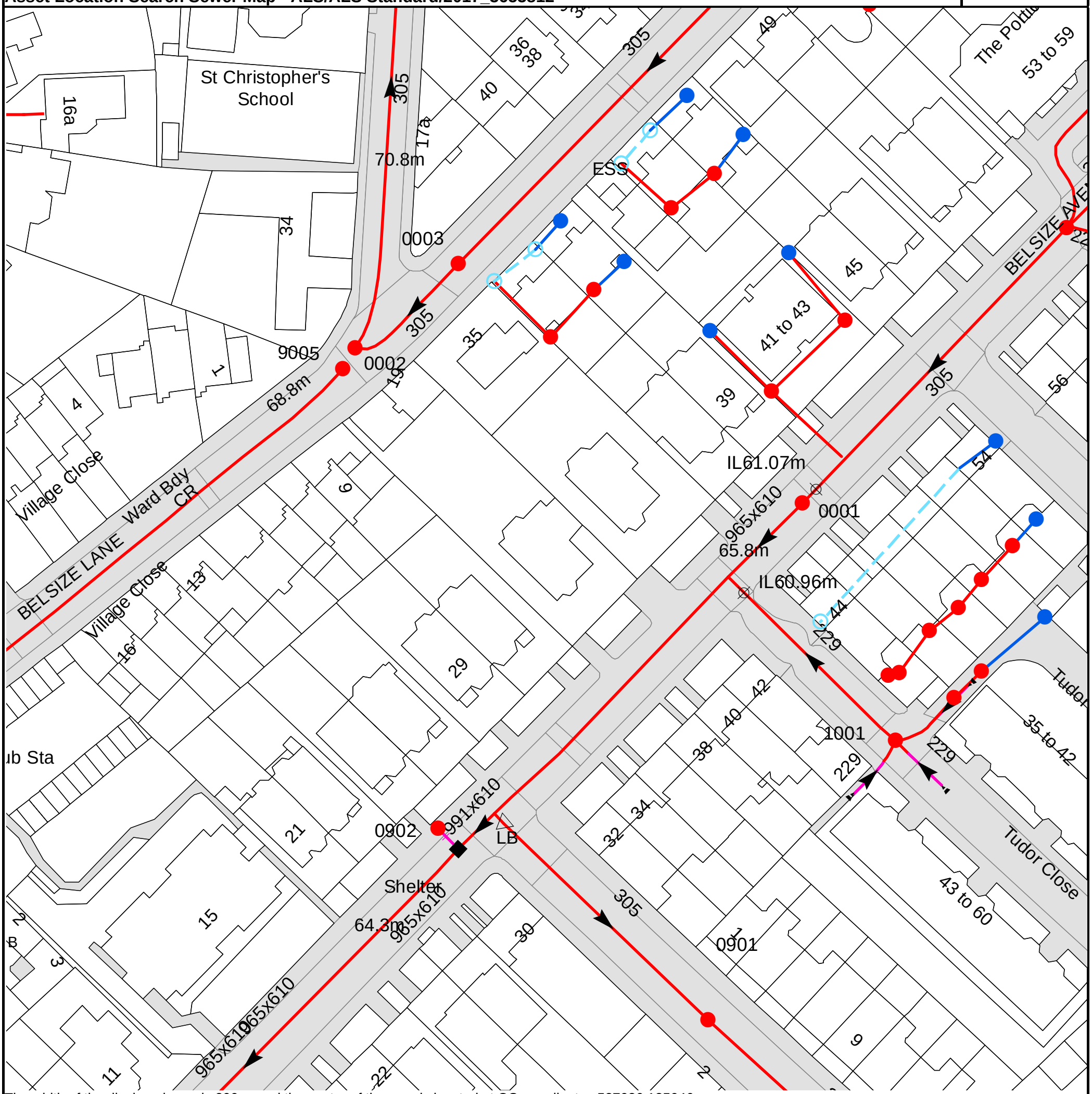
Clean Water queries

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

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

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

Asset Location Search Sewer Map - ALS/ALS Standard/2017_3653812



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 527036,185046

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

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

Manhole Reference	Manhole Cover Level	Manhole Invert Level
00AG	n/a	n/a
00CB	n/a	n/a
00AF	n/a	n/a
1001	64.47	61.74
00BA	n/a	n/a
10BC	n/a	n/a
10AD	n/a	n/a
10BD	n/a	n/a
10BE	n/a	n/a
10AB	n/a	n/a
10BI	n/a	n/a
10BF	n/a	n/a
10BG	n/a	n/a
10AC	n/a	n/a
1101	68.22	63.83
9005	n/a	n/a
0002	69.2	65.64
0902	n/a	n/a
0003	69.82	66.47
00DD	n/a	n/a
01CF	n/a	n/a
00DC	n/a	n/a
01CC	n/a	n/a
00DB	n/a	n/a
01BJ	n/a	n/a
00DA	n/a	n/a
01CE	n/a	n/a
01BI	n/a	n/a
01CD	n/a	n/a
0901	62.91	58.78
00CD	n/a	n/a
01BH	n/a	n/a
01BG	n/a	n/a
00CC	n/a	n/a
00CF	n/a	n/a
0001	65.67	60.94

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

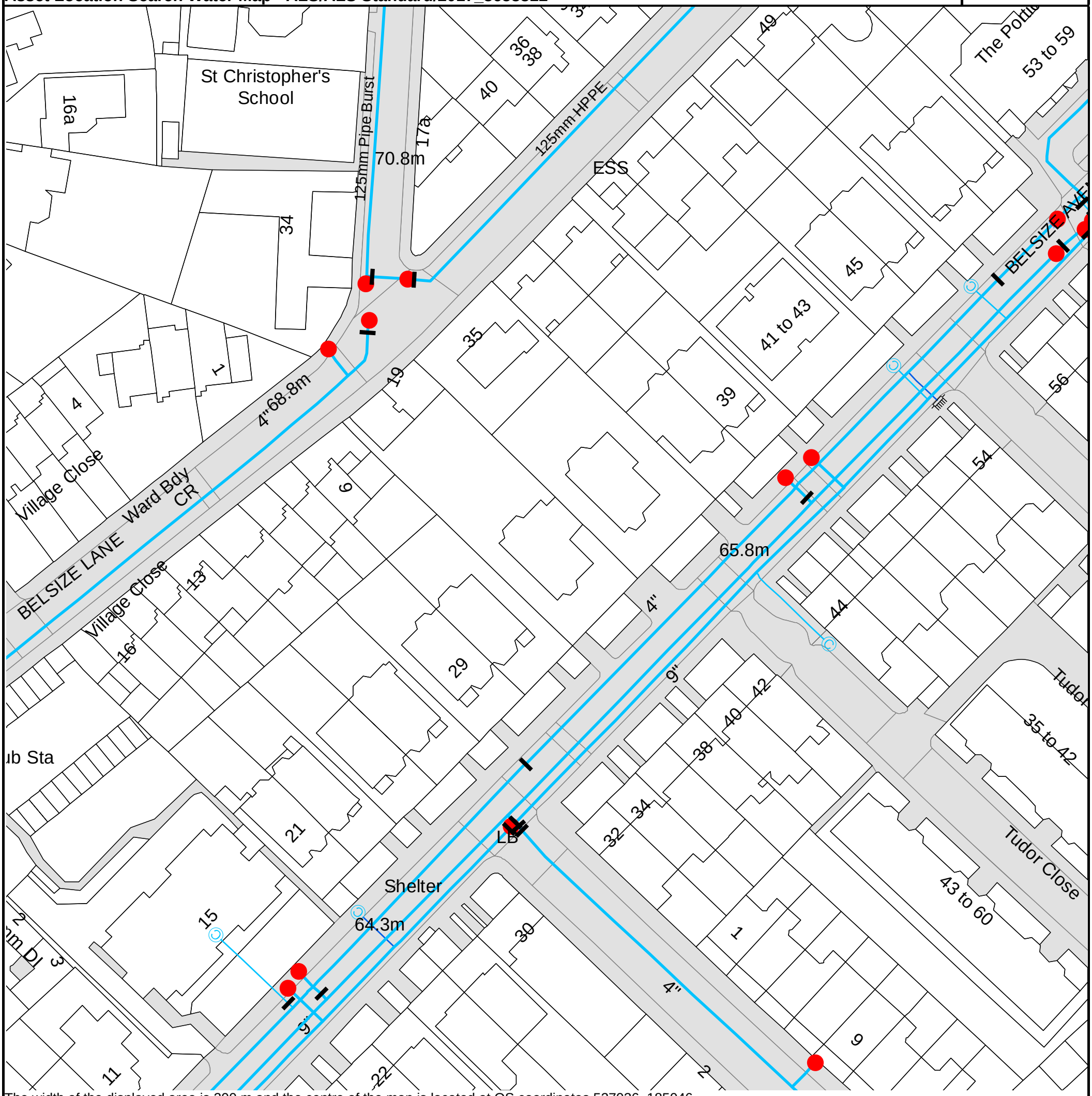
Proposed

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/2017_3653812



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 527036, 185046.

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**

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

Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

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

The Search Code:

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

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

The Code's core principles

Firms which subscribe to the Search Code will:

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

Complaints

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

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

TPOs Contact Details

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

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

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

APPENDIX C: SURFACE WATER CALCULATIONS

XCO2 Energy Ltd
www.xco2.com
17-18 Haywards Place,
Clerkenwell,
London EC1R 0EQ
Tel: +44 (0)20 7700 1000
Email: mail@xco2energy.com

MasterDrain
HY 9.36

Job No. 8_997			
Sheet no. 1			
Date 21/09/17			
Project 33 Belsize Avenue	By SL	Checked	Reviewed
Title Surface Water Run-Off calculations			

Data:-

Hydrology:-

Location = 33 Belsize Avenue		WRAP	= 4
Long reference = 0		Grid reference =	
M5-60 (mm)	= 21	SAAR (mm/yr)	= 700
r	= 0.45	Soil	=0.47
Hyd. area	= 7	Hyd. zone	= 8
Hydrograph	= Summer	Area = England and Wales	

Site values used in design:-

Total site area	= 0.0875 ha	Climate change factor	= 30%
Pre-dev area drained	= 0.0570 ha	Post-dev area drained	= 0.0497 ha
Imperm runoff factor	= 98%	Perm runoff factor	= 20%

Pre-development

Area to soakaways	= 0.0000 ha	Area to other SUDS	= 0.0000 ha
Perv. area to SUDS	= 0.0000 ha	Pre-dev flow to drain	= 0.00 l/s

Post-development

Area to soakaways	= 0.0000 ha	Area to other SUDS	= 0.0000 ha
Perv. area to SUDS	= 0.0000 ha	Post-dev flow to drain	= 0.00 l/s

Calculations:-

Revised Post-dev Imperm. area = 0.050 ha
Equiv. Post-dev Imperm. area = 0.049 ha
Equiv. Post-dev Perm. area = 0.008 ha
Total Pre-dev equiv. area ha = 0.062 ha
Total Post-dev equiv. area ha = 0.056 ha
100 yr 6 hour mean intensity = 10.37mm/hr

Results:-

Pre-dev peakflow runoff (l/s)(m³/s)

R.P.	15	30	60	120	240	360	480	600	Max	CCF	Final	R.P.
1	23.0	15.0	9.4	5.5	3.3	2.5	2.0	1.7	23.0	N/A	23.0	1
30	56.2	35.9	21.8	12.9	7.5	5.4	4.3	3.6	56.2	N/A	56.2	30
100	73.2	47.0	28.7	16.9	9.7	7.0	5.5	4.6	73.2	N/A	73.2	100

Post-dev peakflow runoff (l/s)

R.P.	15	30	60	120	240	360	480	600	Max	CCF	Final	R.P.
1	20.9	13.6	8.5	5.0	3.0	2.3	1.8	1.5	20.9	30	27.1	1
30	51.0	32.6	19.8	11.7	6.8	4.9	3.9	3.2	51.0	30	66.3	30
100	66.4	42.7	26.1	15.4	8.8	6.4	5.0	4.2	66.4	30	86.4	100

100 year 6 hour (x Climate Change Factor) storm gives:-
Pre-dev runoff volume m³ = 38.6m³
Post-dev rainfall volume = 45.5m³
Post-dev volume m³ (excess above SUDS) = 45.5m³
100 yr 6 hour mean intensity = 10.37mm/hr
Pre-dev volume to drain at 0 l/s = 0.0 m³
Post-dev volume to drain at 0 l/s = 0.0 m³
Post-dev storage volume = 45.5m³
Post-dev 5mm imperm volume = 2.5 m³
Post-dev 5mm perm volume = 1.9 m³

$Q_{BAR(rural)}$ = 0.422 l/s or 4.828 l/s/ha or 0.000 cumecs - from IoH 124.

The rainfall rates are calculated using the location specific values above in accordance with the Wallingford procedure.

XCO2 Energy Ltd
www.xco2.com
17-18 Haywards Place,
Clerkenwell,
London EC1R 0EQ
Tel: +44 (0)20 7700 1000
Email: mail@xco2energy.com

MasterDrain
HY 9.36

Job No. 8_997			
Sheet no. 2			
Date 21/09/17			
Project 33 Belsize Avenue	By SL	Checked	Reviewed
Title Surface Water Run-Off calculations			

Data summary.

Use the data below for the SUR1 form

Site areas:-

Total site area =	0.0875 ha ;875.0 m²	[3A]
Pre-development impermeable area =	0.0570 ha	[3B]
Pre-development permeable area =	0.0305 ha	
Post-development impermeable area =	0.0497 ha	[3C]
Post-development permeable area =	0.0378 ha	

Peak runoff:-

Pre-development 1 year storm (15min) =	23.0 l/s	[6A]
Pre-development 100 year storm (15min) =	73.2 l/s	[6C]
Post-development 1 year storm (15min) =	20.9 l/s	[6B]
Post-development 100 year storm (15min)=	66.45 l/s	[6D]

Greenfield runoff:-

$Q_{BAR(rural)}$ **= 0.422 l/s or 4.828 l/s/ha or 0.000 cumecs - from IoH 124.**

Climate change factor:-
CCF = 30%

Volumes:-
Pre-development 100 yr/6hr storm [12A]= 50.1m³
Post-development 100 yr/6hr storm (add. volume with no SUDS) [12B]= 45.5m³
Post-development 100 yr/6hr storm (add. volume with SUDS) = 45.5m³
Post-development add. predicted volume (No SUDS) [12C] = -4.6m³

You may also require
Data relating to the infiltration test calculations (if applicable)
Evidence to show runoff reduction (if applicable)
Information on calculation methods (if applicable see next sheet)

Note
Numbers in square brackets relate to the
Nov. 2010 v1.1 / issued 11/02/10 copy of SUR1

XCO2 Energy Ltd
www.xco2.com
17-18 Haywards Place,
Clerkenwell,
London EC1R 0EQ
Tel: +44 (0)20 7700 1000
Email: mail@xco2energy.com

Job No.	8_997
Sheet no.	3
Date	21/09/17

Project	By	Checked	Reviewed
33 Belsize Avenue	SL		

Title: **Surface Water Run-Off calculations**

Definitions and methods

Hydrology

The hydrological constants are derived from the Wallingford maps. They are used to calculate location specific rainfall figures.

Site values and factors

Areas of the site should be entered in hectares (10000 m²). If the Pre-development site is a green field, this box is blank.
Climate Change Factor is initially set at 20% - this may be changed as required.
Greenfield runoff is calculated using the method described in IoH 124.
Runoff factors

The impermeable runoff factor is initially set at 98%
The permeable runoff factor is initially set at 20%

Note: the CCF and the runoff factors may be changed by the user to suit the development
The areas draining to soakaways and other SUDS are entered in the appropriate box (in hectares)

Calculations

The post-development area is reduced by subtracting the areas that drain to soakaways or other SUDS, to give a revised figure.
All areas are then multiplied by the appropriate runoff factor to give an equivalent area with 100% runoff.
These are then summated.
This gives a total pre-development equivalent area, and a similar figure for the post-development area.
The 'Post-dev volume to drain (no SUDS)' gives the total runoff to drain if no SUDS were used.

Results

The pre- and post-development areas are subjected to 1,30 and 100 year return period storms with a duration of 15 to 600 minutes.
The Revised Post-dev Imperm. area is the area (in ha) that is not going to SUDS x impervious runoff factor.
The runoff rates are calculated for the chosen hydrograph (Summer or Winter) as l/s. Figures in red indicate m³/s
The peak value is measured, multiplied by the CCF and the total maximum rate is shown.
The pre- and post-development volumes for a 100 year / 6 hour storm are calculated from the area under the hydrograph curve.
Post-dev volume (i.e. excess above SUDS) is that volume produced by the drained area that does not go to SUDS.
Qbar(rural) is calculated in accordance with the procedure laid down in IoH 124

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