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GARAGES TO THE SOUTH OF 27a WEST END LANE

SuDS Drainage Assessment with Outline FRA – Revision A

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SuDS Drainage Assessment with Outline FRA

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Reference: EW/CC/P16-1126/02 Revision A

Date: June 2020

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Revision and Date	Amendment Details	Revision Prepared By	Revision Approved By
A 19.02.2021	Updated to reflect latest proposals	EW	JJ

1.0 INTRODUCTION

Brief

1.1 Create Consulting Engineers Ltd was instructed by AG Homes to develop a drainage strategy and undertake a Drainage Assessment for the proposed development of Garages to the South of 27a West End Lane, West Hampstead, NW6 4QJ.

Project Context

1.2 It is understood that this Drainage Assessment Report will be used by AG Homes to support a planning application for the proposed demolition of the existing eight garages and the erection of a three storey plus lower ground floor building comprising 3x1 bed units, 4x2 bed units, and 1x3 bed units (Class C3) with associated amenity space, cycle store, bin store, new landscaping and other associated works.

1.3 Plans showing the proposed scheme are included on Drawings WEL/PL/02 to WEL/PL/08.

Objectives

1.4 To prepare a Foul and Surface Water Drainage Strategy and undertake a drainage assessment in accordance with the National Planning Policy Framework (NPPF)[1], Planning Practice Guidance (PPG)[2] and local policy documents.

Planning Policy Context

1.5 The potential consequences of inappropriate development in a flood risk area for occupiers, either of the development or elsewhere, pose significant risks in terms of personal safety and damage to property.

National Planning Policy

1.6 The National Planning Policy Framework includes Government policy on development and flood risk stating that:

> *163. When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:*

1 NPPF accessed online (June 2020) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf
2 PPG accessed online (June 2020) http://planningguidance.planningportal.gov.uk/

a) Within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
b) The development is appropriately flood resistant and resilient;
c) It incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
d) Any residual risk can be safely managed; and
e) *Safe access and escape routes are included where appropriate, as part of an agreed emergency plan.*

1.7 The Planning Practice Guidance to the NPPF requires that at the planning stage, the developer should prepare and submit an appropriate FRA to demonstrate how flood risk from all sources of flooding to the development itself and flood risk to others will be managed now and when taking climate change into account.

1.8 To comply with the NPPF an FRA must be submitted for planning applications for developments within flood zones 2 and 3 (medium or high risk of fluvial or tidal flooding) and for all developments located in Flood Zone 1 (low risk) which are 1 hectare or greater; which has been identified by the Environment Agency as having critical drainage problems; identified in a strategic flood risk assessment as being at increased flood risk in future; or that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

1.9 An FRA should be appropriate to the scale, nature and location of the development and should identify and assess the risk from all sources of flooding to and from the development and demonstrate how any flood risks will be managed over the lifetime of the development.

Local Planning Policy

1.10 The Local Development Plans for the Camden area are the Camden Local Plan (London Borough of Camden, 2017) and London Borough of Camden Local Development Framework (London Borough of Camden, 2010).

1.11 The relevant policies from the Local Plan (London Borough of Camden, 2017) are as follows:

- Policy CC2 – Adapting to climate change

  The Council will require development to be resilient to climate change. We will ensure that schemes include appropriate climate change adaptation measures, such as:

  a) protecting existing green spaces and promoting new appropriate green infrastructure;
  b) not increasing and wherever possible reducing surface water run-off;
  c) incorporate green roofs, combination green and blue roofs and green walls where appropriate; and

d) measures to reduce the impact of urban and dwelling overheating.

- Policy CC3 – Water and flooding

  The Council will require developments to mitigate against flooding, be adaptable and reduce their water consumption. We will ensure that development:

  a) considers the impact of development on Local Flood Risk Zones (including drainage);

  b) does not locate vulnerable development (such as basements dwellings) in flood-prone areas;

  c) achieves a greenfield run-off rate or, where this is not possible, achieve runoff rates that do not exceed those predevelopment;

  d) incorporates water efficiency measures; and

  e) avoids harm to the water environment and water quality.

  Development should not increase flood risk and should reduce the risk of flooding where possible. Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable.

1.12 The relevant policy from the Camden Local Development Framework Core Strategy (London Borough of Camden, 2010) is as follows:

- Policy DP23 – Water

  The Council will require developments to reduce their water consumption, the pressure on the combined sewer network and the risk of flooding by:

  a) incorporating water efficient features and equipment and capturing, retaining and re-using surface water and grey water on-site;

  b) limiting the amount and rate of run-off and waste water entering the combined storm water and sewer network through the methods outlined in part a) and other sustainable urban drainage methods to reduce the risk of flooding;

  c) reducing the pressure placed on the combined storm water and sewer network from foul water and surface water run-off and ensuring developments in the areas identified by the North London Strategic Flood Risk Assessment and shown on Map 23 as being at risk of surface water flooding are designed to cope with the potential flooding;

  d) ensuring that developments are assessed for upstream and downstream groundwater flood risks in areas where historic underground streams are known to have been present; and

  e) encouraging the provision of attractive and efficient water features.

1.13 The relevant policies from these local planning documents have been considered as part of this flood risk assessment and drainage strategy.

1.14 The Strategic Flood Risk Assessment (SFRA) for Camden (URS, 2014), the SFRA for North London (Mouchel, 2008) and the Preliminary Flood Risk Assessment (PFRA) for Camden (Drain and Halcrow, 2011) provides a summary of the flood risks for the local area.

Climate Change

1.15 Climate change has important implications for the assessment and management of flood risk. The NPPF requires that climate change is considered when making an assessment of flood risk posed to future development.

1.16 Climate change has the potential to affect all identified sources of flooding at the Site. The likely impacts of climate change include increased severity of rainfall events as well as wetter winters leading to higher groundwater levels and increased frequency and severity of surface water flooding.

1.17 The influence of climate change on rainfall intensity has been taken into account by the surface water drainage strategy. An inclusion of 40% has been made for climate change for all rainfall events up to and including the 1 in 100 year event in accordance with NPPF requirements, and 'Flood Risk Assessments: Climate Change Allowances'[3].

Constraints and Limitations

1.18 The copyright of this report is vested in Create Consulting Engineers Ltd and the Client, AG Homes. The Client, or his appointed representatives, may copy the report for purposes in connection with the development described herein. It shall not be copied by any other party or used for any other purposes without the written consent of Create Consulting Engineers Ltd or the Client.

1.19 Create Consulting Engineers Ltd accepts no responsibility whatsoever to other parties to whom this report, or any part thereof, is made known. Any such other parties rely upon the report at their own risk.

1.20 The flood risk assessment addresses the flood risk posed to and from the proposed development, the extent of which is shown by the site boundary, as indicated by the location plan attached with this report.

1.21 This report has been undertaken with the assumption that the Site will be developed in accordance with the above proposals without significant change. The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the Site.

[3] Environment Agency (2016) *Flood Risk Assessments: Climate Change Allowances*.

1.22 Create Consulting Engineers Ltd has endeavoured to assess all information provided to them during this appraisal. Should additional information become available which may affect the opinions expressed in this report, Create Consulting reserves the right to review this information and, if warranted, to modify the opinions presented in the report accordingly.

1.23 The revised Construction (Design and Management) Regulations 2015 (CDM Regulations) came into force on April 2015 to update certain duties on all parties involved in a construction project, including those promoting the development. One of the designer's responsibilities is to ensure that the client organisation, in this instance AG Homes, is made aware of their duties under the CDM Regulations. Further information on the CDM Regulations is provided in the client guide and is available at www.hse.gov.uk/pubns/indg411.pdf. It has been assumed for the purposes of this assessment that the lead designer will be responsible for advising the Client.

1.24 The approach to this FRA follows the ethos of the CDM Regulation, inasmuch as during the assessment process the proposed development is considered and any foreseeable associated health and safety flood risks are identified. It is then considered how these flood risks can be eliminated, or mitigations identified to reduce or control them. The outcome of this assessment process is presented in this report. While preparing this FRA no other health and safety risks have been identified.

2.0 SOURCES OF INFORMATION

2.1 The information contained in this report is based on a review of readily available information pertinent to the site and consultation with interested parties.

Records Review

2.2 Key reports, drawings and websites pertinent to this assessment are detailed below in Table 2.1.

Document/Website	Author/Publisher	Date
Fluvial/Tidal Flood Maps, Surface Water, and Reservoir Flood Mapping – https://flood-warning-information.service.gov.uk	Environment Agency (EA)	Accessed June 2020
Groundwater Mapping (Magic Map) - https://magic.defra.gov.uk/magicmap.aspx	DEFRA	Accessed June 2020
London Borough of Camden Strategic Flood Risk Assessment	Camden	July 2014
North London SFRA	Mouchel	2008
London Borough of Camden SFRA	URS	2014
London Borough of Camden PFRA	Drain/Halcrow	2011
London Borough of Camden Surface Water Management Plan (SWMP)	Drain/Halcrow	2013
The Lost Rivers of London	Nicholas Barton	1992
Proposed Floor Plans (Drawings WEL/PL/02 to WEL/PL/08)	Stanhope Gate Architecture	February 2021
Thames Water Sewer Flooding History Enquiry (Appendix A)	Thames Water	May 2020
Thames Water Asset Plans (Appendix B)	Thames Water	August 2016
Thames Water Pre Development Enquiry (Appendix C)	Thames Water	April 2020

Table 2.1: Key Information Sources

Consultation

2.3 The parties consulted as part of this Flood Risk Assessment are detailed in Table 2.2.

Consultee	Form of Consultation	Topics Discussed and Actions Agreed
Thames Water Developer Services Team	Request for Sewer Flooding History Report	A sewer flooding history enquiry was submitted to Thames Water. The response dated May 2020 (Appendix A) confirmed that Thames Water do not hold any records of flooding in the requested area as a result of surcharging public sewers.
	Request for Asset Plans	Asset plans were requested in order to inform the foul and surface water drainage strategies.

Consultee	Form of Consultation	Topics Discussed and Actions Agreed
		The asset plans (Appendix B), dated 24 August 2016, show a combined sewer, 1143 x 763 mm in size, passing in a south western direction along West End Lane adjacent to the site. This adjoins with a series of combined sewers along Bransdale Close and Mutrix Road (unknown sizes) and enters into the Ranelagh Sewer (1245 x 864 mm) located 80 m south west of the site. All of the sewers in the local area appear to drain towards the Ranelagh sewer, which drains in a south easterly direction. There are no individual foul and surface water sewers in the vicinity of the site.
	Pre Development Enquiry	A Pre Development Enquiry was submitted on 15 April 2020 to ensure sufficient capacity is available the public sewer network for the foul and surface water flows from the site. The response (included as Appendix C), received on 4 May 2020 confirms that there is sufficient capacity in both the foul and surface water network to take the proposed flows from the Site.
London Borough of Camden as Lead Local Flood Authority	Email correspondence	Confirmation was sought from the LLFA (Lead Local Flood Authority) that the proposed surface water drainage strategy is acceptable in principle in line with the local planning policies. A response is awaited at the time of writing.

Table 2.2: List of Parties Consulted

Site Walkover

2.4 A site walkover was not undertaken for the purposes of this assessment.

Site Investigation

2.5 No intrusive site investigation has been carried out for the purposes of this assessment due to the impermeable nature of the identified underlying geology (the London Clay Formation).

3.0 SITE SETTING

Site Location

3.1 The Site is located at 27a West End Lane within the London Borough of Camden, at grid reference 525487E 183841N and Postcode NW6 4QJ. The area of the Site is 305 m^2.

Description of Site and Surroundings

3.2 The Site comprises a series of 8 garages, located along the southern boundary of the Site, with a hardstanding car-parking area forming the remainder of the Site. The Site is bounded by residential gardens to the north and north west of the Site, a block of residential dwellings to the north east, a car park (associated with the residential block) to the east and West End Lane to the south. The surrounding land use is predominantly residential, however Kilburn High Street is located approximately 190 m to the south west and Kilburn High Road Station is located 240 m south of the Site.

3.3 Relative to ordnance datum the site falls from approximately 36.8 mAOD in the northern corner to approximately 35.0 mAOD in the south.

Hydrological Setting

Surface Watercourses

3.4 The nearest watercourse to the Site is Regents Canal which is located approximately 1.97 km south east of the Site.

3.5 The River Thames is located approximately 6.2 km south of the site.

Estuaries and Coastal Watercourses

3.6 The River Thames is tidal at this location, as it is downstream of the tidal limit at Teddington Lock.

Culverted Watercourses

3.7 According to the Lost Rivers of London Map (Barton, 1992) the Site is located approximately 80 m south west of the site to the culverted River Westbourne which now forms part of the Ranelagh Sewer.

Artificial Waterbodies

3.8 There are no artificial waterbodies in the vicinity of the Site. The nearest is a boating lake within Regents Park 2.34 km south east of the Site.

Ground Conditions

3.9 British Geological Survey (BGS) mapping shows bedrock geology at the Site to be comprised of the London Clay Formation (Clay and Silt). There are no superficial deposits recorded at the Site.

3.10 Local BGS borehole records confirm this geological sequence. A BGS borehole (TQ128SE1448) located within the Site boundary, encountered made ground to a depth of 0.45 m below ground level (bgl) with the London Clay Formation recorded directly below to the end of the borehole at 15.25 mbgl.

Groundwater

3.11 The Site does not lie within any Groundwater Source Protection Zones, as identified by the Environment Agency mapping (EA website, accessed June 2020). The mapping also designates the London Clay bedrock at the site as unproductive.

3.12 Groundwater was not recorded in this or other BGS boreholes in the vicinity of the Site.

Public Sewers

3.13 Thames Water Asset records (Appendix B) show a combined sewer, 1143 x 763 mm in size, passing in a south western direction along West End Lane adjacent to the Site. This adjoins with a series of combined sewers along Bransdale Close and Mutrix Road (unknown sizes) and enters into the Ranelagh Sewer (1245 x 864 mm) located 80 m south west of the Site. All of the sewers in the local area appear to drain towards the Ranelagh sewer, which drains in a south easterly direction.

3.14 There are no individual foul and surface water sewers in the vicinity of the Site.

Water Mains

3.15 Thames Water potable water supply records (included in Appendix B) show a number of water mains within the vicinity of the site. A 180 mm diameter distribution main made of high performance poly-ethylene is located adjacent to the site and supplies West End Lane. This main adjoins with several other mains including two 500 mm trunk mains located along Kilburn High Street 180 m south west of the site. None of these mains are shown to lie within the site boundary.

Flood Zones

3.16 The Site lies within the Environment Agency's (EA) Flood Zone 1, which is described within the NPPF Technical Guidance as having a less than 1 in 1000 annual probability of river or tidal flooding (<0.1%) in any one year.

3.17 The EA Surface Water Flood Maps indicate that the site area has a 'very low' risk of flooding from surface water (i.e. a less than 1 in 1000 (<0.1%) annual probability of flooding from extreme rainfall). Part of West End Lane adjacent to the site has a 'low' risk of surface water flooding (i.e. an associated risk of between 1 in 100 and 1 in 1000 (1-0.1 %) annual probability of flooding from extreme rainfall). Flood depths are however estimated to be <300 mm.

3.18 According to the Surface Water Management Plan (SWMP) for the London Borough of Camden, the Site is located within a critical drainage area (CDA). The area has been designated as a CDA in the SWMP due to surface water flooding and sewer capacity problems. The Site, however, is located on the edge of this CDA and flood water will likely flow past the Site in a south westerly direction (rather than ponding) due to the topography in the immediate vicinity of the Site.

3.19 With regard to reservoir flooding, the EA reservoir flood maps indicate that the site lies outside of the area that may be flooded in the event of a breach of any reservoirs.

Flood History

3.20 The SWMP identifies West End Lane as an area that was affected during the 2002 flood event as a result of the main sewer reaching capacity during an excessive rainfall event. It is unclear where exactly on West End Lane this flooding occurred. Figure 5a within the SFRA identifies the Site, as part of a larger area (approximately 9.0km^2 in size), as having two sewer flooding incidents. Due to the low resolution of the mapping it is unclear whether these events effected the Site or immediate vicinity.

3.21 A Thames Water Sewer Flooding History Enquiry (Appendix A) reported no historic records of any surcharging sewers in the vicinity of the Site.

4.0 SCHEME DESCRIPTION AND PROPOSED DRAINAGE STRATEGY

The Scheme

4.1 It is understood that this Drainage Assessment Report will be used by AG Homes to support a planning application for the proposed demolition of the existing eight garages and the erection of a three storey plus lower ground floor building comprising 3x1 bed units, 4x2 bed units, and 1x3 bed units (Class C3) with associated amenity space, cycle store, bin store, new landscaping and other associated works.

4.2 Plans showing the proposed scheme are included on Drawings WEL/PL/02 to WEL/PL/08.

Existing Foul Water Drainage Strategy

4.3 There are no foul services located on the Site.

Proposed Foul Water Drainage Strategy

4.4 Foul water from the 9 apartments will be designed to drain via a private foul water drainage network to a private pump chamber beneath the courtyard of Flat 3. This will then pump flows towards the public sewer network with a new connection into the Thames Water combined sewer in West End Lane.

4.5 Details of the proposed foul water drainage strategy are included on Drawing 1126/02/001A.

4.6 Foul water flows from the site will increase with peak flows anticipated to be approximately 0.42 l/s, compared to the existing scenario whereby there is currently no foul water connection from the Site (calculations included in Appendix D). Thames Water have been asked to confirm that the local network has capacity to accept the increase in foul flows from the Site. A response is awaited at the time of writing.

Existing Surface Water Drainage Strategy

4.7 The roofs of the garages are profiled towards the car parking area to ensure any surface water drains from them towards a slot drain located in the centre of the Site. The slot drain runs parallel to the garages (from the north eastern edge to the south western edge of the Site). The car park topography falls towards the channel drain resulting in surface water runoff from the car park draining towards it. It is assumed that the surface water subsequently will drain to the south west and enter the combined sewer along West End Lane.

4.8 A manhole is located along the western edge of the Site. It is unclear whether this man hole connects to the Site's surface water system or is a part of a separate system.

4.9 Existing brownfield flows for the Site (which is understood to be currently wholly impermeable) are summarised in Table 4.1 with calculations shown in Appendix E.

Storm Event	Existing Brownfield Flow Rate (l/s)
1 year (15 minute)	3.50
30 year (15 minute)	8.57
100 year (15 minute)	11.05

Table 4.1. Existing Critical Brownfield Flow rates

Proposed Surface Water Drainage Strategy

Specific Planning Considerations Informing the Drainage Strategy

4.10 The NPPF states that flood risk should not be increased elsewhere by the development, therefore, adequate drainage from the proposed new buildings should be provided. In accordance with best practice, all events up to and including the 30 year event will be kept below ground, whilst making a 30% inclusion for climate change. Further to this the 100 year event (with a 40% inclusion for climate change in line with EA Guidance) should be kept on the site with no flooding of the ground floors of the buildings.

4.11 Best practice requires that where feasible site drainage should utilise sustainable drainage techniques (SuDS). In accordance with the SuDS hierarchy, infiltration forms of SuDS (permeable paving, soakaways, swales) should be used where viable, followed by attenuation systems (ponds/below ground storage) with traditional discharge to surface water sewers and then combined sewers being a last resort.

4.12 Camden Council require that developments meet the requirements of The London Plan. The London Plan Sustainable Design and Construction Supplementary Planning Guidance (Mayor of London, 2014) states that equivalent site greenfield runoff rates should be targeted where possible and where they are not proposed a full justification as to why they cannot be achieved should be provided with runoff rates reduced as low as possible. In such instances a 50% reduction in existing runoff rates should be achieved as an absolute minimum.

4.13 This remains relevant within Policy SI13 of the Draft New London Plan (Mayor of London, 2017).

Potential for Infiltration Systems

4.14 The Building Regulations Part H state that no concentrated soakage device can be placed within 5.0 m of a building or adoptable road. Given the site has less than a 5 m easement from neighbouring buildings it is not possible to include soakaways in the scheme. Permeable paving and an attenuation tank will however be implemented.

Proposed Greenfield Runoff Rates

4.15 Estimated runoff rates based on the proposed impermeable area (100% of the Site) are summarised in Table 4.2 with calculations shown in Appendix F.

Rainfall Event	Greenfield runoff rate whole Site (l/s)
Q 1 year	0.10
Q 30 year	0.27
Q 100 year	0.38

Table 4.2: Greenfield Runoff Rates from the Site for Various Rainfall Events.

Proposed Surface Water Drainage

4.16 The following provides a summary of the proposed method of management and disposal of surface water runoff from the Site:

- Surface water flows will be attenuated using SuDS such that flows from the Site are restricted (with an allowance for an increase in rainfall intensity of 40% due to climate change) prior to a discharge into the Thames Water combined sewer in West End Lane. This will be confirmed with Thames Water at the detailed design stage.
- A single surface water outfall is proposed using a pumped connection from the southern boundary of the Site.
- There is little potential for Infiltration forms of SuDS (i.e. soakaways) to be viable due to the impermeable nature of the underlying bedrock geology (London Clay Formation) which would result in very poor infiltration rates. On the basis that infiltration systems are not viable the following forms of SuDS are proposed:
  - An attenuation tank providing 24.2 m^3 storage, measuring 8.0 m x 1.0 m with an effective depth of 3.1 m, will be incorporated beneath the basement courtyards of Flats 1 and 2 on the west of the Site;
  - Approximately 54.0 m^2 tanked permeable paving will be included in the front entrance pathway on the upper ground floor as well as in basement courtyards of Flats 1 and 2 in order to provide appropriate pollution control only. Attenuation storage and final outflow control restricting the run off to greenfield rates will be provided by the attenuation tank; and
  - Approximately 67.0 m^2 of green roofs will be incorporated on the roof of the second storey.
- Micro Drainage calculations included in Appendix G indicate that an attenuation tank with a total of 24.2 m^3 storage is required. This volume should be considered to be approximate at this stage, calculations undertaken as part of the detailed design will confirm the storage volume required based upon the final design proposals.
- A pumped flow control restricting runoff from the attenuation tank to 1.0 l/s will be included prior to discharge into the Thames Water combined sewer in West End Lane.

This will restrict flows to this level for all events up to and including the 1 in 100 year plus 40% climate change event. Given that the attenuation tank is located below basement level a pumped flow control is required in order to prevent surcharge of the sewer into the tank. The pump will force against the flow of the surcharged sewer preventing backflow which could lead to flooding on the Site. Additionally, in order to provide the required volume of attenuation, as there is no site area at ground level to provide it, the invert level of the tank will be below that of the sewer and therefore a gravity based flow control is not achievable. The need for a pumped outfall should be reassessed at the detailed design following a detailed survey of the Thames Water combined sewer to confirm the invert level of the proposed new connection.

- The 1.0 l/s restricting flow rate is the minimum standard operable flow allowed to avoid blockage making this rate as near to greenfield as can be practically achieved, which is still a large reduction on the existing flow from the Site.
- Green roof areas will also be positively drained with overflows constructed in line with modern design standards. Consideration should be given at the detailed design stage towards the inclusion of a blue roof in order to minimise the volume of storage required in the attenuation tank. This will require detailed calculation input from the manufacturer. Again at detailed design stage the possibility to discharge the green or blue roof to the sewer via gravity should be considered. Again this would reduce the volume of storage required in the attenuation tank.
- All new on site drainage will be separated until the point of connection to the public sewer in order to meet Thames Water requirements.
- A Thames Water Pre Development Enquiry (Appendix C) has confirmed there is sufficient capacity to take the surface water flows from the Site.
- An appropriate Section 106 application will be submitted to Thames Water at the detailed design stage to agree the site drainage layout, connection point, flow rates and any alterations to the existing drainage infrastructure.
- The surface water drainage strategy is summarised on drawing 1126/02/001A.

4.17 A summary of the potential SUDS options which led to the above drainage strategy is included in Table 4.3.

SUDS Option	Suitability/Included in the Scheme?	Comments
Soakaways and porous paving	X	Not suitable for use given the impermeable nature of the underlying geology of the Site (the London Clay Formation).
Porous paving (storage)	✓	Approximately 54.0 m^2 of tanked permeable paving is included in the scheme to provide appropriate pollution control.
Rainwater Harvesting	*	Not currently included in the scheme.
Swales	X	Not suitable for use given the constraints of the site.

SUDS Option	Suitability/Included in the Scheme?	Comments
Attenuation Ponds (above ground storage)	X	Not suitable for use given the constraints of the site.
Below ground storage in cellular systems	✓	An attenuation tank providing 24.2 m^3 of storage is included within the scheme.
Green Roofs/Brown Roofs/Blue Roofs	✓	An area of green roof totalling approximately 67.0 m^2 is included in the scheme.

Table 4.3: SUDS Options

Key:

✓ *Suitable for use and included in the scheme*

* *Possibly suitable for use – not included in the client and architect design proposal at present – should be considered further as part of the detailed design*

X Unlikely to be suitable for use

Pollution Control Measures

4.18 Pollution control requirements are determined by using the Simple Index Approach as detailed in the CIRIA SuDS Manual.

4.19 Suitable pollution hazard indices are allocated for the proposed land uses. The indices range from 0 (no pollution hazard for this contaminant type) to 1 (high pollution hazard for this contaminant type).

4.20 From the designated hazard indices a total SuDS mitigation index is calculated for each of suspended solids, metals and hydrocarbons using:

$$\textit{Total SuDS mitigation index} = \textit{mitigation index}_1 + 0.5(\textit{mitigation index}_2)$$

Where:

$\textit{Mitigation index}_n$ = *mitigation index for component n*

4.21 To deliver adequate treatment the selected SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type).

$$\textit{Total SuDS mitigation index} \geq \textit{pollution hazard index}$$

4.22 In this case the SuDS mitigation indexes are detailed in Table 4.4.

Land Use	Total Suspended Solids	Metals	Hydrocarbons
Other roofs (commercial roofs)	0.3	0.2	0.05
External pedestrian areas*	0.5	0.4	0.4
TOTAL MITIGATION INDEX	**0.55**	**0.4**	**0.25**

**N.B. The CIRIA SuDS Manual does not provide mitigation indices for external pedestrian areas and therefore the pollution mitigation indices for "Individual property driveways, residential car parks, low traffic roads (e.g. cul de sacs, home zones and general access roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. <300 traffic movements a day" have been used to represent a worst case scenario. There will be no traffic flows over the external pedestrian areas.*

Table 4.4: Calculated SuDS pollution mitigation indexes for the Site

4.23 All external areas will drain through the tanked permeable paving and the second floor roof area will drain through the proposed green roof. Permeable paving provides mitigation indices (Table 4.5) that equal or exceed those required for the Site (see Table 4.4) in all cases and therefore is considered an appropriate method to deliver adequate pollution mitigation treatment. The green roof will provide appropriate pollution control for the second floor roof drainage.

SuDS Component	Total Suspended Solids	Metals	Hydrocarbons
Permeable Paving	0.7	0.6	0.7
Green Roofs	No mitigation indices provided by the CIRIA SuDS Manual		

Table 4.5: Indicative SuDS mitigation indices

4.24 It should be noted that SuDS components only deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the CIRIA SuDS Manual.

Maintenance

4.25 Regular inspection and maintenance of public and private drainage by Camden Council, Thames Water, and site management respectively, will be necessary to minimise the residual risks associated with surface water/sewers.

4.26 The following maintenance schedule (Table 4.6) for the proposed SUDS should be adhered to in order to ensure efficient operation and to prevent failure.

Drainage Feature	Maintenance	Maintenance Period
Manholes	Check free from silt and debris and water discharging freely through. Jet/clear out as necessary.	Every 6 months As required
Drainage Pipework	CCTV inspection/condition survey Sewer jetting	Every 5 years Every 2 years
Attenuation Tank	Inspection of silt traps, manholes, pipework, pre-treatment devices, and inlets Removal of unwanted sediment /debris	Monthly for the first year then every 6 months thereafter As required
Foul and surface water pump chambers	General Service: - Visual inspection for correct operation/ damage and replace any items if required. Major Service: - Lift and clean pumps and control panel. - Check pump volute, impeller, wear rings, motor windings, motor cables, clean level control floats, wet well pipework and pump lifting system for damage. - Remove and replace oil drain if required. - Check and adjust all pump controls where necessary. - Check and test all safety / alarm facilities. - Check earth loop resistance. - Clean and remove potential items to cause pump blockages from pump chamber.	2 times a year Annually
Tanked Permeable Paving	Avoid stockpiling materials on permeable paving – soil and building materials can clog and degrade permeability of paving. Suction/mechanical sweeping. Clear clogged joints and top up with new permeable jointing aggregate.	As necessary Annually As necessary As necessary

Drainage Feature	Maintenance	Maintenance Period
	Check for depressed, cracked or broken blocks which are considered detrimental to the structural performance, and replace if necessary.	
Green Roof	Check free from silt and debris and water discharging freely through. Remove any debris from roof ensuring it is not simply flushed down rainwater pipes. Inspect the waterproofing system visible at all upstands, to ensure it is firmly adhered to the detail this it is waterproofing. Cut back tree limbs that overhang the roof to give a 1.0 m clearance outside the roof edge in order to significantly reduce the blockage of fallen leaves. Ensure that all rainwater pipes are free from blockages and that water flows freely through them.	Every 6 months As necessary Every 6 months Every 6 months

Table 4.6: SuDS Maintenance Schedule

5.0 ASSESSMENT OF DRAINAGE AND FLOOD RISK

5.1 The scope of this report was refined to meet the brief outlined in Chapter 1 and primarily considers potential for the design, construction and operation of the Site to increase the risk of flooding to neighbouring properties. It also briefly assesses the flood risks posed to the Site. Consideration is then given to any necessary mitigation measures to mitigate identified potential flood risks, climate change and residual flood risks.

5.2 The approach is consistent with the NPPF, PPG and the requirements of local planning policy.

Flood Risk to the Proposed Development

5.3 Based on our understanding of the scheme and the site setting, the potential sources of flooding have been identified and assessed in Table 5.1.

Potential Source	Pathway	Potential Linkage to Site	Justification
Fluvial/Tidal (River Thames)	Overtopping of banks and overland flow	No	The Site is assessed as having a less than 1 in 1000 (<0.1%) probability of flooding from rivers and sea in any one year. Therefore, the Site is at a **negligible** risk of flooding from fluvial events and this source is not considered further in this report.
Groundwater (shallow)	Perched/shallow groundwater may be present	No	Groundwater is not anticipated to be shallow in the vicinity of the Site.
Artificial water Bodies	Breach and overland flow	No	No significant sources identified in the immediate vicinity of the Site therefore this source is not considered further within this report.
Infrastructure failure from water mains and internal water supply system	Failure of the Thames Water network and/or internal water supply and distribution system	Yes	Flood risk from this source is considered to be a residual risk with the main threat being from internal pipe work during any building works. Flooding from this source poses a **low** risk as no records of flooding local to impact the proposed development as there is a basement. Flooding from this source is considered a residual flood risk and appropriate mitigation measures are discussed in Table 5.2
Sewer flooding from Thames Water assets and private site drainage	Surcharge in site drainage and the public sewer network due to blockage or exceedance of capacity	Yes	Records of historic flooding from this source are reported in the vicinity of the Site. The risk of sewer flooding is considered to be **moderate** as there is no evidence to suggest the Site has been impacted by these. Flooding from this source is considered a residual flood risk and appropriate mitigation measures are

Potential Source	Pathway	Potential Linkage to Site	Justification
			discussed in Table 5.2 .Sewer flooding from blockage of internal building drainage as well as the Thames Water network is also a residual risk managed by the design of the site drainage and regular inspection and maintenance of the public and private sewer network. The flood risk associated with this source may also increase over time due to the effects of climate change.
Surface water flooding as a result of extreme rainfall and runoff from overland flow	Flooding of the surrounding roads due to extreme rainfall	Yes	The Site is located within a CDA however the EA Surface Water Flood Maps show the Site itself is at a **very low** risk from surface water flooding whilst part of West End Lane adjacent to the property is at a **low** risk. Surface water flooding from this source is considered a residual flood risk and appropriate mitigation measures are discussed in Table 5.2

Table 5.1: Potential Sources of Flooding to the Development

5.4 In summary, the risk of flooding from surcharges in the site drainage and public sewer is considered to be moderate whereas all other sources are generally considered to be at low risk. A number of mitigation measures are recommended to address and manage the risk and residual risk from these forms of flooding in Table 5.2.

Drainage Assessment

Changes in runoff

5.5 The surface water drainage system will help attenuate increased flows as a result of climate change.

Impact on the public sewer network

5.6 The overall impact on the receiving sewer network is considered negligible when the potential decrease in peak surface flows is considered.

5.7 However, sewer flows (volumes) will increase overtime as a result of climate change.

Mitigation Measures

5.8 Table 5.2 sets out appropriate mitigation measures to minimise the identified flood risks.

Type of Flooding	Issue	Mitigation Measures	Justification	Residual Risk *
Flooding from surface and foul water – sewer blockage/surcharging and intense rainfall	Blockages or surcharges in the site drainage or the public sewer network within the site and in the site vicinity may result in flooding of the basement and ground floors.	• Appropriate design of the private drainage at the detailed design stage to include an allowance for climate change. The surface water pumped drainage system should be able to handle any reasonable sewer flooding. • Routine inspection and maintenance of the site and public drainage systems by the site owner and Thames Water. • Monitor flood risk throughout the life of the development in order to confirm the risk posed to the scheme over time. • Consider opportunities for flood resilient design.	These measures will ensure flood risk from these sources is minimised.	Low
Flooding from Water mains (internal water supply system and Thames Water apparatus)	Flooding of the water supply and distribution system may result in flooding of the internal building.	• The surface water pumped drainage system should be able to handle any reasonable water main flooding. • Routine inspection of the site and public water supply and distribution system by the site owner and Thames Water. • Consider the need and opportunities for raised thresholds as part of the detailed design.	Will ensure the risk of flooding is minimised.	Low
Flooding from Surface Water	Flooding to the basement and ground floors may occur as a result of extreme rainfall and runoff from overland flow	• The surface water pumped drainage system should be able to handle any reasonable surface water flooding. • Consider opportunities for flood resilient design and/or for flood resistant design. • Consider the need and opportunities for raised thresholds as part of the detailed design. • Monitor flood risk throughout the life of the development in order to confirm the risk posed to the scheme over time.	Will ensure the risk of flooding is minimised	Low
Impact of the development on the public sewer network	The site has potential to change foul and surface water flows to the local public sewer network	• Attenuation is being proposed to greatly reduce the current surface run-off. • Water saving devices are recommended in the development to minimise the slight increase in foul flow. • Undertake appropriate drainage surveys and refurbish/replace any retained drainage connections as appropriate. • Agree any modifications to the public sewer, the outfall location and flow rates with Thames Water. • Routine inspection and maintenance of the site and public drainage systems by the site owner and Thames Water.	Will ensure the risk of flooding is minimised.	Low

Table 5.2. Mitigation Measures

*Following adoption of the mitigation measures

Residual Flood Risks

5.9 A number of residual risks have been identified, associated with public sewers, site drainage, water supply pipes and intense rainfall.

5.10 As long as the public sewer networks and site drainage/water supply infrastructure are regularly inspected by maintained by Thames Water and site management respectively then the residual risk will be minimised.

Climate Change

5.11 Climate change has important implications for the assessment and management of flood risk. The NPPF requires that climate change is considered when making an assessment of flood risk posed to future development.

5.12 Climate change has the potential to affect all identified sources of flooding at the Site. The likely impacts of climate change include increased severity of rainfall events as well as wetter winters leading to higher groundwater levels and increased frequency and severity of surface water flooding.

5.13 The influence of climate change on rainfall intensity has been taken into account by the surface water drainage strategy with the inclusion of a 40% increase in rainfall intensity to account for climate change for all rainfall events up to and including the 1 in 100 year event in accordance with NPPF requirements, and 'Flood Risk Assessments: Climate Change Allowances'[4].

4 Environment Agency (2016) *Flood Risk Assessments: Climate Change Allowances*.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 The surface water drainage strategy set out in this report demonstrates that the scheme can be constructed with adequate drainage to ensure flood risk to surrounding areas is not increased. We recommend that the assessment of residual risks should be reviewed by site owners as new flood risk information becomes available, and the flood risk associated with adjacent sewers may also increase over time in the area due to climate change.

6.2 The proposed surface water drainage strategy ensures surface water flows are attenuated using SuDS such that flows from the Site are restricted (with an allowance for an increase in rainfall intensity of 40% due to climate change) prior to a discharge into the Thames Water combined sewer in West End Lane. The proposed strategy, through the use of green roof and tanked permeable paving, provides appropriate pollution control in line with local policy and a maintenance plan is provided which should be adhered to in order to ensure efficient operation and to prevent failure.

6.3 The detailed design of the drainage should be informed by a full drainage survey of the public and private sewer network (where drainage/outfalls will be retained). The detailed design of the drainage will need to be submitted to the local planning authority and Thames Water and any other affected parties for approval.

6.4 Even though the Site will be more intensely occupied post development, i.e. there will be an increase in the number of receptors that could be impacted by flooding, as the likelihood of flooding is low to very low it would seem reasonable to conclude that the flood risk still remains low.

6.5 In conclusion, this assessment demonstrates that the proposal complies with the relevant national, regional and local planning policy with respect to flood risk and is appropriate development at this location.

7.0 REFERENCES

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vii. London Borough of Camden. (2014). *London Borough of Camden Strategic Flood Risk Assessment*. URS.

viii. London Borough of Camden. (2017). *Camden Local Plan*. Camden Council.

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x. Mayor of London. (2014). *London Plan Sustainable Design and Construction Supplementary Planning Guidance*. Mayor of London.

xi. Mayor of London. (2016). London Sustainable Drainage Action Plan.

xii. Mayor of London. (2017). The Draft New London Plan.

APPENDICES

APPENDIX A

Sewer Flooding
History Enquiry

Property Searches

Create Consulting Engineers Ltd
Norwich Norwich
Princes Street

Search address supplied	Garages To The South Of 27A West End Lane London NW6 4QJ
Your reference	P16-1126
Our reference	SFH/SFH Standard/2020_4184347
Received date	**24 April 2020**
Search date	**1 May 2020**

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

Sewer Flooding
History Enquiry

Property Searches

Search address supplied: Garages To The South Of,27A,West End Lane,London,NW6 4QJ

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

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

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

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

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

(iv) compensation payments

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

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

0845 070 9148

Sewer Flooding
History Enquiry

Thames Water Property Searches

History of Sewer Flooding

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

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

For your guidance:

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

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

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

0845 070 9148

APPENDIX B

Asset Location Search

Create Consulting Engineers Ltd
15Princes Street
NORWICH
NR3 1AF

Search address supplied Bransdale Close
West End Lane
London
NW6 4QJ

Your reference P16-1126

Our reference ALS/ALS Standard/2016_3397787

Search date 24 August 2016

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

searchcode

Asset Location Search

Search address supplied: Bransdale Close, West End Lane, London, NW6 4QJ

Dear Sir / Madam

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

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

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

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

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

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

Contact Us

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

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

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

Asset Location Search

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and

pressure test to be carried out for a fee.

For your guidance:

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

Payment for this Search

A charge will be added to your suppliers account.

Asset Location Search

Further contacts:

Waste Water queries

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

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

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

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

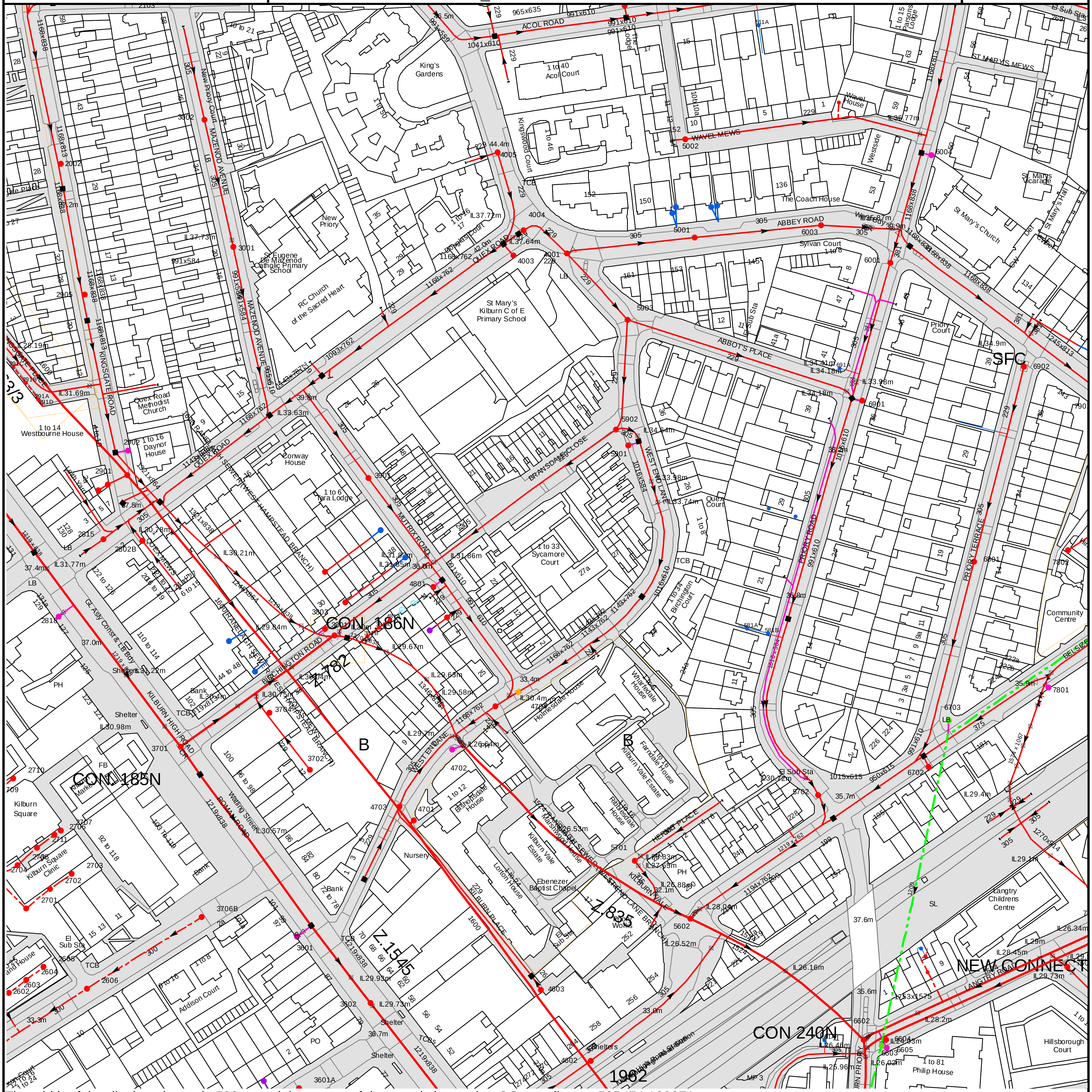
Clean Water queries

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

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

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

Asset Location Search Sewer Map - ALS/ALS Standard/2016_3397787



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 525474,183871

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
4602	34.34	30.72
6605	34.67	31.04
6603	34.66	22.79
661A	n/a	n/a
6604	34.66	26.48
6602	34.96	n/a
661D	n/a	n/a
7604	34.06	n/a
661B	n/a	n/a
661C	n/a	n/a
5602	32.55	26.45
5701	32.53	27.65
5702	35.75	29.18
6702	35.51	31.45
6703	35.7	n/a
7801	36.03	32.37
581B	n/a	n/a
581A	n/a	n/a
6801	36.62	32.66
7802	36.8	34.48
581D	n/a	n/a
581C	n/a	n/a
5901	n/a	n/a
5902	38.91	35.03
6901	n/a	n/a
691A	n/a	n/a
6902	38.55	34.35
5903	40.41	37.27
6001	39.34	35.05
4001	n/a	38.82
5001	40.67	37.9
6003	40.11	n/a
50BD	n/a	n/a
50BC	n/a	n/a
50BB	n/a	n/a
50BA	n/a	n/a
6004	n/a	n/a
5002	41.76	40.42
601A	n/a	n/a
511A	n/a	n/a
5101	n/a	n/a
3601A	35.56	31.88
3602	36.73	n/a
4603	34.62	33.56
2901	37.55	27.93
2902	n/a	n/a
2802B	37.01	33.99
3701	37.05	30.92
38DE	n/a	n/a
38DI	n/a	n/a
3704	36.04	33.97
3702	36.34	33.41
3802	n/a	n/a
38DD	n/a	n/a
3801	35.83	29.71
38DJ	n/a	n/a
381B	n/a	n/a
3901	n/a	n/a
381A	n/a	n/a
38DB	n/a	n/a
481A	n/a	n/a
4703	33.77	31.55
4817	n/a	n/a
48CF	n/a	n/a
4818	n/a	n/a
4701	33.83	n/a
4819	n/a	n/a
4801	n/a	n/a
4820	n/a	n/a
4702	n/a	n/a
4704	n/a	n/a
291D	n/a	n/a
291A	n/a	n/a
291B	n/a	n/a
291C	n/a	n/a
2905	37.32	n/a
4003	n/a	n/a
3001	42.23	37.37
4004	42.32	39.15
2002	37.19	n/a
4005	44.05	41.61
3002	43.07	38.56
2710	36.59	35.45
2705	n/a	n/a
2711	n/a	n/a
2706	n/a	n/a
2818	37.08	n/a
2707	n/a	n/a
2816	n/a	n/a
2815	n/a	n/a
2817	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
2603	n/a	n/a
2701	n/a	n/a
2604	n/a	n/a
2605	n/a	n/a
2702	n/a	n/a
2703	n/a	n/a
2606	34.33	31.08
3706B	36.48	33.71
361A	n/a	n/a
3601	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.

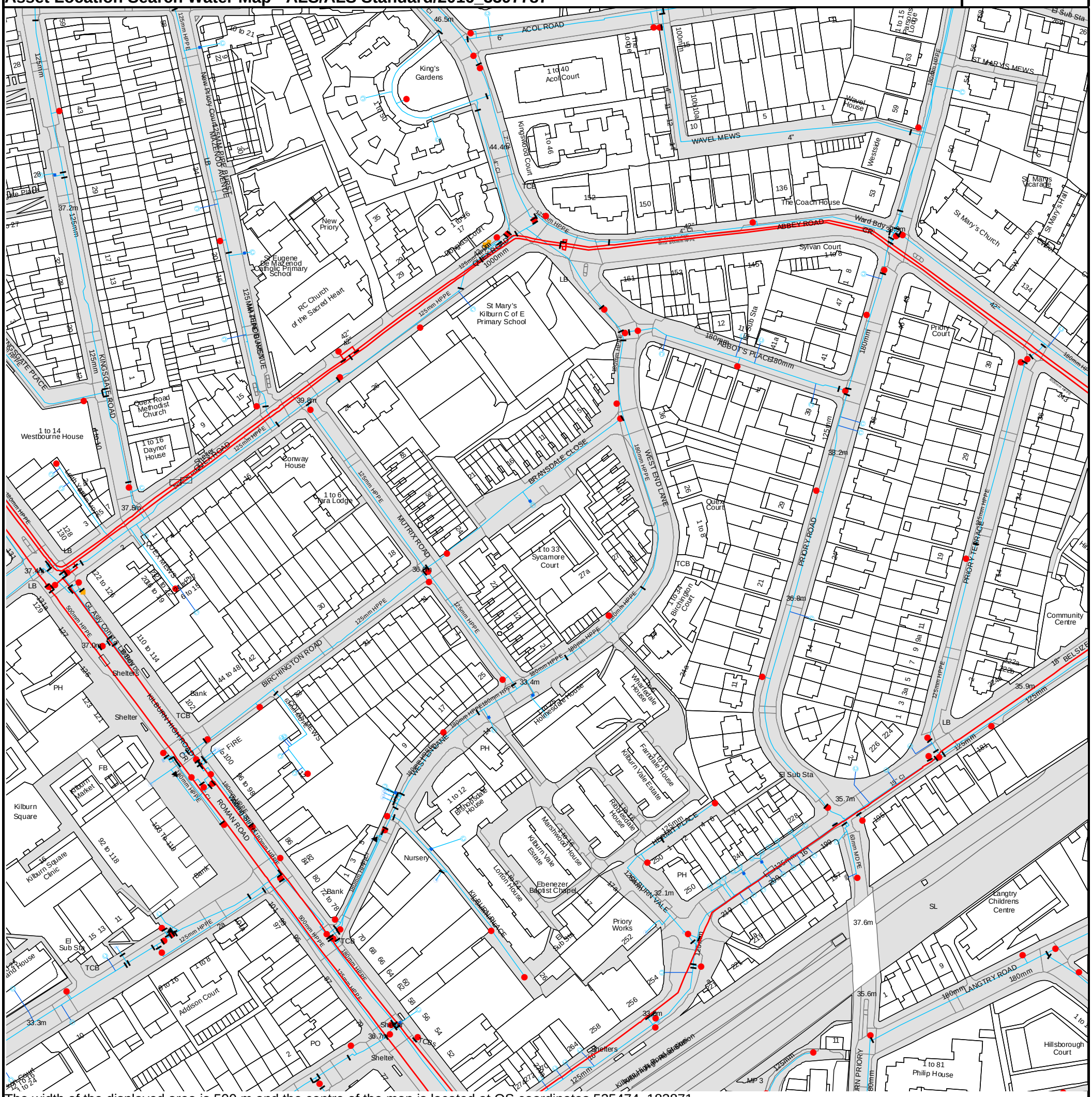
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

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/2016_3397787



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 525474, 183871.

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

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

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

16"

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

3" SUPPLY

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

3" FIRE

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

3" METERED

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

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

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

Valves

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

Hydrants

- Single Hydrant

Meters

- Meter

End Items

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

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

Operational Sites

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

Other Symbols

- Data Logger

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

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

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

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

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

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

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

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

Ways to pay your bill

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

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

Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

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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

Create Consulting Engineers Ltd
109-112 Temple Chambers
3-7 Temple Avenue
London
EC4Y 0HP

Wastewater pre-planning
Our ref DS6072720

4 May 2020

Pre-planning enquiry: Confirmation of sufficient capacity

Dear Ms Jordan,

Thank you for providing information on your development.

Site: 27A West End Lane, London, NW6 4QJ.

Proposed site: Demolition of existing garages and development of site for 9 flats.
Proposed foul water: To connect to 1143mm x 762mm public combined water sewer in West End Lane.
Proposed surface water sewer: Surface water discharge limited to 1l/s to drain via pump and gravity connection to 1143mm x 762mm public combined water sewer in West End Lane.

We're pleased to confirm that there will be sufficient foul water capacity in the public combined water network to serve your development. If the surface water from the site discharges at the above proposed rates, there will also be sufficient capacity within the public combined water sewer system.

This confirmation is valid for 12 months or for the life of any planning approval that this information is used to support, to a maximum of three years.

You'll need to keep us informed of any changes to your design – for example, an increase in the number or density of homes. Such changes could mean there is no longer sufficient capacity.

What happens next?

Please make sure you submit your connection application, giving us at least 21 days' notice of the date you wish to make your new connection/s.
If you've any further questions, please contact me on 0203 577 9223.

Yours sincerely

Alan Dovey
Development Engineer
Developer Services – Sewer Adoptions Team

APPENDIX D

Calc for expected Foul Water

CALCULATION OF NEW DEMAND ON FOUL SEWERS USING PROPERTY TYPE.

	Existing Discharge from Site					Proposed Discharge from Site				
	Dry weather flow (in litres per day)	Daily Discharge (in litres)	No. of :-	Total Discharge (in litres per day)	Housing Equivalent	Dry weather flow (in litres per day)	Daily Discharge (in litres)	No. of :-	Total Discharge (in litres per day)	Housing Equivalent
General Housing per property	600	4000		0	0	600	4000	9	36000	9
School per pupil	80	528		0	0	80	528		0	0
Assembly Hall per seat	10	66		0	0	10	66		0	0
Cinema per seat	10	66		0	0	10	66		0	0
Theatre per seat	10	66		0	0	10	66		0	0
Sports Hall per person	50	330		0	0	50	330		0	0
Hotel per room	550	3630		0	0	550	3630		0	0
Guest House per room	200	1320		0	0	200	1320		0	0
Motel per room	300	1980		0	0	300	1980		0	0
Holiday Apartment per person	150	990		0	0	150	990		0	0
Leisure Park per person	220	1452		0	0	220	1452		0	0
Caravan Pk standard per space	250	1650		0	0	250	1650		0	0
Caravan Site serviced per space	450	2970		0	0	450	2970		0	0
Camping site standard per space	200	1320		0	0	200	1320		0	0
Camping site serviced per space	350	2310		0	0	350	2310		0	0
Public House per seat	150	990		0	0	150	990		0	0
Restaurant/Day Care Centre per person	270	1782		0	0	270	1782		0	0
Drive in restaurant per seat	380	2508		0	0	380	2508		0	0
Hospital per bed	750	4950		0	0	750	4950		0	0
Nursing/Care Home per bed	375	2475		0	0	375	2475		0	0
Offices per 100m sq	750	4950		0	0	750	4950		0	0
Shopping Centre per 100m sq	400	2640		0	0	400	2640		0	0
Warehouse per 100m sq	150	990		0	0	150	990		0	0
Commercial premises per 100 m sq	300	1980		0	0	300	1980		0	0
Manufacturing unit per 100m sq	550	3630		0	0	550	3630		0	0

Total Discharge / Housing Equivalent			0	0	Total Discharge / Housing Equivalent	36000	9
			0.00 l/s			0.42 l/s	

Net gain to system per day/property equivalent	**36000**	**9**
Net foul water increase to system =	**0.42 l/s**	

Calc for expected Surface Water

CALCULATION OF NEW DEMAND ON SURFACE WATER SEWERS

Are there public surface water sewers near the site to connect into Y/N? **Y** **If 'N' no further action required if 'Y' continue below**

Where an existing site is to be redeveloped, Thames Water will honour the current rate of discharge if verification of the existing flow regime can be confirmed. Where verification of the existing flow regime can't be confirmed or in the case of green field sites, a maximum discharge rate of 5 l/s/ha of the undeveloped site shall be applied within any development proposals.
Any flows generated above this figure will have to be attenuated on site.

If redeveloped site with existing discharge NOT verified then treat as a greenfield site and use 5 l/s/ha .

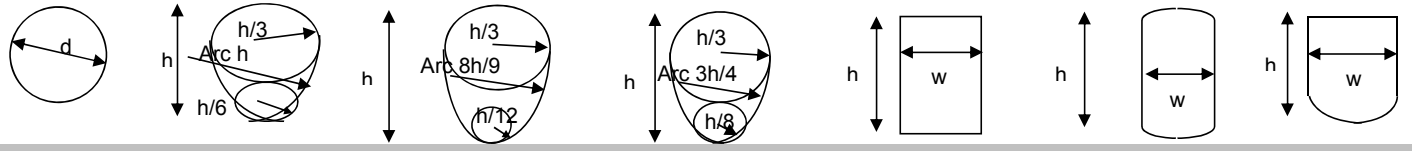
If redeveloped site with existing discharge rate verified then no further action is required, honour existing discharge rate.

Greenfield Site

Rate at which surface water will be discharged from the site.	**5**	l/s/ha
Enter area of site.	0.36	ha
Net surface water increase to system =	**1.8**	l/s

Foul Water Sewer

Circular | Egg 3:2 (Old Type) | Egg 3:2 (New Type) | Egg 4:3 | Rectangular | Oval | U-Shaped



Circular
Egg 3:2 (Old Type)
Egg 3:2 (New Type)
Egg 4:3
Rectangular
Oval
U-Shaped

1

LENGTH (m)	USIL (m)	DSIL (m)	GRADIENT (1 in)	ks (mm)	Shape	ø or height (mm)	Width (mm)	Area (m^2)	Hydraulic Radius (m)	Net foul water increase to system (l/s)	Flow Rate (l/s)	% of pipes max Flow
Entry	Entry	Entry	Calculated	Fixed	Select	Entry	Entry	Calculated	Calculated	Calculated	Calculated	Calculated
			#DIV/0!	1.5	Circular			0.00	0.00	0.42	#DIV/0!	#DIV/0!

2 **If no invert levels are available then insert into table (right) FLOW RATE l/s and pipe diameter >>>>>**

from flow rate tables below.

ø or height (mm)	Net foul water increase to system (l/s)	Flow Rate (l/s)	% of pipes max Flow
Entry	Calculated	Entry	Calculated
	0.42		#DIV/0!

USIL = Upstream Invert Level (measured as metres AOD)
DSIL = Downstream Invert Level (measured as metres AOD)
ks = roughness coefficient of pipe (assume 1.5 for foul water sewers and 0.6 for surface water sewers irrespective of pipe material - based on sewers for adoption standards)

% Capacity 'significant' if >15% pipe full capacity for > 300mm pipe or >10% for <300mm pipe.

PERCENTAGE WARNING	1	#DIV/0!
PERCENTAGE WARNING	2	#DIV/0!

Pumping Station

Capacity of downstream PS (if known) Reference ?

Sewage Treatment Works

PE of STW Development site as % of STW PE. #DIV/0!

% capacity 'significant' if >15% of STW population equivalent

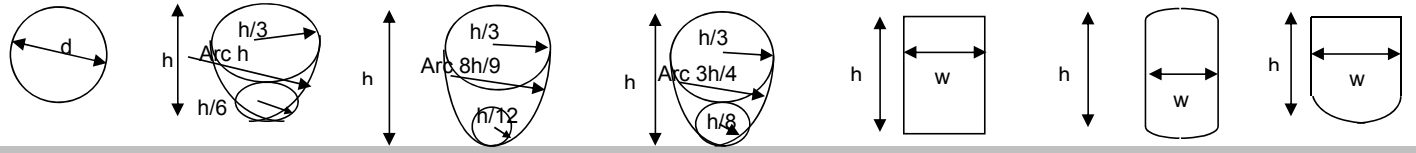
PERCENTAGE WARNING	#DIV/0!

Significant Size Development if greater than 500 dwellings

SIZE WARNING	

Surface Water Sewer

Circular | Egg 3:2 (Old Type) | Egg 3:2 (New Type) | Egg 4:3 | Rectangular | Oval | U-Shaped



Circular
Egg 3:2 (Old Type)
Egg 3:2 (New Type)
Egg 4:3
Rectangular
Oval
U-Shaped

1

LENGTH (m)	USIL (m)	DSIL (m)	GRADIENT (1 in)	ks (mm)	Shape	ø or height (mm)	Width (mm)	Area (m^2)	Hydraulic Radius (m)	Net surface water increase to system (l/s)	Flow Rate (l/s)	% of pipes max Flow
Entry	Entry	Entry	Calculated	Fixed	Select	Entry	Entry	Calculated	Calculated	Calculated	Calculated	Calculated
			#DIV/0!	0.6	Circular			0.00	0.00	1.80	#DIV/0!	#DIV/0!

2 **If no invert levels are available then insert into table (right) FLOW RATE l/s and pipe diameter >>>>>**

from flow rate tables below.

ø or height (mm)	Net surface water increase to system (l/s)	Flow Rate (l/s)	% of pipes max Flow
Entry	calculated	Entry	calculated
	1.80		#DIV/0!

USIL = Upstream Invert Level (measured as metres AOD)
DSIL = Downstream Invert Level (measured as metres AOD)
ks = roughness coefficient of pipe (assume 1.5 for foul water sewers and 0.6 for surface water sewers irrespective of pipe material - based on sewers for adoption standards)

% Capacity 'significant' if >15% pipe full capacity for > 300mm pipe or >10% for <300mm pipe.

PERCENTAGE WARNING	1	#DIV/0!
PERCENTAGE WARNING	2	#DIV/0!

APPENDIX E

Location : **27a West End Lane**

M5-60 : 20 mm

r : 0.425

Wallingford Method - maps

\\cre001-net01\company data\Reference\Technical Library\wallingford

For different durations,

From Table 1

Duration, D	Z1			
15 min	0.65	**M5-15:**	Z1 x M5-60	13.00 mm
30 min	0.82	**M5-30:**	Z1 x M5-60	16.40 mm
60 min	1	**M5-60:**	Z1 x M5-60	20.00 mm
6hr	1.51	**M5-360:**	Z1 x M5-60	30.20 mm

For different return intervals,

From Table 2*

		Z2	
Duration, D	M1	M30	M100
15 min	0.62	1.52	1.96
30 min	0.62	1.53	2.00
60 min	0.64	1.54	2.03
6 hr	0.68	1.51	1.97

Average point intensity, API = I/(D/60)

	D min	Calculation	I mm	API mm/hr
M 1-15	15	M5-15*Z2(M1)	8.06	32.24
M 1-30	30	M5-30*Z2(M1)	10.17	20.34
M 1-60	30	M5-360*Z2(M1)	12.80	25.60
M1-360	360	M5-360*Z2(M1)	20.54	3.42
M 30-15	15	M5-15*Z2(M30)	19.76	79.04
M 30-30	30	M5-30*Z2(M30)	25.09	50.18
M 30-60	60	M5-60*Z2(M30)	30.80	30.80
M30-360	360	M5-360*Z2(M30)	45.60	7.60
M 100-15	15	M5-15*Z2(M100)	25.48	101.92
M 100-30	30	M5-30*Z2(M100)	32.80	65.60
M100-60	60	M5-60*Z2(M100)	40.60	40.60
M100-360	360	M5-360*Z2(M100)	59.49	9.92

Peak Runoff

Q=2.78CiA Rational Method, SUDS Manual Section 4.3.3

where: (1) C = Cv Cr

Cv = 1 **

Cr = 1.3 constant value for design purposes

therefore , C = 1.3

(2) i = API, defined above

(3) A = areas measured for subcatchments

Q=2.78CiA

** Cv varies between 0.6 (rapidly draining soils) and 0.9 (heavy clay) with an average of 0.75 taken if ground conditions not known.

2.78*C= **3.614**

Table 1

Rainfall Duration D

Minutes					Hours					
r	5	10	15	30	1	2	4	6	10	24
0.12	0.22	0.34	0.45	0.67	1.00	1.48	2.17	2.75	3.70	6.00
0.15	0.25	0.38	0.48	0.69	1.00	1.42	2.02	2.46	3.32	4.90
0.18	0.27	0.41	0.51	0.71	1.00	1.36	1.86	2.25	2.86	4.30
0.21	0.29	0.43	0.54	0.73	1.00	1.33	1.77	2.12	2.62	3.60
0.24	0.31	0.46	0.56	0.75	1.00	1.30	1.71	2.00	2.40	3.35
0.27	0.33	0.48	0.58	0.76	1.00	1.27	1.64	1.88	2.24	3.10
0.30	0.34	0.49	0.59	0.77	1.00	1.25	1.57	1.78	2.12	2.84
0.33	0.35	0.50	0.61	0.78	1.00	1.23	1.53	1.73	2.04	2.60
0.36	0.36	0.51	0.62	0.79	1.00	1.22	1.48	1.67	1.90	2.42
0.39	0.37	0.52	0.63	0.80	1.00	1.21	1.46	1.62	1.82	2.28
0.42	0.38	0.53	0.64	0.81	1.00	1.20	1.42	1.57	1.74	2.16
0.45	0.39	0.54	0.65	0.82	1.00	1.19	1.38	1.51	1.68	2.03

Table 2 - England and Wales

Growth Factor Z2

M5 rainfall	M1	M2	M3	M4	M5	M10	M20	M50	M100	M30 interpolated
5.00	0.62	0.79	0.89	0.97	1.02	1.19	1.36	1.56	1.79	1.25
10.00	0.61	0.79	0.90	0.97	1.03	1.22	1.41	1.65	1.91	1.49
15.00	0.62	0.80	0.90	0.97	1.03	1.24	1.44	1.70	1.99	1.53
20.00	0.64	0.81	0.90	0.97	1.03	1.24	1.45	1.73	2.03	1.54
25.00	0.66	0.82	0.91	0.97	1.03	1.24	1.44	1.72	2.01	1.53
101.92 30.00	0.68	0.83	0.91	0.97	1.03	1.22	1.42	1.70	1.97	1.51
40.00	0.70	0.84	0.92	0.97	1.02	1.19	1.38	1.64	1.89	1.47
50.00	0.72	0.85	0.93	0.98	1.02	1.17	1.34	1.58	1.81	1.42
75.00	0.76	0.87	0.93	0.98	1.02	1.14	1.28	1.47	1.64	1.34
100.00	0.78	0.88	0.94	0.98	1.02	1.13	1.25	1.40	1.54	1.30
150.00	0.78	0.88	0.94	0.98	1.01	1.12	1.21	1.33	1.45	1.25
200.00	0.78	0.88	0.94	0.98	1.01	1.11	1.19	1.30	1.40	1.23

* The rainfall depths from cells E8-E11 are compared with the depths given in cells J29-J40 and Z2 interpolated accordingly for each return period

		Contributing Impermeable Area Ha	
	i mm/hr	Site 0.03	Per hectare 1
M 1-15	32.24	3.50	116.52
M 1-30	20.34	2.20	73.49
M 1-60	25.60	2.78	73.49
M1-360	3.42	0.37	12.37
M 30-15	79.04	**8.57**	285.65
M 30-30	50.18	5.44	181.36

		Contributing Impermeable Area Ha	
	i mm/hr	Site 0.03	Per hectare 1
M 30-60	30.80	3.34	181.36
M30-360	7.60	0.82	27.47
M 100-15	101.92	**11.05**	368.34
M 100-30	65.60	7.11	237.08
M 100-60	40.60	4.40	237.08
M100-360	9.92	1.08	35.84

APPENDIX F

IoH 124 Calculation of Greenfield Runoff Rate

Date: 22/02/2021
By: EW

OS Location 525487 183841

SAAR	630	mm	See Wallingford Map
Site area =	50	ha	Always assume 50ha and prorata for specific site
	0.5	km^2	
Soil WRA Class	4		See Wallingford Map
Soil Type SPR Value	0.45		Conversion to SPR

$Qbar_{rural} = 0.00108 \times (AREA)^{0.89} \times (SAAR)^{1.17} \times (SOIL)^{2.17}$

Qbar-50ha = 0.194 m^3/s

From Regional Growth Curve Factor

Region: 6

Return period	1	2	5	10	25	30	50	100	500
Growth Factor	0.85	0.88	1.28	1.62	2.14	2.24	2.62	3.19	4.49

Q_1 50ha =	0.165 m^3/s	=	165.05 l/s	=	3.301	l/s/ha
Q_2 50ha =	0.171 m^3/s	=	170.88 l/s	=	3.418	l/s/ha
Q_5 50ha =	0.249 m^3/s	=	248.55 l/s	=	4.971	l/s/ha
Q_{10} 50ha =	0.315 m^3/s	=	314.57 l/s	=	6.291	l/s/ha
Q_{25} 50ha =	0.416 m^3/s	=	415.55 l/s	=	8.311	l/s/ha
Q_{30} 50ha =	0.435 m^3/s	=	434.97 l/s	=	8.699	l/s/ha
Q_{50} 50ha =	0.509 m^3/s	=	508.75 l/s	=	10.175	l/s/ha
Q_{100} 50ha =	0.619 m^3/s	=	619.44 l/s	=	12.389	l/s/ha
Q_{500} 50ha =	0.872 m^3/s	=	871.87 l/s	=	17.437	l/s/ha

Factored for Development Impermeable Area

Site area = 0.0305 ha

Q_{bar} site =	0.000 m^3/s	=	0.12 l/s	=	3.9	l/s/ha
Q_1 site =	0.000 m^3/s	=	0.10 l/s	=	3.3	l/s/ha
Q_2site =	0.000 m^3/s	=	0.10 l/s	=	3.4	l/s/ha
Q_5site =	0.000 m^3/s	=	0.15 l/s	=	5.0	l/s/ha
Q_{10} site =	0.000 m^3/s	=	0.19 l/s	=	6.3	l/s/ha
Q_{25} site =	0.000 m^3/s	=	0.25 l/s	=	8.3	l/s/ha
Q_{30} site =	0.000 m^3/s	=	0.27 l/s	=	8.7	l/s/ha
Q_{50} site =	0.000 m^3/s	=	0.31 l/s	=	10.2	l/s/ha
Q_{100} site =	0.000 m^3/s	=	0.38 l/s	=	12.4	l/s/ha
Q_{500} site =	0.001 m^3/s	=	0.53 l/s	=	17.4	l/s/ha

Note: For greenfield site, the critical duration is generally not relevant and the prediction of the peak rate of runoff using IH124 does not require consideration of storm duration.

APPENDIX G

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	30.655	1.355	1.0	10.8	O K
30 min Summer	31.049	1.749	1.0	14.0	O K
60 min Summer	31.364	2.064	1.0	16.5	O K
120 min Summer	31.746	2.446	1.0	19.6	O K
180 min Summer	31.832	2.532	1.0	20.3	O K
240 min Summer	31.827	2.527	1.0	20.2	O K
360 min Summer	31.708	2.408	1.0	19.3	O K
480 min Summer	31.545	2.245	1.0	18.0	O K
600 min Summer	31.369	2.069	1.0	16.6	O K
720 min Summer	31.192	1.892	1.0	15.1	O K
960 min Summer	30.848	1.548	1.0	12.4	O K
1440 min Summer	30.248	0.948	1.0	7.6	O K
2160 min Summer	29.641	0.341	1.0	2.7	O K
2880 min Summer	29.348	0.048	1.0	0.4	O K
4320 min Summer	29.300	0.000	0.8	0.0	O K
5760 min Summer	29.300	0.000	0.6	0.0	O K
7200 min Summer	29.300	0.000	0.5	0.0	O K
8640 min Summer	29.300	0.000	0.4	0.0	O K
10080 min Summer	29.300	0.000	0.4	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	182.560	0.0	13.3	21
30 min Summer	117.600	0.0	17.1	34
60 min Summer	71.820	0.0	21.0	64
120 min Summer	46.270	0.0	27.2	122
180 min Summer	35.180	0.0	31.0	180
240 min Summer	28.665	0.0	33.7	208
360 min Summer	21.093	0.0	37.3	272
480 min Summer	16.740	0.0	39.5	336
600 min Summer	13.901	0.0	40.9	404
720 min Summer	11.900	0.0	42.1	470
960 min Summer	9.258	0.0	43.6	598
1440 min Summer	6.428	0.0	45.4	850
2160 min Summer	4.445	0.0	47.0	1188
2880 min Summer	3.424	0.0	48.2	1496
4320 min Summer	2.380	0.0	50.1	0
5760 min Summer	1.848	0.0	51.7	0
7200 min Summer	1.528	0.0	53.3	0
8640 min Summer	1.315	0.0	54.8	0
10080 min Summer	1.163	0.0	56.4	0

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	30.843	1.543	1.0	12.3	O K
30 min Winter	31.296	1.996	1.0	16.0	O K
60 min Winter	31.677	2.377	1.0	19.0	O K
120 min Winter	32.175	2.875	1.0	23.0	O K
180 min Winter	32.322	3.022	1.0	24.2	O K
240 min Winter	32.311	3.011	1.0	24.1	O K
360 min Winter	32.151	2.851	1.0	22.8	O K
480 min Winter	31.927	2.627	1.0	21.0	O K
600 min Winter	31.673	2.373	1.0	19.0	O K
720 min Winter	31.412	2.112	1.0	16.9	O K
960 min Winter	30.902	1.602	1.0	12.8	O K
1440 min Winter	30.039	0.739	1.0	5.9	O K
2160 min Winter	29.321	0.021	1.0	0.2	O K
2880 min Winter	29.300	0.000	0.8	0.0	O K
4320 min Winter	29.300	0.000	0.6	0.0	O K
5760 min Winter	29.300	0.000	0.4	0.0	O K
7200 min Winter	29.300	0.000	0.4	0.0	O K
8640 min Winter	29.300	0.000	0.3	0.0	O K
10080 min Winter	29.300	0.000	0.3	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	182.560	0.0	14.9	23
30 min Winter	117.600	0.0	19.3	36
60 min Winter	71.820	0.0	23.6	62
120 min Winter	46.270	0.0	30.5	120
180 min Winter	35.180	0.0	34.8	176
240 min Winter	28.665	0.0	37.8	230
360 min Winter	21.093	0.0	41.8	290
480 min Winter	16.740	0.0	44.2	364
600 min Winter	13.901	0.0	45.9	438
720 min Winter	11.900	0.0	47.1	510
960 min Winter	9.258	0.0	49.0	646
1440 min Winter	6.428	0.0	50.9	892
2160 min Winter	4.445	0.0	52.7	1144
2880 min Winter	3.424	0.0	54.1	0
4320 min Winter	2.380	0.0	56.2	0
5760 min Winter	1.848	0.0	58.0	0
7200 min Winter	1.528	0.0	59.8	0
8640 min Winter	1.315	0.0	61.6	0
10080 min Winter	1.163	0.0	63.4	0

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 525350 183050 TQ 25350 83050
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.033

Time From: (mins)	To: (mins)	Area (ha)
0	4	0.033

Green Roof

Area (m^3) 67 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time From: (mins)	To: (mins)	Area (ha)	Time From: (mins)	To: (mins)	Area (ha)	Time From: (mins)	To: (mins)	Area (ha)	Time From: (mins)	To: (mins)	Area (ha)
0	4	0.001218	32	36	0.000246	64	68	0.000050	96	100	0.000010
4	8	0.000997	36	40	0.000201	68	72	0.000041	100	104	0.000008
8	12	0.000816	40	44	0.000165	72	76	0.000033	104	108	0.000007
12	16	0.000668	44	48	0.000135	76	80	0.000027	108	112	0.000005
16	20	0.000547	48	52	0.000110	80	84	0.000022	112	116	0.000005
20	24	0.000448	52	56	0.000090	84	88	0.000018	116	120	0.000004
24	28	0.000367	56	60	0.000074	88	92	0.000015			
28	32	0.000300	60	64	0.000061	92	96	0.000012			

Time Area Diagram

Total Area (ha) 0.000

Time From: (mins)	To: (mins)	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 33.000

Tank or Pond Structure

Invert Level (m) 29.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	8.0	3.100	8.0	3.101	0.0

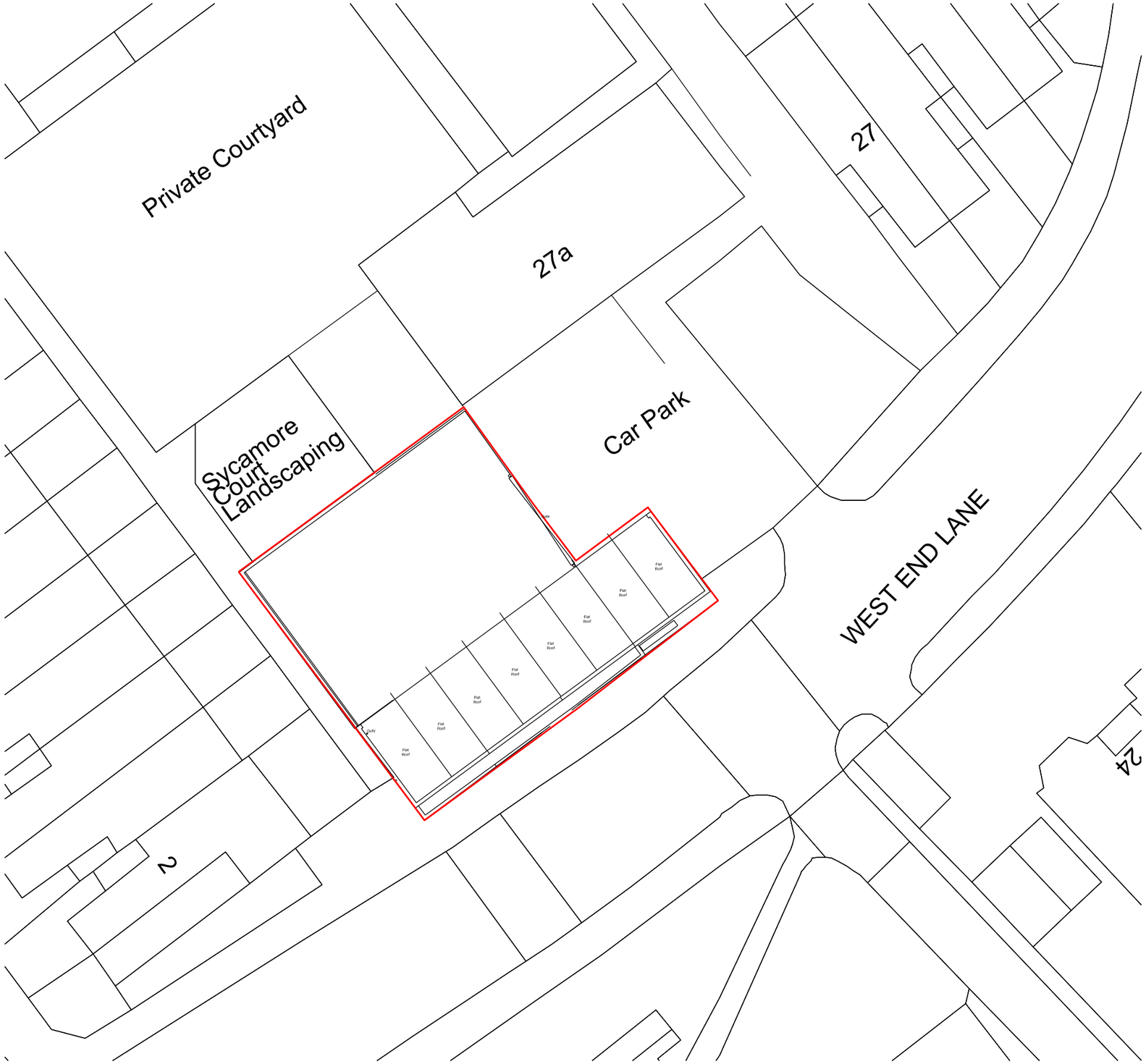
Pump Outflow Control

Invert Level (m) 29.200

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.0000	0.900	1.0000	1.700	1.0000	2.500	1.0000
0.200	1.0000	1.000	1.0000	1.800	1.0000	2.600	1.0000
0.300	1.0000	1.100	1.0000	1.900	1.0000	2.700	1.0000
0.400	1.0000	1.200	1.0000	2.000	1.0000	2.800	1.0000
0.500	1.0000	1.300	1.0000	2.100	1.0000	2.900	1.0000
0.600	1.0000	1.400	1.0000	2.200	1.0000	3.000	1.0000
0.700	1.0000	1.500	1.0000	2.300	1.0000	3.100	1.0000
0.800	1.0000	1.600	1.0000	2.400	1.0000		

PLANS

Notes:
1. Do not scale. Dimensions govern.
2. All dimensions are in millimetres unless noted otherwise.
3. All dimensions to be verified on site before proceeding with the work.
4. The designer shall be notified in writing of any discrepancies.



01 Existing site plan @ 1.500 N

Denotes Site Boundary

0 5 10 20 30m

01 Site plan @ 1.1250 N

Denotes Site Boundary

0 10 30m

Rev	Date	Description	Checked
A	12.06.20	Plan updated	MF

Atomik Architecture
41 Water Lane, London, E15 4NL
+44 (0) 208 221 2915
info@atomikarchitecture.com
atomikarchitecture.com

Project
West End Lane

Title
Existing Site Plan

Project No.	Scale	Drawing Size
0390	1:500 1:1250	A3

Drawing No.	Revision
0390 (10) 099	A

FLAT 1
2 BED 4P
BASEMENT FLOOR 55 SQM

FLAT 2
3 BED 5P
BASEMENT FLOOR 67 SQM

FLAT 3
2 BED 4P
BASEMENT FLOOR 53 SQM

KEY:

PROPOSED WALL

GIA:

FLAT 1	2 BED 4 P	94 SQM
FLAT 2	3 BED 5 P	101 SQM
FLAT 3	2 BED 4 P	86 SQM
FLAT 4	2 BED 3 P	61 SQM
FLAT 5	1 BED 2 P	50 SQM
FLAT 6	2 BED 4 P	70 SQM

REV.	DATE	DESCRIPTION

WEST END LANE
LONDON

Proposed Basement Plan

DRNG No	SCALE	DATE
PL-02	1:50 @ A1 1:100 @ A3	FEB 2021

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N

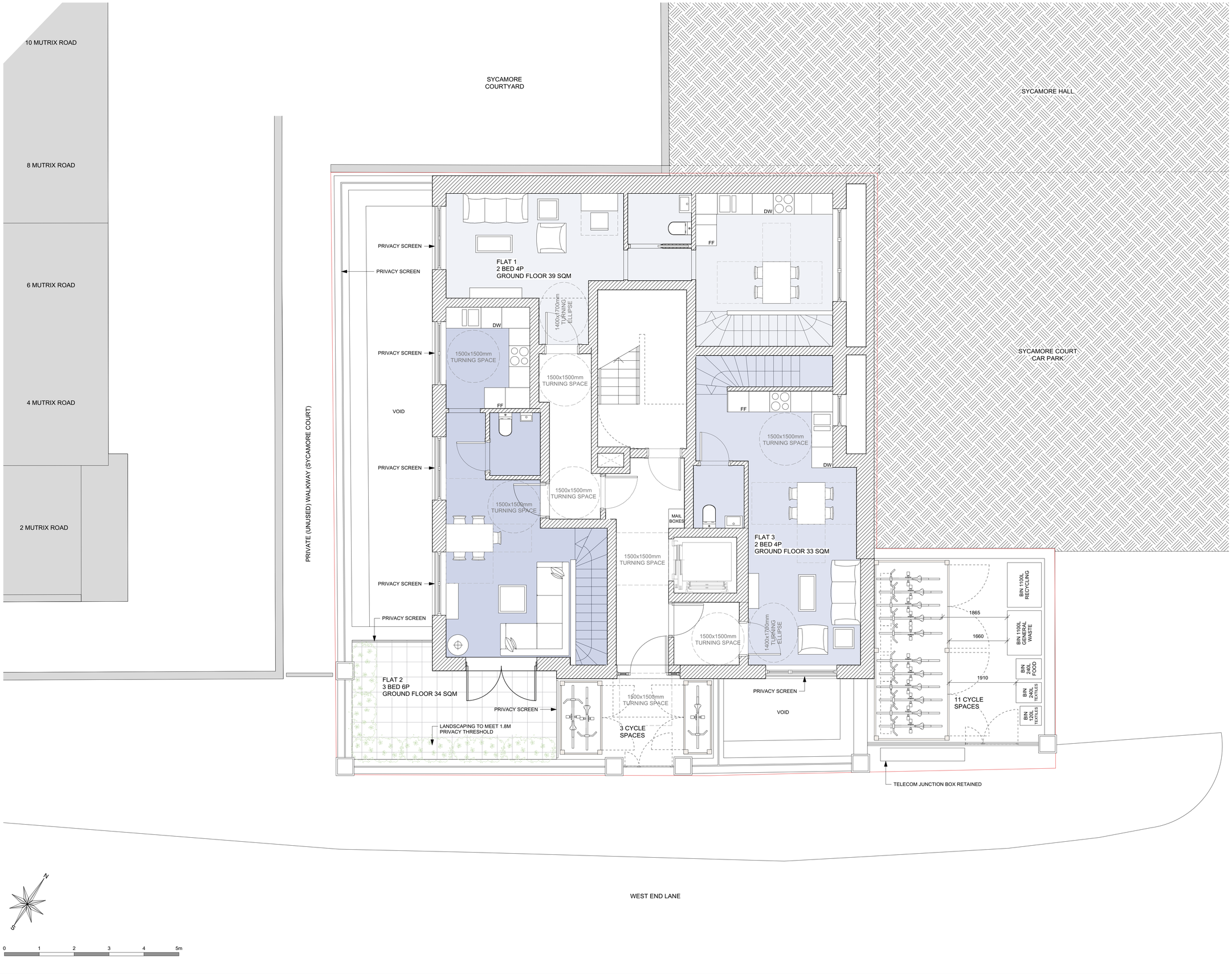
0 1 2 3 4 5m

KEY:

PROPOSED WALL

GIA:

FLAT 1	2 BED 4 P	94 SQM
FLAT 2	3 BED 5 P	101 SQM
FLAT 3	2 BED 4 P	86 SQM
FLAT 4	2 BED 3 P	61 SQM
FLAT 5	1 BED 2 P	50 SQM
FLAT 6	2 BED 4 P	70 SQM



REV.	DATE	DESCRIPTION

WEST END LANE
LONDON

Proposed Ground Floor Plan

DRNG No	SCALE	DATE
PL-03	1:50 @ A1 1:100 @ A3	FEB 2021

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10 MUTRIX ROAD

8 MUTRIX ROAD

6 MUTRIX ROAD

4 MUTRIX ROAD

2 MUTRIX ROAD

SYCAMORE COURTYARD

SYCAMORE HALL

SYCAMORE COURT CAR PARK

PRIVATE (UNUSED) WALKWAY (SYCAMORE COURT)

N

0 1 2 3 4 5m

KEY:

PROPOSED WALL

GIA:

FLAT 1	2 BED 4 P	94 SQM
FLAT 2	3 BED 5 P	101 SQM
FLAT 3	2 BED 4 P	86 SQM
FLAT 4	2 BED 3 P	61 SQM
FLAT 5	1 BED 2 P	50 SQM
FLAT 6	2 BED 4 P	70 SQM

REV.	DATE	DESCRIPTION

WEST END LANE
LONDON

Proposed First Floor Plan

DRNG No	SCALE	DATE
PL-04	1:50 @ A1 1:100 @ A3	FEB 2021

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KEY:

PROPOSED WALL

GIA:

FLAT 1	2 BED 4 P	94 SQM
FLAT 2	3 BED 5 P	101 SQM
FLAT 3	2 BED 4 P	86 SQM
FLAT 4	2 BED 3 P	61 SQM
FLAT 5	1 BED 2 P	50 SQM
FLAT 6	2 BED 4 P	70 SQM

REV.	DATE	DESCRIPTION

WEST END LANE
LONDON

Proposed Second Floor Plan

DRNG No	SCALE	DATE
PL-05	1:50 @ A1 1:100 @ A3	FEB 2021

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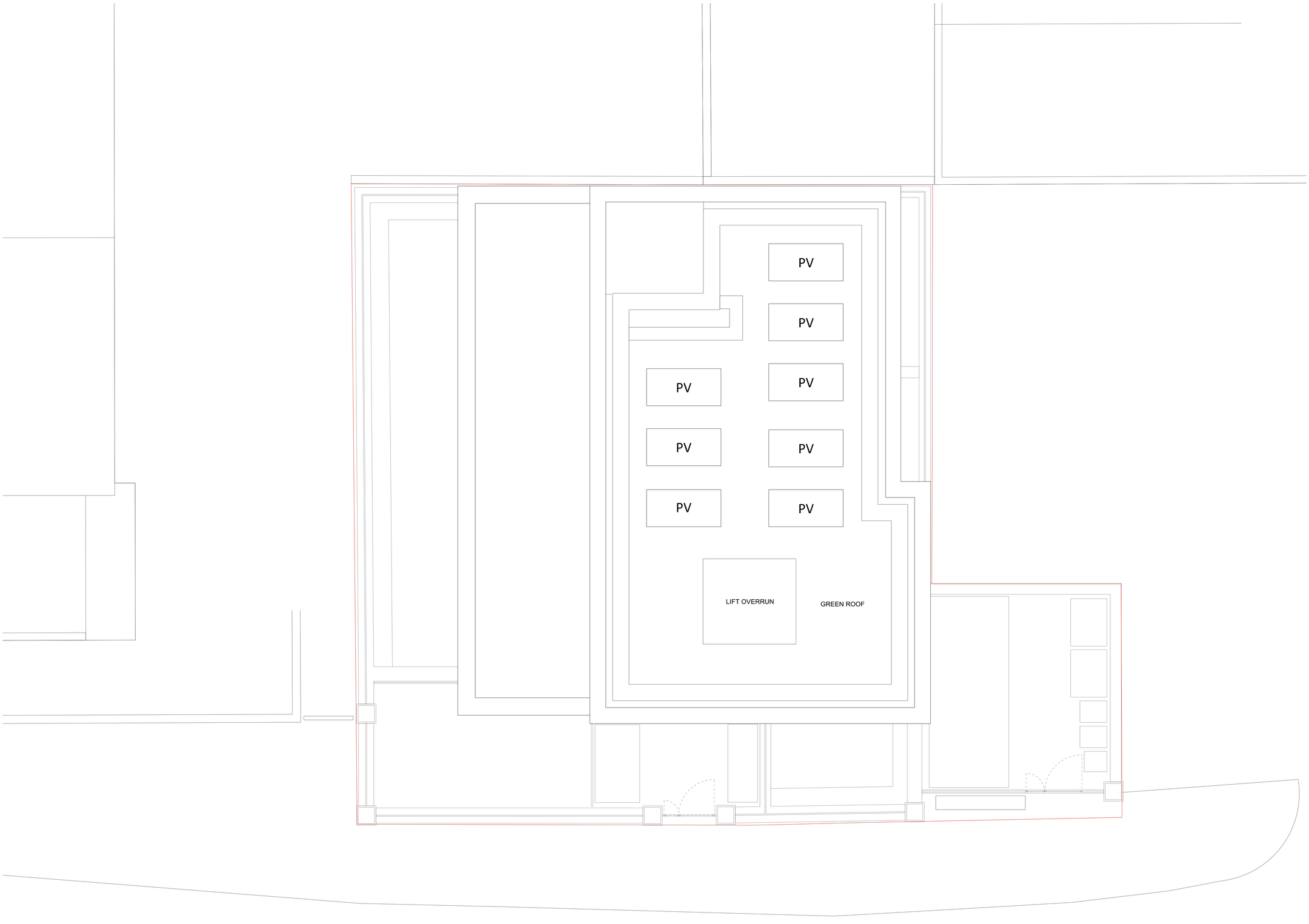

THIS DRAWING IS FOR AESTHETIC DESIGN INFORMATION PURPOSES ONLY & DOES NOT CONTAIN ANY INFORMATION FOR CONSTRUCTION OR COMPLIANCE TO BUILDING REGULATIONS.

DRAWINGS MAY BE SCALED FOR THE PURPOSES OF PLANNING ONLY. ALL DIMENSIONS TO BE CHECKED ON SITE.

KEY:

PROPOSED WALL

GIA:

FLAT 1	2 BED 4 P	94 SQM
FLAT 2	3 BED 5 P	101 SQM
FLAT 3	2 BED 4 P	86 SQM
FLAT 4	2 BED 3 P	61 SQM
FLAT 5	1 BED 2 P	50 SQM
FLAT 6	2 BED 4 P	70 SQM

REV.	DATE	DESCRIPTION

WEST END LANE
LONDON

Proposed Roof Plan

DRNG No	SCALE	DATE
PL-06	1:50 @ A1 1:100 @ A3	FEB 2021

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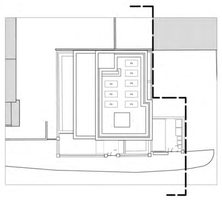
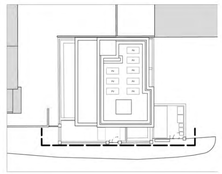
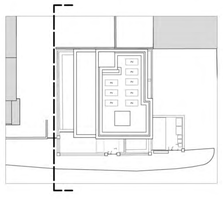
1 EAST ELEVATION - STREET LEVEL
Scale: 1:100

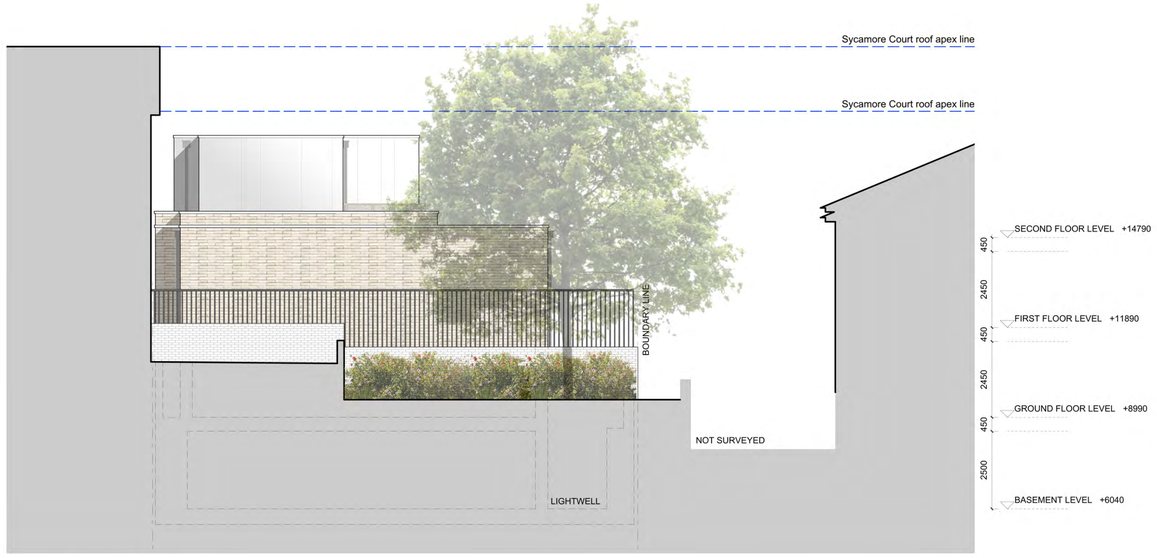


2 SOUTH ELEVATION - STREET LEVEL
Scale: 1:100

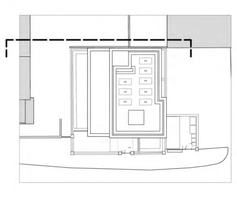


3 WEST ELEVATION - STREET LEVEL
Scale: 1:100





4 NORTH ELEVATION
Scale: 1:100



0 1 2 3 4 5 10m

REV.	DATE	DESCRIPTION

WEST END LANE
LONDON

Proposed Elevations

DRNG No	SCALE	DATE
PL-07	1:100@ A1	FEB 2021

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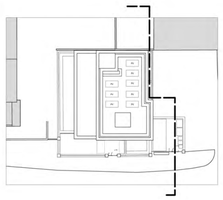
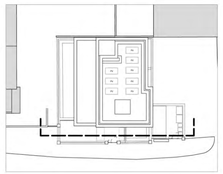
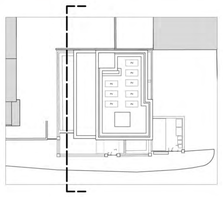
1 EAST ELEVATION
Scale: 1:100



2 SOUTH ELEVATION
Scale: 1:100



3 WEST ELEVATION
Scale: 1:100



0 1 2 3 4 5 10m

REV.	DATE	DESCRIPTION

WEST END LANE
LONDON

Proposed Elevations 2

DRNG No	SCALE	DATE
PL-08	1:100@ A1	FEB 2021

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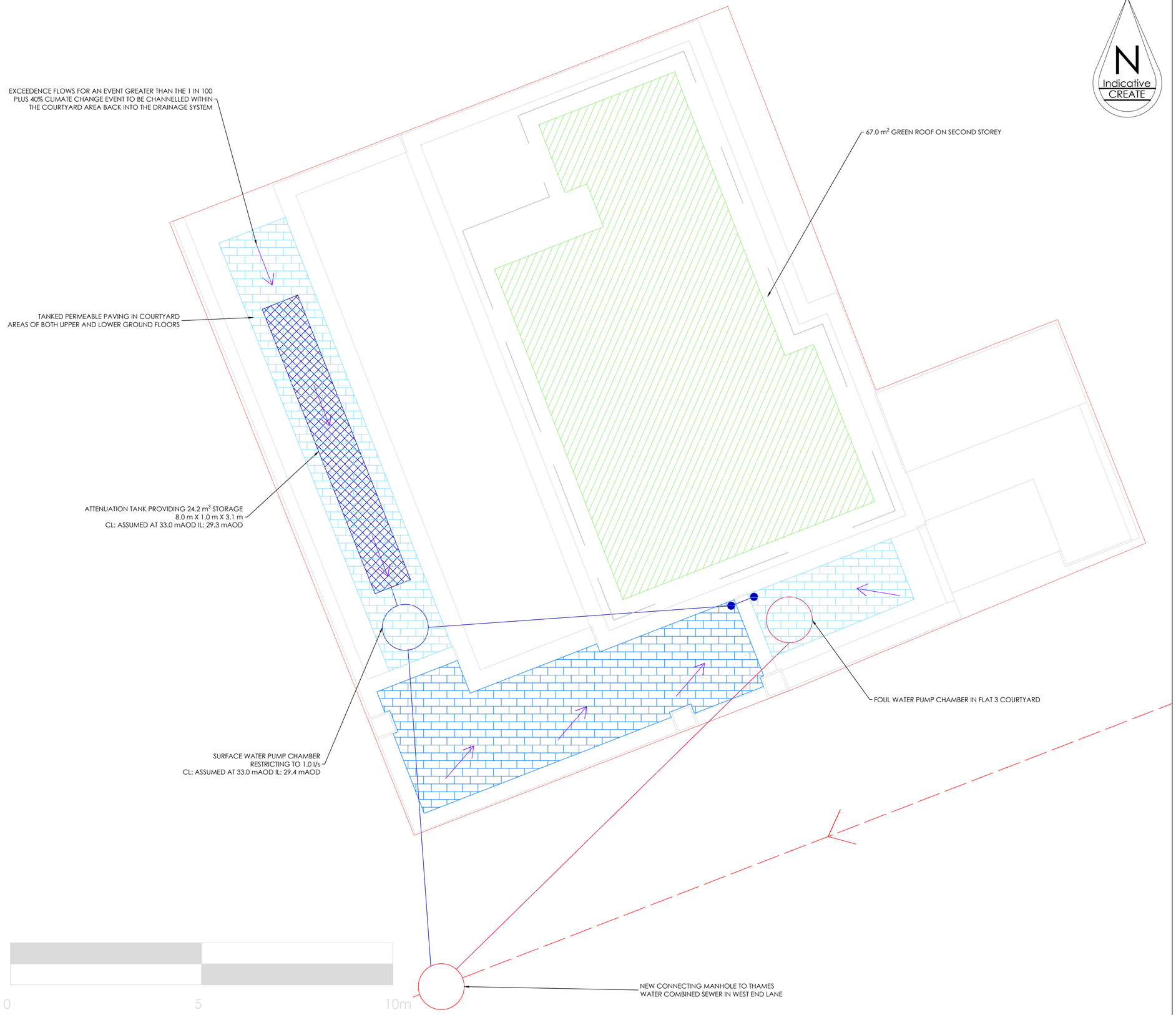

N

Indicative

CREATE

NOTES:

1. THIS DRAWING IS BASED UPON DRAWING WEL CO-06 ENTITLED PROPOSED BASEMENT FLOOR PLAN BY STANHOPE GATE ARCHITECTURE DATED FEBRUARY 2021. PROPOSED DRAINAGE LAYOUT SUBJECT TO CONFIRMATION OF EXISTING DRAINAGE PROVISION.

KEY:

- TANKED PERMEABLE PAVING- UPPER GROUND FLOOR
- TANKED PERMEABLE PAVING - LOWER GROUND FLOOR
- ATTENUATION TANK
- GREEN ROOF
- PRIVATE SURFACE WATER DRAINAGE
- PRIVATE FOUL WATER DRAINAGE
- THAMES WATER COMBINED WATER SEWER
- EXCEEDENCE FLOW ROUTE
- REDLINE BOUNDARY

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REV	DATE	AMENDMENT DETAILS	DRAWN	APPROVED
A	12.02.21	UPDATED TO REFLECT LATEST PROPOSALS	EW	JJ

PROJECT: GARAGES TO THE SOUTH OF 27A WEST END LANE	DATE: 23.04.2020	DRAWING STATUS: INFORMATION	
	SCALE(S): 1:50	DESIGNED: EW / DRAWN: EW	
DRAWING TITLE: SURFACE AND FOUL WATER DRAINAGE STRATEGY		CHECKED: GS / APPROVED: GS	
	JOB No: 1126		
CLIENT: AG HOMES	DRAWING No: 02/001	REVISION: A	

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DO NOT SCALE ORIGINAL SHEET SIZE - A1 Landscape