LANMOR Consulting

Civil Engineers & Transport Planners

Stephenson Way, London

Drainage Strategy

April 2018

181023/DS/MK/RS/01

LANMOR Consulting

Civil Engineers & Transport Planners

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1 INTRODUCTION

1.1.1 Lanmor Consulting has been appointed by Churchgate to prepare a Drainage Strategy for the proposed development site at Stephenson Way, London, NW1 2HD. This report has been prepared in support of a planning application for the construction of student accommodation and has been commissioned to advise on the feasibility of providing a solution for the surface water and foul water drainage for the proposed development.

1.1.2 This report will consider the proposed drainage regime for the site and set out the drainage strategy for the development including discharge rates and any requirements for attenuation.

1.1.3 The information within this report will be refined, modified, and updated as the detailed design is progressed. The scope of the works for this drainage strategy report is outlined below:

- Review available data in relation to on-site drainage and other drainage networks near the site.
- Review of the ground conditions for the suitability of Sustainable Urban Drainage Systems (SUDS).
- Consider the use of SUDS as an option for disposal of surface water runoff from the proposed development.
- Undertake drainage assessments to establish attenuation requirements to deal with any increase in surface water runoff from the development.

2 SITE LOCATION AND DESCRIPTION

2.1 Location

2.1.1 The site is located on Stephenson Way, within Euston area of London, the nearest watercourse is the Regent's Canal approximately 1.1km to the northeast of the site. The total area of the site is approximately 0.04 hectares. Figure 2.1 below shows the location of the site.

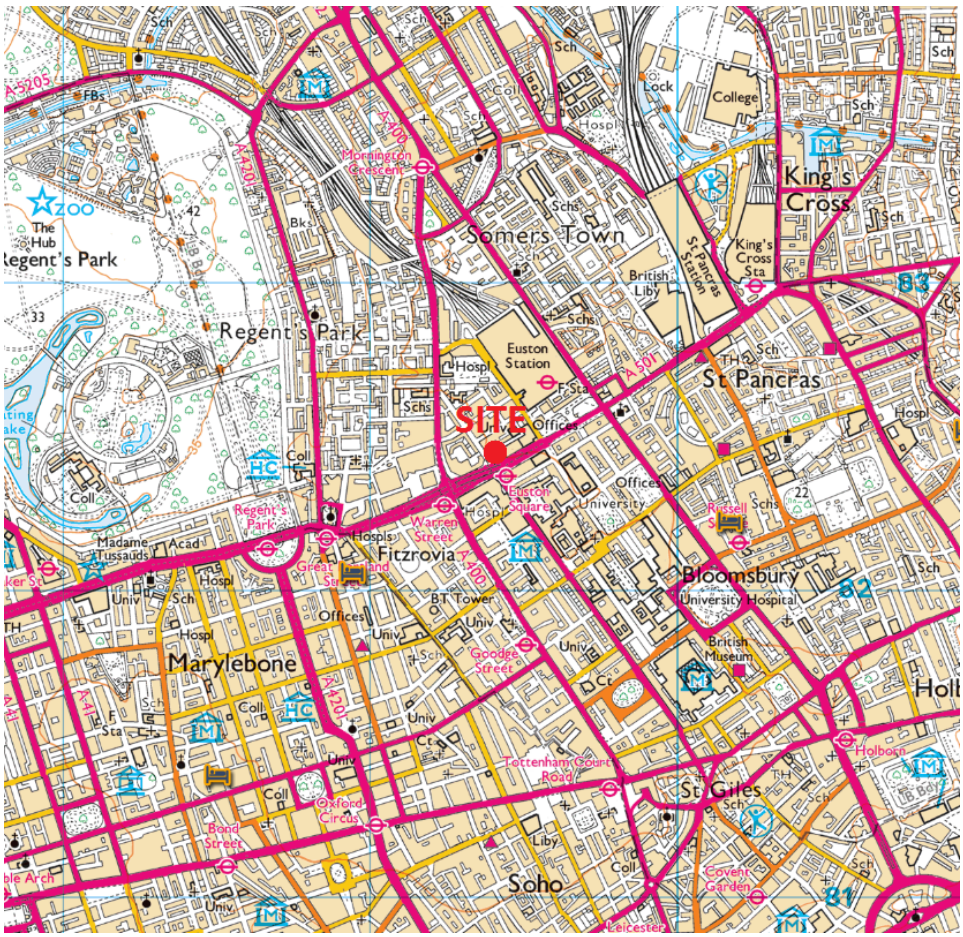


Figure 2.1 - Site Location

2.2 Proposed Development

2.2.1 The development proposals seek the construction of a 6-storey building of student accommodation comprising of 78 studios and study rooms/club rooms. The proposed site plan of the development is included in Appendix A.

2.3 Regional Geology

2.3.1 The British Geological Survey (BGS) indicates that the location of the site is underlain by London Clay Formation, containing clay, silt and sand. This sedimentary bedrock was formed approximately 48 to 56 million years ago in the Palaeogene Period.

2.3.2 Superficial deposits are also present across the site according the BGS and is identified as Lynch Hill Gravel Member, containing sand and gravel. The deposits were formed up to 2 million years ago in the Quaternary Period.

3 EXISTING DRAINAGE REGIME

3.1 Existing Foul and Surface Water Drainage

3.1.1 The Thames Water Sewer Records show there is an existing combined sewer in Stephenson Way to the north. The site is currently used as a car park, there is a manhole within the site's boundary however it is unclear where this sewer drains to or what it caters for. Therefore, both foul and surface water from the site will require new networks to drain the application site.

3.1.2 The Thames Water Asset Location Search is included in Appendix A which shows the existing combined sewer network in the area of the site.

4 PROPOSED DRAINAGE REGIME

4.1 Proposed Foul Water Drainage

4.1.1 A new network of foul drainage will be provided to serve the 6-storey student accommodation building. The peak flow rate for the 78 units in the proposed building is estimated to be between 5-6 l/s.

4.1.2 Foul water will be collected through a series of pipes from the units and discharged into the existing Thames Water combined sewer towards the north of the site on Stephenson Way. The proposals will allow for foul water drainage to discharge to the local drainage network via a new network, subject to a S106 application with Thames Water.

4.2 Proposed Surface Water Drainage

4.2.1 Sustainable Urban Drainage systems (SUDs) were considered as part of this assessment for the disposal of surface water runoff from the proposed development. The building will comprise of a terrace on the sixth floos as well as photovoltaic panels on the roof. This reduces the available area to install green roofs and therefore has been considered to be inadequate for the development and discounted as a SuDs method for disposal of runoff.

4.2.2 Rainwater harvesting was also considered to re-use surface water run-off within the building. These systems require a separate network of pipework within the property, tanks and pumps to store the rainwater and distribute it throughout. To implement a rainwater harvesting systems on the site it was considered impractical within the site due to lack of space and excessive cost for the development.

4.2.3 Furthermore, rainwater harvesting tanks should not be included in the assessment of attention required to store runoff from a development as there is no guarantee that the tank will be sufficiently empty to receive another storm.

4.2.4 Should the rainwater harvesting tank be full at the start of the storm, it will not be able to receive any more runoff, therefore additional storage of a similar size would be required to cater for all storm events and the rainwater harvesting tank will provide no benefit in terms of attenuation. For those reasons, and the excessive cost of providing the system, this method has been discounted.

4.2.5 Next on the Sustainable Drainage Hierarchy is the use of ground infiltration techniques such as soakaways and infiltration basins. The limited space on site means it is not possible to achieve the 5m separation required under building regulations from a building to a soakaway. The British Geological Survey records also indicate the ground conditions to consist of London Clay Formation. Therefore, infiltration of the surface water runoff is not a viable option.

4.2.6 Discharge to a watercourse is the next option on the Sustainable Drainage Hierarchy, however the proposed development is not situated near to a watercourse and therefore this is not a viable option.

4.2.7 Next is discharge to sewers. A connection to a surface water sewer is the preferred option for discharge of runoff, however Thames Water have no surface water sewers in the area, so this is not possible.

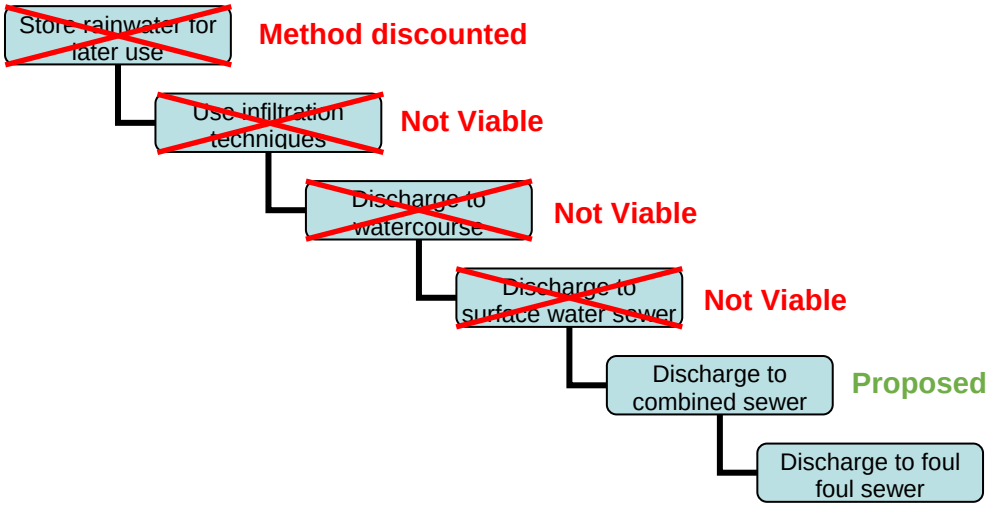


Figure 4.1 – Sustainable Drainage Hierarchy

4.2.8 The only viable option for the discharge of the surface water will be to attenuate flows and restrict the discharge into the existing combined network. Drawings 181023/DS/01, 181023/DS/02 and 181023/DS/03 in Appendix B shows the indicative drainage layout for the development as well as the sewer sections. Calculations have also been undertaken to determine the greenfield runoff rates for the existing site these are tabulated in Table 4.1 below. The full calculations are included in Appendix B.

Return Period	Rate
QBAR	0.2 l/s
1 in 1	0.1 l/s
1 in 30	0.3 l/s
1 in 100	0.5 l/s

Table 4.1 – Greenfield Runoff Rates

4.2.9 Further calculations have also been carried out to determine the brownfield runoff rates for the existing site and are listed below in Table 4.2.

Return Period	Rate
1 in 1	3.7 l/s
1 in 30	8.6 l/s
1 in 100	11.5 l/s

Table 4.2 – Brownfield Runoff Rates

4.2.10 The greenfield runoff rate has been calculated to be 0.1 l/s. It is not practical or advisable to restrict the discharge from the site to a rate of 0.1 l/s, as using such low rates can lead to long term maintenance problems of blocking and flooding. To prevent this, the discharge rate has been set at 3.7 l/s the minimum rate advisable to maintain self-cleansing velocity in the pipework from the pump station.

4.2.11 Drainage calculations have been undertaken to determine the necessary size of the attenuation tank needed to ensure no flooding occurs on the site for a 1 in 100-year return period plus 40% climate change. The attenuation tank will have a volume of 11.1m^3 and cater for all surface water runoff produced from the roof of the building and hardstanding areas. The runoff will then be pumped from the attenuation tank through a new connection to the existing Thames Water network located towards the north of the site, subject to a S106 application, however it will have a restricted flow rate of 3.7 l/s controlled via the use of the Pump.

4.2.12 The necessary attenuation storage tank will be provided in the form of below ground AquaCell tanks. A typical layout for the attenuation tank is provided below and full calculations for the tank have been calculated using MicroDrainage and are provided in Appendix B.

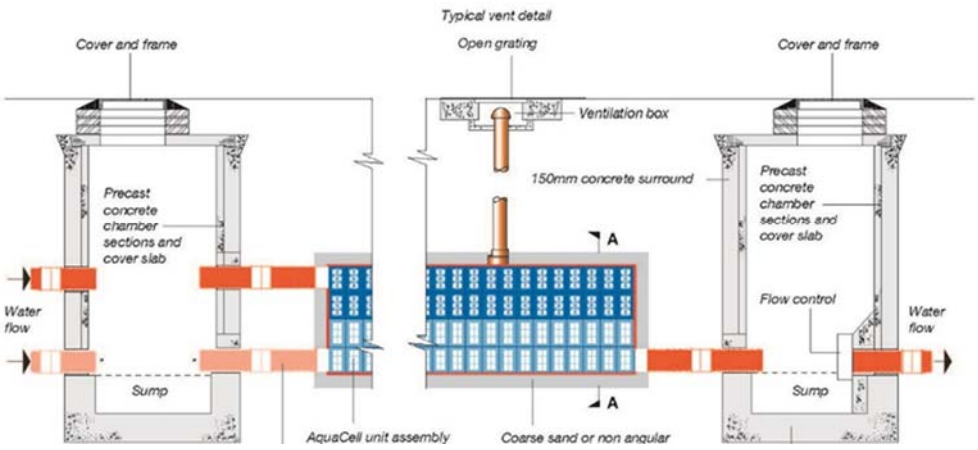


Figure 4.2 – AquaCell Attenuation Storage Tank

4.2.13 The surface water will be discharged from the tank via a pump which will have a restrict flow rate of 3.7 l/s. This rate has been selected to ensure the unit will function appropriately and to achieve self-cleansing velocity. Full calculations for the proposed drainage networks have been included in Appendix B.

5 SUMMARY AND CONCLUSION

5.1.1 The proposed development of student accommodation at Stephenson Way, Euston will consist of a total of 78 studios units with associated facilities for students provided on various floors.

5.1.2 After reviewing the Thames Water Sewer records, it was identified that there is a combined Thames Water sewer which runs along Stephenson Way. The site is currently hard surfaced, there is an existing manhole on-site however it is unknown where this drains to or what it currently serves therefore new surface and foul water drainage networks will be provided from the site via a new connection to the Thames Water combined sewer in Stephenson Way, subject to a S106 application. It is proposed the surface water will be attenuated on site in an underground tank and discharged at a rate of 3.7 l/s into the existing combined sewer to the north. The attenuation storage tank will be located under the plant room which will collect all surface water runoff.

5.1.3 MicroDrainage calculations for the attenuation tank have been provided to show that it can cater for a storm event with a return period of 1 in 100 years plus 40% climate change without causing flooding on site or in the surrounding area.

5.1.4 This report has demonstrated that the drainage requirement for the development can be provided for in accordance with the Sustainable Drainage Hierarchy. For the reasons outlined within this drainage strategy, we see no reason to refuse planning permission on the ground of there being insufficient capacity to discharge run-off from the development.

APPENDIX A

Drawing D 0100 – Proposed Site Plan

Institute of Family Therapy

Royal College of Ophthalmologists

STEPHENSON WAY

service access

main entrance

+24.68

+24.53

+24.48

+24.50

+24.81

ramp down to LG level

+24.66

+24.44

+24.07

+23.52

+22.91

+22.63

+22.59

+22.60

study

riser

lift

riser

riser

entrance lobby

+24.530 AOD

parcel storage

reception

riser

riser

laundry

Institute of Ismaili Studies

UCL Farr Institute

CLIENT

STRUCTURAL ENGINEER

SERVICES ENGINEER

CONSULTANT

KEY PLAN

NOTES:

DO NOT SCALE. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING. CHECK DIMENSIONS ON SITE AND REPORT DISCREPANCIES TO THE ARCHITECT.

ALL AREAS HAVE BEEN MEASURED FROM CURRENT DRAWINGS. THEY MAY VARY BECAUSE OF (EG) SURVEY, DESIGN DEVELOPMENT, CONSTRUCTION TOLERANCES, STATUTORY REQUIREMENTS OR RE-DEFINITION OF THE AREAS TO BE MEASURED.

PRELIMINARY

No.	Date	Comment	Drawn	Chk'd
D1	-	--		

Revisions

Issue Status

PLANNING

tp bennett
architecture
interiors
planning

One America Street London SE1 0NE UK +44 (0) 20 7208 2000 www.tpbennett.com

Project

Stephenson Way
London

Drawing Title

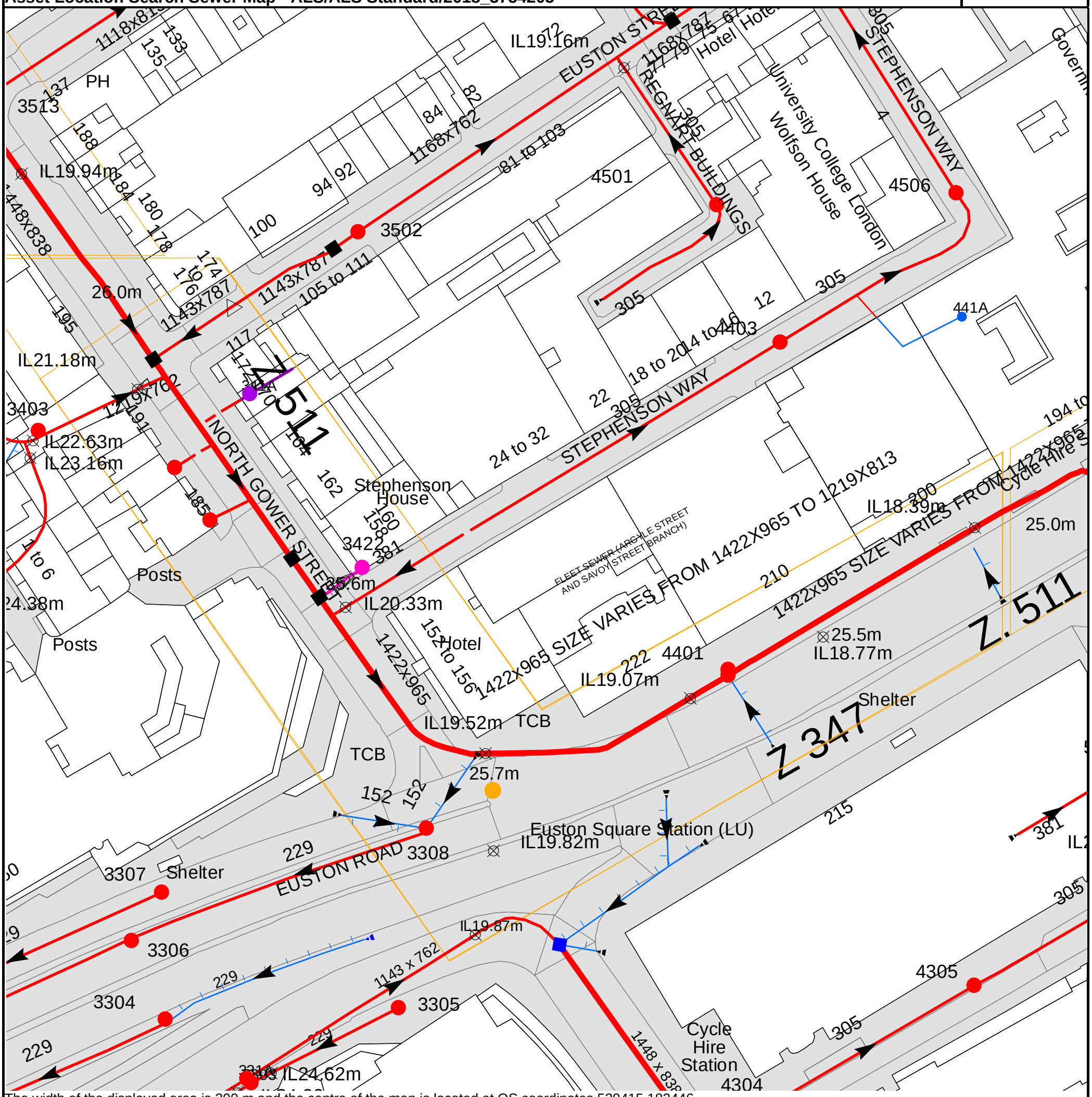
Proposed Ground Floor Plan

Drawn	Date	Scale @ A1	Alt. Ref.
DK	07.03.2018	1:100	--

tp bennett Project No.	Drawing Number	Rev
A11261	D 0100	D1

Thames Water Asset Location Search

Asset Location Search Sewer Map - ALS/ALS Standard/2018_3754205



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 529415,182446

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
3426	n/a	n/a
3425	n/a	n/a
341A	n/a	n/a
3502	25.1	19.82
3422	25.42	n/a
4501	23.36	19.42
44BI	n/a	n/a
4401	25.45	n/a
4403	24.14	19.78
4506	n/a	n/a
441A	n/a	n/a
3403	27.64	n/a
3306	23.78	21.81
3307	26.3	25.26
3304	23.78	21.81
331A	n/a	n/a
3303	26.27	n/a
3305	26.07	25.01
3308	26.13	24.55
4305	26.31	21.49

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

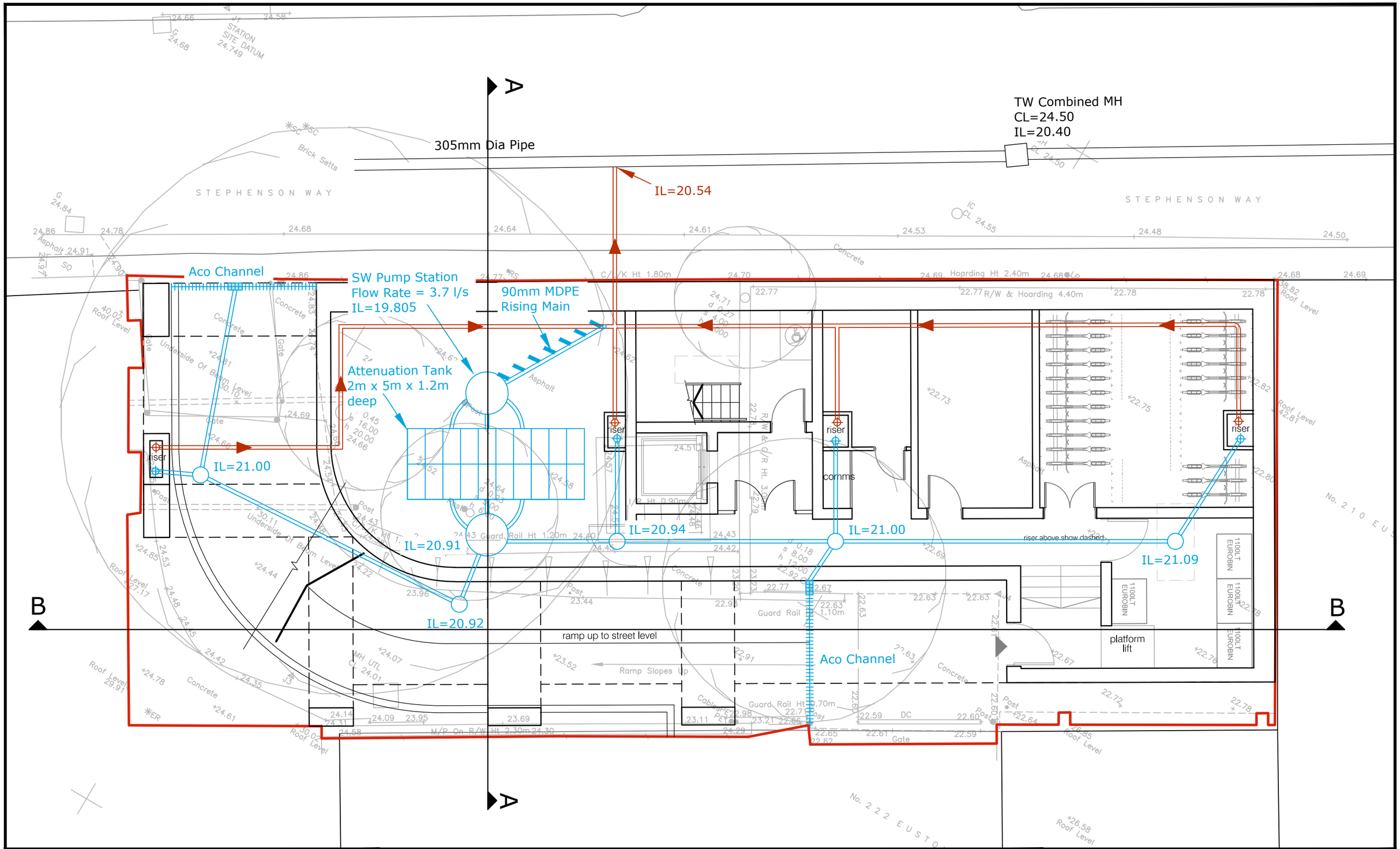
Abandoned Sewer

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.

APPENDIX B

Drawing 181023/DS/01 – Proposed Drainage Strategy



Churchgate

Stephenson Way
London

Proposed
Drainage Strategy

SCALE	DRAWN BY	PRJ No.	DWG No.
1:100	MK	181023	181023/DS/01

LANMOR Consulting
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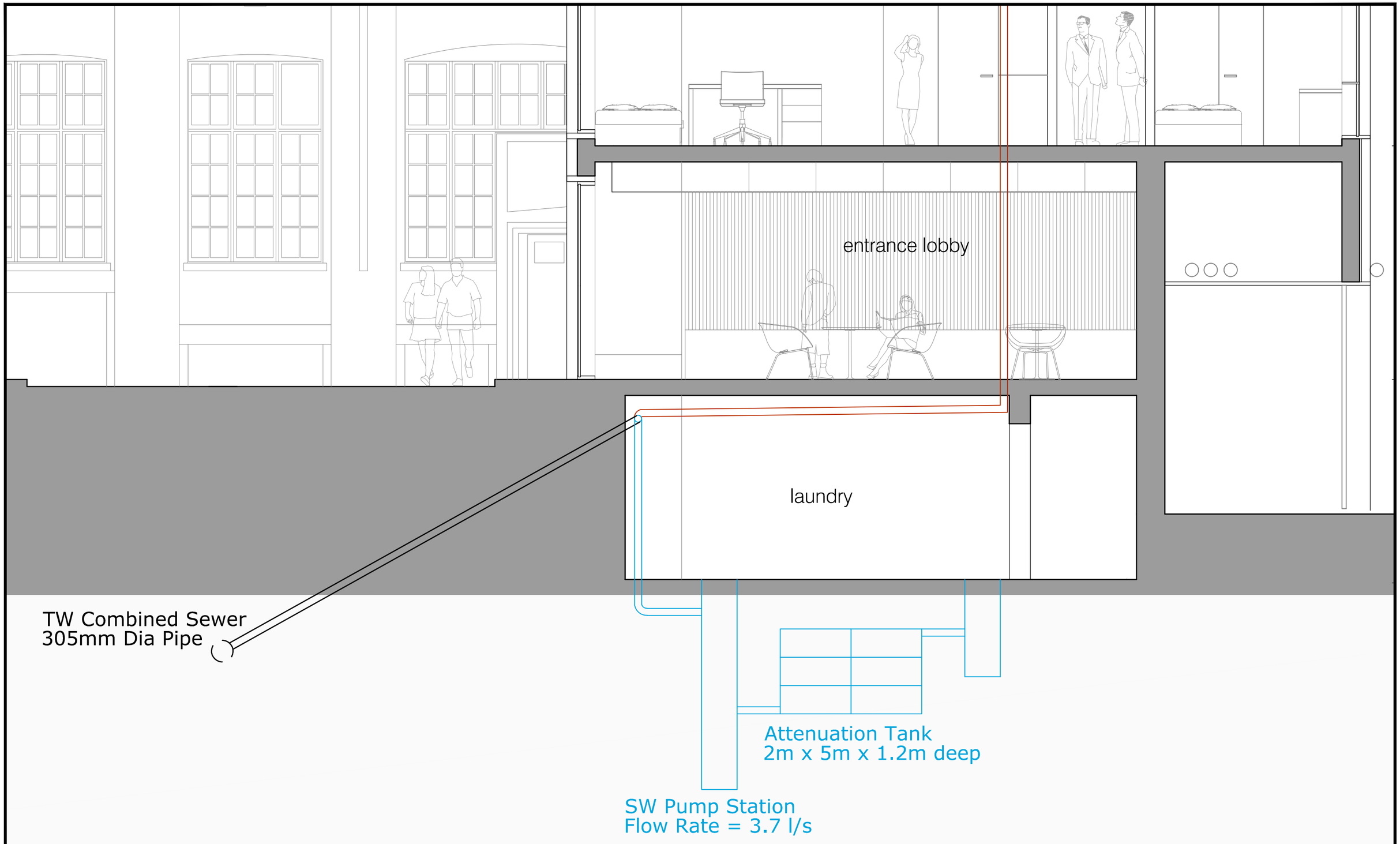
Drawing 181023/DS/02 – Proposed Drainage Sewer Section AA



Churchgate

Stephenson Way
London

Proposed Drainage
Sewer Section AA

SCALE	DRAWN BY	PRJ No.	DWG No.
1:50	MK	181023	181023/DS/02

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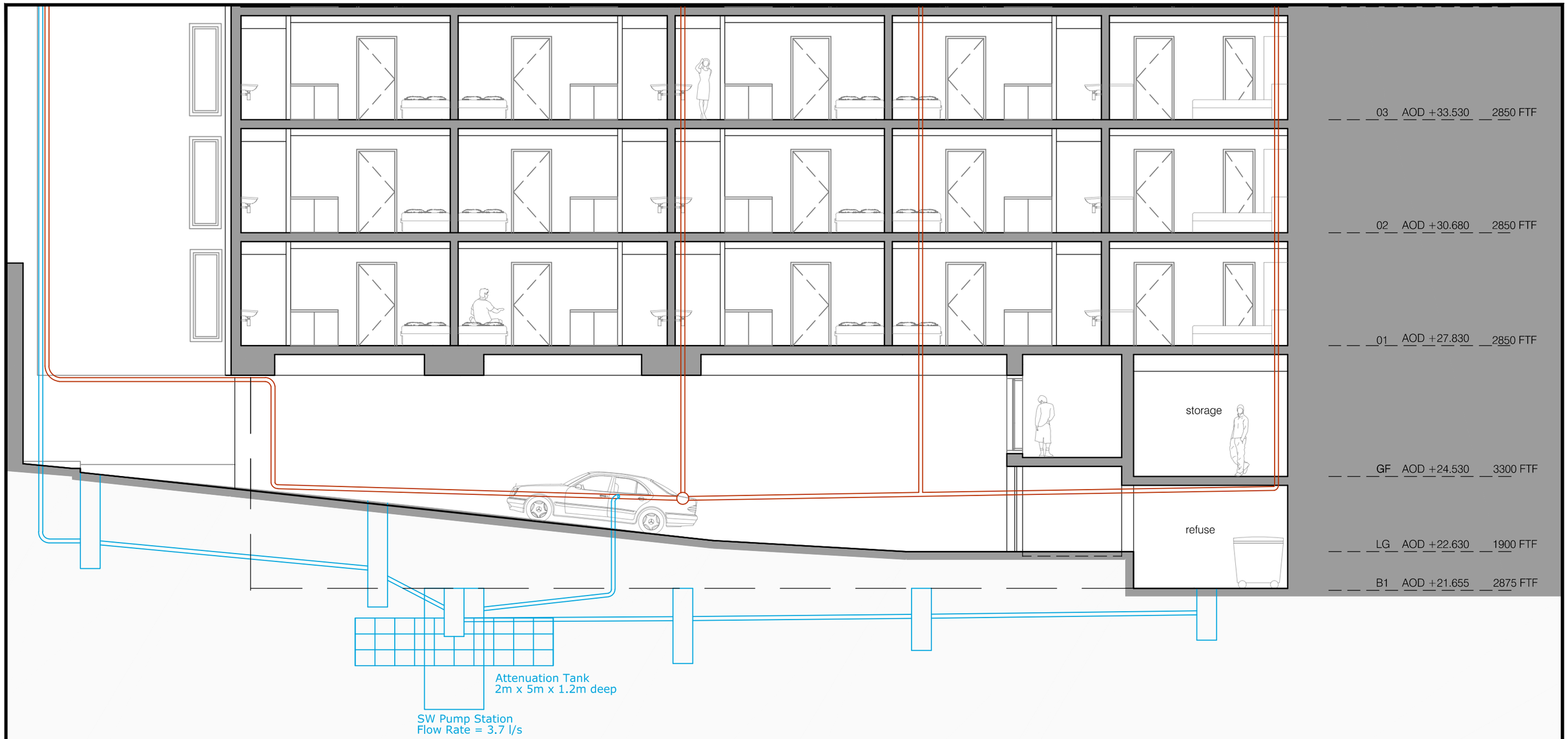
Drawing 181023/DS/03 – Proposed Drainage Sewer Section BB



Churchgate

Stephenson Way
London

Proposed Drainage
Sewer Section BB

SCALE	DRAWN BY	PRJ No.	DWG No.
1:100	MK	181023	181023/DS/03

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MicroDrainage - Greenfield Runoff Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	0.041	Urban	0.000
SAAR (mm)	600	Region Number	Region 6

Results l/s

QBAR Rural	0.2
QBAR Urban	0.2
Q100 years	0.5
Q1 year	0.1
Q30 years	0.3
Q100 years	0.5

MicroDrainage - Attenuation Tank Calculations

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	20.665	0.860	3.7	8.6	O K
30 min Summer	20.750	0.945	3.7	9.4	O K
60 min Summer	20.713	0.908	3.7	9.1	O K
120 min Summer	20.544	0.739	3.7	7.4	O K
180 min Summer	20.370	0.565	3.7	5.6	O K
240 min Summer	20.215	0.410	3.7	4.1	O K
360 min Summer	20.005	0.200	3.7	2.0	O K
480 min Summer	19.910	0.105	3.7	1.0	O K
600 min Summer	19.892	0.087	3.2	0.9	O K
720 min Summer	19.880	0.075	2.8	0.8	O K
960 min Summer	19.865	0.060	2.2	0.6	O K
1440 min Summer	19.848	0.043	1.6	0.4	O K
2160 min Summer	19.836	0.031	1.1	0.3	O K
2880 min Summer	19.829	0.024	0.9	0.2	O K
4320 min Summer	19.823	0.018	0.7	0.2	O K
5760 min Summer	19.819	0.014	0.5	0.1	O K
7200 min Summer	19.817	0.012	0.4	0.1	O K
8640 min Summer	19.815	0.010	0.4	0.1	O K
10080 min Summer	19.814	0.009	0.3	0.1	O K
15 min Winter	20.798	0.993	3.7	9.9	O K
30 min Winter	20.913	1.108	3.7	11.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	150.416	0.0	11.6	16
30 min Summer	97.118	0.0	14.9	26
60 min Summer	59.609	0.0	18.3	44
120 min Summer	35.327	0.0	21.7	78
180 min Summer	25.675	0.0	23.7	110
240 min Summer	20.358	0.0	25.0	140
360 min Summer	14.677	0.0	27.1	196
480 min Summer	11.628	0.0	28.6	248
600 min Summer	9.700	0.0	29.8	306
720 min Summer	8.361	0.0	30.8	368
960 min Summer	6.610	0.0	32.5	488
1440 min Summer	4.739	0.0	35.0	734
2160 min Summer	3.394	0.0	37.6	1092
2880 min Summer	2.675	0.0	39.5	1448
4320 min Summer	1.911	0.0	42.3	2188
5760 min Summer	1.504	0.0	44.4	2904
7200 min Summer	1.249	0.0	46.1	3656
8640 min Summer	1.072	0.0	47.5	4320
10080 min Summer	0.942	0.0	48.7	5104
15 min Winter	150.416	0.0	12.9	16
30 min Winter	97.118	0.0	16.7	29

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
60 min Winter	20.851	1.046	3.7	10.5	O K
120 min Winter	20.587	0.782	3.7	7.8	O K
180 min Winter	20.318	0.513	3.7	5.1	O K
240 min Winter	20.097	0.292	3.7	2.9	O K
360 min Winter	19.900	0.095	3.5	1.0	O K
480 min Winter	19.881	0.076	2.8	0.8	O K
600 min Winter	19.868	0.063	2.3	0.6	O K
720 min Winter	19.860	0.055	2.0	0.5	O K
960 min Winter	19.848	0.043	1.6	0.4	O K
1440 min Winter	19.836	0.031	1.2	0.3	O K
2160 min Winter	19.827	0.022	0.8	0.2	O K
2880 min Winter	19.823	0.018	0.7	0.2	O K
4320 min Winter	19.818	0.013	0.5	0.1	O K
5760 min Winter	19.815	0.010	0.4	0.1	O K
7200 min Winter	19.813	0.008	0.3	0.1	O K
8640 min Winter	19.812	0.007	0.3	0.1	O K
10080 min Winter	19.811	0.006	0.2	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.609	0.0	20.5	46
120 min Winter	35.327	0.0	24.3	84
180 min Winter	25.675	0.0	26.5	116
240 min Winter	20.358	0.0	28.0	144
360 min Winter	14.677	0.0	30.3	186
480 min Winter	11.628	0.0	32.0	246
600 min Winter	9.700	0.0	33.4	306
720 min Winter	8.361	0.0	34.6	368
960 min Winter	6.610	0.0	36.4	492
1440 min Winter	4.739	0.0	39.2	716
2160 min Winter	3.394	0.0	42.1	1084
2880 min Winter	2.675	0.0	44.2	1424
4320 min Winter	1.911	0.0	47.4	2128
5760 min Winter	1.504	0.0	49.7	2904
7200 min Winter	1.249	0.0	51.6	3552
8640 min Winter	1.072	0.0	53.2	4296
10080 min Winter	0.942	0.0	54.5	5000

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	21.000	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.041

Time (mins) From:	To:	Area (ha)
0	4	0.041

Model Details

Storage is Online Cover Level (m) 21.655

Tank or Pond Structure

Invert Level (m) 19.805

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	10.0	1.200	10.0	1.201	0.0

Pump Outflow Control

Invert Level (m) 19.805

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.7000	0.900	3.7000	1.700	3.7000	2.500	3.7000
0.200	3.7000	1.000	3.7000	1.800	3.7000	2.600	3.7000
0.300	3.7000	1.100	3.7000	1.900	3.7000	2.700	3.7000
0.400	3.7000	1.200	3.7000	2.000	3.7000	2.800	3.7000
0.500	3.7000	1.300	3.7000	2.100	3.7000	2.900	3.7000
0.600	3.7000	1.400	3.7000	2.200	3.7000	3.000	3.7000
0.700	3.7000	1.500	3.7000	2.300	3.7000		
0.800	3.7000	1.600	3.7000	2.400	3.7000		

Event: 30 min Winter