INFRASTRUCTURE DESIGN LTD

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FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY REPORT

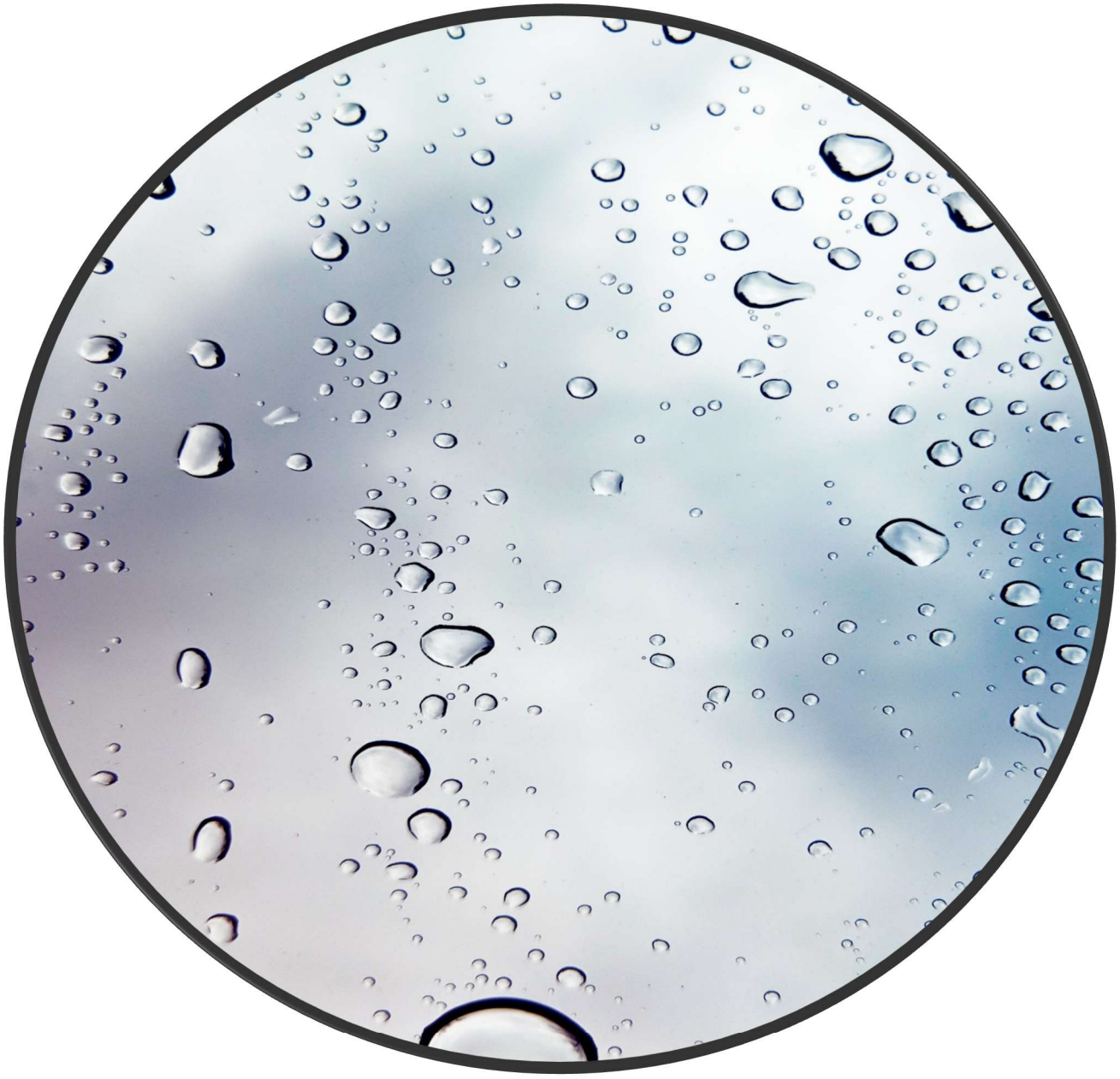
THE BARN HOTEL, WEST END ROAD, RUISLIP

HA4 6JB

ON BEHALF OF CHASE NEW HOMES LIMITED

MARCH 2026

IDL/1143/DS/003



INFRASTRUCTURE DESIGN LTD

SUITE 44, HARBOROUGH INNOVATION CENTRE, AIRFIELD BUSINESS PARK,
LEICESTER ROAD,
MARKET HARBOROUGH,
LEICESTERSHIRE,
LE16 7WB

+44 (0)1858 411570

www.infrades.co.uk

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY REPORT

IDL/1143/DS/003

REPORT ISSUE

Revision	Date	Notes
P01	20/03/2026	Drainage Strategy issued for planning

PREPARED BY

Brijesh Mistry
Infrastructure Engineer March 2026

REVIEWED BY

Phil Tomes
Director March 2026

DISCLAIMER

CONTENTS

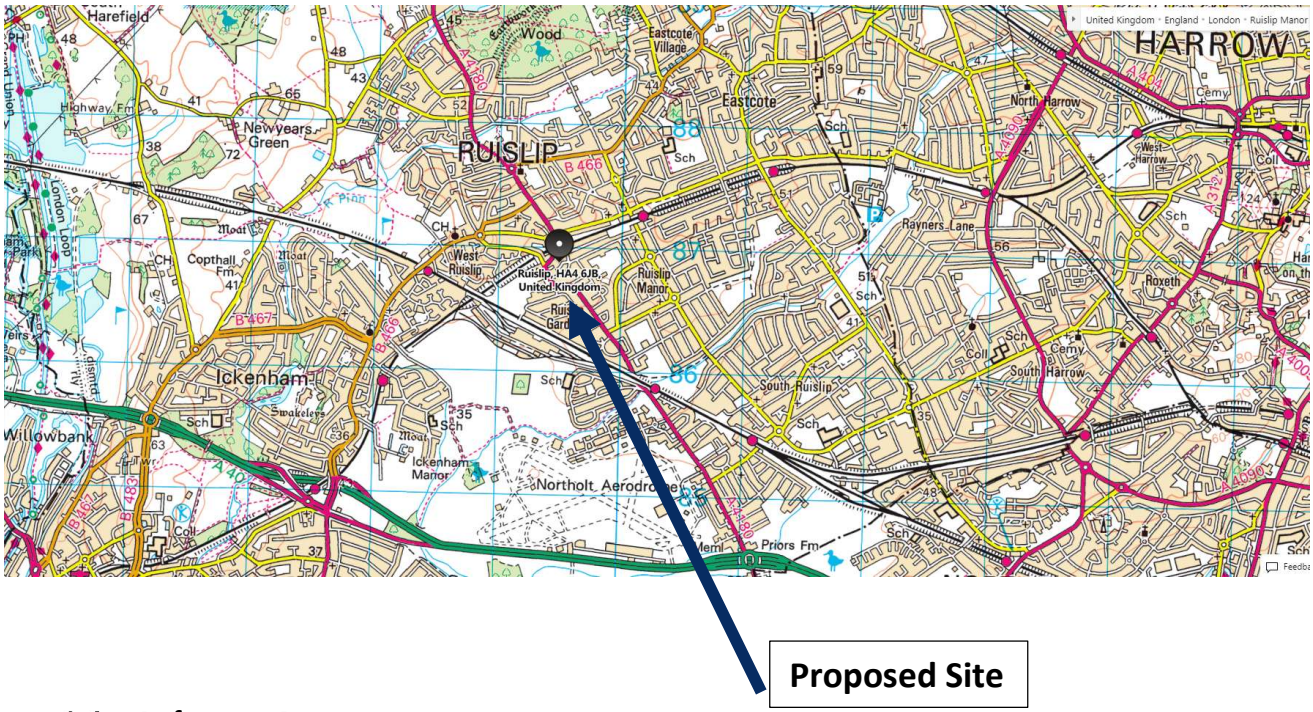
1 INTRODUCTION

1.1 Chase New Homes Limited has appointed Infrastructure Design Ltd (IDL) to prepare this Drainage Strategy Summary Report in support of their planning application for their site off West End Road in Ruislip.

1.2 This report has been prepared in accordance with relevant national and local planning policies and with reference to CIRIA C753 – The SuDS Manual and Approved Document H of the Building Regulations, Approved Document Part H.

1.3 The site is located off West End Road, Ruislip, in the London Borough of Hillingdon. The site is bounded to the north by Metropolitan and Piccadilly overground rail lines and Ruislip tube station, west by West End Road (A4180), and east & south by Garden Close and Residential properties. The National Grid Reference for the site is TQ 09491 86889.

Figure 1 *– Site Location Plan*



1.4 Reference Documents:-

- Desk study, Geotechnical and Geoenvironmental Interpretative report by CGL
- Site Survey carried out by Land Utility Group Ltd drawing no:LUG /9.0
- Thames Water sewer record map.
- Proposed site Layout Plan
- Tree Constraints Plan by Keen Consultant drawing no:2091-KC-XX-YTREE-TCP01Rev0

1.5 The site access is from West End Road. The site currently comprises The Barn Hotel, including Grade II listed buildings that are to be retained. The site has a relatively steep bank along the western boundary, supported by a crib wall. The site slopes from north to south. Refer to Appendix D for a copy of the topographical survey.

1.6 The development comprises the partial demolition of 1no. Grade II Listed Building and conversion of both (2no.) listed buildings to provide 3no. dwellings. Demolition and redevelopment of the remainder of the site for residential use with associated infrastructure, public open space and landscaping. Appendix E provides a copy of the proposed site plan.

1.7 The site benefits from two points of access: the primary access from West End Road and a secondary access from Garden Close, serving the two-storey houses.

1.8 The planning red line boundary extends to 9600 m2 (0.96 hectares).

1.9 A 375mm diameter Thames Water surface water sewer runs from north to south through the site and connects to the surface water sewer in West End Road at the existing site entrance. 150mm diameter Thames Water foul and surface water sewers are located in the Garden Close and head towards Eversley Crescent. Refer to Appendix C for a copy of the Thames Water sewer record map and Appendix D for a topographical survey showing the location of the surveyed sewers.

1.10 CGL has prepared a Geotechnical and Geoenvironmental Interpretative Report. The ground conditions during the investigation comprised made ground overlying Clay soil strata. Infiltration techniques are therefore unsuitable for this site, and an alternative surface-water outfall has been considered.

1.11 The site is not located within a groundwater source protection zone.

1.12 The existing listed building levels are to be retained. The proposed finish floor level of all buildings is set between 45.75-44.00m AOD. The access road to the site and the car park level have been set between 45.20-44.0m AOD.

2 SOURCES OF FLOODING

2.1 Long Term Flood Risk Mapping has been reviewed from the government web site https://flood-warning-information.service.gov.uk/long-term-flood-risk/map.

2.2 **Fluvial Flooding** – From the EA flood map demonstrates that the site is in flood zone 1. This means the likelihood of flooding from Fluvial sources is less than 1 in 1000 in any one year or 1%AEP (Annual Exceedance Probability).

2.3 **Flooding from Surface Water** - Low to medium risk of surface water flood risk is shown on the map. The minor extent of surface water flooding noted during a low-risk storm event, relates to the existing site where currently there a buildings around a localised low point which prevent natural drainage from occurring.

2.4 **Groundwater Flooding** – Groundwater was identified at depths ranging from 6.14 to 7.12m BGL, with perched water over the cohesive soils at approx. 1.00m BGL. The site is, therefore, at low risk of groundwater flooding.

2.5 **Flooding from Reservoirs** – The site is not in a location shown to be at risk of reservoir flooding.

3 FLOOD RISK VULNERABILITY CLASSIFICATION AND FLOOD ZONE COMPATIBILITY

3.1 The proposed site use is classified as more vulnerable in accordance with National Planning Policy Framework (NPPF, 2021) Annex 3. The site is fully within flood zone 1. An extract from Table 2 of the Planning Practice Guidance (Paragraph:079 Reference ID:7-079-20220825) given below. The red circle indicates the appropriate nature of the site's development's classification.

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Key:

✓ Development is appropriate

✗ Development should not be permitted.

4 FLOOD RISK MANAGEMENT

4.1 **Fluvial Flooding** - The site is in flood zone 1, and therefore, the risk from fluvial flooding is low.

4.2 **Flooding from Surface Water** - The proposed site levels have been designed so that there will be a low risk of surface water collecting on-site. A flow path is shown in the drainage plan.

4.3 **Flooding from Groundwater** - It is considered that groundwater will be sub-surface only and would not be a flood risk to the new development. The proposed site levels have been designed so that there will be a low risk of groundwater flooding.

4.4 **Flooding from Reservoirs** - There is no flood risk from this source.

4.5 **Flood Risk during Construction** – As noted above, the risk is low. At the detailed design stage, methods to prevent flooding due to construction work will be considered part of the surface water management plan.

5 FOUL WATER DRAINAGE

5.1 FW drainage for the proposed buildings will connect via a gravity drain to the existing Thames Water foul sewer manhole located in Garden Close through the eastern site access.

5.2 The drainage strategy layout is included in Appendix E.

6 SURFACE WATER DRAINAGE & SUDS

6.1 The total site area is 9600 m2 (0.96 hectares).

6.2 The total proposed impermeable area for the site is 4390 m2 (0.439 Ha). The proposed impermeable area layout is included in Appendix E.

6.3 A hierarchical approach has been taken to selecting SuDS for the surface water drainage system outfalls. In order of priority, the methods of surface water discharge considered are:

i) via infiltration techniques

ii) to the nearest watercourse

iii) and to the nearest sewer.

6.4 As mentioned in section 1.10, infiltration techniques are not a viable option for discharging the proposed surface water run-off from the site. Discharging the proposed surface water run-off to the Thames Water sewer is considered the most feasible option for the site.

6.5 Once developed, the impermeable area will be generated. It is proposed to incorporate flow controls that limit the flow off the site to as close as practicable to the greenfield run-off rates whilst ensuring the system requires minimal maintenance. Figure 2a below gives the greenfield discharge rates for the site;

Figure 2 *Greenfield Run-off Rates – Using Proposed Site Impermeable Area*

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	2.40
Greenfield Method	IH124	Growth Factor 100 year	3.19
Positively Drained Area (ha)	0.437	Betterment (%)	0
SAAR (mm)	644	QBar	1.9
Soil Index	4	Q 1 year (l/s)	1.6
SPR	0.47	Q 2 year (l/s)	1.7
Region	6	Q 30 year (l/s)	4.6
Growth Factor 1 year	0.85	Q 100 year (l/s)	6.1
Growth Factor 2 year	0.88		

6.6 The proposed residential development will incorporate the use of SuDS techniques selected for their suitability given the site layout, topographical levels and geotechnical constraints. Refer to Appendix A to view the SuDS Hierarchy.

6.7 To summarise, the following SuDs devices will be applied to the scheme;

6.8 **Permeable paving -** To parking areas and access roads

Cellular Storage - To accommodate the run-off from all storm events, including peak 1 in 100 years, plus climate change storm events.

Green Roofs – To binstore and bike store. (5mm depression storage only)

Rainwater Harvesting System and Water butts- Below-ground rainwater Harvesting tanks for the Railway Block and water butts proposed for two-storey flats and residential houses. Water collected for irrigation and binstore washdown (Railway Block).

Rain Planters – These have been included to collect rainwater from some RWPs on the apartment blocks.

6.8 Permeable paving with a subbase lined in an impermeable membrane will be used in forming the new access roads and parking areas. This will serve to delay run-off into the cellular storage and outfall via perforated pipes surrounded by granular material. Permeable paving improves water quality before discharging into the wider SW network.

6.9 A minimum permeable stone layer of 375mm is required where the sub-base is laid level (<1:60).

6.10 All building roof areas will be drained through conventional gravity drainage, with cellular storage within the parking areas/access road providing attenuation during periods of heavy or prolonged rainfall.

6.11 Detached bin and bike stores will incorporate green roofs. This will provide storage for low rainfall events and improve water quality before discharging into the underground drainage network.

6.12 Appendix E provides the *Flow* software results summary for the 1 in 1, 1 in 30 (3.3%) (plus a 35% allowance for 'upper end' climate change) and 1 in 100 (1%) years (plus a 40% allowance for 'upper end' climate change) return period events for the cellular storage. Refer to Appendix F for the surface water calculations and simulation.

6.13 The tables below summarise the greenfield and post-development run-off rates and the storage volumes available within each SuDs feature.

Figure 3 Comparison of pre- and post-development run-off rates

Location / Storm Event	Greenfield Rate (l/s)	Proposed Run-off Rate (l/s)
(QBar)	1.9	
1 in 1 year	1.6	1.3 l/s
1 in 2 year	1.7	1.3 l/s
1 in 30 year	4.6	1.3 l/s
1 in 30 year +35% CC	-	1.4 l/s
1 in 100 year	6.1	1.4 l/s
1 in 100 year (+40%cc)	-	1.9 l/s

Figure 4 *Storage volumes available within each SuDS feature*

LOCATION	SuDS DEVICE	AVAILABLE STORAGE
Access Road	Granular sub-base /Permeable Paving:1309m2 x 0.375m-0.400m x 0.33(33% void ratio)	**165.611** m3
Cellular storage	Cellular 1(138m2 x 1.125m) Cellular 2(188m2 x 1.125m)	155.25 m3 + 211.5 m3 = **366.75** m3

To bin and bike store	Green Roof	Negligible However, about 12-15mm (estimated based on 100% retention of rainfall for 1:1 year, 1-hour event in the UK and 72% retention for 1:1 year 24-hour event)

7 CONCLUSION

7.1 The site is in flood zone 1. Sources of flooding and their impacts have been assessed. There will be no increase in flood risk either on-site or offsite.

7.2 The foul water drainage for the proposed buildings will connect via a gravity drain to the existing Thames Water foul sewer manhole located in Garden Close through the eastern site access.

7.3 A hierarchal approach has been considered to the selection of SuDS features for the surface water drainage system and their outfalls.

7.4 The ground conditions are comprised of made-ground overlying Clay soil strata. Infiltration techniques are, therefore, unsuitable for this site. Discharging the proposed surface water run-off to the Thames Water sewer is considered the most appropriate option for the site.

7.5 SuDS features such as rainwater harvesting, water butts, permeable paving and green roof, rain planters and cellular storage tanks have been proposed to store/control the surface water run-off for the development.

7.6 The proposed surface water run-off for up to 1 in 100 years storm events plus 40% climate change have been controlled via hydrobrakes as close as possible to the greenfield run-off rate. Refer to Figure 2 for greenfield run-off and proposed run-off.

7.7 A pre-planning enquiry has been made with Thames Water, and it is confirmed that there is sufficient capacity in the foul and surface water networks. Refer to Appendix C for a copy of correspondence with Thames Water.

7.8 A Management and Maintenance has been prepared regime has been set up for the drainage generally and all the SuDS features. The responsibility for maintaining all

elements of the development remains with Chase New Homes until it is handed over to the management company. Refer to Appendix H for detailed information.

8 ENCLOSURES

7.1 Appendix A includes the SuDS Hierarchy.

7.2 Appendix B Flood Risk Maps

7.3 Appendix C includes a copy of the Thames Water asset search and a copy of the pre-planning inquiry.

7.4 Appendix D includes a copy of the Topographical Site Survey.

7.5 Appendix E includes a copy of the Drainage Strategy Layouts.

7.6 Appendix F includes the Surface Water / SuDS calculations and simulation results.

7.7 Appendix G includes the SuDS proforma

7.8 Appendix H Management & Maintenance Regime.

APPENDIX A – SUDS HIERARCHY

Most Sustainable	SUDS technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit	Included in the scheme?	Comments
	Living roofs	√	√	√	√	The scheme incorporates green roofs to detached bin and bike stores . Rain planters have been proposed to the apartment blocks.
	Basins and ponds	√	√	√		Given the proposed layout of this site, these SuDS features are not suitable.
	Filter strips and swales	√	√	√		Given the site density and insufficient space exists within the main body of the site for these types of SuDS features.
	Infiltration devices	√	√	√		The presence of London Clay formation which impermeable soil strata and a potential source of soil contamination infiltration techniques, are not suitable for this site. An alternative drainage solution is recommended for the proposed development.
	Permeable surfaces and infiltration blanket	√	√		√	Permeable paving is proposed to be used extensively across the site. This will assist in pollution reduction and the 'delay' of run-off.
Least Sustainable	**Tanked systems-Over size Pipes**	√	√		√	Cellular storage is proposed to store run-off from heavy or prolonged rainfall events.

Appendix A (i) - The London Plan, Policy 5.13 Hierarchy

POLICY 5.13 SUSTAINABLE DRAINAGE

A Development should utilise sustainable urban drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

1 store rainwater for later use
The London Plan's priority of considering rainwater harvesting was considered; however, as such facilities would require mains water top-up in case of low rainfall, any non-potable distribution network would require individual metering. Spatially, this is impractical, and the risk for cross-contamination with future connections is increased. Furthermore, their use is often overstated as a SuDS measure, as we have to discount their inclusion when determining the hydraulic capacity of a surface water drainage system (ie we assume that during a storm event, there is no spare capacity within the harvesting tanks. That said, we proposed to include a small below-ground rainwater collection tank to serve the Railway Block and water butts to the 2-storey elements. Water collected will be used for irrigation purposes and (in the case of Railway Block) for binstore washdown.

2 Use infiltration techniques, such as porous surfaces in non-clay areas
The geology is unsuitable for infiltration techniques.

3 attenuate rainwater in ponds or open water features for gradual
Given the LPA's desires and the site's viability, the density of this development is such that insufficient communal space is available for this larger above-ground SuDS feature. However, green roofs are being used atop the detched bin and bike stores, which will store the water and gradually release it to the rest of the drainage system at very low discharge rates. Rain planters have been incorporated to accept runoff from parts of the apartment block roofs.

4. Attenuate rainwater by storing it in tanks or sealed water features for gradual release
Cellular attenuation cells are proposed, along with a control-flow device to limit discharge rates as closely as practicable to greenfield run-off rates.

5 discharge rainwater directly to a watercourse
There are no watercourses within the immediate vicinity of the site.

6 discharge rainwater to a surface water sewer/drain
Discharging the proposed surface water run-off to the Thames Water sewer is considered the most feasible option for the site

7 Discharge rainwater to the combined sewer.
Not required.

APPENDIX B– FLOOD RISK MAPS

Environment Agency

Flood map for planning

Your reference
THE BARN HOTEL, WEST END

Location (easting/northing)
509458/186894

Scale
1:2500

Created
1 Mar 2023 11:35

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60m

Select the type of flood risk information you're interested in. The map will then update.

Flood risk

Extent of flooding

Location

HA4 6JB

Extent of flooding from rivers or the sea

High Medium Low Very low Location you selected

Flood risk from rivers or the sea is none.

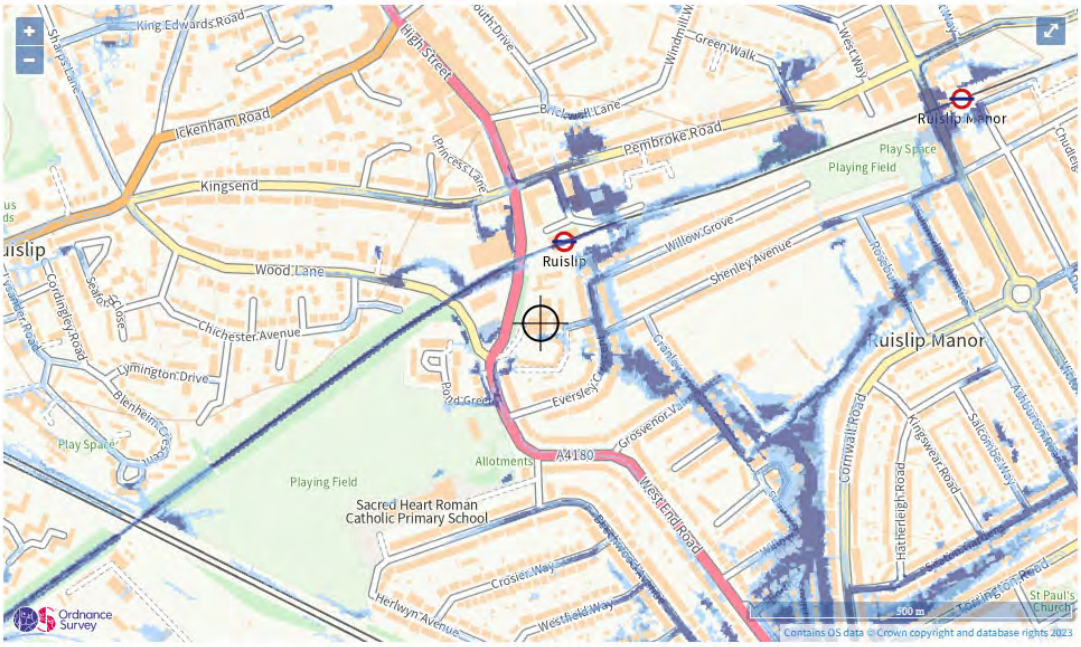
Select the type of flood risk information you're interested in. The map will then update.

Flood risk

Extent of flooding

Location

HA4 6JB



Extent of flooding from surface water

High Medium Low Very low Location you selected

Flood risk from surface water is low to medium.

Select the type of flood risk information you're interested in. The map will then update.

Flood risk

Extent of flooding

Location

HA4 6JB

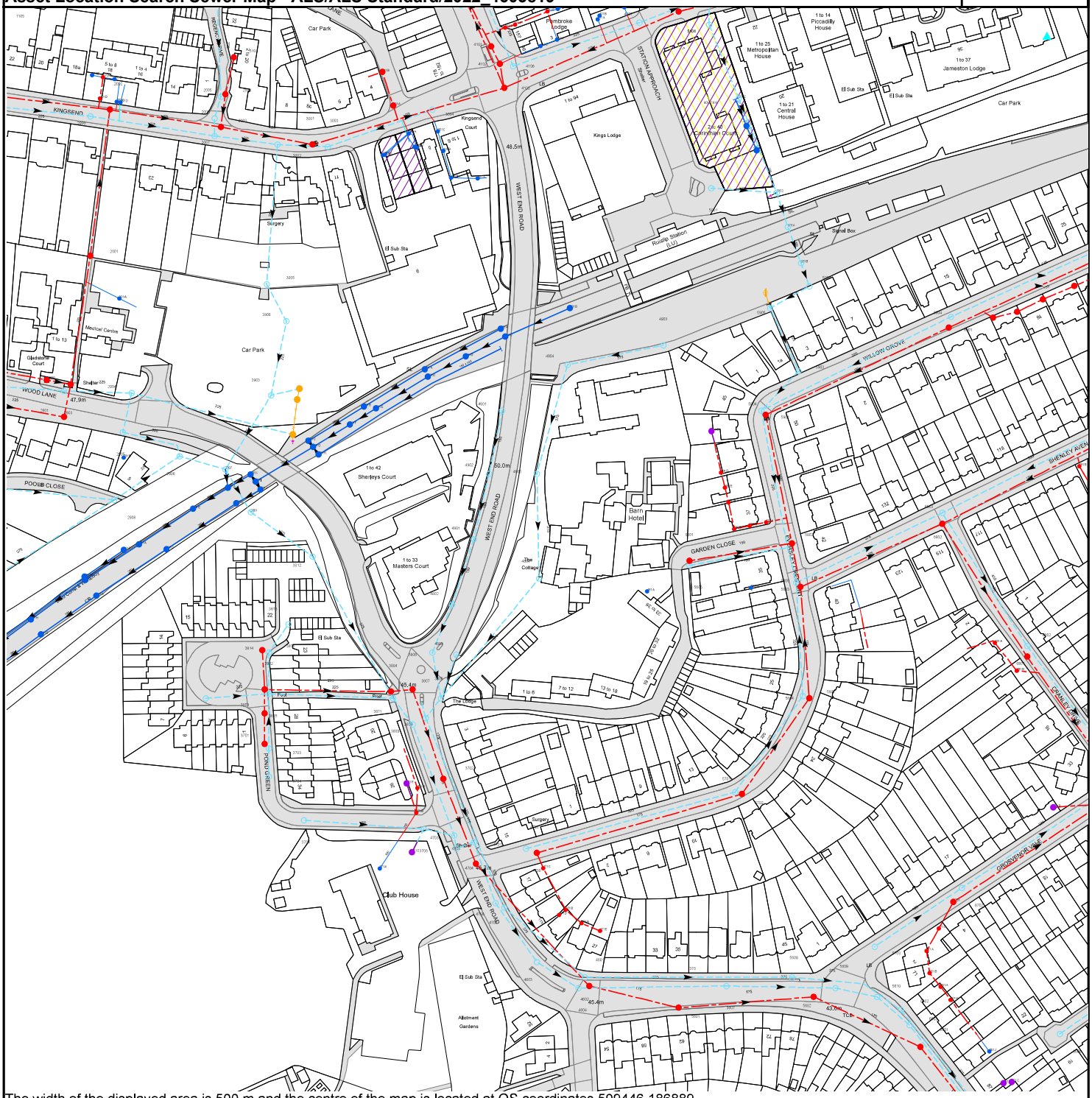
Maximum extent of flooding from reservoirs:

when river levels are normal | when there is also flooding from rivers | Location you selected

Flood risk from reservoirs is none.

APPENDIX C – THAMES WATER ASSET SEARCH AND COPY OF PRE-PLANNING ENQUIRY

Asset Location Search Sewer Map - ALS/ALS Standard/2022_4605819



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 509446,186889

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
201B	n/a	n/a
211A	n/a	n/a
301G	n/a	n/a
301J	n/a	n/a
301H	n/a	n/a
301I	n/a	n/a
301F	n/a	n/a
411G	n/a	n/a
681B	n/a	n/a
6801	41.48	39.63
6802	41.54	40.05
691B	n/a	n/a
6905	n/a	n/a
6002	n/a	n/a
6003	n/a	n/a
661D	n/a	n/a
661C	n/a	n/a
6606	41.94	40.49
671B	n/a	n/a
5804	42.43	40.92
5807	42.44	41.24
681A	n/a	n/a
581A	n/a	n/a
5803	42.62	40.39
5806	42.6	40.85
5802	42.71	40.51
581B	n/a	n/a
581C	n/a	n/a
6902	42.86	39.97
591A	n/a	n/a
6903	42.95	40.47
591B	n/a	n/a
591E	n/a	n/a
591D	n/a	n/a
591C	n/a	n/a
5901	43.05	40.85
5904	43.15	41.18
5903	43.61	41.89
6901	44.86	42.61
6002	n/a	n/a
6904	44.97	43.28
5905	43.96	43.13
5003	n/a	n/a
501B	n/a	n/a
501A	n/a	n/a
5002	46.34	44.3
n/a	n/a	n/a
n/a	n/a	n/a
501C	n/a	n/a
5601	44.78	41.07
5607	44.36	42.19
5702	43.61	41.94
5701	43.56	41.47
5608	44.01	41.72
5602	43.59	40.33
5609	43.63	41.71
5703	43.28	41.8
5610	43.36	41.47
6602	43.07	40.71
6603	42.84	40.95
6601	42.66	39.33
671A	n/a	n/a
661B	n/a	n/a
671C	n/a	n/a
661A	n/a	n/a
661H	n/a	n/a
6701	42.34	40.93
6702	42.22	40.57
661J	n/a	n/a
411D	n/a	n/a
5101	46.83	45.69
481A	n/a	n/a
4804	44.33	42.66
5805	43.54	41.64
5801	43.46	41.47
4905	44.55	42.83
4902	49.36	47.74
4901	50.66	49.31
4904	45.81	42.95
4903	44.42	43.02
491C	n/a	n/a
491A	45.19	44
491B	n/a	n/a
5001	46.34	45.12
401A	n/a	n/a
4103	47.26	45.49
4106	47.09	45.25
4102	47.18	45.37
4101	47.16	45.36
411C	n/a	n/a
411J	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
5104	45.92	44.78
411F	n/a	n/a
4107	46.8	44.16
411A	n/a	n/a
411B	n/a	n/a
411E	n/a	n/a
411I	n/a	n/a
4104	47.66	46.73
411H	n/a	n/a
4105	47.54	46.28
3705	46.47	45.46
371A	n/a	n/a
371C	n/a	n/a
371B	n/a	n/a
371D	n/a	n/a
3706	45.69	44.3
4703	45.63	43.36
4704	45.62	43.29
4705	45.67	43.26
4701	44.78	42.51
4706	45.59	43.11
4707	45.65	42.19
4708	45.88	44.31
4603	45.37	42.95
4702	45.83	43.93
471C	n/a	n/a
471D	n/a	n/a
471B	n/a	n/a
4604	45.31	42.67
471A	n/a	n/a
4602	45.53	42.04
4601	45.16	41.72
471E	n/a	n/a
3802	46.74	45.21
3815	46.71	44.74
3814	46.59	45.01
3704	46.74	45.56
3703	46.82	45.42
3903	46.61	45.74
3813	46.33	45.37
391C	44.66	43.08
3812	46.51	44.25
391G	44.72	43.33
391H	44.6	43.38
391F	n/a	n/a
391B	44.9	43.67
391E	n/a	n/a
3804	45.67	44.36
3811	45.67	43.76
371E	n/a	n/a
3805	45.74	43.35
3809	45.66	43.68
3808	45.52	42.52
391D	n/a	n/a
3806	45.86	43.09
3807	45.51	42.51
3702	45.61	42.92
4802	46.7	44.83
4803	45.79	44.81
4801	48.06	46.52
2001	48.6	46.42
2008	50.09	47
211B	n/a	n/a
2002	49.9	46.08
211C	n/a	n/a
201C	n/a	n/a
201A	n/a	n/a
201D	n/a	n/a
2007	n/a	n/a
2006	n/a	n/a
2005	n/a	n/a
2003	n/a	n/a
2004	n/a	n/a
3101	n/a	n/a
3005	47.84	45.79
3002	48.76	45.94
3906	46.91	45.81
3001	48.53	45.91
3003	48.41	46.18
311B	n/a	n/a
301A	n/a	n/a
391A	45.15	43.87
3004	47.54	46.41
301C	n/a	n/a
301B	n/a	n/a
401B	n/a	n/a
491D	n/a	n/a
291A	n/a	n/a
2903	47.88	46.17
2901	48.28	46.69
2902	47.7	46.48
281G	n/a	n/a
281B	44.23	42.39

Manhole Reference	Manhole Cover Level	Manhole Invert Level
281D	44.06	42.73
2908	47.9	45.51
2905	47.96	45.68
281F	n/a	n/a
291B	n/a	n/a
2904	47.35	46.03
281A	44.31	42.83
281C	44.25	43.05
2906	47.9	45.39
291E	44.37	42.96
2801	47.26	45.88
2907	46.9	44.88
291D	44.65	43.37
391L	44.47	43.53
391K	44.51	43.25
3901	46.6	44.47
391I	44.47	43.33
391J	44.48	43.25
3801	46.6	45.34
3803	46.88	45.33
3701	46.83	45.51
281H	44.01	42.46
281E	43.9	42.63

Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

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

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

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

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

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

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

Sewer Fittings

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

- Air Valve
- Meter
- Dam Chase
- Vent
- Fitting

Operational Controls

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

- Ancillary
- Drop Pipe
- Control Valve
- Weir

End Items

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

- Inlet
- Outfall
- Undefined End

Other Symbols

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

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

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Chamber
- Operational Site

Ducts or Crossings

- Casement — Ducts may contain high voltage cables. Please check with Thames Water.
- Conduit Bridge
- Subway
- Tunnel

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plan are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded
5) 'na' or '0' on a manhole indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology, please contact Property Searches on 0800 009 4540.

Mr Brijesh Mistry

Infrastructure Design Ltd
33 The Point
Market Harborough

LE16 7QU

Wastewater pre-planning
Our ref DS6103134

22 March 2023

Pre-planning enquiry: Confirmation of sufficient capacity

Site Address: The Barn Hotel, West End Road, Ruislip, Greater London, HA4 6JB

Dear Brijesh,

Thank you for providing information on your development.

Proposed site: residential development comprised of 89 flats and 7 no of houses, re-using listed grade 2 buildings. Proposed foul water drainage connect via existing gravity drain to the existing TW FWMH5801 located on Garden Close through the eastern site access. Proposed surface water connects at 2l/s into SWMH3807 in West End Road and 1.5l/s into SWMH5805 in Garden Close.

We have completed the assessment of the foul water flows and surface water run-off based on the information submitted in your application with the purpose of assessing sewerage capacity within the existing Thames Water sewer network.

Foul Water

If your proposals progress in line with the details you've provided, we're pleased to confirm that there will be sufficient sewerage capacity in the adjacent foul water sewer network to serve your development.

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.

Surface Water

When developing a site, policy 5.13 of the London Plan and Policy 3.4 of the Supplementary Planning Guidance (Sustainable Design And Construction) states that every attempt should be made to use flow attenuation and SuDS/Storage to reduce the surface water discharge from the site as much as possible.

In accordance with the Building Act 2000 Clause H3.3, positive connection of surface water to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal

methods have been examined and proven to be impracticable. Before we can consider your surface water needs, you'll need written approval from the lead local flood authority that you have followed the sequential approach to the disposal of surface water and considered all practical means.

The disposal hierarchy being:

1) rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
2) rainwater infiltration to ground at or close to source
3) rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
4) rainwater discharge direct to a watercourse (unless not appropriate)
5) controlled rainwater discharge to a surface water sewer or drain
6) controlled rainwater discharge to a combined sewer.

Where connection to the public sewerage network is required to manage surface water flows we will accept these flows at a discharge rate in line with CIRIA's best practice guide on SuDS or that stated within the sites planning approval.

If the above surface water hierarchy has been followed and if the flows are restricted to a total of 3.5 l/s then Thames Water would not have any objections to the proposal.

Please see the attached 'Planning your wastewater' leaflet for additional information.

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.

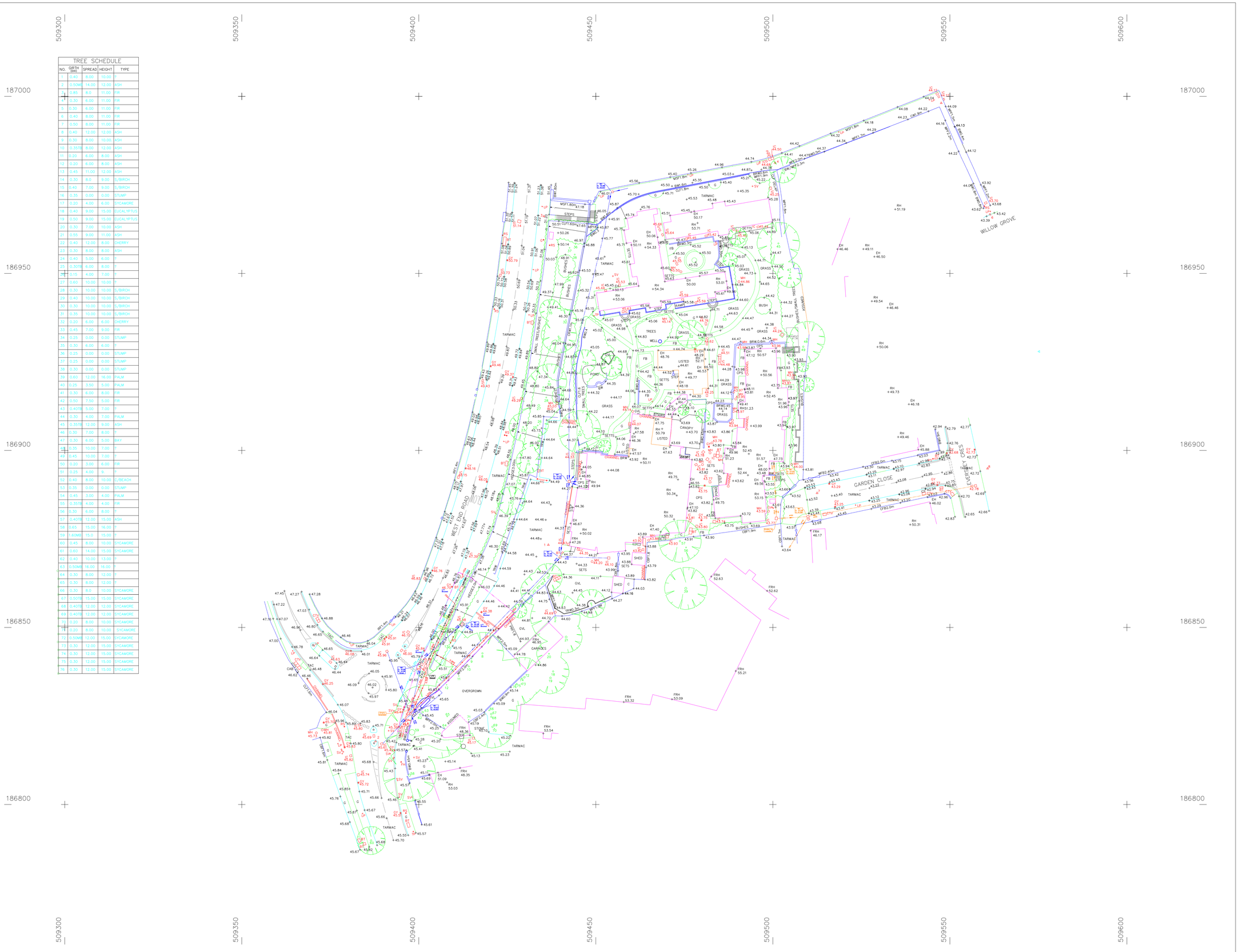
If you've any further questions, please contact me on 07747 641 932.

Yours sincerely

Natalya Bacon
Developer Services – Adoptions Engineer
Mobile: 07747 641 932
Clearwater Court, Vastern Road, Reading, RG1 8DB
Find us online at developers.thameswater.co.uk
Get advice on making your sewer connection correctly at connectright.org.uk

APPENDIX D – TOPOGRAPHICAL SITE SURVEY

TREE SCHEDULE				
NO.	GIRTH (M)	SPREAD	HEIGHT	TYPE
1	0.40	8.00	10.00	T
2	0.50MB	14.00	12.00	ASH
3	0.85	8.0	11.00	FIR
4	0.30	6.00	11.00	FIR
5	0.30	6.00	11.00	FIR
6	0.40	8.00	11.00	FIR
7	0.50	8.00	11.00	FIR
8	0.40	12.00	12.00	ASH
9	0.30	8.00	10.00	ASH
10	0.35TR	8.00	12.00	ASH
11	0.20	6.00	8.00	ASH
12	0.20	6.00	8.00	ASH
13	0.45	11.00	12.00	ASH
14	0.30	8.0	9.00	S/BIRCH
15	0.40	7.00	9.00	S/BIRCH
16	0.35	0.00	0.00	STUMP
17	0.20	4.00	6.00	SYCAMORE
18	0.40	9.00	15.00	EUCALYPTUS
19	0.50	9.00	15.00	EUCALYPTUS
20	0.30	7.00	10.00	ASH
21	0.55	9.00	11.00	ASH
22	0.40	12.00	8.00	CHERRY
23	0.30	8.00	8.00	ASH
24	0.40	5.00	6.00	T
25	0.30TR	6.00	8.00	T
26	0.15	4.00	7.00	T
27	0.60	10.00	10.00	T
28	0.30	10.00	10.00	S/BIRCH
29	0.40	10.00	10.00	S/BIRCH
30	0.30	10.00	10.00	S/BIRCH
31	0.35	10.00	10.00	S/BIRCH
32	0.20	6.00	6.00	CHERRY
33	0.45	7.00	9.00	FIR
34	0.25	0.00	0.00	STUMP
35	0.30	6.00	6.00	T
36	0.25	0.00	0.00	STUMP
37	0.25	0.00	0.00	STUMP
38	0.30	0.00	0.00	STUMP
39	0.60	12.00	16.00	PALM
40	0.25	3.50	5.00	PALM
41	0.30	6.00	8.00	FIR
42	0.50	7.50	9.00	FIR
43	0.40TR	5.00	7.00	T
44	0.30	4.00	7.00	PALM
45	0.35TR	12.00	9.00	ASH
46	0.30	7.00	8.00	T
47	0.30	6.00	5.00	BAY
48	0.35	10.00	7.00	T
49	0.45	10.00	7.00	T
50	0.20	3.00	6.00	FIR
51	0.25	4.00	9.	T
52	0.40	8.00	10.00	C/BEACH
53	0.35	0.00	0.00	STUMP
54	0.45	3.00	4.00	PALM
55	0.35TR	4.00	4.00	FIR
56	0.30	6.00	8.00	T
57	0.40TR	12.00	15.00	ASH
58	0.65	15.00	16.00	T
59	1.60MB	15.0	15.00	T
60	0.45	8.00	10.00	SYCAMORE
61	0.60	14.00	15.00	SYCAMORE
62	0.40	10.00	13.00	T
63	0.50MB	16.00	16.00	T
64	0.30	8.00	12.00	T
65	0.30	8.00	12.00	T
66	0.30	8.0	10.00	SYCAMORE
67	0.50TR	15.00	15.00	SYCAMORE
68	0.40TR	12.00	12.00	SYCAMORE
69	0.40TR	12.00	12.00	SYCAMORE
70	0.20	8.00	10.00	SYCAMORE
71	0.20	8.00	10.00	SYCAMORE
72	0.50MB	12.00	15.00	SYCAMORE
73	0.30	12.00	15.00	SYCAMORE
74	0.30	12.00	15.00	SYCAMORE
75	0.30	12.00	15.00	SYCAMORE
76	0.30	12.00	15.00	SYCAMORE



ABBREVIATIONS

ABH	Arched Beam Height	KO	Kerb Outlet
B	Brick	L	Light
BAL	Balcony	LP	Lamp Post
BB	Belisha Beacon	MH	Manhole
BD	Bollard	MKR	Marker
BH	Beam Height	MSF	Metal Security Fence
BL	Bed Level	N/A	No Access
BP	Brick Pier	OHC	Overhead Cables
BRW	Brick Retaining Wall	P	Post
BS	Bus Stop	PALF	Palisade Fence
BT	British Telecom	PF	Picket Fence
BW	Brick Wall	PIT	Trial Pit
BWF	Barbed Wire Fence	PL	Pavement Light
C	Concrete	PM	Parking Meter
CAB	Cabinet	PRF	Post & Rail Fence
CBF	Close Boarded Fence	PWF	Post & Wire Fence
CBW	Concrete Block Wall	R	Render
CIF	Corrugated Iron Fence	RAD	Radiator
CL	Cover Level	RE	Rodding Eye
CLF	Chain Link Fence	RH	Ridge Height
COL	Column	RS	Road Sign
CPF	Concrete Panel Fence	RWP	Rain Water Pipe
CPS	Concrete Paving Slabs	S	Stone
CRW	Concrete Retaining Wall	SV	Stop Valve
CSU	Ceiling Slopes Up	SL	Skylight
CTV	Cable Television	SP	Soil Pipe
CW	Concrete Wall	SPS	Stone Paving Slabs
CZY	Crazy Paving	SRW	Stone Retaining Wall
D	Door	SW	Stone Wall
DH	Door Height	SWS	Surface Water Sewer
EC	Electricity Cover	TJ	Top of Joist
ESG	Electrical Switch Gear	T	TILE
EH	Eave Height	TI	Timber
EP	Electricity Pole	TRW	Timber Retaining Wall
FB	Flower Bed	UJ	Underside of Joist
FC	False Ceiling	UR	Underside of Ridge Board
F/E	Fire Escape	UWP	Underside of Wall Plate
FH	Fire Hydrant	V	Vent
FL	Floor Level	VP	Vent Pipe
GY	Gully	W	Window
GV	Gas Valve	WL	Water Level
HA	Hatch	WM	Water Meter
IC	Inspection Cover	WMF	Wire Mesh Fence
IL	Invert Level	WPF	Wooden Panel Fence
IRF	Iron Railing Fence	WCL	Window Cill Height
IWF	Interwoven Fence	WHL	Window Head Height
		WRW	Wooden Retaining Wall

Top of Banks / Bottom
Fences
Change in Surface
Edge of Vegetation
OS Data
3.28 Floor to Ceiling Height
Gate
Survey Station
+10.60 Floor Level
Tree

STATION CO-ORDINATE TABLE

Ref.	East	North	Elevation
1	509436.598	186873.332	44.453
2	509387.799	186817.886	45.800
3	509435.348	186966.123	51.238
4	509500.639	186981.226	44.636
5	509547.561	186998.113	44.146
6	509561.328	186966.642	43.575
7	509512.496	186887.962	43.462
8	509560.652	186894.904	42.899

NOTES

UTILITY LINETYPE MENU & KEY

HV - B1	HIGH VOLTAGE CABLE
LV - B1	LOW VOLTAGE CABLE
VM - B1	VIRGIN MEDIA
FO - B1	COMMS
BT - B1	BT CABLE
GPR - B2	RADAR TRACE
G - B1	GAS PIPE
W - B1	WATER MAIN
U - B1	UNIDENTIFIED SERVICE
	SURFACE DRAINAGE
	FOUL DRAINAGE

MEASURED DEPTH BGL TO PIPE/CABLE/DUCT	0.65d
INVERT LEVEL OF PIPE/DUCT/CABLE	IL 12.34
SOFFIT LEVEL OF PIPE/DUCT/CABLE	SL 45.67
COVER LEVEL OF INSPECTION CHAMBER	CL 78.90
DIAMETER OF PIPE/DUCT IN MILLIMETERS	150Ø
NUMBER OF DUCTS	2W

REVISIONS DATE

INDICATIVE ONLY

SCALE: 1:500@A1
DATE: JUNE 2022
DRAWN: SDC

TITLE: SITE SURVEY

JOB: THE BARN HOTEL, W END Rd. RUISLIP, HA4 6JB

CLIENT: CHASE GREEN HOMES

DWG. No: LUG / 9.0

LAND UTILITY GROUP LTD.

MIDLANDS OFFICE
UNIT 10
STRENSHAM BUSINESS PARK
TWYNING ROAD
WORCESTER
WR8 9JZ

T: 0845 602 3966
M: 07979 367282

LONDON OFFICE
BRICKFIELD HOUSE
HIGH ROAD
THORNWOOD
EPPING
ESSEX
CM16 6TH

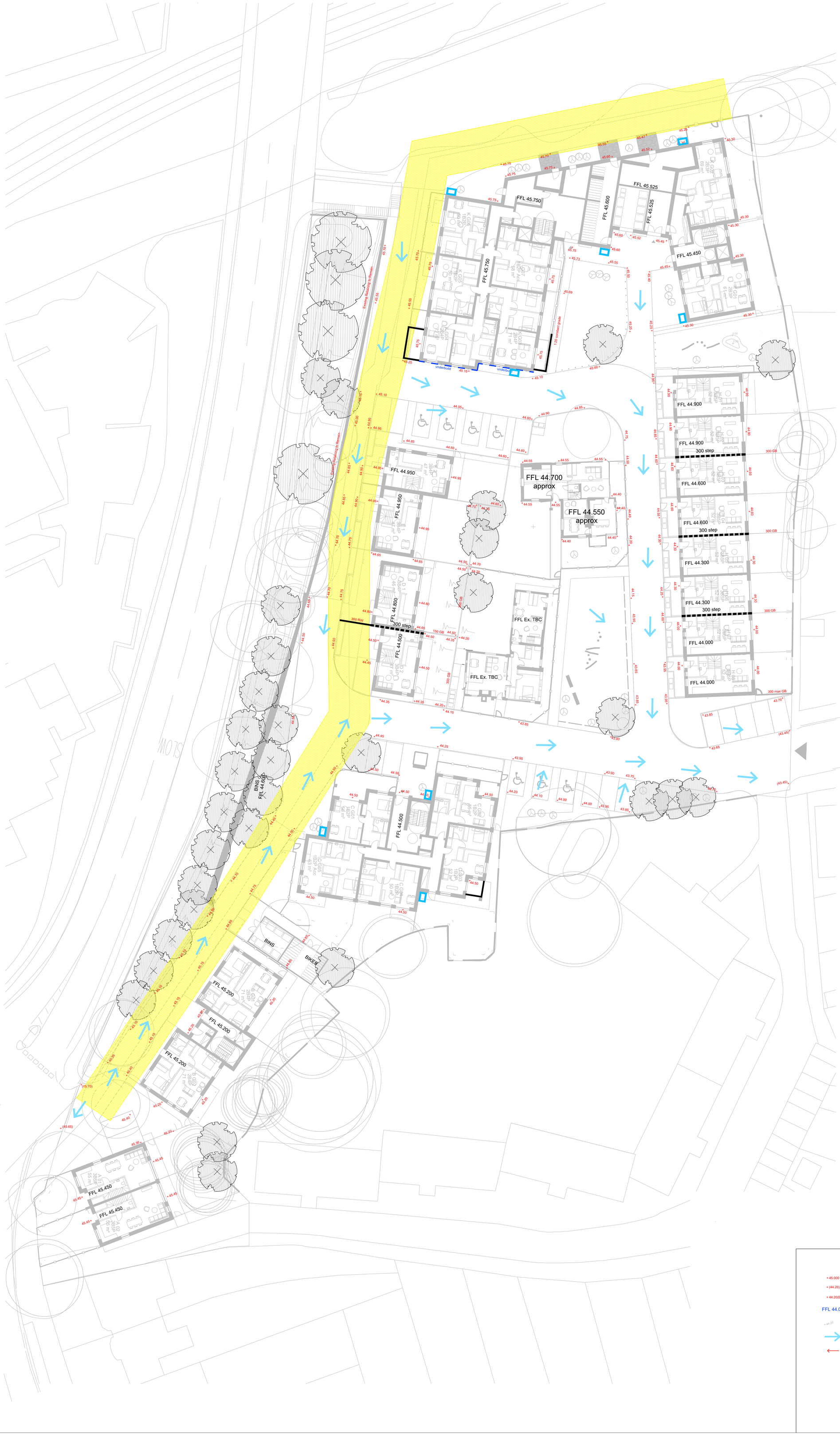
T: 01992 566698
M: 07977 112286
M: 07977 111935

APPENDIX E – PROPOSED DRAINAGE STRATEGY LAYOUTS & DRAINAGE AREA PLANS

CONTRACT DOCUMENT

Notes

1 This drawing is to be read in conjunction with the private drainage construction details IDL/1143/07/series and all other relevant contract documents.



Rev	Description	Date
5	Site Layout and levels revised	18.03.26
4	Exceedance flow added	28.02.25
3	Site Layout and levels revised	24.08.24
2	Site Layout and levels revised	19.07.24
1	Preliminary Issue	24.02.23

Status:

Preliminary Issue

Scale :	1:200@A0		
Date :	Feb 2023	Checked:	Approved:
Drawn :	IDL	BM	PT

Title :

Levels Stategy Layout

Project :

The Barn Hotel, Ruislip

Drg. No:	Rev:	File Ref:	1143-05.dwg
1143/CNH05/D3/3051	5	Plot Ref:	1143-05-01.pdf

33 The Point
Rockingham Road
Market Harborough
Leicestershire LE16 7QU
Tel: 01858 411570 Fax: 01858 411571
Email: info@infrades.co.uk URL: www.infrades.co.uk

INFRASTRUCTURE DESIGN LIMITED
working for

Chase New Homes Limited
Jasmine House
8 Park Way
Welwyn Garden City
Hertfordshire, AL8 6HG

Tel: 01992 766658
Fax: 01992 715406

Key

+ 45.000	Proposed finished levels
+ (44.20)	Interpolated existing spot levels
+ 44.20(Ex)	Existing spot levels to remain
FFL 44.000	Proposed finished floor level
+ 44.20	Existing (pre-demolition) levels
→	Exceedance flood flow routing
←	Fall arrow denoting approx. flow direction of sw runoff

CONTRACT DOCUMENT

Notes

1. This drawing is to be read in conjunction with the private drainage construction details IDL/1143/07/series and all other relevant contract documents.
2. All private drainage works to be carried out in accordance with the provisions laid down in BS EN 944 & The Building Regulations, Part H.
3. Levels shown in buildings are Finished Floor Level.
4. Before commencing any Sewer or drainage works, the Developer's Groundworker must satisfy themselves, the developer and the Local Authority of actual levels and conditions of existing sewers.
5. Buried concrete to satisfy the requirements of BRE Special Digest 1 as predetermined by the site's Geotechnical Report
6. Depth and Location of existing services to be traced prior to any excavation.
7. All private drainage to be laid to levels shown using flexibly jointed pipes, either uPVC to BS 4660 and BS 5481 or vitrified clayware to BS EN 295.
8. Generally pipes to have granular Bed & Surround in accordance with manufacturers recommendations, ensuring adequate protection with respect to depth and location. Where bedding material is placed at depths susceptible to ground water ingress, it is to be wrapped in a geotextile (Terram 700 or better).
9. Private precast concrete manholes and catchpits to be constructed using conc. box sections or circular rings to BS 5911-200, with 150mm conc. surround, size and construction to comply with Table 12 of Approved Document, Part H.
10. Rodding eyes, etc are to be laid to manufacturers minimum cover and depth to allow adequate fall from adjoining unit.
11. Access panels are to be provided to all rainwater pipes, a max. 600 above finished ground level.
12. All manholes / inspection chambers in hard surfaced areas, to have recessed covers. These are to be orientated such as to minimise cut blocks.
13. All pipework to be 100mmØ unless otherwise stated, 150mm dia from road gullies.
14. All levels in metres (m) unless specified otherwise.
15. Upon completion of all underground drainage works, the groundworker is to provide a written report and CCTV record of the as built foul and surface water drainage systems installed
16. All drain runs from SVP's, stub stacks or FW gullies to be laid at min. 1:40 gradient unless otherwise stated.
17. Svp's, stub stacks & RWP's are shown indicative only. Refer to Architectural dimensioned GA's for accurate locations
18. External drainage to be laid prior to erection of scaffold.
19. All cover and invert levels shown are in metres. All pipe diameters are in millimetres U.N.O.
20. IMPORTANT NOTE: At depths where groundwater ingress is encountered, consider the use of a sump / pump arrangement. Where excavations are >1m deep, consider the use of full perimeter trench support.
21. IMPORTANT NOTE: The new sewer connections are be successfully made prior to commencing any upstream drainage works.
22. IMPORTANT NOTE: Upon completion of all underground drainage works, the groundworker is to provide a written report and CCTV record of the as built foul and surface water drainage systems installed

Rev	Description	Date
6	Site layout revised, Drainage strategy revised	18.03.26
5	For Design Team Comment	27.02.26
4	Site layout revised	24.08.24
3	Site layout revised	17.07.24
2	Rainwater Harvesting tank added	11.09.23
1	Preliminary Issue	01.03.23

Status: Prelimary Issue

Scale : 1:200@A0 | Date : Feb 2026 | Drawn : IDL | Checked: BM | Approved: PT

Title : Drainage Strategy Layout

Project : The Barn Hotel, Ruislip

Drg. No:	Rev:	File Ref:	1143-CNH007
1143/CNH007/D3/3700	6	Plot Ref:	As DRG No

Suite 44
Harborough Innovation Centre
Airfield Business Park, Leicester Road
Market Harborough, Leicestershire, LE16 7WB
Tel: 01858 411570 Fax: 01858 411571
Email: info@infrades.co.uk URL: www.infrades.co.uk

INFRASTRUCTURE DESIGN LTD
EST 2000

working for

CHASE NEW HOMES

Chase New Homes Limited
Jasmine House
8 Park Way
Welwyn Garden City
Hertfordshire, AL8 6HG

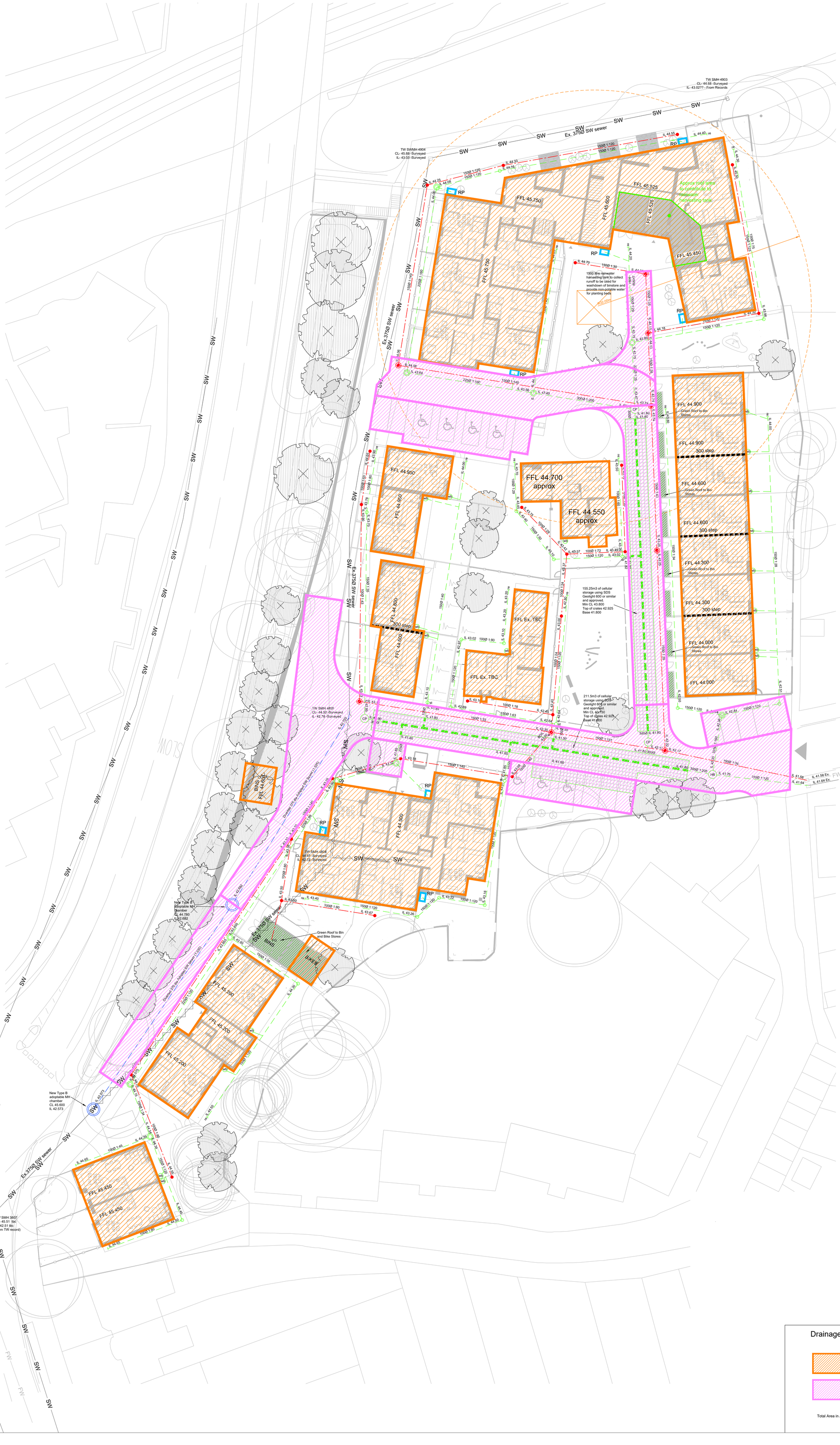
Tel: 01992 766658
Fax: 01992 715406

Key

- Existing foul water sewer
- Existing Surface Water sewer
- Foul Water Drainage
- Surface Water Drainage
- HB — Hydrobrake with 300mm deep sump
- 150Ø — Perforated Pipe at the subbase
- nme — Polypropylene universal inspection chambers 3000mm deep max, Where >1200mm deep, use reduced size access cover.
- R500 / R600 — Denotes 500/600 dia ppic, 3000mm deep max Where >1200mm deep, use reduced size access cover. Wavin Range 500/600 or similar.
- st — Polypropylene silt trap with 300mm sump
- WB — Water Butt (Min 200 liters)
- 1500 RWHT — Rainwater Harvesting tank
- RP — Rain Planter
- Private access roads and Parking space in Permeable Paving (System C - lined)
- Cellular storage system
- Extent to Green Roof

CONTRACT DOCUMENT

Notes



Rev	Description	Date
4	Site layout revised, Drainage strategy revised	18.03.26
3	Site layout revised, Drainage strategy revised	24.08.24
2	Site layout revised, Drainage strategy revised	17.07.24
1	Preliminary Issue	01.03.23

Status:

Preliminary Issue

Scale :	1:200@A0		
Date :	Feb 2023	Checked:	Approved:
Drawn :	IDL	BM	PT

Title :

Drainage Area Layout

Project :

The Barn Hotel, Ruislip

Drg. No:	Rev:	File Ref:	1143-07.dwg
1143/CNH007/D3/3701	4	Plot Ref:	1143-07-01.pdf

33 The Point
Rockingham Road
Market Harborough
Leicestershire LE16 7QU
Tel: 01858 411570 Fax: 01858 411571
Email: info@infrades.co.uk URL: www.infrades.co.uk

INFRASTRUCTURE DESIGN LIMITED
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Tel: 01992 766658
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Drainage Key

Roof Area 2720m2
Approximately 2675m2 (Including 10% Urban Creep for Block A,D,E & H)

Paved Area
Approximately 1670m2

Total Area in Area is 4390m2 (0.439 ha)

APPENDIX F – SURFACE WATER DRAINAGE CALCULATION

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	1.000
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	4.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	150.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S19	0.015	5.00	45.450	450	509417.910	186816.634	1.000
S20			45.240	600	509413.198	186828.909	0.900
S21	0.032	5.00	45.400	600	509410.246	186836.598	1.325
S29	0.002	5.00	45.200	600	509434.974	186851.438	0.900
S22	0.026	5.00	44.900	600	509424.960	186858.245	1.045
S23			44.500	600	509440.619	186881.284	0.925
S24	0.020	5.00	44.450	600	509449.404	186883.868	2.650
S1	0.013	5.00	45.720	450	509464.675	186971.080	1.560
S2	0.022	5.00	45.750	600	509455.388	186968.670	1.750
S3	0.027	5.00	45.200	600	509450.996	186941.341	1.520
S4	0.018	5.00	45.010	600	509469.635	186938.357	1.530
S30	0.011	5.00	45.300	450	509503.371	186950.146	1.340
S31	0.064	5.00	45.250	600	509484.118	186946.724	1.500
S5			44.800	1200	509484.555	186935.959	3.000
S32	0.012	5.00	44.550	450	509467.129	186920.972	1.150
S33			44.400	450	509472.632	186913.894	1.300
S34			44.300	450	509482.747	186914.305	2.500
S6			43.810	1200	509486.544	186886.988	2.010
S17		5.00	44.885	450	509445.080	186920.826	0.885
S18	0.085		44.350	1200	509444.767	186890.459	2.550
S25	0.007	5.00	44.500	450	509452.531	186861.272	1.240
S26			44.500	450	509455.746	186864.077	1.280
S27			44.500	450	509462.454	186862.998	1.340
S28			44.200	450	509465.396	186881.298	2.400
S12	0.012	5.00	44.100	450	509465.281	186901.544	1.000
S13			44.200	450	509459.026	186902.089	1.230
S14			44.140	450	509457.429	186892.145	1.250
S15			43.850	450	509472.951	186889.650	2.050
S16			44.350	450	509454.031	186892.842	2.550
S11	0.026	5.00	43.700	450	509505.831	186892.632	1.190
S9	0.027	5.00	43.950	450	509490.875	186892.003	1.450
S10			43.800	600	509497.399	186890.954	1.440
S7	0.020	5.00	43.700	1200	509495.996	186882.224	1.940
S8			43.450	450	509510.098	186880.581	1.810

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S19	S20	13.149	0.600	44.450	44.340	0.110	119.5	150	4.00	0.0
1.001	S20	S21	8.236	0.600	44.340	44.150	0.190	43.3	150	4.00	0.0
1.002	S21	S22	26.173	0.600	44.075	43.855	0.220	119.0	225	4.00	0.0
2.000	S29	S22	12.108	0.600	44.300	43.930	0.370	32.7	150	4.00	0.0
1.003	S22	S23	27.857	0.600	43.855	43.575	0.280	99.5	225	4.00	0.0
1.004	S23	S24	9.157	0.600	43.575	43.320	0.255	35.9	225	4.00	0.0
3.000	S1	S2	9.594	0.600	44.160	44.080	0.080	119.9	150	4.00	0.0
3.001	S2	S3	27.680	0.600	44.000	43.680	0.320	86.5	225	4.00	0.0
3.002	S3	S4	18.877	0.600	43.680	43.560	0.120	157.3	225	4.00	0.0
3.003	S4	S5	15.111	0.600	43.480	43.400	0.080	188.9	300	4.00	0.0
4.000	S30	S31	19.555	0.600	43.960	43.800	0.160	122.2	150	4.00	0.0
4.001	S31	S5	10.774	0.600	43.750	43.470	0.280	38.5	225	4.00	0.0
5.000	S32	S33	8.965	0.600	43.400	43.100	0.300	29.9	150	4.00	0.0
5.001	S33	S34	10.123	0.600	43.100	43.020	0.080	126.5	150	4.00	0.0
6.000	S17	S18	30.369	0.600	44.000	43.100	0.900	33.7	150	4.00	0.0
7.000	S25	S26	4.267	0.600	43.260	43.220	0.040	106.7	150	4.00	0.0
7.001	S26	S27	6.795	0.600	43.220	43.160	0.060	113.3	150	4.00	0.0
7.002	S27	S28	18.534	0.600	43.160	43.010	0.150	123.6	150	4.00	0.0
8.000	S12	S13	6.279	0.600	43.100	43.020	0.080	78.5	150	4.00	0.0
8.001	S13	S14	10.072	0.600	42.970	42.890	0.080	125.9	150	4.00	0.0
8.002	S14	S15	15.721	0.600	42.890	42.640	0.250	62.9	150	4.00	0.0
10.000	S11	S10	8.597	0.600	42.510	42.440	0.070	122.8	150	4.00	0.0
11.000	S9	S10	6.608	0.600	42.500	42.440	0.060	110.1	150	4.00	0.0
10.001	S10	S7	8.842	0.600	42.360	42.300	0.060	147.4	225	4.00	0.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	0.918	16.2	0.0	0.850	0.750	0.015	0.0
1.001	1.532	27.1	0.0	0.750	1.100	0.015	0.0
1.002	1.197	47.6	0.0	1.100	0.820	0.047	0.0
2.000	1.766	31.2	0.0	0.750	0.820	0.002	0.0
1.003	1.311	52.1	0.0	0.820	0.700	0.075	0.0
1.004	2.190	87.1	0.0	0.700	0.905	0.075	0.0
3.000	0.916	16.2	0.0	1.410	1.520	0.013	0.0
3.001	1.406	55.9	0.0	1.525	1.295	0.035	0.0
3.002	1.040	41.3	0.0	1.295	1.225	0.062	0.0
3.003	1.140	80.6	0.0	1.230	1.100	0.080	0.0
4.000	0.908	16.0	0.0	1.190	1.300	0.011	0.0
4.001	2.115	84.1	0.0	1.275	1.105	0.075	0.0
5.000	1.848	32.7	0.0	1.000	1.150	0.012	0.0
5.001	0.892	15.8	0.0	1.150	1.130	0.012	0.0
6.000	1.739	30.7	0.0	0.735	1.100	0.000	0.0
7.000	0.972	17.2	0.0	1.090	1.130	0.007	0.0
7.001	0.943	16.7	0.0	1.130	1.190	0.007	0.0
7.002	0.903	15.9	0.0	1.190	1.040	0.007	0.0
8.000	1.136	20.1	0.0	0.850	1.030	0.012	0.0
8.001	0.894	15.8	0.0	1.080	1.100	0.012	0.0
8.002	1.270	22.4	0.0	1.100	1.060	0.012	0.0
10.000	0.905	16.0	0.0	1.040	1.210	0.026	0.0
11.000	0.957	16.9	0.0	1.300	1.210	0.027	0.0
10.001	1.075	42.7	0.0	1.215	1.175	0.053	0.0

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.006	S7	S8	14.197	0.600	41.760	41.640	0.120	118.3	150	4.00	0.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.006	0.923	16.3	0.0	1.790	1.660	0.073	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	13.149	119.5	150	Circular	45.450	44.450	0.850	45.240	44.340	0.750
1.001	8.236	43.3	150	Circular	45.240	44.340	0.750	45.400	44.150	1.100
1.002	26.173	119.0	225	Circular	45.400	44.075	1.100	44.900	43.855	0.820
2.000	12.108	32.7	150	Circular	45.200	44.300	0.750	44.900	43.930	0.820
1.003	27.857	99.5	225	Circular	44.900	43.855	0.820	44.500	43.575	0.700
1.004	9.157	35.9	225	Circular	44.500	43.575	0.700	44.450	43.320	0.905
3.000	9.594	119.9	150	Circular	45.720	44.160	1.410	45.750	44.080	1.520
3.001	27.680	86.5	225	Circular	45.750	44.000	1.525	45.200	43.680	1.295
3.002	18.877	157.3	225	Circular	45.200	43.680	1.295	45.010	43.560	1.225
3.003	15.111	188.9	300	Circular	45.010	43.480	1.230	44.800	43.400	1.100
4.000	19.555	122.2	150	Circular	45.300	43.960	1.190	45.250	43.800	1.300
4.001	10.774	38.5	225	Circular	45.250	43.750	1.275	44.800	43.470	1.105
5.000	8.965	29.9	150	Circular	44.550	43.400	1.000	44.400	43.100	1.150
5.001	10.123	126.5	150	Circular	44.400	43.100	1.150	44.300	43.020	1.130
6.000	30.369	33.7	150	Circular	44.885	44.000	0.735	44.350	43.100	1.100
7.000	4.267	106.7	150	Circular	44.500	43.260	1.090	44.500	43.220	1.130
7.001	6.795	113.3	150	Circular	44.500	43.220	1.130	44.500	43.160	1.190
7.002	18.534	123.6	150	Circular	44.500	43.160	1.190	44.200	43.010	1.040
8.000	6.279	78.5	150	Circular	44.100	43.100	0.850	44.200	43.020	1.030

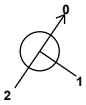
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S19	450	Manhole	Adoptable	S20	600	Manhole	Adoptable
1.001	S20	600	Manhole	Adoptable	S21	600	Manhole	Adoptable
1.002	S21	600	Manhole	Adoptable	S22	600	Manhole	Adoptable
2.000	S29	600	Manhole	Adoptable	S22	600	Manhole	Adoptable
1.003	S22	600	Manhole	Adoptable	S23	600	Manhole	Adoptable
1.004	S23	600	Manhole	Adoptable	S24	600	Manhole	Adoptable
3.000	S1	450	Manhole	Adoptable	S2	600	Manhole	Adoptable
3.001	S2	600	Manhole	Adoptable	S3	600	Manhole	Adoptable
3.002	S3	600	Manhole	Adoptable	S4	600	Manhole	Adoptable
3.003	S4	600	Manhole	Adoptable	S5	1200	Manhole	Adoptable
4.000	S30	450	Manhole	Adoptable	S31	600	Manhole	Adoptable
4.001	S31	600	Manhole	Adoptable	S5	1200	Manhole	Adoptable
5.000	S32	450	Manhole	Adoptable	S33	450	Manhole	Adoptable
5.001	S33	450	Manhole	Adoptable	S34	450	Manhole	Adoptable
6.000	S17	450	Manhole	Adoptable	S18	1200	Manhole	Adoptable
7.000	S25	450	Manhole	Adoptable	S26	450	Manhole	Adoptable
7.001	S26	450	Manhole	Adoptable	S27	450	Manhole	Adoptable
7.002	S27	450	Manhole	Adoptable	S28	450	Manhole	Adoptable
8.000	S12	450	Manhole	Adoptable	S13	450	Manhole	Adoptable

Pipeline Schedule

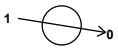
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
8.001	10.072	125.9	150	Circular	44.200	42.970	1.080	44.140	42.890	1.100
8.002	15.721	62.9	150	Circular	44.140	42.890	1.100	43.850	42.640	1.060
10.000	8.597	122.8	150	Circular	43.700	42.510	1.040	43.800	42.440	1.210
11.000	6.608	110.1	150	Circular	43.950	42.500	1.300	43.800	42.440	1.210
10.001	8.842	147.4	225	Circular	43.800	42.360	1.215	43.700	42.300	1.175
1.006	14.197	118.3	150	Circular	43.700	41.760	1.790	43.450	41.640	1.660

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
8.001	S13	450	Manhole	Adoptable	S14	450	Manhole	Adoptable
8.002	S14	450	Manhole	Adoptable	S15	450	Manhole	Adoptable
10.000	S11	450	Manhole	Adoptable	S10	600	Manhole	Adoptable
11.000	S9	450	Manhole	Adoptable	S10	600	Manhole	Adoptable
10.001	S10	600	Manhole	Adoptable	S7	1200	Manhole	Adoptable
1.006	S7	1200	Manhole	Adoptable	S8	450	Manhole	Adoptable

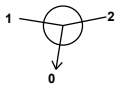
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S19	509417.910	186816.634	45.450	1.000	450		0	1.000	44.450	150
S20	509413.198	186828.909	45.240	0.900	600		1 0	1.000 1.001	44.340 44.340	150 150
S21	509410.246	186836.598	45.400	1.325	600		1 0	1.001 1.002	44.150 44.075	150 225
S29	509434.974	186851.438	45.200	0.900	600		0	2.000	44.300	150
S22	509424.960	186858.245	44.900	1.045	600		1 2 0	2.000 1.002 1.003	43.930 43.855 43.855	150 225 225
S23	509440.619	186881.284	44.500	0.925	600		1 0	1.003 1.004	43.575 43.575	225 225
S24	509449.404	186883.868	44.450	2.650	600		1	1.004	43.320	225
S1	509464.675	186971.080	45.720	1.560	450		0	3.000	44.160	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S2	509455.388	186968.670	45.750	1.750	600	1	3.000	44.080	150
									
						0	3.001	44.000	225
S3	509450.996	186941.341	45.200	1.520	600	 1	3.001	43.680	225
						0	3.002	43.680	225
S4	509469.635	186938.357	45.010	1.530	600	1	3.002	43.560	225
									
						0	3.003	43.480	300
S30	509503.371	186950.146	45.300	1.340	450				
						0	4.000	43.960	150
S31	509484.118	186946.724	45.250	1.500	600	1	4.000	43.800	150
									
						0	4.001	43.750	225
S5	509484.555	186935.959	44.800	3.000	1200	 1	4.001	43.470	225
						2	3.003	43.400	300
S32	509467.129	186920.972	44.550	1.150	450				
						0	5.000	43.400	150
S33	509472.632	186913.894	44.400	1.300	450	1	5.000	43.100	150
									
						0	5.001	43.100	150
S34	509482.747	186914.305	44.300	2.500	450	1	5.001	43.020	150
									
S6	509486.544	186886.988	43.810	2.010	1200				
S17	509445.080	186920.826	44.885	0.885	450				
						0	6.000	44.000	150
S18	509444.767	186890.459	44.350	2.550	1200	1	6.000	43.100	150
									
S25	509452.531	186861.272	44.500	1.240	450				
						0	7.000	43.260	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S26	509455.746	186864.077	44.500	1.280	450	1  0	7.000 7.001	43.220 43.220	150 150
S27	509462.454	186862.998	44.500	1.340	450	1  0	7.001 7.002	43.160 43.160	150 150
S28	509465.396	186881.298	44.200	2.400	450	1 	7.002	43.010	150
S12	509465.281	186901.544	44.100	1.000	450	 0	8.000	43.100	150
S13	509459.026	186902.089	44.200	1.230	450	1  0	8.000 8.001	43.020 42.970	150 150
S14	509457.429	186892.145	44.140	1.250	450	1  0	8.001 8.002	42.890 42.890	150 150
S15	509472.951	186889.650	43.850	2.050	450	1 	8.002	42.640	150
S16	509454.031	186892.842	44.350	2.550	450				
S11	509505.831	186892.632	43.700	1.190	450	 0	10.000	42.510	150
S9	509490.875	186892.003	43.950	1.450	450	 0	11.000	42.500	150
S10	509497.399	186890.954	43.800	1.440	600	1 2  0	11.000 10.000 10.001	42.440 42.440 42.360	150 150 225
S7	509495.996	186882.224	43.700	1.940	1200	1  0	10.001 1.006	42.300 41.760	225 150
S8	509510.098	186880.581	43.450	1.810	450	1 	1.006	41.640	150

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	✓	1 year (l/s)	1.6
Rainfall Events	Singular	Drain Down Time (mins)	10080	2 year (l/s)	1.7
Summer CV	1.000	Additional Storage (m³/ha)	0.0	30 year (l/s)	4.6
Winter CV	1.000	Starting Level (m)		100 year (l/s)	6.1
Analysis Speed	Detailed	Check Discharge Rate(s)	✓	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
2	0	0	0
30	0	0	0
30	35	0	0
100	0	0	0
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	2.40
Greenfield Method	IH124	Growth Factor 100 year	3.19
Positively Drained Area (ha)	0.437	Betterment (%)	0
SAAR (mm)	644	QBar	1.9
Soil Index	4	Q 1 year (l/s)	1.6
SPR	0.47	Q 2 year (l/s)	1.7
Region	6	Q 30 year (l/s)	4.6
Growth Factor 1 year	0.85	Q 100 year (l/s)	6.1
Growth Factor 2 year	0.88		

Node S7 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	41.760	Product Number	CTL-SHE-0056-1900-1940-1900
Design Depth (m)	1.940	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.9	Min Node Diameter (mm)	1200

Node S6 Tank Storage Structure

Invert Level (m)	41.800	Time to half empty (mins)	2385	Analyse flow through structure	x

Inlets

S5 | S34

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	138.0	0.750	138.0	1.125	138.0	1.126	0.0

Node S7 Tank Storage Structure

Invert Level (m)	41.800	Time to half empty (mins)	2370	Analyse flow through structure	x

Inlets

S18		S24		S16		S28		S15		S6	
Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**	**Depth (m)**	**Area (m²)**	**Depth (m)**	**Area (m²)**	**Depth (m)**	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	188.0	0.750	188.0	1.125	188.0	1.126	0.0				

Node S7 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	43.000	Slope (1:X)	60.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	315	Depth (m)	0.425
Safety Factor	2.0	Width (m)	42.700	Inf Depth (m)	
Porosity	0.33	Length (m)	10.000		

Node S22 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	44.200	Slope (1:X)	60.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	2	Depth (m)	0.375
Safety Factor	2.0	Width (m)	11.700	Inf Depth (m)	
Porosity	0.33	Length (m)	10.000		

Node S18 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	43.750	Slope (1:X)	60.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.375
Safety Factor	2.0	Width (m)	30.000	Inf Depth (m)	
Porosity	0.33	Length (m)	10.000		

Node S6 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	43.300	Slope (1:X)	60.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	165	Depth (m)	0.375
Safety Factor	2.0	Width (m)	22.600	Inf Depth (m)	
Porosity	0.33	Length (m)	10.000		

Node S5 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	44.100	Slope (1:X)	60.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.375
Safety Factor	2.0	Width (m)	23.900	Inf Depth (m)	
Porosity	0.33	Length (m)	10.000		

Results for 1 year Critical Storm Duration. Lowest mass balance: 98.56%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S19	10	44.483	0.033	1.6	0.0053	0.0000	OK
15 minute summer	S20	10	44.365	0.025	1.6	0.0071	0.0000	OK
15 minute summer	S21	10	44.123	0.048	5.0	0.0137	0.0000	OK
15 minute winter	S29	12	44.309	0.009	0.2	0.0025	0.0000	OK
15 minute summer	S22	11	43.916	0.061	7.8	0.0173	0.0000	OK
15 minute summer	S23	11	43.623	0.048	7.7	0.0135	0.0000	OK
600 minute summer	S24	495	41.994	0.194	2.0	0.0000	0.0000	OK
15 minute summer	S1	10	44.190	0.030	1.4	0.0048	0.0000	OK
15 minute summer	S2	10	44.039	0.039	3.7	0.0109	0.0000	OK
15 minute summer	S3	11	43.741	0.061	6.4	0.0173	0.0000	OK
15 minute summer	S4	11	43.547	0.067	8.2	0.0188	0.0000	OK
15 minute summer	S30	10	43.988	0.028	1.2	0.0044	0.0000	OK
15 minute summer	S31	10	43.798	0.048	7.8	0.0137	0.0000	OK
600 minute summer	S5	480	41.997	0.196	3.4	0.2222	0.0000	OK
15 minute summer	S32	10	43.420	0.020	1.3	0.0032	0.0000	OK
15 minute summer	S33	10	43.129	0.029	1.3	0.0047	0.0000	OK
600 minute summer	S34	510	41.994	0.194	1.7	0.0000	0.0000	OK
600 minute summer	S6	495	41.994	0.194	3.4	26.3337	0.0000	OK
15 minute summer	S17	1	44.000	0.000	0.0	0.0000	0.0000	OK
600 minute summer	S18	465	41.993	0.193	1.8	0.2188	0.0000	OK
15 minute summer	S25	11	43.281	0.021	0.7	0.0034	0.0000	OK
15 minute summer	S26	10	43.241	0.021	0.7	0.0034	0.0000	OK
15 minute summer	S27	11	43.182	0.022	0.7	0.0034	0.0000	OK
600 minute summer	S28	495	41.992	0.192	1.0	0.0000	0.0000	OK
15 minute summer	S12	10	43.127	0.027	1.3	0.0042	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S19	1.000	S20	1.6	0.658	0.097	0.0318	
15 minute summer	S20	1.001	S21	1.6	0.819	0.057	0.0156	
15 minute summer	S21	1.002	S22	4.9	0.656	0.102	0.1952	
15 minute winter	S29	2.000	S22	0.2	0.491	0.006	0.0049	
15 minute summer	S22	1.003	S23	7.7	1.047	0.148	0.2064	
15 minute summer	S23	1.004	S24	7.7	1.317	0.089	0.0539	
15 minute summer	S1	3.000	S2	1.4	0.552	0.085	0.0239	
15 minute summer	S2	3.001	S3	3.6	0.562	0.065	0.1823	
15 minute summer	S3	3.002	S4	6.3	0.747	0.154	0.1605	
15 minute summer	S4	3.003	S5	8.2	0.726	0.101	0.1704	
15 minute summer	S30	4.000	S31	1.1	0.525	0.071	0.0427	
15 minute summer	S31	4.001	S5	7.8	1.292	0.093	0.0650	
15 minute summer	S32	5.000	S33	1.3	0.675	0.039	0.0172	
15 minute summer	S33	5.001	S34	1.2	0.528	0.079	0.0240	
15 minute summer	S17	6.000	S18	0.0	0.000	0.000	0.0000	
15 minute summer	S25	7.000	S26	0.7	0.456	0.041	0.0066	
15 minute summer	S26	7.001	S27	0.7	0.469	0.042	0.0105	
15 minute summer	S27	7.002	S28	0.7	0.452	0.044	0.0285	
15 minute summer	S12	8.000	S13	1.3	0.624	0.064	0.0129	

Results for 1 year Critical Storm Duration. Lowest mass balance: 98.56%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S13	10	43.000	0.030	1.3	0.0048	0.0000	OK
15 minute summer	S14	11	42.915	0.024	1.3	0.0039	0.0000	OK
600 minute summer	S15	495	41.992	0.192	1.0	0.0000	0.0000	OK
600 minute summer	S16	495	41.992	0.192	1.0	0.0000	0.0000	OK
15 minute summer	S11	10	42.553	0.043	2.7	0.0069	0.0000	OK
15 minute summer	S9	10	42.543	0.043	2.8	0.0069	0.0000	OK
15 minute summer	S10	10	42.417	0.057	5.5	0.0161	0.0000	OK
600 minute summer	S7	480	41.992	0.232	4.5	35.6244	0.0000	SURCHARGED
600 minute summer	S8	480	41.668	0.028	1.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S13	8.001	S14	1.3	0.588	0.080	0.0217	
15 minute summer	S14	8.002	S15	1.3	0.683	0.056	0.0291	
15 minute summer	S11	10.000	S10	2.7	0.657	0.167	0.0351	
15 minute summer	S9	11.000	S10	2.8	0.686	0.165	0.0268	
15 minute summer	S10	10.001	S7	5.4	0.718	0.127	0.0669	
600 minute summer	S7	1.006	S8	1.3	0.544	0.077	0.0327	92.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.63%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S19	10	44.493	0.043	2.6	0.0068	0.0000	OK
15 minute summer	S20	10	44.372	0.032	2.6	0.0091	0.0000	OK
15 minute summer	S21	10	44.137	0.062	8.2	0.0176	0.0000	OK
15 minute summer	S29	12	44.311	0.011	0.3	0.0030	0.0000	OK
15 minute summer	S22	10	43.935	0.080	12.9	0.0225	0.0000	OK
15 minute summer	S23	11	43.637	0.062	12.7	0.0176	0.0000	OK
480 minute winter	S24	464	42.089	0.289	2.3	0.0000	0.0000	OK
15 minute summer	S1	10	44.199	0.039	2.3	0.0063	0.0000	OK
15 minute summer	S2	10	44.050	0.050	6.1	0.0140	0.0000	OK
15 minute summer	S3	11	43.760	0.080	10.7	0.0227	0.0000	OK
15 minute summer	S4	11	43.567	0.087	13.6	0.0246	0.0000	OK
15 minute summer	S30	10	43.995	0.035	1.9	0.0056	0.0000	OK
15 minute summer	S31	10	43.813	0.063	12.9	0.0178	0.0000	OK
480 minute winter	S5	464	42.092	0.292	3.6	0.3304	0.0000	OK
15 minute summer	S32	10	43.426	0.026	2.1	0.0041	0.0000	OK
15 minute summer	S33	10	43.138	0.038	2.1	0.0060	0.0000	OK
480 minute winter	S34	472	42.089	0.289	1.9	0.0000	0.0000	OK
480 minute winter	S6	464	42.089	0.289	3.6	39.2809	0.0000	OK
15 minute summer	S17	1	44.000	0.000	0.0	0.0000	0.0000	OK
480 minute winter	S18	456	42.089	0.289	2.0	0.3267	0.0000	OK
15 minute summer	S25	11	43.288	0.028	1.2	0.0045	0.0000	OK
15 minute summer	S26	10	43.248	0.028	1.2	0.0045	0.0000	OK
15 minute summer	S27	11	43.188	0.028	1.2	0.0045	0.0000	OK
480 minute winter	S28	472	42.087	0.287	1.0	0.0000	0.0000	OK
15 minute summer	S12	10	43.134	0.034	2.1	0.0054	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S19	1.000	S20	2.6	0.754	0.159	0.0453	
15 minute summer	S20	1.001	S21	2.6	0.944	0.095	0.0223	
15 minute summer	S21	1.002	S22	8.1	0.754	0.170	0.2814	
15 minute summer	S29	2.000	S22	0.3	0.556	0.010	0.0065	
15 minute summer	S22	1.003	S23	12.7	1.192	0.244	0.2978	
15 minute summer	S23	1.004	S24	12.8	1.506	0.147	0.0778	
15 minute summer	S1	3.000	S2	2.3	0.635	0.141	0.0344	
15 minute summer	S2	3.001	S3	6.0	0.639	0.107	0.2635	
15 minute summer	S3	3.002	S4	10.6	0.857	0.256	0.2326	
15 minute summer	S4	3.003	S5	13.6	0.835	0.169	0.2469	
15 minute summer	S30	4.000	S31	1.9	0.603	0.115	0.0601	
15 minute summer	S31	4.001	S5	12.9	1.479	0.153	0.0938	
15 minute summer	S32	5.000	S33	2.1	0.770	0.064	0.0246	
15 minute summer	S33	5.001	S34	2.1	0.607	0.130	0.0343	
15 minute summer	S17	6.000	S18	0.0	0.000	0.000	0.0000	
15 minute summer	S25	7.000	S26	1.2	0.527	0.070	0.0097	
15 minute summer	S26	7.001	S27	1.2	0.540	0.072	0.0155	
15 minute summer	S27	7.002	S28	1.2	0.529	0.075	0.0419	
15 minute summer	S12	8.000	S13	2.1	0.715	0.104	0.0183	

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.63%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S13	10	43.008	0.038	2.1	0.0061	0.0000	OK
15 minute summer	S14	11	42.921	0.031	2.1	0.0050	0.0000	OK
480 minute winter	S15	472	42.087	0.287	1.0	0.0000	0.0000	OK
480 minute winter	S16	472	42.087	0.287	1.0	0.0000	0.0000	OK
15 minute summer	S11	10	42.567	0.057	4.5	0.0091	0.0000	OK
15 minute summer	S9	10	42.558	0.058	4.7	0.0092	0.0000	OK
15 minute summer	S10	10	42.435	0.075	9.1	0.0212	0.0000	OK
480 minute winter	S7	464	42.087	0.327	4.9	53.2575	0.0000	SURCHARGED
180 minute summer	S8	140	41.668	0.028	1.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S13	8.001	S14	2.1	0.673	0.131	0.0311	
15 minute summer	S14	8.002	S15	2.1	0.787	0.092	0.0412	
15 minute summer	S11	10.000	S10	4.5	0.752	0.279	0.0510	
15 minute summer	S9	11.000	S10	4.7	0.786	0.276	0.0393	
15 minute summer	S10	10.001	S7	9.1	0.823	0.212	0.0974	
480 minute winter	S7	1.006	S8	1.3	0.545	0.077	0.0329	120.6

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.61%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S19	10	44.526	0.076	7.6	0.0121	0.0000	OK
15 minute summer	S20	10	44.398	0.058	7.5	0.0163	0.0000	OK
15 minute summer	S21	10	44.189	0.114	23.6	0.0323	0.0000	OK
15 minute summer	S29	11	44.318	0.018	1.0	0.0052	0.0000	OK
15 minute summer	S22	10	44.005	0.150	37.5	0.0423	0.0000	OK
15 minute summer	S23	11	43.691	0.116	37.0	0.0328	0.0000	OK
600 minute winter	S24	585	42.532	0.732	4.1	0.0000	0.0000	OK
15 minute summer	S1	10	44.230	0.070	6.6	0.0112	0.0000	OK
15 minute summer	S2	10	44.086	0.086	17.6	0.0243	0.0000	OK
15 minute summer	S3	10	43.833	0.153	31.1	0.0434	0.0000	OK
15 minute summer	S4	11	43.639	0.159	39.4	0.0450	0.0000	OK
15 minute summer	S30	10	44.022	0.062	5.6	0.0099	0.0000	OK
15 minute summer	S31	10	43.868	0.118	37.8	0.0333	0.0000	OK
600 minute winter	S5	585	42.537	0.737	6.8	0.8330	0.0000	OK
15 minute summer	S32	10	43.444	0.044	6.1	0.0070	0.0000	OK
15 minute summer	S33	10	43.168	0.068	6.1	0.0108	0.0000	OK
600 minute winter	S34	600	42.532	0.732	3.7	0.0000	0.0000	OK
600 minute winter	S6	585	42.532	0.732	7.0	99.4879	0.0000	OK
15 minute summer	S17	1	44.000	0.000	0.0	0.0000	0.0000	OK
600 minute winter	S18	585	42.532	0.732	3.7	0.8280	0.0000	OK
15 minute summer	S25	10	43.310	0.050	3.5	0.0079	0.0000	OK
15 minute summer	S26	10	43.269	0.049	3.5	0.0078	0.0000	OK
15 minute summer	S27	11	43.209	0.048	3.5	0.0077	0.0000	OK
600 minute winter	S28	600	42.529	0.729	2.0	0.0000	0.0000	OK
15 minute summer	S12	10	43.161	0.061	6.1	0.0097	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S19	1.000	S20	7.5	0.994	0.465	0.1000	
15 minute summer	S20	1.001	S21	7.5	1.256	0.276	0.0491	
15 minute summer	S21	1.002	S22	23.4	0.969	0.492	0.6309	
15 minute summer	S29	2.000	S22	1.0	0.619	0.032	0.0604	
15 minute summer	S22	1.003	S23	37.0	1.527	0.710	0.6744	
15 minute summer	S23	1.004	S24	37.2	1.955	0.428	0.1745	
15 minute summer	S1	3.000	S2	6.5	0.839	0.404	0.0749	
15 minute summer	S2	3.001	S3	17.5	0.820	0.313	0.5919	
15 minute summer	S3	3.002	S4	30.6	1.107	0.741	0.5221	
15 minute summer	S4	3.003	S5	39.6	1.099	0.491	0.5445	
15 minute summer	S30	4.000	S31	5.5	0.776	0.346	0.1429	
15 minute summer	S31	4.001	S5	37.7	1.925	0.448	0.2107	
15 minute summer	S32	5.000	S33	6.1	1.018	0.186	0.0539	
15 minute summer	S33	5.001	S34	6.0	0.806	0.381	0.0754	
15 minute summer	S17	6.000	S18	0.0	0.000	0.000	0.0000	
15 minute summer	S25	7.000	S26	3.5	0.687	0.203	0.0217	
15 minute summer	S26	7.001	S27	3.5	0.701	0.208	0.0337	
15 minute summer	S27	7.002	S28	3.5	0.715	0.217	0.0897	
15 minute summer	S12	8.000	S13	6.1	0.947	0.302	0.0402	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.61%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S13	10	43.038	0.068	6.1	0.0108	0.0000	OK
15 minute summer	S14	10	42.945	0.055	6.0	0.0087	0.0000	OK
600 minute winter	S15	600	42.530	0.730	2.0	0.0000	0.0000	OK
600 minute winter	S16	600	42.529	0.729	2.0	0.0000	0.0000	OK
15 minute summer	S11	10	42.623	0.113	13.1	0.0180	0.0000	OK
15 minute summer	S9	10	42.613	0.113	13.6	0.0180	0.0000	OK
600 minute winter	S10	585	42.530	0.170	2.3	0.0480	0.0000	OK
600 minute winter	S7	585	42.530	0.770	8.9	135.2157	0.0000	SURCHARGED
120 minute summer	S8	60	41.668	0.028	1.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S13	8.001	S14	6.0	0.892	0.382	0.0682	
15 minute summer	S14	8.002	S15	5.9	1.055	0.265	0.0889	
15 minute summer	S11	10.000	S10	13.0	0.962	0.812	0.1161	
15 minute summer	S9	11.000	S10	13.5	1.005	0.800	0.0888	
600 minute winter	S10	10.001	S7	2.3	0.566	0.054	0.3177	
600 minute winter	S7	1.006	S8	1.3	0.545	0.077	0.0329	273.8

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.66%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S19	10	44.541	0.091	10.2	0.0145	0.0000	OK
15 minute summer	S20	10	44.409	0.069	10.1	0.0194	0.0000	OK
15 minute summer	S21	10	44.212	0.137	31.8	0.0387	0.0000	OK
15 minute summer	S29	10	44.322	0.022	1.4	0.0061	0.0000	OK
15 minute summer	S22	10	44.046	0.191	50.7	0.0539	0.0000	OK
15 minute summer	S23	11	43.717	0.142	50.0	0.0401	0.0000	OK
720 minute winter	S24	705	42.810	1.010	4.7	0.0000	0.0000	OK
15 minute summer	S1	10	44.245	0.085	8.9	0.0135	0.0000	OK
15 minute summer	S2	10	44.101	0.101	23.8	0.0287	0.0000	OK
15 minute summer	S3	11	43.881	0.201	42.0	0.0569	0.0000	OK
15 minute summer	S4	11	43.674	0.194	53.0	0.0548	0.0000	OK
15 minute summer	S30	10	44.032	0.072	7.5	0.0115	0.0000	OK
15 minute summer	S31	10	43.894	0.144	51.0	0.0407	0.0000	OK
720 minute winter	S5	705	42.815	1.015	7.6	1.1479	0.0000	OK
15 minute summer	S32	10	43.451	0.051	8.2	0.0081	0.0000	OK
15 minute summer	S33	10	43.181	0.081	8.2	0.0129	0.0000	OK
720 minute winter	S34	720	42.810	1.010	4.3	0.0000	0.0000	OK
720 minute winter	S6	705	42.810	1.010	8.0	137.1901	0.0000	OK
15 minute summer	S17	1	44.000	0.000	0.0	0.0000	0.0000	OK
720 minute winter	S18	705	42.810	1.010	4.2	1.1422	0.0000	OK
15 minute summer	S25	10	43.320	0.060	4.8	0.0095	0.0000	OK
15 minute summer	S26	10	43.279	0.059	4.8	0.0093	0.0000	OK
15 minute summer	S27	11	43.217	0.057	4.7	0.0091	0.0000	OK
720 minute winter	S28	720	42.807	1.007	2.3	0.0000	0.0000	OK
15 minute summer	S12	10	43.173	0.073	8.2	0.0116	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S19	1.000	S20	10.1	1.064	0.625	0.1252	
15 minute summer	S20	1.001	S21	10.1	1.350	0.371	0.0613	
15 minute summer	S21	1.002	S22	31.7	1.023	0.665	0.8002	
15 minute summer	S29	2.000	S22	1.4	0.591	0.044	0.0976	
15 minute summer	S22	1.003	S23	50.0	1.596	0.960	0.8646	
15 minute summer	S23	1.004	S24	50.3	2.082	0.578	0.2212	
15 minute summer	S1	3.000	S2	8.8	0.900	0.544	0.0939	
15 minute summer	S2	3.001	S3	23.6	0.860	0.423	0.7552	
15 minute summer	S3	3.002	S4	41.3	1.177	0.998	0.6577	
15 minute summer	S4	3.003	S5	53.3	1.173	0.661	0.6864	
15 minute summer	S30	4.000	S31	7.4	0.770	0.464	0.1952	
15 minute summer	S31	4.001	S5	50.7	2.049	0.603	0.2663	
15 minute summer	S32	5.000	S33	8.2	1.091	0.250	0.0674	
15 minute summer	S33	5.001	S34	8.1	0.866	0.512	0.0944	
15 minute summer	S17	6.000	S18	0.0	0.000	0.000	0.0000	
15 minute summer	S25	7.000	S26	4.8	0.737	0.277	0.0276	
15 minute summer	S26	7.001	S27	4.7	0.757	0.283	0.0424	
15 minute summer	S27	7.002	S28	4.7	0.776	0.293	0.1117	
15 minute summer	S12	8.000	S13	8.2	1.018	0.406	0.0503	

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.66%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S13	10	43.051	0.081	8.2	0.0128	0.0000	OK
15 minute summer	S14	10	42.955	0.065	8.1	0.0103	0.0000	OK
720 minute winter	S15	720	42.807	1.007	2.3	0.0000	0.0000	OK
720 minute winter	S16	720	42.807	1.007	2.3	0.0000	0.0000	OK
720 minute winter	S11	705	42.807	0.297	1.3	0.0472	0.0000	SURCHARGED
720 minute winter	S9	705	42.807	0.307	1.3	0.0488	0.0000	SURCHARGED
720 minute winter	S10	705	42.807	0.447	2.6	0.1265	0.0000	SURCHARGED
720 minute winter	S7	705	42.807	1.047	10.1	186.5167	0.0000	SURCHARGED
720 minute winter	S8	705	41.670	0.030	1.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S13	8.001	S14	8.1	0.960	0.514	0.0852	
15 minute summer	S14	8.002	S15	8.0	1.138	0.357	0.1109	
720 minute winter	S11	10.000	S10	1.3	0.538	0.081	0.1513	
720 minute winter	S9	11.000	S10	1.3	0.556	0.077	0.1163	
720 minute winter	S10	10.001	S7	2.6	0.585	0.061	0.3517	
720 minute winter	S7	1.006	S8	1.4	0.564	0.087	0.0357	376.3

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.66%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S19	10	44.539	0.089	9.8	0.0141	0.0000	OK
15 minute summer	S20	10	44.407	0.067	9.7	0.0189	0.0000	OK
15 minute summer	S21	10	44.208	0.133	30.4	0.0377	0.0000	OK
15 minute summer	S29	10	44.321	0.021	1.3	0.0059	0.0000	OK
15 minute summer	S22	10	44.037	0.182	48.4	0.0516	0.0000	OK
15 minute summer	S23	11	43.712	0.137	47.7	0.0388	0.0000	OK
720 minute winter	S24	705	42.782	0.982	4.7	0.0000	0.0000	OK
15 minute summer	S1	10	44.242	0.082	8.5	0.0131	0.0000	OK
15 minute summer	S2	10	44.099	0.099	22.7	0.0279	0.0000	OK
15 minute summer	S3	11	43.871	0.191	40.2	0.0542	0.0000	OK
15 minute summer	S4	11	43.668	0.188	50.7	0.0531	0.0000	OK
15 minute summer	S30	10	44.031	0.071	7.2	0.0113	0.0000	OK
15 minute summer	S31	10	43.889	0.139	48.8	0.0394	0.0000	OK
720 minute winter	S5	705	42.787	0.987	7.5	1.1161	0.0000	OK
15 minute summer	S32	10	43.450	0.050	7.8	0.0079	0.0000	OK
15 minute summer	S33	10	43.179	0.079	7.8	0.0125	0.0000	OK
720 minute winter	S34	720	42.782	0.982	4.2	0.0000	0.0000	OK
720 minute winter	S6	705	42.782	0.982	7.9	133.3786	0.0000	OK
15 minute summer	S17	1	44.000	0.000	0.0	0.0000	0.0000	OK
720 minute winter	S18	705	42.782	0.982	4.1	1.1105	0.0000	OK
15 minute summer	S25	10	43.318	0.058	4.6	0.0093	0.0000	OK
15 minute summer	S26	10	43.277	0.057	4.6	0.0091	0.0000	OK
15 minute summer	S27	11	43.216	0.056	4.5	0.0088	0.0000	OK
720 minute winter	S28	720	42.779	0.979	2.3	0.0000	0.0000	OK
15 minute summer	S12	10	43.171	0.071	7.8	0.0113	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S19	1.000	S20	9.7	1.055	0.600	0.1214	
15 minute summer	S20	1.001	S21	9.7	1.337	0.356	0.0595	
15 minute summer	S21	1.002	S22	30.3	1.018	0.636	0.7715	
15 minute summer	S29	2.000	S22	1.3	0.591	0.041	0.0907	
15 minute summer	S22	1.003	S23	47.7	1.590	0.916	0.8302	
15 minute summer	S23	1.004	S24	48.0	2.064	0.552	0.2131	
15 minute summer	S1	3.000	S2	8.4	0.891	0.521	0.0908	
15 minute summer	S2	3.001	S3	22.6	0.856	0.404	0.7286	
15 minute summer	S3	3.002	S4	39.5	1.166	0.956	0.6376	
15 minute summer	S4	3.003	S5	51.0	1.162	0.633	0.6631	
15 minute summer	S30	4.000	S31	7.1	0.769	0.445	0.1870	
15 minute summer	S31	4.001	S5	48.5	2.031	0.576	0.2571	
15 minute summer	S32	5.000	S33	7.8	1.079	0.238	0.0650	
15 minute summer	S33	5.001	S34	7.7	0.857	0.489	0.0910	
15 minute summer	S17	6.000	S18	0.0	0.000	0.000	0.0000	
15 minute summer	S25	7.000	S26	4.6	0.730	0.265	0.0266	
15 minute summer	S26	7.001	S27	4.5	0.750	0.271	0.0410	
15 minute summer	S27	7.002	S28	4.5	0.767	0.281	0.1081	
15 minute summer	S12	8.000	S13	7.8	1.006	0.387	0.0485	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.66%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S13	10	43.048	0.078	7.8	0.0125	0.0000	OK
15 minute summer	S14	10	42.953	0.063	7.7	0.0100	0.0000	OK
720 minute winter	S15	720	42.779	0.979	2.3	0.0000	0.0000	OK
720 minute winter	S16	720	42.779	0.979	2.3	0.0000	0.0000	OK
720 minute winter	S11	705	42.779	0.269	1.3	0.0428	0.0000	SURCHARGED
720 minute winter	S9	705	42.779	0.279	1.3	0.0444	0.0000	SURCHARGED
720 minute winter	S10	705	42.779	0.419	2.6	0.1186	0.0000	SURCHARGED
720 minute winter	S7	705	42.779	1.019	10.0	181.3209	0.0000	SURCHARGED
720 minute winter	S8	705	41.670	0.030	1.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S13	8.001	S14	7.7	0.948	0.490	0.0822	
15 minute summer	S14	8.002	S15	7.7	1.125	0.341	0.1072	
720 minute winter	S11	10.000	S10	1.3	0.538	0.081	0.1513	
720 minute winter	S9	11.000	S10	1.3	0.556	0.077	0.1163	
720 minute winter	S10	10.001	S7	2.6	0.585	0.061	0.3517	
720 minute winter	S7	1.006	S8	1.4	0.562	0.086	0.0354	366.8

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.72%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S19	10	44.562	0.112	13.7	0.0179	0.0000	OK
15 minute summer	S20	11	44.494	0.154	13.5	0.0437	0.0000	SURCHARGED
15 minute summer	S21	11	44.436	0.361	41.0	0.1023	0.0000	SURCHARGED
15 minute summer	S29	10	44.324	0.024	1.8	0.0069	0.0000	OK
15 minute summer	S22	11	44.243	0.388	65.3	0.3300	0.0000	SURCHARGED
15 minute summer	S23	12	43.742	0.167	62.6	0.0474	0.0000	OK
960 minute winter	S24	945	43.666	1.866	5.1	0.0000	0.0000	OK
15 minute summer	S1	10	44.263	0.103	11.8	0.0163	0.0000	OK
15 minute summer	S2	10	44.120	0.120	31.7	0.0340	0.0000	OK
15 minute summer	S3	10	44.010	0.330	56.0	0.0935	0.0000	SURCHARGED
15 minute summer	S4	10	43.721	0.241	71.5	0.0683	0.0000	OK
15 minute summer	S30	10	44.045	0.085	10.0	0.0135	0.0000	OK
15 minute summer	S31	10	43.932	0.182	68.2	0.0514	0.0000	OK
960 minute winter	S5	945	43.671	1.871	8.3	2.1166	0.0000	OK
960 minute winter	S32	945	43.667	0.267	0.6	0.0425	0.0000	SURCHARGED
960 minute winter	S33	945	43.667	0.567	0.6	0.0902	0.0000	SURCHARGED
960 minute winter	S34	945	43.667	1.867	4.6	0.0000	0.0000	OK
960 minute winter	S6	945	43.667	1.867	8.6	177.5869	0.0000	OK
15 minute summer	S17	1	44.000	0.000	0.0	0.0000	0.0000	OK
960 minute winter	S18	945	43.665	1.865	4.5	2.1092	0.0000	OK
600 minute winter	S25	600	43.662	0.402	0.6	0.0640	0.0000	SURCHARGED
600 minute winter	S26	600	43.662	0.442	0.6	0.0703	0.0000	SURCHARGED
600 minute winter	S27	600	43.662	0.502	0.6	0.0799	0.0000	SURCHARGED
600 minute winter	S28	600	43.662	1.862	3.8	0.0000	0.0000	OK
960 minute winter	S12	945	43.663	0.563	0.6	0.0895	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S19	1.000	S20	13.5	1.119	0.833	0.2087	
15 minute summer	S20	1.001	S21	13.3	1.300	0.492	0.1450	
15 minute summer	S21	1.002	S22	40.5	1.026	0.851	1.0409	
15 minute summer	S29	2.000	S22	1.8	0.591	0.057	0.1178	
15 minute summer	S22	1.003	S23	62.6	1.632	1.201	0.9952	
15 minute summer	S23	1.004	S24	62.6	2.165	0.719	0.2640	
15 minute summer	S1	3.000	S2	11.7	0.957	0.723	0.1174	
15 minute summer	S2	3.001	S3	31.4	0.902	0.561	0.8485	
15 minute summer	S3	3.002	S4	55.1	1.394	1.334	0.7188	
15 minute summer	S4	3.003	S5	71.2	1.259	0.883	0.8519	
15 minute summer	S30	4.000	S31	9.9	0.803	0.620	0.2609	
15 minute summer	S31	4.001	S5	67.7	2.149	0.806	0.3383	
960 minute winter	S32	5.000	S33	0.6	0.537	0.018	0.1578	
960 minute winter	S33	5.001	S34	0.6	0.427	0.038	0.1782	
15 minute summer	S17	6.000	S18	0.0	0.000	0.000	0.0000	
600 minute winter	S25	7.000	S26	0.6	0.438	0.035	0.0751	
600 minute winter	S26	7.001	S27	0.6	0.434	0.036	0.1196	
600 minute winter	S27	7.002	S28	0.6	0.433	0.038	0.3263	
960 minute winter	S12	8.000	S13	0.6	0.502	0.030	0.1105	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.72%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	S13	945	43.663	0.693	0.6	0.1101	0.0000	SURCHARGED
960 minute winter	S14	945	43.663	0.773	0.6	0.1229	0.0000	SURCHARGED
960 minute winter	S15	945	43.663	1.863	2.5	0.0000	0.0000	OK
960 minute winter	S16	945	43.662	1.862	2.5	0.0000	0.0000	OK
960 minute winter	S11	945	43.662	1.152	1.4	0.1832	0.0000	FLOOD RISK
960 minute winter	S9	945	43.662	1.162	1.4	0.1848	0.0000	FLOOD RISK
960 minute winter	S10	945	43.662	1.302	2.8	0.3685	0.0000	FLOOD RISK
960 minute winter	S7	945	43.662	1.902	12.0	261.4680	0.0000	FLOOD RISK
960 minute winter	S8	945	41.674	0.034	1.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute winter	S13	8.001	S14	0.6	0.471	0.038	0.1773	
960 minute winter	S14	8.002	S15	0.6	0.547	0.027	0.2768	
960 minute winter	S11	10.000	S10	1.4	0.538	0.087	0.1513	
960 minute winter	S9	11.000	S10	1.4	0.568	0.083	0.1163	
960 minute winter	S10	10.001	S7	2.7	0.579	0.062	0.3517	
960 minute winter	S7	1.006	S8	1.9	0.609	0.115	0.0435	530.5

APPENDIX G –SUDS PROFORMA

BARNET LONDON BOROUGH

GREATERLONDONAUTHORITY

LoDEG

1. Project & Site Details

Project / Site Name (including sub-catchment / stage / phase where appropriate)	The Barn Hotel
Address & post code	The Barn Hotel,West End Road, Ruislip HA4 6JB
OS Grid ref. (Easting, Northing)	E 509491
	N 186889
LPA reference (if applicable)	
Brief description of proposed work	The site will be redeveloped for residential purposes comprising new apartment blocks and low-rise two-storey houses with private gardens at the east of the site.
Total site Area	9600 m^2
Total existing impervious area	2800 m^2
Total proposed impervious area	4390m2 m^2
Is the site in a surface water flood risk catchment (ref. local Surface Water Management Plan)?	The site is in flood zone 1
Existing drainage connection type and location	An existing 150mm diameter into the Thames Water Sewer.
Designer Name	Phil Tomes
Designer Position	Director
Designer Company	Infrastructure Design Ltd

2. Proposed Discharge Arrangements

2a. Infiltration Feasibility

Superficial geology classification	
Bedrock geology classification	Made Ground and Clay
Site infiltration rate	Not appropriate m/s
Depth to groundwater level	m below ground level
Is infiltration feasible?	No

2b. Drainage Hierarchy

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

2c. Proposed Discharge Details

Proposed discharge location	See IDL drainage strategy report
Has the owner/regulator of the discharge location been consulted?	Not Yet

3. Drainage Strategy

3a. Discharge Rates & Required Storage

	Greenfield (GF) runoff rate (l/s)	*Existing discharge rate (l/s)*	*Required storage for GF rate (m^3)*	*Proposed discharge rate (l/s)*
Qbar	1.9			
1 in 1	1.6	unknown		1.3
1 in 30	1.7	unknown		1.3
1 in 100	6.1	unknown		1.4
1 in 100 + CC			See DS report	1.9
Climate change allowance used		40%		

3b. Principal Method of Flow Control	Hydrobrake manholes

3c. Proposed SuDS Measures

	Catchment area (m^2)	*Plan area (m^2)*	*Storage vol. (m^3)*
Rainwater harvesting	0		0
Infiltration systems	0		0
Green roofs	See DS report	See DS report	
Blue roofs	0	0	0
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	0	0	0
Pervious pavements	1309	1309	165.611
Swales	0	0	0
Basins/ponds	0	0	0
Attenuation tanks	See DS report		366.75
Total	**1309**	**1309**	**532.361**

4. Supporting Information

4a. Discharge & Drainage Strategy	*Page/section of drainage report*
Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	n/a
Drainage hierarchy (2b)	See IDL drainage strategy report
Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	See IDL drainage strategy report
Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	See IDL drainage strategy report
Proposed SuDS measures & specifications (3b)	See IDL drainage strategy report
4b. Other Supporting Details	*Page/section of drainage report*
Detailed Development Layout	See IDL drainage strategy report
Detailed drainage design drawings, including exceedance flow routes	See IDL drainage strategy report
Detailed landscaping plans	See IDL drainage strategy report
Maintenance strategy	See IDL drainage strategy report
Demonstration of how the proposed SuDS measures improve:	See IDL drainage strategy report
a) water quality of the runoff?	See IDL drainage strategy report
b) biodiversity?	See IDL drainage strategy report
c) amenity?	See IDL drainage strategy report

APPENDIX H – MANAGEMENT & MAINTENANCE REGIME

The Management Company

The management and maintenance of the SW drainage system is essentially split into 2 categories:-

The responsibility for maintaining all drainage elements of the development remains with Chase New Homes until it is handed over to the management company or freeholders.

1. The Management Company are responsible for all plot shared drainage, manholes, plastic inspection chambers and shared permeable paving.

2. The Freeholders are generally responsible for on-plot parking/hardstanding areas, on-plot drainage, and permeable paving for private drives.

The Management Company

Handover to the Management Company coincides with the completion of the final residential unit.

The Management Company employs a specialist Managing Agent to manage the development, including all maintenance aspects.

At handover, the Management Company and Managing Agent receive as-built information and operating and maintenance manuals detailing all maintenance protocols.

Approximately after 1 year of completion of the final unit, the residents will be invited to elect members to become directors of the Management Company, the Chase New Homes appointed directors at that time resign from the Management Company to be replaced by the elected representatives of the residents.

To ensure continuity and a full understanding of the development and the operation and maintenance of its various components, the representative of the Managing Agent remains as a director of the Management Company and the appointment of the Managing Agents is fixed for a minimum period of two years following the date of resignation of the last Chase New Homes director.

After two years, the Management Company have the right to re-tender the Managing Agent services.

Within the first two years from the final unit completion on the development, the residents have two ways in which they can report any defects and problems which would include flooding and that is either to Chase New Homes Aftersales department or to the Managing Agents, the residents are issued with telephone numbers for both which include out of hours emergency response.

After two years, Chase New Homes Aftersales contacts are normally replaced by members of the Management Company. The residents, therefore, have the ability to contact them or the managing agents, which then remains throughout the development.

The Freeholders

Handover to the Freeholders coincides with the completion and sale of each respective residential unit. At handover, the Freeholders will receive as-built information together with (where applicable) operating and maintenance manuals that detail all maintenance protocols.

Cellular Storage

The principal means of surface water attenuation/disposal from the development is via cellular storage.

The Management Company will ensure that the following measures are undertaken to ensure the longevity of the surface water drainage system;

Inspections to identify any areas not operating correctly, pollution, blocked inlets or outlets, standing water, etc.

Collect and remove from the site all extraneous rubbish that is detrimental to the operation or detracts from the site's appearance, including paper, bottles, cans, and similar debris.

On-site Surface Water Drainage System (generally)

The Management Company will ensure that the following measures are undertaken to ensure the longevity of the surface water drainage system;

Every 6 months: Remove silt buildup from all catch pits and road gullies.

Annually: elect approx. 20% of the development's surface water inspection chambers (situated in accessible non-private areas) and inspect for blockages/silt build-up. Remove silt and debris. Rotate on a 5-year cycle to cover all such chambers during this period.

Every 2-5 years (depending on outcome of aforementioned inspections)

> Commission a CCTV survey and report on the condition of the surface water piped drainage system upstream of the soakaways to assess structural integrity and hydraulic performance. Carry out promptly any remedial work as advised by the CCTV company.

Permeable Paving

External parking areas and access roads are to be constructed in permeable block paving in order to;

a) Delay the surface water run-off from these areas, and
b) Enhance the quality of the rainwater prior to discharge into the receiving sewer.

The Management Company will ensure that the following measures are undertaken to ensure the longevity of the pervious pavement;

Quarterly

i) Inspect the permeable pavement for signs of ponding and ensure there is no migration of soils from adjacent landscaped areas or other deleterious material that may prematurely clog up the jointing stone situated in the gaps between the blocks. Ideally, this type of inspection should be undertaken immediately following a heavy rainfall event.

ii) Commission vacuum sweeping and brushing of the pervious pavement to ensure joints are kept free of silt. Minimum 3 sweeping per year, thus;

a) End of Winter (April) – to collect winter debris
b) Mid-Summer (July/August) – to collect dust, flower and grass-type deposits.
c) After Autumn leaf fall (November)

The company responsible for carrying out this work should ensure that its vacuum equipment is adjusted accordingly to avoid the removal of jointing material.

Any lost material should be replaced promptly to avoid the blocks from being dislodged.

Last Resort Remedial Action

i) Should a portion of the pervious pavement become substantially impervious due to excessive siltation, the following procedure should be followed;

a) Lift block paving and laying course
b) Break out the underlying bitmac base layer and replace with a similar compacted depth of course aggregate subbase material to BS EN 13242:2002 Type 4/20, lined at base and sides with a 2000 gauge impermeable membrane.
c) Renew laying course, replace blocks and renew jointing material

NB. Material removed from the voids or the layers below the surface may contain heavy metals and hydrocarbons and as such may need to be disposed of as 'controlled waste'. Sediment testing should be carried out before disposal to confirm its classification and appropriate disposal methods.

Renew laying course, replace blocks and renew jointing material.NB. Material removed from the voids or the layers below the surface may contain heavy metals and hydrocarbons, and as such may need to be disposed of as 'controlled waste'. Sediment testing should be carried out before disposal to confirm its classification and appropriate disposal methods.

<u>Sedum (Green) Roofs</u>

Springtime Maintenance.

• Removal of unwanted plant material, i.e. grasses, mosses and clover, etc.

• If moss is present, recommend lawn fertiliser and moss (e.g., Mo Bacter moss digester)

• Application of fertiliser. Recommend a 6-month slow-release granular fertiliser (e.g. Miracle-Grow Granular) be applied in April and May, as the sedum cannot be fertilised after September.

• Inspection of rainwater outlet chambers and surrounding vegetation breaks.

• Replenishment of any areas of settled substrate. Aerate the substrate if needed with a fork, or top up with a general-purpose soil.

Summer Maintenance.

• During dry periods, watering little and often will help the sedum and prevent it from turning red.

Autumn Maintenance.

• Removal of dead flower heads (shake first to allow seeds to fall). Only a light trim.• Removal of unwanted plant material, i.e. grasses, mosses and clover, etc.

• Inspection of rainwater outlet chambers and surrounding vegetation breaks.

• Replenishment of any areas of settled substrate.

Winter Maintenance

• No visit needed after the first frost it will turn red and then become dormant until springtime.

Flow Control Chambers

Flow control chambers are to be maintained. Their maintenance regime shall be as follows:

Following installation of the Flow Controls, any extraneous material, i.e., building materials, is removed from the unit and the chamber. After the system is made live, the unit is to be inspected monthly for three months and thereafter at six-monthly intervals with a hose down if required. The Hydrobrake Flow Control is fitted with a pivoting by-pass door, which allows the manhole chamber to be drained down should blockages occur.

Following the drain down and clearance of the blockage, the pivoting by-pass door must be returned to the closed position to enable the hydrobrake to function as designed.

The chambers are to be checked for structural integrity at the six-monthly interval. Any damage/problems should be made good in accordance with the original design drawings.