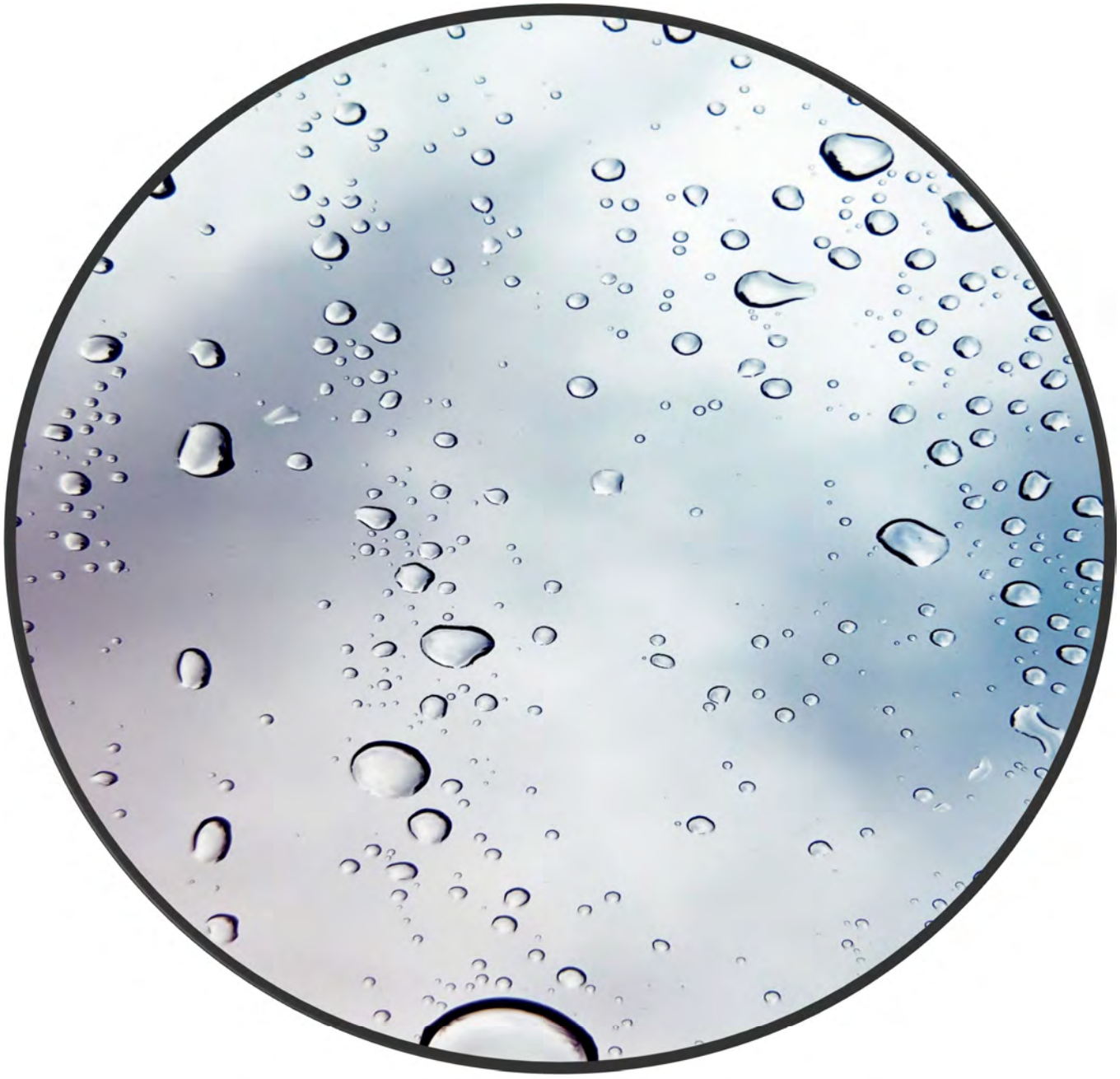
FLOOD RISK ASSESSMENT & 1DRAINAGE STRATEGY REPORT

THE BARN HOTEL, WEST END ROAD, RUISLIP
HA4 6JB
ON BEHALF OF CHASE NEW HOMES LIMITED
MARCH 2023
IDL/1143/DS/001



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IDL/1143/DS/001

REPORT ISSUE

Revision	Date	Notes
P01	01/03/2023	Preliminary Issue
P02	05/09/2023	Report revised to LLFA comments

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DISCLAIMER

CONTENTS

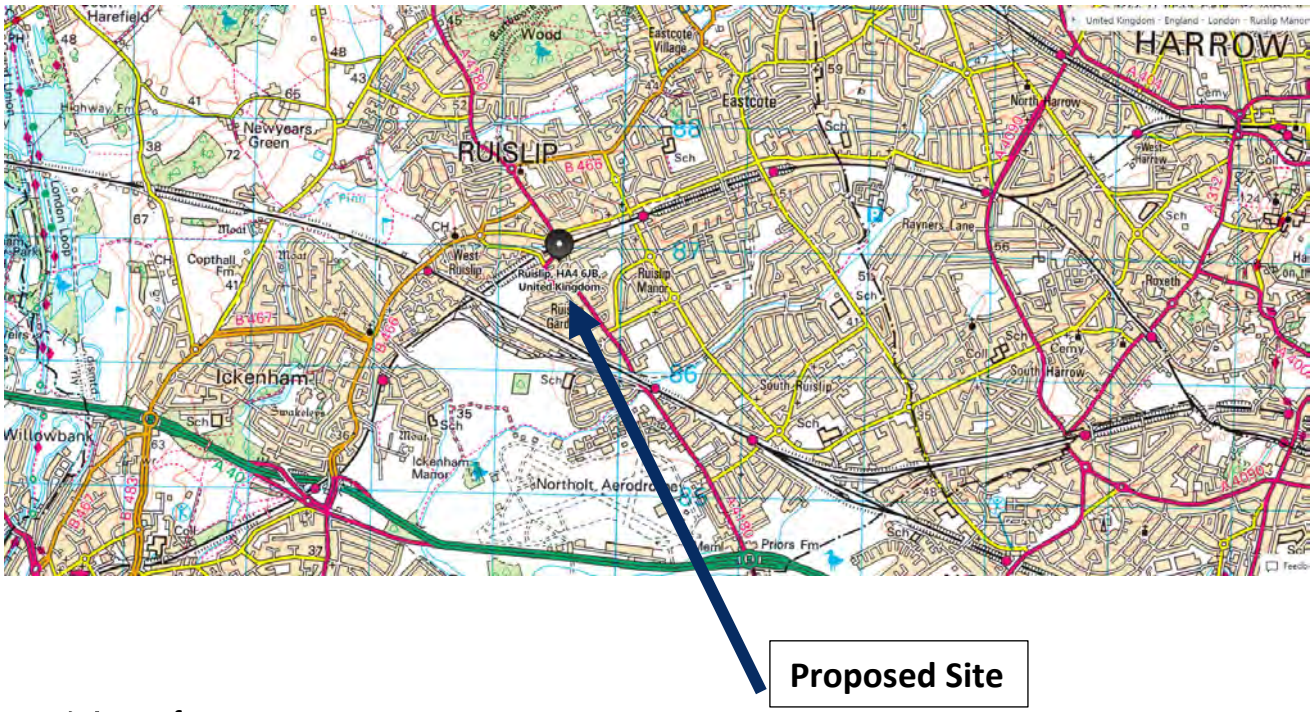
1 INTRODUCTION

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 both national and local planning policy and takes guidance from Ciria 753, The SuDS Manual and The Building Regulations, Approved Document Part H.

1.3 The site is located situated 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 Road 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.
- 22 0063-1 – 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, of which there are a number of existing Grade 2 listed buildings to remain. The site has a relatively steep bank on 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 site will be redeveloped for residential purposes comprising two new apartment blocks, one located in the north of the site (Building 1-Six to two storey) and another located in the south of the site (Building 2-Six storey) along with low-rise two-storey houses with private gardens at the east of the site. Soft and hard landscaping areas and car parking areas will cover the remainder of the site. Appendix E provides a copy of the proposed site plan.

1.7 The proposed main access to the apartment blocks and existing listed buildings will be from the existing vehicle entrances from West End Road with access to the two-storey houses taken from Garden Close.

1.8 The proposed development area, which has been chosen for the new development extends to 8038 m2 (0.804 hectares). The planning red line boundary extends to 9770 m2 (0.977 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 on West End Road at the existing site entrance. A 150mm diameter Thames Water foul and surface water sewers are located on 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 carried out a desk study, geotechnical and geoenvironmental interpretative report. The ground conditions during the investigation comprised made ground overlying Clay soil strata. This soil makes, infiltration techniques unsuitable for this site, and alternative surface water outfalls should be 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 has been set between 45.20-44.0m AOD.

2 SOURCES OF FLOODING

2.1 Government 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** – CGL has carried out a desk study, geotechnical and geoenvironmental interpretative report. 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 onsite. 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 existing flood risk were identified for the site. The proposed development will not cause this situation.

4.5 **Flood Risk during Construction** – Due to high groundwater within the site, flooding problems can occur during heavy rainfall events. At the detail design stage methods to prevent flooding due to high groundwater should be submitted.

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 on Garden Close through the eastern site access. Before making the foul connection, the exact location and levels of the existing sewer manhole will be surveyed.

5.2 The drainage strategy layout is included in Appendix E.

6 SURFACE WATER DRAINAGE & SUDS

6.1 The total site area extends to 8038m^2(0.80 hectares).

6.2 The total proposed impermeable area for the site is 4660 m2(0.466Ha). The proposed site's impermeable area is divided into two. Area 1 -3750m2 (0.375 ha) serving the apartments, and Area 2-910m2 (0.091 ha) serving the two-storey private houses. The impermeable area layout is included in Appendix E.

6.3 A hierarchal approach has been taken to the selection of SuDS being considered for the surface water drainage system outfalls. In order of priority, the method 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 to discharge the proposed surface water runoff from the site. Discharging the proposed surface water runoff 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 runoff rates whilst ensuring that the system will endure minimal maintenance. Figure 2a below gives the greenfield discharge rates for the site;

Figure 2 *Greenfield Runoff 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)	0.466	Betterment (%)	0
SAAR (mm)	644	QBar	2.0
Soil Index	4	Q 1 year (l/s)	1.7
SPR	0.47	Q 2 year (l/s)	1.8
Region	6	Q 30 year (l/s)	4.9
Growth Factor 1 year	0.85	Q 100 year (l/s)	6.5
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 to the scheme;

Permeable paving - To parking areas and access road

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

Sedum Green Roofs – 5mm depression storage only

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 delay runoff into the cellular storage and outfall via perforated pipes surrounded by granular material whilst also improving water quality.

6.9 A minimum permeable stone layer of 375mm is required where the sub-base is laid level.

6.10 All of the building roof areas will be drained through conventional gravity drainage and stored within the crate attenuation tank located within the car park areas.

6.11 Building 1 will incorporate a small green roof. Further information will be provided at the detailed design stage.

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 crate storage. Refer to Appendix F for the surface water calculations and simulation.

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

Figure 3 *Comparison of pre & post-development runoff rates*

Location / Storm Event	Greenfield Rate (l/s)	Proposed Runoff Rate (l/s)
(QBar)	2.0	
1 in 1 year	1.7	Area 1 & 2 (1.7 l/s + 1.1 l/s)=2.8 l/s
1 in 2 year	1.8	Area 1 & 2 (1.7 l/s + 1.1 l/s) =2.8 l/s
1 in 30 year	4.9	Area 1 & 2 (1.8 l/s + 1.1 l/s) =2.9 l/s
1 in 100 year	6.5	Area 1 & 2 (2.0 l/s + 1.5 l/s) =3.5 l/s
1 in 100 year (+40%cc)	-	Area 1 & 2 (2.0 l/s + 1.5 l/s) =3.5 l/s

Figure 4 *Storage volumes available within each SuDS feature*

LOCATION	SuDS DEVICE	AVAILABLE STORAGE
Access Road and Parking areas	Granular sub-base /Permeable Paving:1890m2 x 0.375m x 0.33- Area 1 and 230m2 x 0.375m x 0.33- Area 2	233.8875 m3 + 28.4625 m3 = **262.35** m3
Crate soakaway storage	Crate system Area 1 (117.5m2 x 1.2m) Crate Area 2 (60m2 x 0.8m)	141 m3 + 48 m3 = **189** m3 Please note 95% void ration has been used in the calculation.
Green Roof	Sedum Green Roof	79.18m2

7 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.

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 the use of a green roof.
	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 runoff.
Least Sustainable	**Tanked systems-Over size Pipes**	√	√		√	Crate storage is proposed to store extreme storm events and surface water runoff

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 priority for giving consideration to 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 over-stated 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.

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 desires of the LPA and viability of the site, density on this development is such that insufficient communal space is available for this larger form of above-ground SuDS feature. However green roofs are being used in Building 1 which will store the water and gradually release to the rest of the drainage system at very low discharge rates.

4 attenuate rainwater by storing in tanks or sealed water features for gradual release
Cellular attenuation crates are proposed, along with a control flow device to limit discharge rates to as close as practicable to greenfield runoff rates.

5 discharge rainwater direct 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 runoff 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.

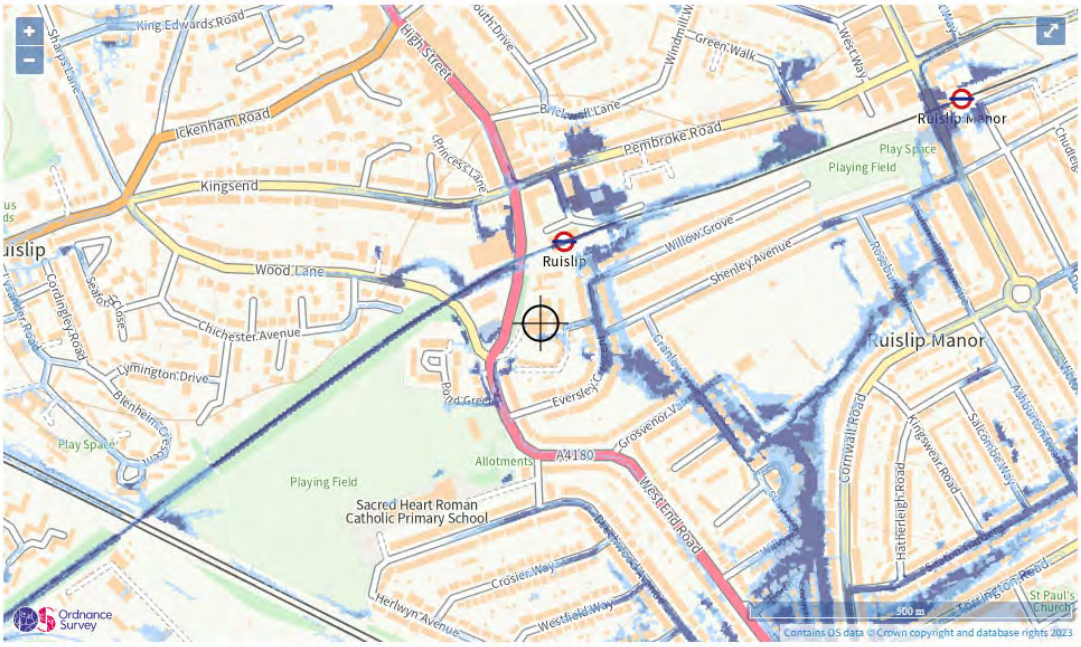
Select the type of flood risk information you're interested in. The map will then update.

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

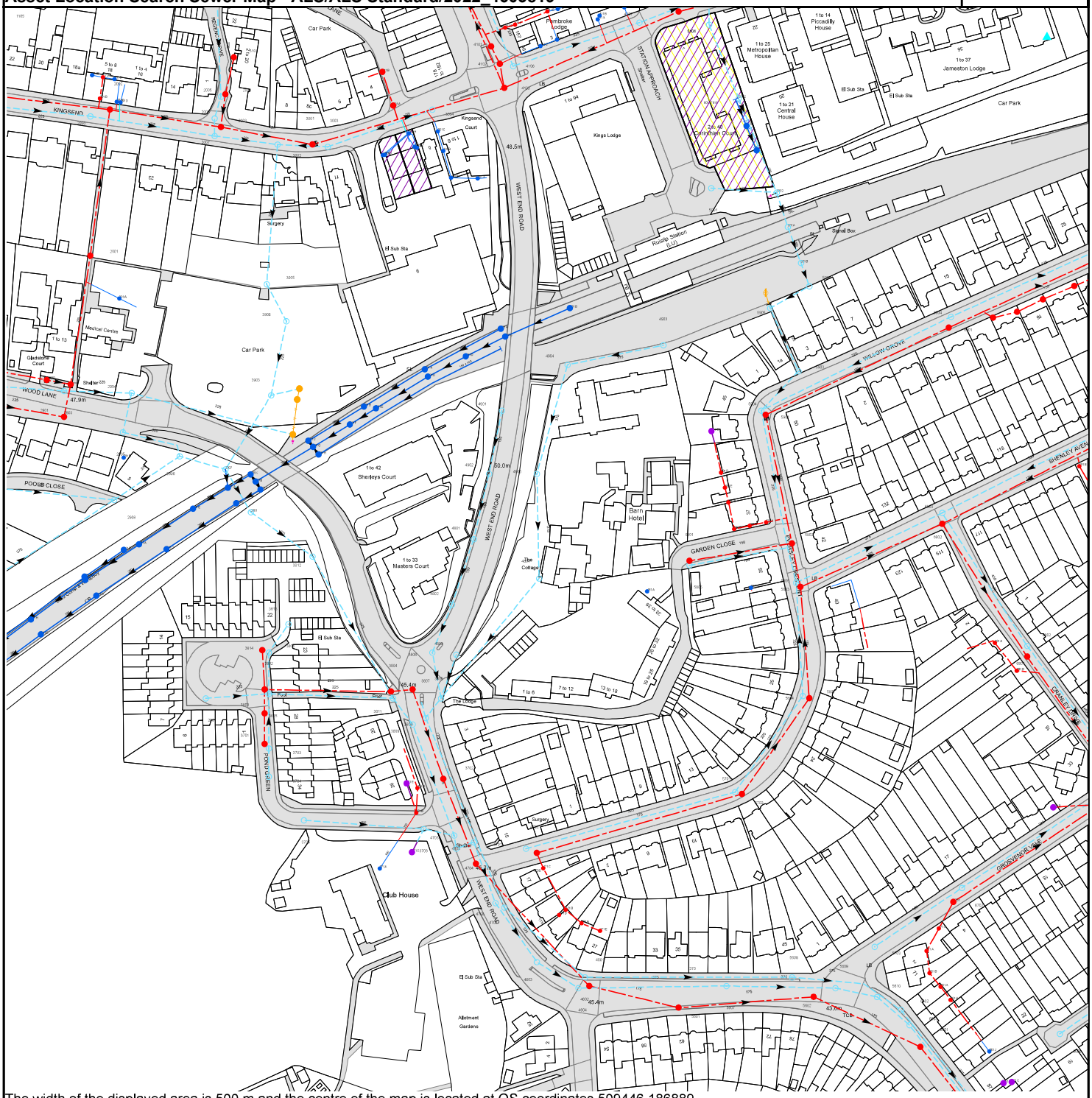
Maximum extent of flooding from reservoirs:

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

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.

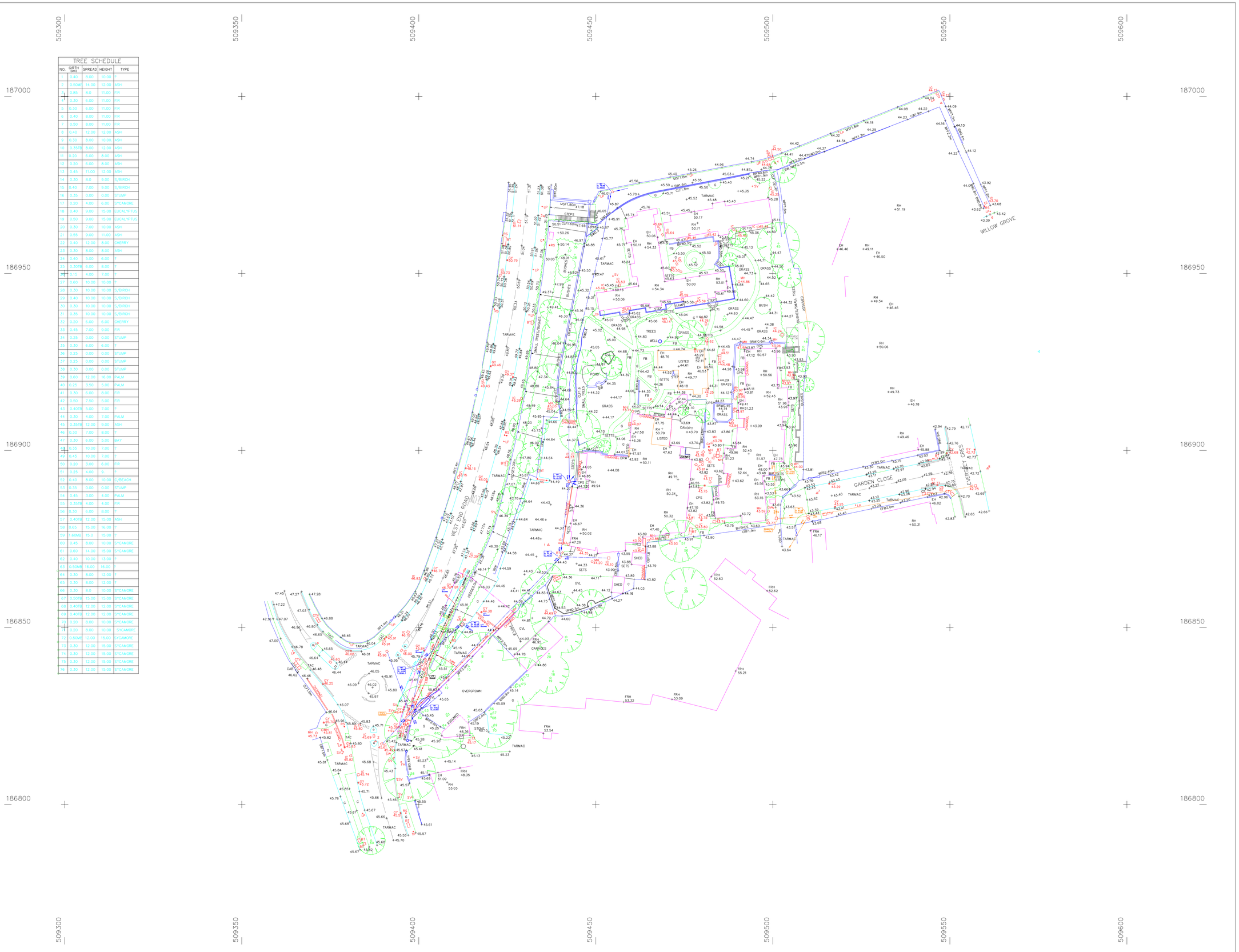
If you've any further questions, please contact me on 07747 641 932.

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.

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UNIT 10
STRENSHAM BUSINESS PARK
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WORCESTER
WR8 9JZ

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M: 07979 367282

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

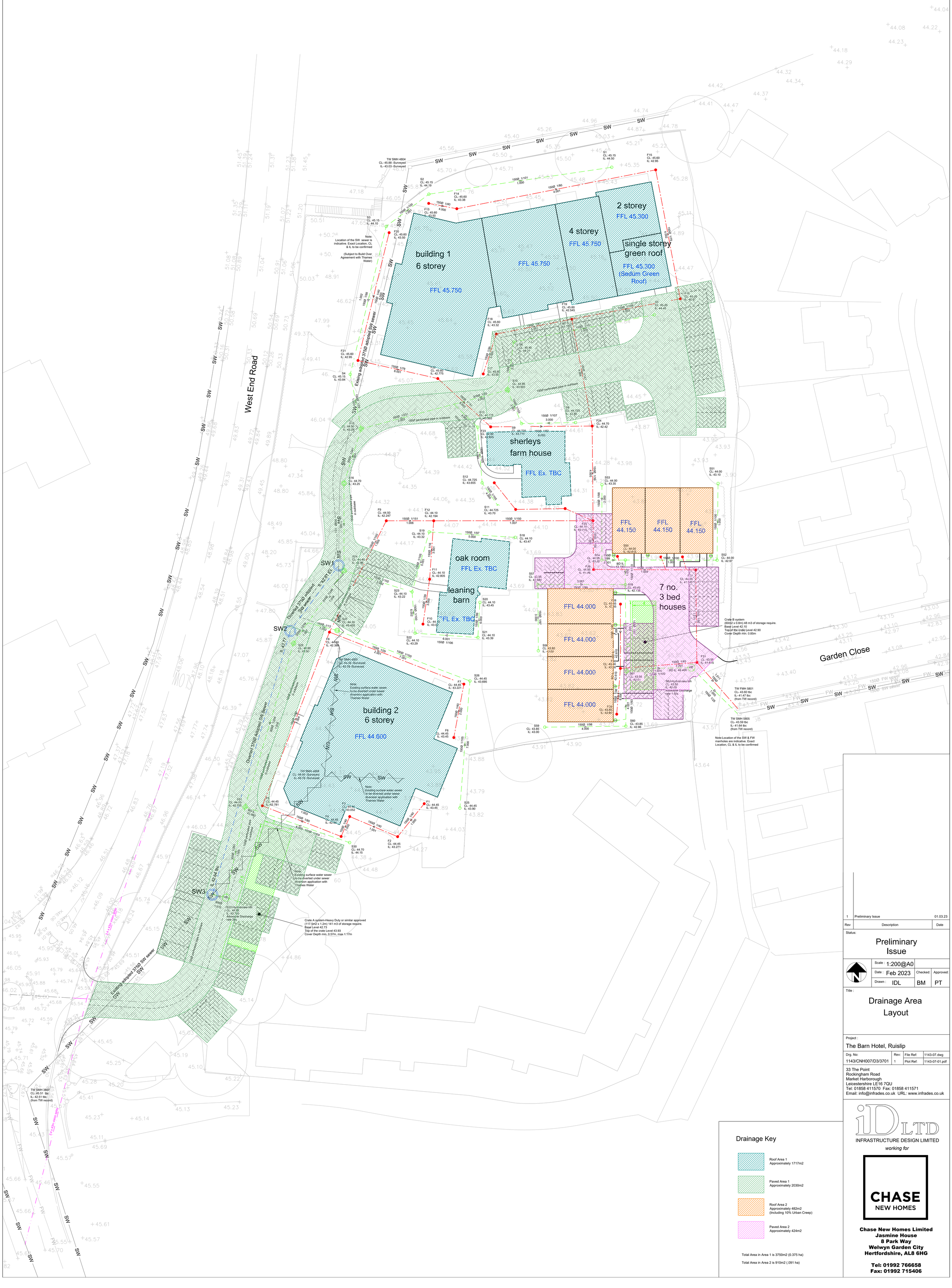
T: 01992 566698
M: 07977 112286
M: 07977 111935

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.



Drainage Key

- Roof Area 1 Approximately 1717m2
- Paved Area 1 Approximately 2030m2
- Roof Area 2 Approximately 482m2 (Including 10% Urban Creep)
- Paved Area 2 Approximately 424m2

Total Area in Area 1 is 3750m2 (0.375 ha)

Total Area in Area 2 is 910m2 (.091 ha)

Rev	Description	Date
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	1	Plot Ref:	1143-07-01.pdf

33 The Point
Rockingham Road
Market Harborough
Leicestershire LE16 7QU
Tel: 01858 411570 Fax: 01858 411571
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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

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

West End Road

Garden Close

building 1
6 storey
FFL 45.750

4 storey
FFL 45.750

2 storey
FFL 45.300

single storey green roof
FFL 45.300
(Sedum Green Roof)

building 2
6 storey
FFL 44.600

sherleys farm house
FFL Ex. TBC

oak room
FFL Ex. TBC

leaning barn
FFL Ex. TBC

7 no. 3 bed houses
FFL 44.000

FFL 44.150

Existing adopted 375Ø SW sewer

Diverted 375Ø adopted SW Sewer

Diverted 375Ø adopted SW sewer

Existing adopted 375Ø SW sewer

TW SMH 4804
CL- 45.88 -Surveyed
IL- 43.03 -Surveyed

TW SMH 4805
CL- 44.32 -Surveyed
IL- 42.78 -Surveyed

TW SMH 4804
CL- 44.45 -Surveyed
IL- 42.72 -Surveyed

TW SMH 3807
CL- 45.51 tbc
IL- 42.51 tbc
(from TW record)

TW FMH 5801
CL- 43.60 tbc
IL- 41.47 tbc
(from TW record)

TW SMH 5805
CL- 43.59 tbc
IL- 41.64 tbc
(from TW record)

Note:
Location of the SW sewer is indicative. Exact Location, CL & IL to be confirmed

(Subject to Build Over Agreement with Thames Water)

Note:
Existing surface water sewer to be diverted under sewer diversion application with Thames Water

Note:Location of the SW & FW manholes are indicative. Exact Location, CL & IL to be confirmed

Crate A system-Heavy Duty or similar approved
(117.5m2 x 1.2m) 141 m3 of storage require.
Base Level 42.73
Top of the crate Level 43.93
Cover Depth min. 0.57m, max 1.17m

Crate B system
(60m2 x 0.8m) 48 m3 of storage require.
Base Level 42.10
Top of the crate Level 42.90
Cover Depth min. 0.85m

S32-Hydrobrake Mh
CL: 44.65
IL: 42.725
Allowable Discharge rate 2l/s

SW1 IL 42.31 Ex.
SW2 IL 42.71
SW3 IL 42.64 tbc

S1 CL: 45.15 IL: 44.50
S2 CL: 45.15 IL: 44.19
S3 CL: 45.15 IL: 44.10
S4 CL: 45.15 IL: 43.84
S5 CL: 45.20 IL: 44.45
S6 CL: 45.40 IL: 44.00
S7 CL: 44.95 IL: 43.505
S8 CL: 44.725 IL: 43.80
S9 CL: 44.725 IL: 43.715
S10 CL: 44.95 IL: 43.505
S11 CL: 44.725 IL: 43.70
S12 CL: 44.725 IL: 43.655
S13 CL: 44.725 IL: 43.565
S15 CL: 44.90 IL: 43.25
S16 CL: 44.70 IL: 43.25
S18 CL: 44.10 IL: 43.47
S19 CL: 44.10 IL: 43.32
S20 CL: 44.10 IL: 43.45
S21 CL: 44.10 IL: 43.39
S22 CL: 44.10 IL: 43.29
S23 CL: 44.10 IL: 43.22
S24 CL: 44.40 IL: 42.96
S25 CL: 44.45 IL: 43.90
S26 CL: 44.45 IL: 43.695
S27 CL: 44.30 IL: 43.250
S29 CL: 44.60 IL: 42.90
S30 CL: 44.70 IL: 44.15
S31 CL: 44.55 IL: 42.785
S51 CL: 44.00 IL: 43.10
S52 CL: 44.00 IL: 42.97
S53 CL: 44.00 IL: 43.35
S54 CL: 44.05 IL: 43.22
S55 CL: 44.05 IL: 42.815
S56 CL: 43.85 IL: 43.00
S57 CL: 43.85 IL: 42.885
S58 CL: 43.85 IL: 42.735
S59 CL: 43.85 IL: 43.00
S60 CL: 43.85 IL: 42.86
S61 CL: 43.95 IL: 42.51
S62-Hydrobrake Mh CL: 43.55 IL: 42.00 Allowable Discharge rate 1.5l/s

F1 CL: 44.45 IL: 43.45
F2 CL: 44.45 IL: 43.271
F3 CL: 44.45 IL: 43.052
F4 CL: 44.45 IL: 42.96
F5 CL: 44.45 IL: 42.781
F8 CL: 44.60 IL: 42.388
F9 CL: 44.60 IL: 42.247
F10 CL: 44.10 IL: 43.00
F11 CL: 44.10 IL: 42.805
F12 CL: 44.10 IL: 42.194
F13 CL: 45.60 IL: 43.50
F14 CL: 45.60 IL: 43.38
F15 CL: 45.60 IL: 42.95
F16 CL: 45.20 IL: 42.67
F17 CL: 45.60 IL: 43.50
F18 CL: 45.60 IL: 43.32
F19 CL: 45.60 IL: 42.545
F20 CL: 45.60 IL: 43.50
F21 CL: 45.60 IL: 42.95
F22 CL: 45.60 IL: 42.775
F23 CL: 44.90 IL: 42.695
F24 CL: 44.70 IL: 42.42
F25 CL: 44.15 IL: 42.015
F26 CL: 44.00 IL: 41.96
F27 CL: 44.00 IL: 41.845
F28 CL: 43.85 IL: 42.85
F29 CL: 43.85 IL: 42.85
F30 CL: 43.90 IL: 42.00
F31 CL: 43.55 IL: 41.675

RWHT-01
IL (in) 43.43
IL (out) 43.27
RWHT-01 IL (in) 44.25 IL (out) 44.09

BD IL: 43.180
BD IL: 42.915
BD IL: 42.400

150Ø perforated pipe in subbase
300Ø perforated pipe in subbase

Key

- Existing foul water sewer
- Existing Surface Water sewer
- Existing Surface water sewer to be abandoned
- Foul Water Drainage
- Surface Water Drainage
- Hydrobrake with 300mm deep sump
- Perforated Pipe at the subbase
- Surface Water Diversion (Subject to S185 Sewer Diversion)
- Polypropylene universal inspection chambers 3000mm deep max, Where >1200mm deep, use reduced size access cover.
- Denotes 500/600 dia ppic, 3000mm deep max Where >1200mm deep, use reduced size access cover. Wavin Range 500/600 or similar.
- Polypropylene silt trap with 300mm sump
- Water Butt (Min 200 liters)
- Rainwater Harvesting tank
- Private access roads in Permeable Block Paving (tanked)
- Parking spaces and drives in Permeable Block Paving (tanked)
- Cellular storage system
- Extent to Green Roof to Building 1

Rev	Description	Date
2	Rainwater Harvesting tank added	11.09.23
1	Preliminary Issue	01.03.23

Status: Preliminary Issue

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

Title : Private Drainage Layout

Project : The Barn Hotel, Ruislip

Drg. No:	Rev:	File Ref:	
1143/CNH007/D3/3700	2	File Ref:	1143-07.dwg
		Plot Ref:	1143-07-01.pdf

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working for

CHASE NEW HOMES

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

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Fax: 01992 715406

CONTRACT DOCUMENT

Notes

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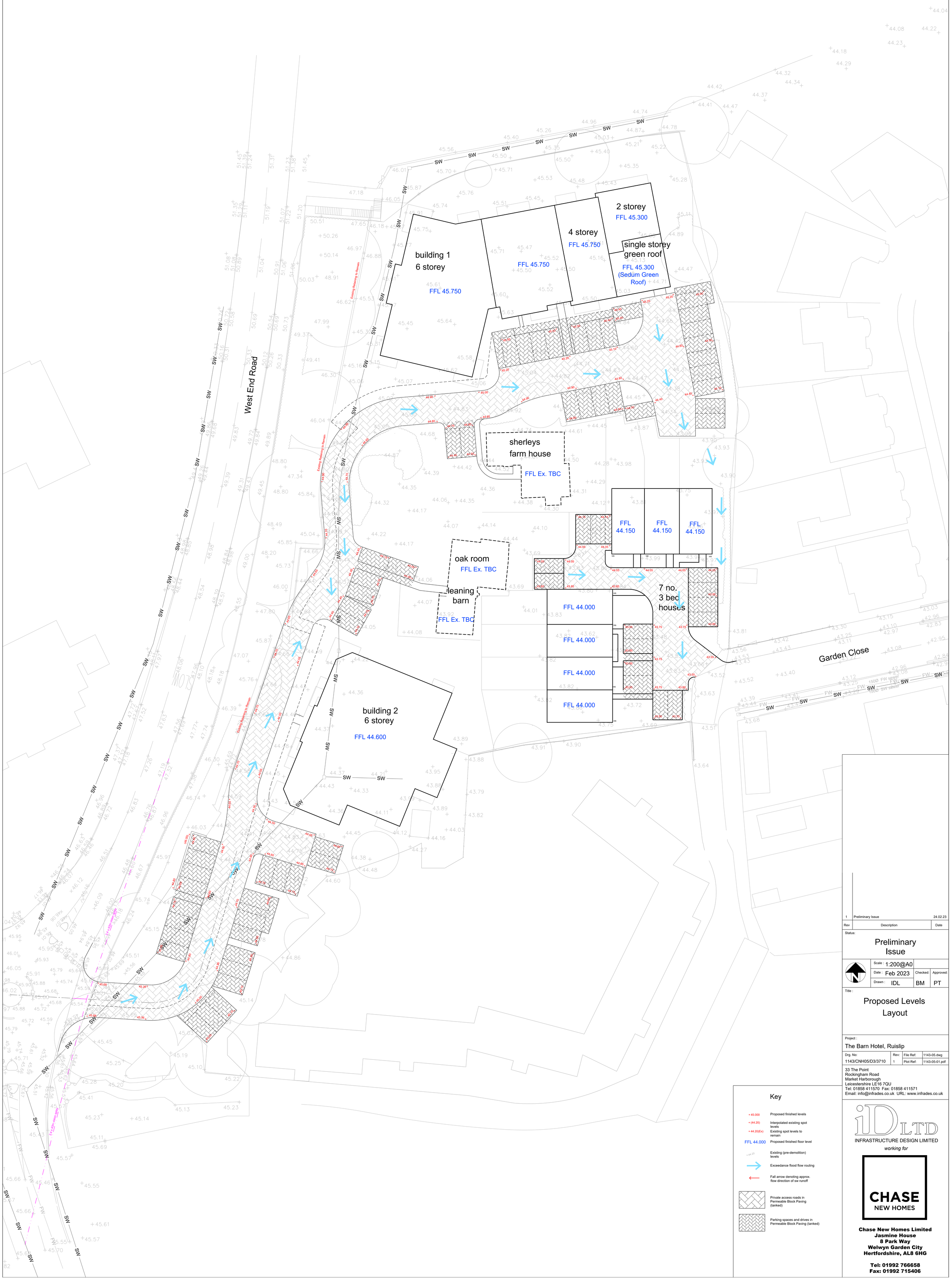

Key

+ 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
	Private access roads in Permeable Block Paving (tanked)
	Parking spaces and drives in Permeable Block Paving (tanked)

Rev	Description	Date
1	Preliminary Issue	24.02.23

Status: Preliminary Issue

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

Title : Proposed Levels Layout

Project : The Barn Hotel, Ruislip

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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	0.950	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.010	5.00	45.150	450	509488.555	186972.857	0.650
2	0.010	5.00	45.150	450	509457.663	186968.305	0.960
3	0.010	5.00	45.150	450	509450.448	186962.869	1.050
4	0.010	5.00	45.150	450	509444.384	186937.875	1.310
5	0.010	5.00	45.200	450	509495.747	186947.925	0.750
6	0.010	5.00	45.400	450	509471.971	186943.350	1.190
8	0.010	5.00	44.725	450	509482.431	186929.730	0.925
9	0.010	5.00	44.725	450	509473.323	186929.560	1.010
10	0.010	5.00	44.950	600	509470.951	186935.235	1.445
11	0.010	5.00	44.725	450	509469.358	186915.642	1.025
12	0.010	5.00	44.725	450	509466.665	186919.533	1.070
13	0.010	5.00	44.725	450	509465.900	186928.951	1.160
14	0.010	5.00	44.800		509461.870	186932.825	1.440
15	0.031	5.00	44.900	600	509446.237	186928.676	1.610
16	0.031	5.00	44.700	600	509443.320	186919.472	1.450

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
18	0.002	5.00	44.100	450	509472.266	186910.327	0.630
19	0.002	5.00	44.100	450	509457.721	186911.252	0.780
20	0.002	5.00	44.100	450	509466.283	186899.349	0.650
21	0.002	5.00	44.100	450	509465.945	186893.420	0.710
22	0.002	5.00	44.100	450	509455.336	186894.142	0.810
23	0.002	5.00	44.200	450	509454.829	186901.121	0.980
24	0.031	5.00	44.400	600	509444.245	186904.742	1.440
25	0.010	5.00	44.450	450	509462.903	186864.601	0.550
26	0.010	5.00	44.450	450	509464.598	186886.077	0.755
27	0.010	5.00	44.300	450	509442.166	186894.611	0.845
28	0.010	5.00	44.500		509437.591	186895.789	1.585
29	0.031	5.00	44.600	600	509435.365	186892.794	1.700
30	0.010	5.00	44.700	450	509444.198	186858.576	0.550
31	0.031	5.00	44.550	600	509427.581	186864.613	1.765
32	0.031	5.00	44.650	1200	509423.396	186849.461	1.925
S3			44.650	1	509421.085	186849.964	1.935

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	1	2	31.226	0.600	44.500	44.190	0.310	100.7	150	5.52	50.0
1.001	2	3	9.034	0.600	44.190	44.100	0.090	100.4	150	5.67	50.0
1.002	3	4	25.719	0.600	44.100	43.840	0.260	98.9	150	6.09	50.0
1.003	4	15	9.383	0.600	43.840	43.440	0.400	23.5	150	6.17	50.0
2.000	5	6	24.212	0.600	44.450	44.210	0.240	100.9	150	5.40	50.0
2.001	6	10	8.179	0.600	44.210	43.655	0.555	14.7	150	5.46	50.0
3.000	8	9	9.110	0.600	43.800	43.715	0.085	107.2	150	5.16	50.0
3.001	9	10	6.150	0.600	43.715	43.655	0.060	102.5	150	5.26	50.0
2.002	10	14	9.396	0.600	43.505	43.360	0.145	64.8	300	5.54	50.0
4.000	11	12	4.732	0.600	43.700	43.655	0.045	105.2	150	5.08	50.0
4.001	12	13	9.449	0.600	43.655	43.565	0.090	105.0	150	5.24	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.001	17.7	1.7	0.500	0.810	0.010	0.0	31	0.633
1.001	1.003	17.7	3.4	0.810	0.900	0.020	0.0	45	0.779
1.002	1.010	17.9	5.1	0.900	1.160	0.030	0.0	55	0.877
1.003	2.088	36.9	6.9	1.160	1.310	0.040	0.0	44	1.601
2.000	1.000	17.7	1.7	0.600	1.040	0.010	0.0	31	0.632
2.001	2.637	46.6	3.4	1.040	1.145	0.020	0.0	27	1.539
3.000	0.970	17.1	1.7	0.775	0.860	0.010	0.0	32	0.620
3.001	0.992	17.5	3.4	0.860	1.145	0.020	0.0	45	0.770
2.002	1.956	138.3	8.6	1.145	1.140	0.050	0.0	50	1.098
4.000	0.979	17.3	1.7	0.875	0.920	0.010	0.0	32	0.626
4.001	0.980	17.3	3.4	0.920	1.010	0.020	0.0	45	0.766

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)
4.002	13	14	5.590	0.600	43.565	43.510	0.055	101.6	150	5.33	50.0
2.003	14	15	16.174	0.600	43.360	43.290	0.070	231.1	300	5.80	50.0
1.004	15	16	9.656	0.600	43.290	43.250	0.040	241.4	300	6.33	50.0
1.005	16	24	14.759	0.600	43.250	42.960	0.290	50.9	300	6.44	50.0
5.000	18	19	14.575	0.600	43.470	43.320	0.150	97.2	150	5.24	50.0
5.001	19	23	10.536	0.600	43.320	43.220	0.100	105.4	150	5.42	50.0
6.000	20	21	5.939	0.600	43.450	43.390	0.060	99.0	150	5.10	50.0
6.001	21	22	10.633	0.600	43.390	43.290	0.100	106.3	150	5.28	50.0
6.002	22	23	6.998	0.600	43.290	43.220	0.070	100.0	150	5.40	50.0
5.002	23	24	11.186	0.600	43.220	43.110	0.110	101.7	150	5.60	50.0
1.006	24	28	11.155	0.600	42.960	42.915	0.045	247.9	300	6.63	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
4.002	0.996	17.6	5.1	1.010	1.140	0.030	0.0	55	0.865
2.003	1.030	72.8	15.4	1.140	1.310	0.090	0.0	93	0.822
1.004	1.007	71.2	27.6	1.310	1.150	0.161	0.0	130	0.946
1.005	2.209	156.1	33.0	1.150	1.140	0.192	0.0	93	1.760
5.000	1.019	18.0	0.3	0.480	0.630	0.002	0.0	14	0.392
5.001	0.978	17.3	0.7	0.630	0.830	0.004	0.0	20	0.471
6.000	1.010	17.8	0.3	0.500	0.560	0.002	0.0	14	0.388
6.001	0.974	17.2	0.7	0.560	0.660	0.004	0.0	20	0.469
6.002	1.005	17.8	1.0	0.660	0.830	0.006	0.0	24	0.544
5.002	0.996	17.6	2.1	0.830	1.140	0.012	0.0	35	0.671
1.006	0.994	70.3	40.3	1.140	1.285	0.235	0.0	163	1.027

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)
7.000	25	26	21.542	0.600	43.900	43.695	0.205	105.1	150	5.37	50.0
7.001	26	27	24.000	0.600	43.695	43.455	0.240	100.0	150	5.76	50.0
7.002	27	28	4.725	0.600	43.455	43.065	0.390	12.1	150	5.79	50.0
1.007	28	29	3.731	0.600	42.915	42.900	0.015	248.7	300	6.69	50.0
1.008	29	31	29.237	0.600	42.900	42.785	0.115	254.2	300	7.19	50.0
8.000	30	31	17.680	0.600	44.150	43.980	0.170	104.0	150	5.30	50.0
1.009	31	32	15.719	0.600	42.785	42.725	0.060	262.0	300	7.46	50.0
1.010	32	S3	2.365	0.600	42.725	42.715	0.010	236.5	300	7.50	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
7.000	0.980	17.3	1.7	0.400	0.605	0.010	0.0	32	0.626
7.001	1.005	17.8	3.4	0.605	0.695	0.020	0.0	45	0.780
7.002	2.910	51.4	5.1	0.695	1.285	0.030	0.0	32	1.868
1.007	0.992	70.1	47.2	1.285	1.400	0.275	0.0	181	1.062
1.008	0.981	69.4	52.5	1.400	1.465	0.306	0.0	196	1.076
8.000	0.985	17.4	1.7	0.400	0.420	0.010	0.0	32	0.629
1.009	0.966	68.3	59.6	1.465	1.625	0.347	0.0	218	1.084
1.010	1.018	71.9	64.9	1.625	1.635	0.378	0.0	224	1.147

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	31.226	100.7	150	Circular	45.150	44.500	0.500	45.150	44.190	0.810
1.001	9.034	100.4	150	Circular	45.150	44.190	0.810	45.150	44.100	0.900
1.002	25.719	98.9	150	Circular	45.150	44.100	0.900	45.150	43.840	1.160
1.003	9.383	23.5	150	Circular	45.150	43.840	1.160	44.900	43.440	1.310
2.000	24.212	100.9	150	Circular	45.200	44.450	0.600	45.400	44.210	1.040
2.001	8.179	14.7	150	Circular	45.400	44.210	1.040	44.950	43.655	1.145
3.000	9.110	107.2	150	Circular	44.725	43.800	0.775	44.725	43.715	0.860
3.001	6.150	102.5	150	Circular	44.725	43.715	0.860	44.950	43.655	1.145
2.002	9.396	64.8	300	Circular	44.950	43.505	1.145	44.800	43.360	1.140
4.000	4.732	105.2	150	Circular	44.725	43.700	0.875	44.725	43.655	0.920
4.001	9.449	105.0	150	Circular	44.725	43.655	0.920	44.725	43.565	1.010

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	450	Manhole	Adoptable	2	450	Manhole	Adoptable
1.001	2	450	Manhole	Adoptable	3	450	Manhole	Adoptable
1.002	3	450	Manhole	Adoptable	4	450	Manhole	Adoptable
1.003	4	450	Manhole	Adoptable	15	600	Manhole	Adoptable
2.000	5	450	Manhole	Adoptable	6	450	Manhole	Adoptable
2.001	6	450	Manhole	Adoptable	10	600	Manhole	Adoptable
3.000	8	450	Manhole	Adoptable	9	450	Manhole	Adoptable
3.001	9	450	Manhole	Adoptable	10	600	Manhole	Adoptable
2.002	10	600	Manhole	Adoptable	14		Junction	
4.000	11	450	Manhole	Adoptable	12	450	Manhole	Adoptable
4.001	12	450	Manhole	Adoptable	13	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)
4.002	5.590	101.6	150	Circular	44.725	43.565	1.010	44.800	43.510	1.140
2.003	16.174	231.1	300	Circular	44.800	43.360	1.140	44.900	43.290	1.310
1.004	9.656	241.4	300	Circular	44.900	43.290	1.310	44.700	43.250	1.150
1.005	14.759	50.9	300	Circular	44.700	43.250	1.150	44.400	42.960	1.140
5.000	14.575	97.2	150	Circular	44.100	43.470	0.480	44.100	43.320	0.630
5.001	10.536	105.4	150	Circular	44.100	43.320	0.630	44.200	43.220	0.830
6.000	5.939	99.0	150	Circular	44.100	43.450	0.500	44.100	43.390	0.560
6.001	10.633	106.3	150	Circular	44.100	43.390	0.560	44.100	43.290	0.660
6.002	6.998	100.0	150	Circular	44.100	43.290	0.660	44.200	43.220	0.830
5.002	11.186	101.7	150	Circular	44.200	43.220	0.830	44.400	43.110	1.140
1.006	11.155	247.9	300	Circular	44.400	42.960	1.140	44.500	42.915	1.285

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
4.002	13	450	Manhole	Adoptable	14		Junction	
2.003	14		Junction		15	600	Manhole	Adoptable
1.004	15	600	Manhole	Adoptable	16	600	Manhole	Adoptable
1.005	16	600	Manhole	Adoptable	24	600	Manhole	Adoptable
5.000	18	450	Manhole	Adoptable	19	450	Manhole	Adoptable
5.001	19	450	Manhole	Adoptable	23	450	Manhole	Adoptable
6.000	20	450	Manhole	Adoptable	21	450	Manhole	Adoptable
6.001	21	450	Manhole	Adoptable	22	450	Manhole	Adoptable
6.002	22	450	Manhole	Adoptable	23	450	Manhole	Adoptable
5.002	23	450	Manhole	Adoptable	24	600	Manhole	Adoptable
1.006	24	600	Manhole	Adoptable	28		Junction	

Pipeline Schedule

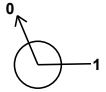
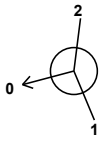
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
7.000	21.542	105.1	150	Circular	44.450	43.900	0.400	44.450	43.695	0.605
7.001	24.000	100.0	150	Circular	44.450	43.695	0.605	44.300	43.455	0.695
7.002	4.725	12.1	150	Circular	44.300	43.455	0.695	44.500	43.065	1.285
1.007	3.731	248.7	300	Circular	44.500	42.915	1.285	44.600	42.900	1.400
1.008	29.237	254.2	300	Circular	44.600	42.900	1.400	44.550	42.785	1.465
8.000	17.680	104.0	150	Circular	44.700	44.150	0.400	44.550	43.980	0.420
1.009	15.719	262.0	300	Circular	44.550	42.785	1.465	44.650	42.725	1.625
1.010	2.365	236.5	300	Circular	44.650	42.725	1.625	44.650	42.715	1.635

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
7.000	25	450	Manhole	Adoptable	26	450	Manhole	Adoptable
7.001	26	450	Manhole	Adoptable	27	450	Manhole	Adoptable
7.002	27	450	Manhole	Adoptable	28		Junction	
1.007	28		Junction		29	600	Manhole	Adoptable
1.008	29	600	Manhole	Adoptable	31	600	Manhole	Adoptable
8.000	30	450	Manhole	Adoptable	31	600	Manhole	Adoptable
1.009	31	600	Manhole	Adoptable	32	1200	Manhole	Adoptable
1.010	32	1200	Manhole	Adoptable	S3	1	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	509488.555	186972.857	45.150	0.650	450				
						0	1.000	44.500	150
2	509457.663	186968.305	45.150	0.960	450	1	1.000	44.190	150
						0	1.001	44.190	150
3	509450.448	186962.869	45.150	1.050	450	1	1.001	44.100	150
						0	1.002	44.100	150
4	509444.384	186937.875	45.150	1.310	450	1	1.002	43.840	150
						0	1.003	43.840	150
5	509495.747	186947.925	45.200	0.750	450				
						0	2.000	44.450	150
6	509471.971	186943.350	45.400	1.190	450	1	2.000	44.210	150
						0	2.001	44.210	150

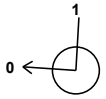
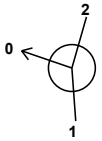
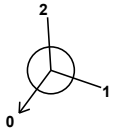
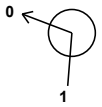
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
8	509482.431	186929.730	44.725	0.925	450				
						0	3.000	43.800	150
9	509473.323	186929.560	44.725	1.010	450		1	3.000	43.715	150
						0	3.001	43.715	150
10	509470.951	186935.235	44.950	1.445	600		1	3.001	43.655	150
							2	2.001	43.655	150
						0	2.002	43.505	300
11	509469.358	186915.642	44.725	1.025	450				
						0	4.000	43.700	150
12	509466.665	186919.533	44.725	1.070	450		1	4.000	43.655	150
						0	4.001	43.655	150
13	509465.900	186928.951	44.725	1.160	450		1	4.001	43.565	150
						0	4.002	43.565	150

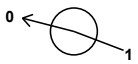
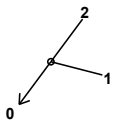
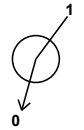
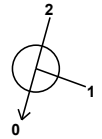
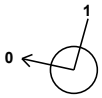
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
14	509461.870	186932.825	44.800	1.440		1	4.002	43.510	150
						2	2.002	43.360	300
						0	2.003	43.360	300
15	509446.237	186928.676	44.900	1.610	600	1	2.003	43.290	300
						2	1.003	43.440	150
						0	1.004	43.290	300
16	509443.320	186919.472	44.700	1.450	600	1	1.004	43.250	300
						0	1.005	43.250	300
18	509472.266	186910.327	44.100	0.630	450	0	5.000	43.470	150
19	509457.721	186911.252	44.100	0.780	450	1	5.000	43.320	150
						0	5.001	43.320	150
20	509466.283	186899.349	44.100	0.650	450	0	6.000	43.450	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
21	509465.945	186893.420	44.100	0.710	450		1	6.000	43.390	150
							0	6.001	43.390	150
22	509455.336	186894.142	44.100	0.810	450		1	6.001	43.290	150
							0	6.002	43.290	150
23	509454.829	186901.121	44.200	0.980	450		1	6.002	43.220	150
							2	5.001	43.220	150
							0	5.002	43.220	150
24	509444.245	186904.742	44.400	1.440	600		1	5.002	43.110	150
							2	1.005	42.960	300
							0	1.006	42.960	300
25	509462.903	186864.601	44.450	0.550	450					
							0	7.000	43.900	150
26	509464.598	186886.077	44.450	0.755	450		1	7.000	43.695	150
							0	7.001	43.695	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
27	509442.166	186894.611	44.300	0.845	450		1	7.001	43.455	150
							0	7.002	43.455	150
28	509437.591	186895.789	44.500	1.585			1	7.002	43.065	150
							2	1.006	42.915	300
							0	1.007	42.915	300
29	509435.365	186892.794	44.600	1.700	600		1	1.007	42.900	300
							0	1.008	42.900	300
30	509444.198	186858.576	44.700	0.550	450					
							0	8.000	44.150	150
31	509427.581	186864.613	44.550	1.765	600		1	8.000	43.980	150
							2	1.008	42.785	300
							0	1.009	42.785	300
32	509423.396	186849.461	44.650	1.925	1200		1	1.009	42.725	300
							0	1.010	42.725	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S3	509421.085	186849.964	44.650	1.935	1	1	1.010	42.715	300

Simulation Settings

Rainfall Methodology	FEH-22	Drain Down Time (mins)	1440	30 year (l/s)	4.9
Summer CV	0.950	Additional Storage (m³/ha)	20.0	100 year (l/s)	6.5
Winter CV	0.950	Check Discharge Rate(s)	✓	Check Discharge Volume	✓
Analysis Speed	Normal	1 year (l/s)	1.7	100 year 360 minute (m³)	169
Skip Steady State	✓	2 year (l/s)	1.8		

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

Pre-development Discharge Rate

Site Makeup	Greenfield	Region	6	QBar	2.0
Greenfield Method	IH124	Growth Factor 1 year	0.85	Q 1 year (l/s)	1.7
Positively Drained Area (ha)	0.466	Growth Factor 2 year	0.88	Q 2 year (l/s)	1.8
SAAR (mm)	644	Growth Factor 30 year	2.40	Q 30 year (l/s)	4.9
Soil Index	4	Growth Factor 100 year	3.19	Q 100 year (l/s)	6.5
SPR	0.47	Betterment (%)	0		

Pre-development Discharge Volume

Site Makeup	Greenfield	SPR	0.47	Storm Duration (mins)	360
Greenfield Method	FSR/FEH	CWI	96.889	Betterment (%)	0
Positively Drained Area (ha)	0.466	Return Period (years)	100	PR	0.458
Soil Index	4	Climate Change (%)	0	Runoff Volume (m^3)	169

Node 32 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	42.725	Product Number	CTL-SHE-0063-2000-1300-2000
Design Depth (m)	1.300	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node 32 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	42.725
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	117.5	0.0	0.400	117.5	0.0	0.800	117.5	0.0	1.200	117.5	0.0	1.201	0.0	0.0

Node 32 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	43.800	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	744	Depth (m)	0.375
Safety Factor	2.0	Width (m)	80.000	Inf Depth (m)	
Porosity	0.33	Length (m)	10.000		

Node 24 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	43.700	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	1072	Depth (m)	0.375
Safety Factor	2.0	Width (m)	42.500	Inf Depth (m)	
Porosity	0.33	Length (m)	10.000		

Node 15 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	43.700	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	1072	Depth (m)	0.375
Safety Factor	2.0	Width (m)	66.500	Inf Depth (m)	
Porosity	0.33	Length (m)	10.000		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	109.753	31.056	2 year 2160 minute winter	2.610	1.047
2 year 15 minute winter	77.019	31.056	2 year 2880 minute summer	3.133	0.840
2 year 30 minute summer	70.202	19.865	2 year 2880 minute winter	2.106	0.840
2 year 30 minute winter	49.264	19.865	2 year 4320 minute summer	2.398	0.627
2 year 60 minute summer	46.287	12.232	2 year 4320 minute winter	1.579	0.627
2 year 60 minute winter	30.752	12.232	2 year 5760 minute summer	2.020	0.517
2 year 120 minute summer	33.739	8.916	2 year 5760 minute winter	1.308	0.517
2 year 120 minute winter	22.415	8.916	2 year 7200 minute summer	1.765	0.450
2 year 180 minute summer	27.375	7.044	2 year 7200 minute winter	1.139	0.450
2 year 180 minute winter	17.794	7.044	2 year 8640 minute summer	1.588	0.405
2 year 240 minute summer	22.122	5.846	2 year 8640 minute winter	1.025	0.405
2 year 240 minute winter	14.697	5.846	2 year 10080 minute summer	1.461	0.373
2 year 360 minute summer	17.024	4.381	2 year 10080 minute winter	0.943	0.373
2 year 360 minute winter	11.066	4.381	30 year 15 minute summer	317.101	89.729
2 year 480 minute summer	13.310	3.517	30 year 15 minute winter	222.527	89.729
2 year 480 minute winter	8.843	3.517	30 year 30 minute summer	205.257	58.081
2 year 600 minute summer	10.787	2.950	30 year 30 minute winter	144.040	58.081
2 year 600 minute winter	7.370	2.950	30 year 60 minute summer	135.665	35.852
2 year 720 minute summer	9.510	2.549	30 year 60 minute winter	90.133	35.852
2 year 720 minute winter	6.391	2.549	30 year 120 minute summer	85.608	22.624
2 year 960 minute summer	7.655	2.016	30 year 120 minute winter	56.876	22.624
2 year 960 minute winter	5.071	2.016	30 year 180 minute summer	65.657	16.896
2 year 1440 minute summer	5.395	1.446	30 year 180 minute winter	42.679	16.896
2 year 1440 minute winter	3.626	1.446	30 year 240 minute summer	51.403	13.584
2 year 2160 minute summer	3.788	1.047	30 year 240 minute winter	34.151	13.584

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year 360 minute summer	38.173	9.823	30 year 10080 minute winter	1.564	0.618
30 year 360 minute winter	24.813	9.823	30 year +35% CC 15 minute summer	428.086	121.134
30 year 480 minute summer	29.216	7.721	30 year +35% CC 15 minute winter	300.412	121.134
30 year 480 minute winter	19.410	7.721	30 year +35% CC 30 minute summer	277.097	78.409
30 year 600 minute summer	23.319	6.378	30 year +35% CC 30 minute winter	194.454	78.409
30 year 600 minute winter	15.933	6.378	30 year +35% CC 60 minute summer	183.148	48.401
30 year 720 minute summer	20.315	5.445	30 year +35% CC 60 minute winter	121.679	48.401
30 year 720 minute winter	13.653	5.445	30 year +35% CC 120 minute summer	115.571	30.542
30 year 960 minute summer	16.054	4.227	30 year +35% CC 120 minute winter	76.782	30.542
30 year 960 minute winter	10.634	4.227	30 year +35% CC 180 minute summer	88.637	22.809
30 year 1440 minute summer	11.038	2.958	30 year +35% CC 180 minute winter	57.616	22.809
30 year 1440 minute winter	7.418	2.958	30 year +35% CC 240 minute summer	69.394	18.339
30 year 2160 minute summer	7.514	2.077	30 year +35% CC 240 minute winter	46.104	18.339
30 year 2160 minute winter	5.178	2.077	30 year +35% CC 360 minute summer	51.534	13.261
30 year 2880 minute summer	6.056	1.623	30 year +35% CC 360 minute winter	33.498	13.261
30 year 2880 minute winter	4.070	1.623	30 year +35% CC 480 minute summer	39.441	10.423
30 year 4320 minute summer	4.439	1.161	30 year +35% CC 480 minute winter	26.204	10.423
30 year 4320 minute winter	2.923	1.161	30 year +35% CC 600 minute summer	31.481	8.611
30 year 5760 minute summer	3.612	0.925	30 year +35% CC 600 minute winter	21.510	8.611
30 year 5760 minute winter	2.338	0.925	30 year +35% CC 720 minute summer	27.425	7.350
30 year 7200 minute summer	3.066	0.782	30 year +35% CC 720 minute winter	18.432	7.350
30 year 7200 minute winter	1.979	0.782	30 year +35% CC 960 minute summer	21.672	5.707
30 year 8640 minute summer	2.692	0.687	30 year +35% CC 960 minute winter	14.356	5.707
30 year 8640 minute winter	1.737	0.687	30 year +35% CC 1440 minute summer	14.902	3.994
30 year 10080 minute summer	2.423	0.618	30 year +35% CC 1440 minute winter	10.015	3.994

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +35% CC 2160 minute summer	10.144	2.803	100 year 240 minute winter	45.522	18.107
30 year +35% CC 2160 minute winter	6.990	2.803	100 year 360 minute summer	51.120	13.155
30 year +35% CC 2880 minute summer	8.175	2.191	100 year 360 minute winter	33.229	13.155
30 year +35% CC 2880 minute winter	5.494	2.191	100 year 480 minute summer	39.210	10.362
30 year +35% CC 4320 minute summer	5.993	1.567	100 year 480 minute winter	26.050	10.362
30 year +35% CC 4320 minute winter	3.947	1.567	100 year 600 minute summer	31.309	8.564
30 year +35% CC 5760 minute summer	4.876	1.248	100 year 600 minute winter	21.392	8.564
30 year +35% CC 5760 minute winter	3.156	1.248	100 year 720 minute summer	27.263	7.307
30 year +35% CC 7200 minute summer	4.139	1.056	100 year 720 minute winter	18.322	7.307
30 year +35% CC 7200 minute winter	2.671	1.056	100 year 960 minute summer	21.495	5.660
30 year +35% CC 8640 minute summer	3.634	0.927	100 year 960 minute winter	14.238	5.660
30 year +35% CC 8640 minute winter	2.345	0.927	100 year 1440 minute summer	14.635	3.922
30 year +35% CC 10080 minute summer	3.271	0.835	100 year 1440 minute winter	9.835	3.922
30 year +35% CC 10080 minute winter	2.111	0.835	100 year 2160 minute summer	9.815	2.713
100 year 15 minute summer	414.357	117.249	100 year 2160 minute winter	6.763	2.713
100 year 15 minute winter	290.777	117.249	100 year 2880 minute summer	7.806	2.092
100 year 30 minute summer	271.135	76.722	100 year 2880 minute winter	5.246	2.092
100 year 30 minute winter	190.270	76.722	100 year 4320 minute summer	5.582	1.459
100 year 60 minute summer	179.989	47.566	100 year 4320 minute winter	3.676	1.459
100 year 60 minute winter	119.581	47.566	100 year 5760 minute summer	4.447	1.138
100 year 120 minute summer	113.168	29.907	100 year 5760 minute winter	2.878	1.138
100 year 120 minute winter	75.186	29.907	100 year 7200 minute summer	3.711	0.947
100 year 180 minute summer	87.176	22.433	100 year 7200 minute winter	2.395	0.947
100 year 180 minute winter	56.666	22.433	100 year 8640 minute summer	3.212	0.819
100 year 240 minute summer	68.518	18.107	100 year 8640 minute winter	2.073	0.819

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year 10080 minute summer	2.857	0.729	100 year +40% CC 720 minute summer	38.168	10.229
100 year 10080 minute winter	1.844	0.729	100 year +40% CC 720 minute winter	25.651	10.229
100 year +40% CC 15 minute summer	580.100	164.148	100 year +40% CC 960 minute summer	30.092	7.924
100 year +40% CC 15 minute winter	407.088	164.148	100 year +40% CC 960 minute winter	19.934	7.924
100 year +40% CC 30 minute summer	379.589	107.411	100 year +40% CC 1440 minute summer	20.488	5.491
100 year +40% CC 30 minute winter	266.378	107.411	100 year +40% CC 1440 minute winter	13.769	5.491
100 year +40% CC 60 minute summer	251.985	66.592	100 year +40% CC 2160 minute summer	13.742	3.798
100 year +40% CC 60 minute winter	167.413	66.592	100 year +40% CC 2160 minute winter	9.468	3.798
100 year +40% CC 120 minute summer	158.436	41.870	100 year +40% CC 2880 minute summer	10.928	2.929
100 year +40% CC 120 minute winter	105.261	41.870	100 year +40% CC 2880 minute winter	7.345	2.929
100 year +40% CC 180 minute summer	122.046	31.407	100 year +40% CC 4320 minute summer	7.815	2.043
100 year +40% CC 180 minute winter	79.333	31.407	100 year +40% CC 4320 minute winter	5.147	2.043
100 year +40% CC 240 minute summer	95.926	25.350	100 year +40% CC 5760 minute summer	6.226	1.594
100 year +40% CC 240 minute winter	63.731	25.350	100 year +40% CC 5760 minute winter	4.030	1.594
100 year +40% CC 360 minute summer	71.568	18.417	100 year +40% CC 7200 minute summer	5.196	1.325
100 year +40% CC 360 minute winter	46.521	18.417	100 year +40% CC 7200 minute winter	3.353	1.325
100 year +40% CC 480 minute summer	54.894	14.507	100 year +40% CC 8640 minute summer	4.496	1.147
100 year +40% CC 480 minute winter	36.470	14.507	100 year +40% CC 8640 minute winter	2.902	1.147
100 year +40% CC 600 minute summer	43.832	11.989	100 year +40% CC 10080 minute summer	3.999	1.020
100 year +40% CC 600 minute winter	29.949	11.989	100 year +40% CC 10080 minute winter	2.581	1.020

Results for 2 year Critical Storm Duration. Lowest mass balance: 95.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	44.531	0.031	1.7	0.0144	0.0000	OK
15 minute summer	2	11	44.235	0.045	3.3	0.0166	0.0000	OK
15 minute summer	3	11	44.156	0.056	4.9	0.0197	0.0000	OK
15 minute summer	4	11	43.885	0.045	6.5	0.0140	0.0000	OK
15 minute summer	5	10	44.482	0.032	1.7	0.0136	0.0000	OK
15 minute summer	6	10	44.238	0.028	3.4	0.0091	0.0000	OK
15 minute summer	8	10	43.832	0.032	1.7	0.0119	0.0000	OK
15 minute summer	9	10	43.762	0.047	3.4	0.0167	0.0000	OK
15 minute summer	10	10	43.554	0.049	8.3	0.0208	0.0000	OK
15 minute summer	11	10	43.732	0.032	1.7	0.0114	0.0000	OK
15 minute summer	12	10	43.701	0.046	3.4	0.0160	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	1	1.000	2	1.6	0.473	0.093	0.1101	
15 minute summer	2	1.001	3	3.3	0.627	0.185	0.0474	
15 minute summer	3	1.002	4	4.9	0.944	0.276	0.1344	
15 minute summer	4	1.003	15	6.5	1.529	0.177	0.0401	
15 minute summer	5	2.000	6	1.7	0.663	0.094	0.0606	
15 minute summer	6	2.001	10	3.3	1.492	0.071	0.0181	
15 minute summer	8	3.000	9	1.7	0.457	0.098	0.0337	
15 minute summer	9	3.001	10	3.3	0.735	0.188	0.0277	
15 minute summer	10	2.002	14	8.2	0.658	0.060	0.1211	
15 minute summer	11	4.000	12	1.7	0.459	0.097	0.0174	
15 minute summer	12	4.001	13	3.3	0.625	0.192	0.0504	

Results for 2 year Critical Storm Duration. Lowest mass balance: 95.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	13	10	43.622	0.057	5.0	0.0187	0.0000	OK
15 minute summer	14	11	43.452	0.092	14.9	0.0128	0.0000	OK
15 minute summer	15	11	43.417	0.127	26.5	0.0848	0.0000	OK
15 minute summer	16	10	43.342	0.092	31.6	0.0653	0.0000	OK
15 minute summer	18	12	43.484	0.014	0.3	0.0030	0.0000	OK
15 minute summer	19	12	43.339	0.019	0.6	0.0040	0.0000	OK
15 minute summer	20	12	43.464	0.014	0.3	0.0030	0.0000	OK
15 minute summer	21	12	43.409	0.019	0.6	0.0041	0.0000	OK
15 minute summer	22	12	43.313	0.023	0.9	0.0048	0.0000	OK
360 minute winter	23	336	43.290	0.070	0.6	0.0141	0.0000	OK
360 minute winter	24	336	43.290	0.330	7.2	0.2350	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	13	4.002	14	4.9	0.840	0.281	0.0330	
15 minute summer	14	2.003	15	14.9	0.643	0.205	0.3767	
15 minute summer	15	1.004	16	26.6	1.150	0.374	0.2244	
15 minute summer	16	1.005	24	31.8	0.997	0.204	0.4738	
15 minute summer	18	5.000	19	0.3	0.294	0.017	0.0152	
15 minute summer	19	5.001	23	0.6	0.298	0.035	0.0220	
15 minute summer	20	6.000	21	0.3	0.292	0.017	0.0062	
15 minute summer	21	6.001	22	0.6	0.400	0.035	0.0160	
15 minute summer	22	6.002	23	0.9	0.405	0.051	0.0160	
360 minute winter	23	5.002	24	0.6	0.461	0.034	0.1437	
360 minute winter	24	1.006	28	7.2	0.550	0.102	0.7855	

Results for 2 year Critical Storm Duration. Lowest mass balance: 95.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	25	10	43.931	0.031	1.7	0.0164	0.0000	OK
15 minute summer	26	11	43.742	0.047	3.4	0.0197	0.0000	OK
15 minute summer	27	11	43.486	0.031	4.9	0.0124	0.0000	OK
360 minute winter	28	336	43.291	0.376	8.4	0.0474	0.0000	SURCHARGED
360 minute winter	29	336	43.288	0.388	9.2	0.2509	0.0000	SURCHARGED
15 minute summer	30	10	44.182	0.032	1.7	0.0165	0.0000	OK
360 minute winter	31	336	43.289	0.504	10.0	0.3198	0.0000	SURCHARGED
360 minute winter	32	336	43.289	0.564	10.3	63.7629	0.0000	SURCHARGED
15 minute summer	S3	1	42.715	0.000	1.7	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	25	7.000	26	1.7	0.462	0.096	0.0784	
15 minute summer	26	7.001	27	3.3	0.905	0.185	0.0878	
15 minute summer	27	7.002	28	4.9	1.704	0.095	0.0206	
360 minute winter	28	1.007	29	8.3	0.602	0.118	0.2627	
360 minute winter	29	1.008	31	8.8	0.484	0.126	2.0588	
15 minute summer	30	8.000	31	1.6	0.617	0.094	0.0470	
360 minute winter	31	1.009	32	9.4	0.733	0.138	1.1069	
360 minute winter	32	Hydro-Brake®	S3	1.7				95.1

Results for 30 year Critical Storm Duration. Lowest mass balance: 95.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	44.553	0.053	4.9	0.0250	0.0000	OK
15 minute summer	2	11	44.276	0.086	9.7	0.0315	0.0000	OK
15 minute summer	3	10	44.208	0.108	14.4	0.0377	0.0000	OK
15 minute summer	4	11	43.930	0.090	19.1	0.0282	0.0000	OK
15 minute summer	5	10	44.506	0.056	4.9	0.0237	0.0000	OK
15 minute summer	6	10	44.258	0.048	9.7	0.0156	0.0000	OK
15 minute summer	8	10	43.855	0.055	4.9	0.0205	0.0000	OK
480 minute summer	9	488	43.809	0.094	1.6	0.0335	0.0000	OK
480 minute summer	10	488	43.809	0.304	4.0	0.1279	0.0000	SURCHARGED
480 minute summer	11	480	43.810	0.110	0.8	0.0389	0.0000	OK
480 minute summer	12	480	43.809	0.154	1.6	0.0534	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	1	1.000	2	4.8	0.604	0.273	0.2502	
15 minute summer	2	1.001	3	9.6	0.798	0.540	0.1082	
15 minute summer	3	1.002	4	14.4	1.199	0.807	0.3166	
15 minute summer	4	1.003	15	19.1	1.742	0.519	0.1347	
15 minute summer	5	2.000	6	4.8	0.911	0.273	0.1297	
15 minute summer	6	2.001	10	10.2	1.951	0.218	0.0610	
15 minute summer	8	3.000	9	4.9	0.592	0.284	0.0751	
480 minute summer	9	3.001	10	1.6	0.604	0.091	0.0899	
480 minute summer	10	2.002	14	4.0	0.514	0.029	0.6617	
480 minute summer	11	4.000	12	0.8	0.383	0.046	0.0743	
480 minute summer	12	4.001	13	1.6	0.520	0.092	0.1663	

Results for 30 year Critical Storm Duration. Lowest mass balance: 95.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute summer	13	480	43.809	0.244	2.4	0.0807	0.0000	SURCHARGED
480 minute summer	14	496	43.809	0.449	7.2	0.0624	0.0000	SURCHARGED
480 minute summer	15	480	43.809	0.519	11.8	23.1828	0.0000	SURCHARGED
480 minute summer	16	480	43.809	0.559	13.5	0.3969	0.0000	SURCHARGED
480 minute summer	18	480	43.809	0.339	0.5	0.0756	0.0000	SURCHARGED
480 minute summer	19	480	43.809	0.489	0.8	0.1027	0.0000	SURCHARGED
480 minute summer	20	472	43.809	0.359	0.3	0.0794	0.0000	SURCHARGED
480 minute summer	21	472	43.809	0.419	0.4	0.0901	0.0000	SURCHARGED
480 minute summer	22	472	43.809	0.519	0.5	0.1079	0.0000	SURCHARGED
480 minute summer	23	480	43.809	0.589	1.0	0.1178	0.0000	SURCHARGED
480 minute summer	24	488	43.809	0.849	15.2	15.1983	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)
480 minute summer	13	4.002	14	2.4	0.689	0.136	0.0984	
480 minute summer	14	2.003	15	6.2	0.488	0.085	1.1390	
480 minute summer	15	1.004	16	11.1	0.850	0.156	0.6800	
480 minute summer	16	1.005	24	12.8	0.696	0.082	1.0393	
480 minute summer	18	5.000	19	-0.3	0.209	-0.018	0.2566	
480 minute summer	19	5.001	23	-0.5	0.215	-0.029	0.1855	
480 minute summer	20	6.000	21	0.2	0.208	0.011	0.1046	
480 minute summer	21	6.001	22	0.2	0.287	0.014	0.1872	
480 minute summer	22	6.002	23	0.3	0.292	0.019	0.1232	
480 minute summer	23	5.002	24	-0.7	0.461	-0.040	0.1969	
480 minute summer	24	1.006	28	14.3	0.535	0.204	0.7855	

Results for 30 year Critical Storm Duration. Lowest mass balance: 95.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	25	10	43.954	0.054	4.9	0.0283	0.0000	OK
480 minute summer	26	488	43.810	0.115	1.6	0.0488	0.0000	OK
480 minute summer	27	488	43.810	0.355	2.4	0.1405	0.0000	SURCHARGED
480 minute summer	28	488	43.812	0.897	17.4	0.1130	0.0000	SURCHARGED
480 minute summer	29	472	43.811	0.911	19.5	0.5892	0.0000	SURCHARGED
15 minute summer	30	10	44.206	0.056	4.9	0.0291	0.0000	OK
480 minute summer	31	472	43.810	1.025	22.6	0.6496	0.0000	SURCHARGED
480 minute summer	32	480	43.809	1.084	24.8	123.5640	0.0000	SURCHARGED
15 minute summer	S3	1	42.715	0.000	1.7	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	25	7.000	26	4.8	0.636	0.280	0.1683	
480 minute summer	26	7.001	27	1.6	0.732	0.090	0.3853	
480 minute summer	27	7.002	28	2.4	1.184	0.046	0.0832	
480 minute summer	28	1.007	29	17.1	0.548	0.244	0.2627	
480 minute summer	29	1.008	31	19.4	0.470	0.280	2.0588	
15 minute summer	30	8.000	31	4.8	0.830	0.277	0.1027	
480 minute summer	31	1.009	32	22.4	0.788	0.327	1.1069	
480 minute summer	32	Hydro-Brake®	S3	1.8				187.1

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 95.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	44.563	0.063	6.6	0.0293	0.0000	OK
15 minute summer	2	11	44.304	0.114	13.1	0.0418	0.0000	OK
15 minute summer	3	11	44.263	0.163	19.3	0.0570	0.0000	SURCHARGED
15 minute summer	4	11	43.959	0.119	24.9	0.0372	0.0000	OK
15 minute summer	5	10	44.516	0.066	6.6	0.0281	0.0000	OK
15 minute summer	6	10	44.264	0.054	13.1	0.0178	0.0000	OK
360 minute winter	8	352	43.908	0.108	0.9	0.0406	0.0000	OK
360 minute winter	9	352	43.908	0.193	1.8	0.0689	0.0000	SURCHARGED
360 minute winter	10	352	43.907	0.402	4.5	0.1694	0.0000	SURCHARGED
15 minute summer	11	11	43.937	0.237	6.6	0.0838	0.0000	SURCHARGED
15 minute summer	12	11	43.928	0.273	12.4	0.0943	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	1	1.000	2	6.5	0.637	0.368	0.3317	
15 minute summer	2	1.001	3	12.7	0.815	0.715	0.1444	
15 minute summer	3	1.002	4	18.5	1.178	1.037	0.4193	
15 minute summer	4	1.003	15	24.6	1.871	0.666	0.1530	
15 minute summer	5	2.000	6	6.5	0.988	0.369	0.1600	
15 minute summer	6	2.001	10	13.0	1.956	0.280	0.0947	
360 minute winter	8	3.000	9	0.9	0.400	0.053	0.1423	
360 minute winter	9	3.001	10	1.8	0.623	0.103	0.1083	
360 minute winter	10	2.002	14	4.4	0.519	0.032	0.6617	
15 minute summer	11	4.000	12	6.1	0.559	0.353	0.0833	
15 minute summer	12	4.001	13	12.1	0.782	0.699	0.1663	

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 95.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	13	352	43.907	0.342	2.7	0.1132	0.0000	SURCHARGED
360 minute winter	14	352	43.908	0.548	7.8	0.0761	0.0000	SURCHARGED
360 minute winter	15	352	43.907	0.617	14.0	44.8411	0.0000	SURCHARGED
360 minute winter	16	352	43.907	0.657	14.8	0.4667	0.0000	SURCHARGED
360 minute winter	18	352	43.908	0.438	0.6	0.0976	0.0000	SURCHARGED
360 minute winter	19	352	43.908	0.588	0.9	0.1234	0.0000	SURCHARGED
360 minute winter	20	352	43.907	0.457	0.3	0.1010	0.0000	SURCHARGED
360 minute winter	21	352	43.907	0.517	0.4	0.1112	0.0000	SURCHARGED
360 minute winter	22	352	43.907	0.617	0.6	0.1284	0.0000	SURCHARGED
360 minute winter	23	352	43.907	0.687	1.0	0.1375	0.0000	SURCHARGED
360 minute winter	24	352	43.907	0.947	17.2	29.0284	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)
360 minute winter	13	4.002	14	2.5	0.689	0.140	0.0984	
360 minute winter	14	2.003	15	7.7	0.489	0.106	1.1390	
360 minute winter	15	1.004	16	12.1	0.851	0.170	0.6800	
360 minute winter	16	1.005	24	14.5	0.695	0.093	1.0393	
360 minute winter	18	5.000	19	-0.4	0.209	-0.022	0.2566	
360 minute winter	19	5.001	23	-0.5	0.215	-0.030	0.1855	
360 minute winter	20	6.000	21	0.2	0.208	0.011	0.1046	
360 minute winter	21	6.001	22	0.4	0.287	0.023	0.1872	
360 minute winter	22	6.002	23	0.6	0.292	0.033	0.1232	
360 minute winter	23	5.002	24	1.0	0.461	0.057	0.1969	
360 minute winter	24	1.006	28	16.4	0.550	0.234	0.7855	

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 95.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	25	10	43.964	0.064	6.6	0.0333	0.0000	OK
360 minute winter	26	368	43.907	0.212	1.8	0.0897	0.0000	SURCHARGED
360 minute winter	27	352	43.908	0.453	2.7	0.1794	0.0000	SURCHARGED
360 minute winter	28	360	43.909	0.994	19.6	0.1253	0.0000	SURCHARGED
360 minute winter	29	352	43.907	1.007	22.1	0.6515	0.0000	SURCHARGED
15 minute summer	30	10	44.216	0.066	6.6	0.0344	0.0000	OK
360 minute winter	31	360	43.907	1.122	25.4	0.7114	0.0000	SURCHARGED
360 minute winter	32	360	43.907	1.182	28.0	160.6043	0.0000	SURCHARGED
15 minute summer	S3	1	42.715	0.000	1.7	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	25	7.000	26	6.5	0.665	0.377	0.2421	
360 minute winter	26	7.001	27	1.8	0.732	0.101	0.4225	
360 minute winter	27	7.002	28	2.6	1.184	0.050	0.0832	
360 minute winter	28	1.007	29	19.4	0.602	0.276	0.2627	
360 minute winter	29	1.008	31	21.8	0.563	0.315	2.0588	
15 minute summer	30	8.000	31	6.5	0.896	0.373	0.1281	
360 minute winter	31	1.009	32	25.3	0.862	0.370	1.1069	
360 minute winter	32	Hydro-Brake®	S3	1.9				190.6

Results for 100 year Critical Storm Duration. Lowest mass balance: 95.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	44.562	0.062	6.4	0.0288	0.0000	OK
15 minute summer	2	11	44.295	0.105	12.7	0.0387	0.0000	OK
15 minute summer	3	11	44.246	0.146	18.7	0.0510	0.0000	OK
15 minute summer	4	11	43.957	0.117	24.5	0.0364	0.0000	OK
15 minute summer	5	10	44.515	0.065	6.4	0.0276	0.0000	OK
15 minute summer	6	10	44.263	0.053	12.7	0.0175	0.0000	OK
360 minute winter	8	352	43.902	0.102	0.9	0.0382	0.0000	OK
360 minute winter	9	352	43.901	0.186	1.8	0.0664	0.0000	SURCHARGED
720 minute winter	10	690	43.902	0.397	2.5	0.1670	0.0000	SURCHARGED
15 minute summer	11	11	43.921	0.221	6.4	0.0782	0.0000	SURCHARGED
15 minute summer	12	11	43.912	0.257	12.7	0.0890	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	1	1.000	2	6.3	0.633	0.356	0.3115	
15 minute summer	2	1.001	3	12.4	0.816	0.699	0.1387	
15 minute summer	3	1.002	4	18.3	1.186	1.027	0.4138	
15 minute summer	4	1.003	15	24.3	1.857	0.659	0.1516	
15 minute summer	5	2.000	6	6.3	0.979	0.358	0.1564	
15 minute summer	6	2.001	10	12.7	1.936	0.272	0.0919	
360 minute winter	8	3.000	9	0.9	0.400	0.053	0.1381	
360 minute winter	9	3.001	10	1.8	0.623	0.103	0.1083	
720 minute winter	10	2.002	14	2.5	0.436	0.018	0.6617	
15 minute summer	11	4.000	12	6.3	0.571	0.362	0.0833	
15 minute summer	12	4.001	13	11.8	0.776	0.680	0.1663	

Results for 100 year Critical Storm Duration. Lowest mass balance: 95.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	13	690	43.901	0.336	1.5	0.1114	0.0000	SURCHARGED
360 minute winter	14	360	43.901	0.541	7.6	0.0752	0.0000	SURCHARGED
360 minute winter	15	360	43.900	0.610	14.8	43.2016	0.0000	SURCHARGED
360 minute winter	16	360	43.900	0.650	14.3	0.4615	0.0000	SURCHARGED
360 minute winter	18	360	43.900	0.430	0.2	0.0960	0.0000	SURCHARGED
360 minute winter	19	360	43.900	0.580	0.4	0.1218	0.0000	SURCHARGED
360 minute winter	20	360	43.900	0.450	0.3	0.0994	0.0000	SURCHARGED
360 minute winter	21	360	43.900	0.510	0.6	0.1096	0.0000	SURCHARGED
360 minute winter	22	360	43.900	0.610	0.8	0.1269	0.0000	SURCHARGED
360 minute winter	23	360	43.900	0.680	1.0	0.1360	0.0000	SURCHARGED
360 minute winter	24	360	43.900	0.940	16.7	28.0279	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)
720 minute winter	13	4.002	14	1.5	0.565	0.085	0.0984	
360 minute winter	14	2.003	15	7.5	0.499	0.103	1.1390	
360 minute winter	15	1.004	16	11.7	0.850	0.164	0.6800	
360 minute winter	16	1.005	24	14.1	0.700	0.090	1.0393	
360 minute winter	18	5.000	19	0.1	0.209	0.008	0.2566	
360 minute winter	19	5.001	23	0.3	0.215	0.016	0.1855	
360 minute winter	20	6.000	21	0.2	0.208	0.010	0.1046	
360 minute winter	21	6.001	22	-0.4	0.287	-0.023	0.1872	
360 minute winter	22	6.002	23	-0.6	0.292	-0.031	0.1232	
360 minute winter	23	5.002	24	0.8	0.461	0.048	0.1969	
360 minute winter	24	1.006	28	16.0	0.550	0.228	0.7855	

Results for 100 year Critical Storm Duration. Lowest mass balance: 95.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	25	10	43.963	0.063	6.4	0.0327	0.0000	OK
360 minute winter	26	352	43.901	0.206	1.8	0.0872	0.0000	SURCHARGED
360 minute winter	27	360	43.901	0.446	2.7	0.1766	0.0000	SURCHARGED
360 minute winter	28	360	43.903	0.988	19.3	0.1244	0.0000	SURCHARGED
360 minute winter	29	368	43.901	1.001	22.2	0.6475	0.0000	SURCHARGED
15 minute summer	30	10	44.215	0.065	6.4	0.0338	0.0000	OK
360 minute winter	31	352	43.899	1.114	25.0	0.7064	0.0000	SURCHARGED
360 minute winter	32	352	43.899	1.174	27.4	157.6938	0.0000	SURCHARGED
15 minute summer	S3	1	42.715	0.000	1.7	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	25	7.000	26	6.3	0.678	0.366	0.2214	
360 minute winter	26	7.001	27	1.8	0.707	0.101	0.4225	
360 minute winter	27	7.002	28	2.6	1.184	0.050	0.0832	
360 minute winter	28	1.007	29	19.6	0.602	0.280	0.2627	
360 minute winter	29	1.008	31	21.5	0.563	0.310	2.0588	
15 minute summer	30	8.000	31	6.3	0.889	0.361	0.1251	
360 minute winter	31	1.009	32	24.8	0.862	0.363	1.1069	
360 minute winter	32	Hydro-Brake®	S3	1.9				189.4

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 95.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	12	44.672	0.172	9.0	0.0803	0.0000	SURCHARGED
15 minute summer	2	12	44.613	0.423	17.9	0.1551	0.0000	SURCHARGED
15 minute summer	3	12	44.538	0.438	21.8	0.1533	0.0000	SURCHARGED
15 minute summer	4	12	44.125	0.285	29.2	0.0890	0.0000	SURCHARGED
15 minute summer	5	10	44.529	0.079	9.0	0.0338	0.0000	OK
15 minute summer	6	10	44.274	0.064	17.9	0.0211	0.0000	OK
480 minute winter	8	472	44.080	0.280	1.0	0.1049	0.0000	SURCHARGED
480 minute winter	9	472	44.079	0.364	2.0	0.1300	0.0000	SURCHARGED
480 minute winter	10	480	44.080	0.575	4.8	0.2422	0.0000	SURCHARGED
15 minute summer	11	11	44.136	0.436	9.0	0.1543	0.0000	SURCHARGED
15 minute summer	12	11	44.120	0.465	16.7	0.1609	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	1	1.000	2	8.9	0.657	0.503	0.5497	
15 minute summer	2	1.001	3	14.1	0.814	0.796	0.1590	
15 minute summer	3	1.002	4	20.7	1.178	1.162	0.4528	
15 minute summer	4	1.003	15	28.5	1.804	0.773	0.1652	
15 minute summer	5	2.000	6	8.9	1.069	0.504	0.2017	
15 minute summer	6	2.001	10	17.8	2.124	0.382	0.1015	
480 minute winter	8	3.000	9	1.0	0.399	0.058	0.1604	
480 minute winter	9	3.001	10	1.8	0.603	0.105	0.1083	
480 minute winter	10	2.002	14	4.8	0.491	0.035	0.6617	
15 minute summer	11	4.000	12	8.1	0.572	0.467	0.0833	
15 minute summer	12	4.001	13	16.2	0.918	0.933	0.1663	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 95.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	13	480	44.080	0.515	2.9	0.1703	0.0000	SURCHARGED
480 minute winter	14	472	44.078	0.718	8.6	0.0998	0.0000	SURCHARGED
480 minute winter	15	480	44.081	0.791	15.6	81.8352	0.0000	SURCHARGED
480 minute winter	16	472	44.080	0.830	13.5	0.5890	0.0000	SURCHARGED
480 minute winter	18	472	44.082	0.612	0.4	0.1364	0.0000	FLOOD RISK
480 minute winter	19	472	44.081	0.761	0.6	0.1599	0.0000	FLOOD RISK
480 minute winter	20	480	44.081	0.631	0.3	0.1395	0.0000	FLOOD RISK
480 minute winter	21	480	44.081	0.691	0.7	0.1486	0.0000	FLOOD RISK
480 minute winter	22	480	44.081	0.791	0.9	0.1645	0.0000	FLOOD RISK
480 minute winter	23	472	44.081	0.861	1.0	0.1722	0.0000	SURCHARGED
480 minute winter	24	480	44.080	1.120	15.8	52.7620	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)
480 minute winter	13	4.002	14	2.9	0.661	0.162	0.0984	
480 minute winter	14	2.003	15	8.6	0.452	0.118	1.1390	
480 minute winter	15	1.004	16	11.0	0.804	0.155	0.6800	
480 minute winter	16	1.005	24	13.3	0.691	0.085	1.0393	
480 minute winter	18	5.000	19	-0.3	0.209	-0.017	0.2566	
480 minute winter	19	5.001	23	-0.5	0.215	-0.026	0.1855	
480 minute winter	20	6.000	21	0.2	0.208	0.009	0.1046	
480 minute winter	21	6.001	22	-0.6	0.287	-0.034	0.1872	
480 minute winter	22	6.002	23	-0.8	0.292	-0.045	0.1232	
480 minute winter	23	5.002	24	1.0	0.461	0.056	0.1969	
480 minute winter	24	1.006	28	15.3	0.501	0.218	0.7855	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 95.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	25	12	44.093	0.193	9.0	0.1009	0.0000	SURCHARGED
480 minute winter	26	472	44.082	0.387	2.0	0.1640	0.0000	SURCHARGED
480 minute winter	27	472	44.080	0.625	2.9	0.2476	0.0000	SURCHARGED
480 minute winter	28	472	44.081	1.166	18.0	0.1470	0.0000	SURCHARGED
480 minute winter	29	480	44.081	1.181	20.7	0.7644	0.0000	SURCHARGED
15 minute summer	30	10	44.229	0.079	9.0	0.0415	0.0000	OK
480 minute winter	31	472	44.080	1.295	23.4	0.8210	0.0000	SURCHARGED
480 minute winter	32	472	44.079	1.354	25.7	208.3422	0.0000	SURCHARGED
15 minute summer	S3	1	42.715	0.000	1.8	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	25	7.000	26	8.3	0.681	0.478	0.3792	
480 minute winter	26	7.001	27	1.9	0.703	0.106	0.4225	
480 minute winter	27	7.002	28	2.8	1.098	0.055	0.0832	
480 minute winter	28	1.007	29	18.2	0.543	0.260	0.2627	
480 minute winter	29	1.008	31	20.1	0.563	0.290	2.0588	
15 minute summer	30	8.000	31	8.9	0.967	0.509	0.1620	
480 minute winter	31	1.009	32	23.2	0.883	0.339	1.1069	
480 minute winter	32	Hydro-Brake®	S3	2.0				216.6

Simulation Settings

Rainfall Methodology	FEH-22	Drain Down Time (mins)	1440	30 year (l/s)	8.5
Summer CV	0.950	Additional Storage (m³/ha)	20.0	100 year (l/s)	11.2
Winter CV	0.950	Check Discharge Rate(s)	✓	Check Discharge Volume	✓
Analysis Speed	Normal	1 year (l/s)	3.0	100 year 360 minute (m³)	169
Skip Steady State	✓	2 year (l/s)	3.1		

Storm Durations

15	30	60	120	180	240	360

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	0	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Region	6	QBar	2.0
Greenfield Method	IH124	Growth Factor 1 year	0.85	Q 1 year (l/s)	1.7
Positively Drained Area (ha)	0.466	Growth Factor 2 year	0.88	Q 2 year (l/s)	1.8
SAAR (mm)	644	Growth Factor 30 year	2.40	Q 30 year (l/s)	4.9
Soil Index	4	Growth Factor 100 year	3.19	Q 100 year (l/s)	6.5
SPR	0.47	Betterment (%)	0		

Pre-development Discharge Volume

Site Makeup	Greenfield	SPR	0.47	Storm Duration (mins)	360
Greenfield Method	FSR/FEH	CWI	96.889	Betterment (%)	0
Positively Drained Area (ha)	0.466	Return Period (years)	100	PR	0.458
Soil Index	4	Climate Change (%)	0	Runoff Volume (m³)	169

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.24%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	44.562	0.062	6.4	0.0288	0.0000	OK
15 minute summer	2	11	44.295	0.105	12.7	0.0387	0.0000	OK
15 minute summer	3	11	44.246	0.146	18.7	0.0510	0.0000	OK
15 minute summer	4	11	43.957	0.117	24.5	0.0364	0.0000	OK
15 minute summer	5	10	44.515	0.065	6.4	0.0276	0.0000	OK
15 minute summer	6	10	44.263	0.053	12.7	0.0175	0.0000	OK
360 minute winter	8	352	43.902	0.102	0.9	0.0382	0.0000	OK
360 minute winter	9	352	43.901	0.186	1.8	0.0664	0.0000	SURCHARGED
360 minute winter	10	352	43.901	0.396	4.5	0.1665	0.0000	SURCHARGED
15 minute summer	11	11	43.921	0.221	6.4	0.0782	0.0000	SURCHARGED
15 minute summer	12	11	43.912	0.257	12.7	0.0890	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	1	1.000	2	6.3	0.633	0.356	0.3115	
15 minute summer	2	1.001	3	12.4	0.816	0.699	0.1387	
15 minute summer	3	1.002	4	18.3	1.186	1.027	0.4138	
15 minute summer	4	1.003	15	24.3	1.857	0.659	0.1516	
15 minute summer	5	2.000	6	6.3	0.979	0.358	0.1564	
15 minute summer	6	2.001	10	12.7	1.936	0.272	0.0919	
360 minute winter	8	3.000	9	0.9	0.400	0.053	0.1381	
360 minute winter	9	3.001	10	1.8	0.623	0.103	0.1083	
360 minute winter	10	2.002	14	4.3	0.515	0.031	0.6617	
15 minute summer	11	4.000	12	6.3	0.571	0.362	0.0833	
15 minute summer	12	4.001	13	11.8	0.776	0.680	0.1663	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.24%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	13	352	43.901	0.336	2.7	0.1111	0.0000	SURCHARGED
360 minute winter	14	360	43.901	0.541	7.6	0.0752	0.0000	SURCHARGED
360 minute winter	15	360	43.900	0.610	14.8	43.2016	0.0000	SURCHARGED
360 minute winter	16	360	43.900	0.650	14.3	0.4615	0.0000	SURCHARGED
360 minute winter	18	360	43.900	0.430	0.2	0.0960	0.0000	SURCHARGED
360 minute winter	19	360	43.900	0.580	0.4	0.1218	0.0000	SURCHARGED
360 minute winter	20	360	43.900	0.450	0.3	0.0994	0.0000	SURCHARGED
360 minute winter	21	360	43.900	0.510	0.6	0.1096	0.0000	SURCHARGED
360 minute winter	22	360	43.900	0.610	0.8	0.1269	0.0000	SURCHARGED
360 minute winter	23	360	43.900	0.680	1.0	0.1360	0.0000	SURCHARGED
360 minute winter	24	360	43.900	0.940	16.7	28.0279	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)
360 minute winter	13	4.002	14	2.6	0.687	0.145	0.0984	
360 minute winter	14	2.003	15	7.5	0.499	0.103	1.1390	
360 minute winter	15	1.004	16	11.7	0.850	0.164	0.6800	
360 minute winter	16	1.005	24	14.1	0.700	0.090	1.0393	
360 minute winter	18	5.000	19	0.1	0.209	0.008	0.2566	
360 minute winter	19	5.001	23	0.3	0.215	0.016	0.1855	
360 minute winter	20	6.000	21	0.2	0.208	0.010	0.1046	
360 minute winter	21	6.001	22	-0.4	0.287	-0.023	0.1872	
360 minute winter	22	6.002	23	-0.6	0.292	-0.031	0.1232	
360 minute winter	23	5.002	24	0.8	0.461	0.048	0.1969	
360 minute winter	24	1.006	28	16.0	0.550	0.228	0.7855	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.24%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	25	10	43.963	0.063	6.4	0.0327	0.0000	OK
360 minute winter	26	352	43.901	0.206	1.8	0.0872	0.0000	SURCHARGED
360 minute winter	27	360	43.901	0.446	2.7	0.1766	0.0000	SURCHARGED
360 minute winter	28	360	43.903	0.988	19.3	0.1244	0.0000	SURCHARGED
360 minute winter	29	368	43.901	1.001	22.2	0.6475	0.0000	SURCHARGED
15 minute summer	30	10	44.215	0.065	6.4	0.0338	0.0000	OK
360 minute winter	31	352	43.899	1.114	25.0	0.7064	0.0000	SURCHARGED
360 minute winter	32	352	43.899	1.174	27.4	157.6938	0.0000	SURCHARGED
15 minute summer	S3	1	42.715	0.000	1.7	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	25	7.000	26	6.3	0.678	0.366	0.2214	
360 minute winter	26	7.001	27	1.8	0.707	0.101	0.4225	
360 minute winter	27	7.002	28	2.6	1.184	0.050	0.0832	
360 minute winter	28	1.007	29	19.6	0.602	0.280	0.2627	
360 minute winter	29	1.008	31	21.5	0.563	0.310	2.0588	
15 minute summer	30	8.000	31	6.3	0.889	0.361	0.1251	
360 minute winter	31	1.009	32	24.8	0.862	0.363	1.1069	
360 minute winter	32	Hydro-Brake®	S3	1.9				189.4

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	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
51	0.008	5.00	44.000	450	509506.513	186919.429	0.900
52	0.008	5.00	44.000	450	509506.352	186906.475	1.030
53	0.008	5.00	44.000	450	509486.897	186919.228	0.650
54	0.008	5.00	44.050	450	509486.894	186906.471	0.830
55	0.008	5.00	44.050	450	509490.854	186906.501	1.235
56	0.008	5.00	43.850	450	509476.152	186891.175	0.850
57	0.008	5.00	43.850	450	509476.090	186902.378	0.965
58	0.008	5.00	43.850	450	509490.846	186902.375	1.115
59	0.008	5.00	43.850	450	509477.240	186878.267	0.850
60	0.009	5.00	43.850	450	509490.930	186878.441	0.990
61	0.010	5.00	43.950	450	509491.026	186887.761	1.440
62			43.550	1200	509502.028	186888.323	1.550
5805			43.590	1	509507.971	186881.693	1.950

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	51	52	12.956	0.600	43.100	42.970	0.130	100.0	150	5.21	50.0
1.001	52	55	15.499	0.600	42.970	42.815	0.155	100.0	150	5.47	50.0
2.000	53	54	12.757	0.600	43.350	43.220	0.130	98.1	150	5.21	50.0
2.001	54	55	3.959	0.600	43.220	43.180	0.040	100.0	150	5.28	50.0
1.002	55	58	4.126	0.600	42.815	42.775	0.040	103.2	150	5.54	50.0
3.000	56	57	11.203	0.600	43.000	42.885	0.115	97.4	150	5.18	50.0
3.001	57	58	14.756	0.600	42.885	42.735	0.150	98.4	150	5.43	50.0
1.003	58	61	14.615	0.600	42.735	42.585	0.150	97.4	150	5.78	50.0
4.000	59	60	13.691	0.600	43.000	42.860	0.140	97.8	150	5.22	50.0
4.001	60	61	9.321	0.600	42.860	42.760	0.100	93.2	150	5.37	50.0
1.004	61	62	11.016	0.600	42.510	42.400	0.110	100.0	225	5.92	50.0
1.005	62	5805	8.903	0.600	42.000	41.640	0.360	24.7	150	5.99	50.0

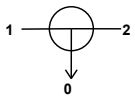
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.005	17.8	1.1	0.750	0.880	0.008	0.0	25	0.552
1.001	1.005	17.8	2.2	0.880	1.085	0.016	0.0	35	0.683
2.000	1.014	17.9	1.1	0.500	0.680	0.008	0.0	25	0.557
2.001	1.005	17.8	2.2	0.680	0.720	0.016	0.0	35	0.683
1.002	0.989	17.5	5.4	1.085	0.925	0.040	0.0	57	0.872
3.000	1.018	18.0	1.1	0.700	0.815	0.008	0.0	25	0.559
3.001	1.013	17.9	2.2	0.815	0.965	0.016	0.0	35	0.689
1.003	1.018	18.0	8.7	0.965	1.215	0.064	0.0	74	1.010
4.000	1.016	18.0	1.1	0.700	0.840	0.008	0.0	25	0.558
4.001	1.041	18.4	2.3	0.840	1.040	0.017	0.0	36	0.715
1.004	1.307	52.0	12.3	1.215	0.925	0.091	0.0	74	1.074
1.005	2.033	35.9	12.3	1.400	1.800	0.091	0.0	61	1.848

Pipeline Schedule

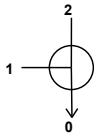
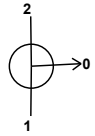
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	12.956	100.0	150	Circular	44.000	43.100	0.750	44.000	42.970	0.880
1.001	15.499	100.0	150	Circular	44.000	42.970	0.880	44.050	42.815	1.085
2.000	12.757	98.1	150	Circular	44.000	43.350	0.500	44.050	43.220	0.680
2.001	3.959	100.0	150	Circular	44.050	43.220	0.680	44.050	43.180	0.720
1.002	4.126	103.2	150	Circular	44.050	42.815	1.085	43.850	42.775	0.925
3.000	11.203	97.4	150	Circular	43.850	43.000	0.700	43.850	42.885	0.815
3.001	14.756	98.4	150	Circular	43.850	42.885	0.815	43.850	42.735	0.965
1.003	14.615	97.4	150	Circular	43.850	42.735	0.965	43.950	42.585	1.215
4.000	13.691	97.8	150	Circular	43.850	43.000	0.700	43.850	42.860	0.840
4.001	9.321	93.2	150	Circular	43.850	42.860	0.840	43.950	42.760	1.040
1.004	11.016	100.0	225	Circular	43.950	42.510	1.215	43.550	42.400	0.925
1.005	8.903	24.7	150	Circular	43.550	42.000	1.400	43.590	41.640	1.800

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	51	450	Manhole	Adoptable	52	450	Manhole	Adoptable
1.001	52	450	Manhole	Adoptable	55	450	Manhole	Adoptable
2.000	53	450	Manhole	Adoptable	54	450	Manhole	Adoptable
2.001	54	450	Manhole	Adoptable	55	450	Manhole	Adoptable
1.002	55	450	Manhole	Adoptable	58	450	Manhole	Adoptable
3.000	56	450	Manhole	Adoptable	57	450	Manhole	Adoptable
3.001	57	450	Manhole	Adoptable	58	450	Manhole	Adoptable
1.003	58	450	Manhole	Adoptable	61	450	Manhole	Adoptable
4.000	59	450	Manhole	Adoptable	60	450	Manhole	Adoptable
4.001	60	450	Manhole	Adoptable	61	450	Manhole	Adoptable
1.004	61	450	Manhole	Adoptable	62	1200	Manhole	Adoptable
1.005	62	1200	Manhole	Adoptable	5805	1	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
51	509506.513	186919.429	44.000	0.900	450				
						0	1.000	43.100	150
52	509506.352	186906.475	44.000	1.030	450		1	1.000	42.970	150
						0	1.001	42.970	150
53	509486.897	186919.228	44.000	0.650	450				
						0	2.000	43.350	150
54	509486.894	186906.471	44.050	0.830	450		1	2.000	43.220	150
						0	2.001	43.220	150
55	509490.854	186906.501	44.050	1.235	450		1	2.001	43.180	150
							2	1.001	42.815	150
						0	1.002	42.815	150
56	509476.152	186891.175	43.850	0.850	450				
						0	3.000	43.000	150
57	509476.090	186902.378	43.850	0.965	450		1	3.000	42.885	150
						0	3.001	42.885	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
58	509490.846	186902.375	43.850	1.115	450		1	3.001	42.735	150
							2	1.002	42.775	150
							0	1.003	42.735	150
59	509477.240	186878.267	43.850	0.850	450					
							0	4.000	43.000	150
60	509490.930	186878.441	43.850	0.990	450		1	4.000	42.860	150
							0	4.001	42.860	150
61	509491.026	186887.761	43.950	1.440	450		1	4.001	42.760	150
							2	1.003	42.585	150
							0	1.004	42.510	225
62	509502.028	186888.323	43.550	1.550	1200		1	1.004	42.400	225
							0	1.005	42.000	150
5805	509507.971	186881.693	43.590	1.950	1		1	1.005	41.640	150

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	2 year (l/s)	1.8	100 year 360 minute (m³)	169
Summer CV	0.950	Drain Down Time (mins)	1440	30 year (l/s)	4.9		
Winter CV	0.950	Additional Storage (m³/ha)	20.0	100 year (l/s)	6.5		
Analysis Speed	Normal	Check Discharge Rate(s)	✓	Check Discharge Volume	✓		

Storm Durations

15	30	60	120	180	240	360

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	0	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	SPR	0.47	Betterment (%)	0
Greenfield Method	IH124	Region	6	QBar	2.0
Positively Drained Area (ha)	0.466	Growth Factor 2 year	0.88	Q 2 year (l/s)	1.8
SAAR (mm)	644	Growth Factor 30 year	2.40	Q 30 year (l/s)	4.9
Soil Index	4	Growth Factor 100 year	3.19	Q 100 year (l/s)	6.5

Pre-development Discharge Volume

Site Makeup	Greenfield	SPR	0.47	Storm Duration (mins)	360
Greenfield Method	FSR/FEH	CWI	96.889	Betterment (%)	0
Positively Drained Area (ha)	0.466	Return Period (years)	100	PR	0.458
Soil Index	4	Climate Change (%)	0	Runoff Volume (m³)	169

Node 62 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	42.000	Product Number	CTL-SHE-0053-1400-1200-1400
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.4	Min Node Diameter (mm)	1200

Node 62 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Width (m)	4.000	Depth (m)	0.800
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	42.000	Length (m)	15.000	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	484	Slope (1:X)	1000.0		

Node 62 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.33	Width (m)	23.000	Depth (m)	0.375
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	43.200	Length (m)	10.000	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)		Slope (1:X)	1000.0		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year 15 minute summer	414.357	117.249	100 year 60 minute winter	119.581	47.566	100 year 240 minute summer	68.518	18.107
100 year 15 minute winter	290.777	117.249	100 year 120 minute summer	113.168	29.907	100 year 240 minute winter	45.522	18.107
100 year 30 minute summer	271.135	76.722	100 year 120 minute winter	75.186	29.907	100 year 360 minute summer	51.120	13.155
100 year 30 minute winter	190.270	76.722	100 year 180 minute summer	87.176	22.433	100 year 360 minute winter	33.229	13.155
100 year 60 minute summer	179.989	47.566	100 year 180 minute winter	56.666	22.433			

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	51	12	43.392	0.292	5.1	0.0983	0.0000	SURCHARGED
15 minute summer	52	12	43.384	0.414	9.6	0.1300	0.0000	SURCHARGED
15 minute summer	53	10	43.404	0.054	5.1	0.0220	0.0000	OK
15 minute summer	54	12	43.360	0.140	10.2	0.0494	0.0000	OK
15 minute summer	55	12	43.348	0.533	20.6	0.1540	0.0000	SURCHARGED
15 minute summer	56	12	43.308	0.308	5.1	0.1067	0.0000	SURCHARGED
15 minute summer	57	12	43.300	0.415	9.2	0.1350	0.0000	SURCHARGED
15 minute summer	58	12	43.265	0.530	31.2	0.1605	0.0000	SURCHARGED
240 minute winter	59	232	43.057	0.057	1.0	0.0197	0.0000	OK
240 minute winter	60	232	43.057	0.197	2.1	0.0670	0.0000	SURCHARGED
240 minute winter	61	232	43.056	0.546	11.1	0.1628	0.0000	SURCHARGED
240 minute winter	62	232	43.056	1.056	11.0	46.3965	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	51	1.000	52	4.7	0.616	0.267	0.2281	
15 minute summer	52	1.001	55	8.4	0.530	0.474	0.2729	
15 minute summer	53	2.000	54	5.1	0.597	0.282	0.1412	
15 minute summer	54	2.001	55	10.1	0.965	0.567	0.0688	
15 minute summer	55	1.002	58	19.3	1.097	1.105	0.0726	
15 minute summer	56	3.000	57	4.3	0.616	0.240	0.1972	
15 minute summer	57	3.001	58	7.9	0.479	0.439	0.2598	
15 minute summer	58	1.003	61	31.0	1.764	1.726	0.2547	
240 minute winter	59	4.000	60	1.0	0.405	0.055	0.1622	
240 minute winter	60	4.001	61	2.1	0.679	0.113	0.1641	
240 minute winter	61	1.004	62	11.0	1.004	0.212	0.4381	
240 minute winter	62	Hydro-Brake®	5805	1.3				64.0

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	5805	1	41.640	0.000	1.1	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)

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	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	499	1350	749	1500	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Circular Link Type

Shape	Circular	Barrels	1	Auto Increment (mm)	75	Follow Ground	x

Available Diameters (mm)

100 | 150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
51	0.008	5.00	44.000	Manhole	Adoptable	450	509506.513	186919.429	0.900
52	0.008	5.00	44.000	Manhole	Adoptable	450	509506.352	186906.475	1.030
53	0.008	5.00	44.000	Manhole	Adoptable	450	509486.897	186919.228	0.650
54	0.008	5.00	44.050	Manhole	Adoptable	450	509486.894	186906.471	0.830
55	0.008	5.00	44.050	Manhole	Adoptable	450	509490.854	186906.501	1.235
56	0.008	5.00	43.850	Manhole	Adoptable	450	509476.152	186891.175	0.850
57	0.008	5.00	43.850	Manhole	Adoptable	450	509476.090	186902.378	0.965
58	0.008	5.00	43.850	Manhole	Adoptable	450	509490.846	186902.375	1.115
59	0.008	5.00	43.850	Manhole	Adoptable	450	509477.240	186878.267	0.850
60	0.009	5.00	43.850	Manhole	Adoptable	450	509490.930	186878.441	0.990
61	0.010	5.00	43.950	Manhole	Adoptable	450	509491.026	186887.761	1.440
62			43.550	Manhole	Adoptable	1200	509502.028	186888.323	1.550
5805			43.590	Manhole	Adoptable	1	509507.971	186881.693	1.950

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)
1.000	51	52	12.956	0.600	Colebrook-White	43.100	42.970	0.130	100.0	150	Circular	5.21	50.0
1.001	52	55	15.499	0.600	Colebrook-White	42.970	42.815	0.155	100.0	150	Circular	5.47	50.0
2.000	53	54	12.757	0.600	Colebrook-White	43.350	43.220	0.130	98.1	150	Circular	5.21	50.0
2.001	54	55	3.959	0.600	Colebrook-White	43.220	43.180	0.040	100.0	150	Circular	5.28	50.0
1.002	55	58	4.126	0.600	Colebrook-White	42.815	42.775	0.040	103.2	150	Circular	5.54	50.0
3.000	56	57	11.203	0.600	Colebrook-White	43.000	42.885	0.115	97.4	150	Circular	5.18	50.0
3.001	57	58	14.756	0.600	Colebrook-White	42.885	42.735	0.150	98.4	150	Circular	5.43	50.0
1.003	58	61	14.615	0.600	Colebrook-White	42.735	42.585	0.150	97.4	150	Circular	5.78	50.0
4.000	59	60	13.691	0.600	Colebrook-White	43.000	42.860	0.140	97.8	150	Circular	5.22	50.0
4.001	60	61	9.321	0.600	Colebrook-White	42.860	42.760	0.100	93.2	150	Circular	5.37	50.0
1.004	61	62	11.016	0.600	Colebrook-White	42.510	42.400	0.110	100.0	225	Circular	5.92	50.0
1.005	62	5805	8.903	0.600	Colebrook-White	42.000	41.640	0.360	24.7	150	Circular	5.99	50.0

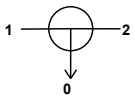
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.005	17.8	1.1	0.750	0.880	0.008	0.0	25	0.552
1.001	1.005	17.8	2.2	0.880	1.085	0.016	0.0	35	0.683
2.000	1.014	17.9	1.1	0.500	0.680	0.008	0.0	25	0.557
2.001	1.005	17.8	2.2	0.680	0.720	0.016	0.0	35	0.683
1.002	0.989	17.5	5.4	1.085	0.925	0.040	0.0	57	0.872
3.000	1.018	18.0	1.1	0.700	0.815	0.008	0.0	25	0.559
3.001	1.013	17.9	2.2	0.815	0.965	0.016	0.0	35	0.689
1.003	1.018	18.0	8.7	0.965	1.215	0.064	0.0	74	1.010
4.000	1.016	18.0	1.1	0.700	0.840	0.008	0.0	25	0.558
4.001	1.041	18.4	2.3	0.840	1.040	0.017	0.0	36	0.715
1.004	1.307	52.0	12.3	1.215	0.925	0.091	0.0	74	1.074
1.005	2.033	35.9	12.3	1.400	1.800	0.091	0.0	61	1.848

Pipeline Schedule

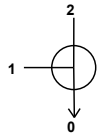
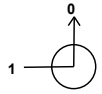
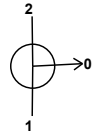
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	12.956	100.0	150	Circular	44.000	43.100	0.750	44.000	42.970	0.880
1.001	15.499	100.0	150	Circular	44.000	42.970	0.880	44.050	42.815	1.085
2.000	12.757	98.1	150	Circular	44.000	43.350	0.500	44.050	43.220	0.680
2.001	3.959	100.0	150	Circular	44.050	43.220	0.680	44.050	43.180	0.720
1.002	4.126	103.2	150	Circular	44.050	42.815	1.085	43.850	42.775	0.925
3.000	11.203	97.4	150	Circular	43.850	43.000	0.700	43.850	42.885	0.815
3.001	14.756	98.4	150	Circular	43.850	42.885	0.815	43.850	42.735	0.965
1.003	14.615	97.4	150	Circular	43.850	42.735	0.965	43.950	42.585	1.215
4.000	13.691	97.8	150	Circular	43.850	43.000	0.700	43.850	42.860	0.840
4.001	9.321	93.2	150	Circular	43.850	42.860	0.840	43.950	42.760	1.040
1.004	11.016	100.0	225	Circular	43.950	42.510	1.215	43.550	42.400	0.925
1.005	8.903	24.7	150	Circular	43.550	42.000	1.400	43.590	41.640	1.800

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	51	450	Manhole	Adoptable	52	450	Manhole	Adoptable
1.001	52	450	Manhole	Adoptable	55	450	Manhole	Adoptable
2.000	53	450	Manhole	Adoptable	54	450	Manhole	Adoptable
2.001	54	450	Manhole	Adoptable	55	450	Manhole	Adoptable
1.002	55	450	Manhole	Adoptable	58	450	Manhole	Adoptable
3.000	56	450	Manhole	Adoptable	57	450	Manhole	Adoptable
3.001	57	450	Manhole	Adoptable	58	450	Manhole	Adoptable
1.003	58	450	Manhole	Adoptable	61	450	Manhole	Adoptable
4.000	59	450	Manhole	Adoptable	60	450	Manhole	Adoptable
4.001	60	450	Manhole	Adoptable	61	450	Manhole	Adoptable
1.004	61	450	Manhole	Adoptable	62	1200	Manhole	Adoptable
1.005	62	1200	Manhole	Adoptable	5805	1	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
51	509506.513	186919.429	44.000	0.900	450	Manhole	Adoptable		0	1.000	43.100	150	Circular
52	509506.352	186906.475	44.000	1.030	450	Manhole	Adoptable		1	1.000	42.970	150	Circular
									0	1.001	42.970	150	Circular
53	509486.897	186919.228	44.000	0.650	450	Manhole	Adoptable		0	2.000	43.350	150	Circular
54	509486.894	186906.471	44.050	0.830	450	Manhole	Adoptable		1	2.000	43.220	150	Circular
									0	2.001	43.220	150	Circular
55	509490.854	186906.501	44.050	1.235	450	Manhole	Adoptable		1	2.001	43.180	150	Circular
									2	1.001	42.815	150	Circular
									0	1.002	42.815	150	Circular
56	509476.152	186891.175	43.850	0.850	450	Manhole	Adoptable		0	3.000	43.000	150	Circular
57	509476.090	186902.378	43.850	0.965	450	Manhole	Adoptable		1	3.000	42.885	150	Circular
									0	3.001	42.885	150	Circular

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
58	509490.846	186902.375	43.850	1.115	450	Manhole	Adoptable		1	3.001	42.735	150	Circular
									2	1.002	42.775	150	Circular
									0	1.003	42.735	150	Circular
59	509477.240	186878.267	43.850	0.850	450	Manhole	Adoptable						
									0	4.000	43.000	150	Circular
60	509490.930	186878.441	43.850	0.990	450	Manhole	Adoptable		1	4.000	42.860	150	Circular
									0	4.001	42.860	150	Circular
61	509491.026	186887.761	43.950	1.440	450	Manhole	Adoptable		1	4.001	42.760	150	Circular
									2	1.003	42.585	150	Circular
									0	1.004	42.510	225	Circular
62	509502.028	186888.323	43.550	1.550	1200	Manhole	Adoptable		1	1.004	42.400	225	Circular
									0	1.005	42.000	150	Circular
5805	509507.971	186881.693	43.590	1.950	1	Manhole	Adoptable		1	1.005	41.640	150	Circular

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	2 year (l/s)	1.8	100 year 360 minute (m³)	169
Summer CV	0.950	Drain Down Time (mins)	1440	30 year (l/s)	4.9		
Winter CV	0.950	Additional Storage (m³/ha)	20.0	100 year (l/s)	6.5		
Analysis Speed	Normal	Check Discharge Rate(s)	✓	Check Discharge Volume	✓		

Storm Durations

15	30	60	120	180	240	360

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	0	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	SPR	0.47	Betterment (%)	0
Greenfield Method	IH124	Region	6	QBar	2.0
Positively Drained Area (ha)	0.466	Growth Factor 2 year	0.88	Q 2 year (l/s)	1.8
SAAR (mm)	644	Growth Factor 30 year	2.40	Q 30 year (l/s)	4.9
Soil Index	4	Growth Factor 100 year	3.19	Q 100 year (l/s)	6.5

Pre-development Discharge Volume

Site Makeup	Greenfield	SPR	0.47	Storm Duration (mins)	360
Greenfield Method	FSR/FEH	CWI	96.889	Betterment (%)	0
Positively Drained Area (ha)	0.466	Return Period (years)	100	PR	0.458
Soil Index	4	Climate Change (%)	0	Runoff Volume (m³)	169

Node 62 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	42.000	Product Number	CTL-SHE-0053-1400-1200-1400
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.4	Min Node Diameter (mm)	1200

Node 62 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Width (m)	4.000	Depth (m)	0.800
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	42.000	Length (m)	15.000	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	484	Slope (1:X)	1000.0		

Node 62 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.33	Width (m)	23.000	Depth (m)	0.375
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	43.200	Length (m)	10.000	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)		Slope (1:X)	1000.0		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year 15 minute summer	414.357	117.249	100 year 60 minute winter	119.581	47.566	100 year 240 minute summer	68.518	18.107
100 year 15 minute winter	290.777	117.249	100 year 120 minute summer	113.168	29.907	100 year 240 minute winter	45.522	18.107
100 year 30 minute summer	271.135	76.722	100 year 120 minute winter	75.186	29.907	100 year 360 minute summer	51.120	13.155
100 year 30 minute winter	190.270	76.722	100 year 180 minute summer	87.176	22.433	100 year 360 minute winter	33.229	13.155
100 year 60 minute summer	179.989	47.566	100 year 180 minute winter	56.666	22.433			

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	51	12	43.392	0.292	5.1	0.0983	0.0000	SURCHARGED
15 minute summer	52	12	43.384	0.414	9.6	0.1300	0.0000	SURCHARGED
15 minute summer	53	10	43.404	0.054	5.1	0.0220	0.0000	OK
15 minute summer	54	12	43.360	0.140	10.2	0.0494	0.0000	OK
15 minute summer	55	12	43.348	0.533	20.6	0.1540	0.0000	SURCHARGED
15 minute summer	56	12	43.308	0.308	5.1	0.1067	0.0000	SURCHARGED
15 minute summer	57	12	43.300	0.415	9.2	0.1350	0.0000	SURCHARGED
15 minute summer	58	12	43.265	0.530	31.2	0.1605	0.0000	SURCHARGED
240 minute winter	59	232	43.057	0.057	1.0	0.0197	0.0000	OK
240 minute winter	60	232	43.057	0.197	2.1	0.0670	0.0000	SURCHARGED
240 minute winter	61	232	43.056	0.546	11.1	0.1628	0.0000	SURCHARGED
240 minute winter	62	232	43.056	1.056	11.0	46.3965	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	51	1.000	52	4.7	0.616	0.267	0.2281	
15 minute summer	52	1.001	55	8.4	0.530	0.474	0.2729	
15 minute summer	53	2.000	54	5.1	0.597	0.282	0.1412	
15 minute summer	54	2.001	55	10.1	0.965	0.567	0.0688	
15 minute summer	55	1.002	58	19.3	1.097	1.105	0.0726	
15 minute summer	56	3.000	57	4.3	0.616	0.240	0.1972	
15 minute summer	57	3.001	58	7.9	0.479	0.439	0.2598	
15 minute summer	58	1.003	61	31.0	1.764	1.726	0.2547	
240 minute winter	59	4.000	60	1.0	0.405	0.055	0.1622	
240 minute winter	60	4.001	61	2.1	0.679	0.113	0.1641	
240 minute winter	61	1.004	62	11.0	1.004	0.212	0.4381	
240 minute winter	62	Hydro-Brake®	5805	1.3				64.0

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	5805	1	41.640	0.000	1.1	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)

APPENDIX G –SUDS PROFORMA

HILLINGDON LONDON

GREATER LONDON AUTHORITY

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 two new apartment blocks and low-rise two-storey houses with private gardens at the east of the site.
Total site Area	8038 m^2
Total existing impervious area	Unknown m^2
Total proposed impervious area	4660 m^2
Is the site in a surface water flood risk catchment (ref. local Surface Water Management Plan)?	The site lies within Flood Zone 1.
Existing drainage connection type and location	An existing 375mm & 150mm diameter into the Thames Water Sewer.
Designer Name	Brijesh Mistry
Designer Position	Civil Engineer
Designer Company	Infrastructure Design Limited

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	2			
1 in 1	1.7			2.8
1 in 30	4.9			2.9
1 in 100	6.5			3.5
1 in 100 + CC				3.5
Climate change allowance used		40%		
3b. Principal Method of Flow Control	See IDL drainage strategy report			

3c. Proposed SuDS Measures

	Catchment area (m^2)	*Plan area (m^3)*	*Storage vol. (m^3)*
Rainwater harvesting	0		0
Infiltration systems	0		0
Green roofs	0	79.18	0
Blue roofs	0	0	0
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	0	0	0
Pervious pavements	0	0	262.35
Swales	0	0	0
Basins/ponds	0	0	0
Attenuation tanks	0		189
Total	**0**	**79.18**	**451.35**

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?	

APPENDIX H – MANAGEMENT & MAINTENANCE REGIME

The Management Company

The responsibility for maintenance of all elements of the development remain with Chase New Homes until handed over to the Management Company.

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

The Management Company employs a specialist Managing Agent to manage the development which includes all aspects of maintenance.

The Management Company BI registered No. ***'tbc'*** *was incorporated in* ***'tbc'*** *and its directors are currently made up of Chase New Homes representatives plus an appointment from the Managing Agent.*

The Managing Agents are ***'tbc'*** *who have over '****tbc'*** *years' experience in the industry.*

At handover the Management Company and Managing Agent receive as built information together with operating and maintenance manuals which detail all maintenance protocols.

Approximately 1 year following 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 that two year period the Management Company have the right to re-tender the Managing Agent services but it is very rare that a change is made as our original appointments provide an excellent service.

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 our 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 our 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 through the life of the development.

Crate Attenuation

The principle means of surface water attenuation/disposal from the development is by way of 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 site all extraneous rubbish that is detrimental to the operation or detract from the appearance of the site, including paper, bottles, cans and similar debris.

Onsite 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 build up from ***all*** catchpits 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 yearly cycle to cover all such chambers over this period.

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

Commission a CCTV survey and report on condition of the surface water piped drainage system upstream of the soakaways to check for structural integrity and hydraulic fluidity. Carry out promptly any remedial work as advised by 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 runoff 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 pervious 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 commissioned to carry out this work should ensure that their 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 underlying bitmac base layer and replace with similar compacted depth of course aggregate subbase material to BS EN 13242:2002 Type 4/20, wrapped in geotextile as Terram 1000 or similar.
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.

Sedum (Green) Roofs

Springtime Maintenance.

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

• If moss is present, recommend lawn fertiliser and moss (eg Mo Bacter moss digester)

• Application of fertiliser. Recommend a 6-month slow release granular fertiliser (eg MiracleGrow Granular) is 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 are 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 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 cleared checked for structural integrity at the six monthly interval. Any damage/problems should be made good as per the original design drawings.