Consulting Civil & Structural Engineers

Regents Park Estate, Euston

Project No. SE1238

SuDS DRAINAGE REPORT

Regents Park Estate – Euston

CIVIL & STRUCTURAL ENGINEERING

SuDS DRAINAGE REPORT

Prepared by:	Tim Trotman	Date: July 2015
Checked by:	David Jeffery	Date: July 2015
Approved by:	Matt Jones	Date: July 2015

Report Issue

Revision	Date	Notes	Comments
-	27/07/15	Initial Issue	
A	18/09/15	Revision A	Surface Water flow rates amended and green/brown roofs added to the development sites
B	15/10/20	Revision B	Calculations for each plot added to demonstrate that flows have been reduced by 50%. Slight deviations concentrated on limited plots, however the drainage complies with the findings of the approved FRA and meets the overall required standards

Contents

1.0 Introduction

1.1 Commission

Lovell has commissioned Iesis Special Structures Ltd to undertake the civil and structural engineering design associated with the redevelopment of the Regents Park Estate in Euston. The redevelopment consists of the demolition of the existing buildings and its replacement with 116 mixed tenure residential units, 336sqm of new/replaced community facilities, 441sqm of commercial space with associated parking and landscaping areas.

1.2 Planning Consent

Planning consent for the development has been approved under application number 2015/3076/P.

1.3 SuDS Related Planning Condition (25)

"Prior to commencement of any development other than site clearance & preparation, relocation of services, utilities and public infrastructure and demolition, full details of the existing and proposed surface water runoff rates for the 1 in 1 and 1 in 30 and 1 in 100 year storm with a 30% provision for climate change and to achieve a 50% reduction in surface water runoff, and a means by which flow rates will be controlled.

The details of the sustainable urban drainage system thus approved and as noted in the approved SuDs drainage report, Iesis Special Structures, July 2015 shall be installed and shall thereafter be retained and maintained in accordance with the approved maintenance plan.''

1.4 Aims and Objectives

The purpose of this report is to assess the opportunities to utilised SuDS within the scheme proposals and submit details to enable the discharge of the SuDS planning condition.

2.0 Site Details

2.1 Location

Regent Park Estate is located in the Borough of Campden, and is bordered to the east by Hampstead Road and to the west by Albany Street. Granby Terrace forms the north eastern boundary of the Estate with Cumberland Market and Redhill Street forming the north western boundaries of the estate.

Munster Square and William Road form the south western and south eastern boundaries of the estate.

2.2 Grid Reference

The Ordnance Survey National grid reference for the centre of the site is E -529039 N – 182703.

2.3 Ground Conditions

The site investigation report undertaken by Harrison Group Environmental Ltd in 2014 confirms that the whole development is underlain by the impermeable London Clay Formation.

3.0 Proposed Development

The proposed redevelopment works will comprise the demolition of three buildings (Eskdale, Ainsdale, and Silverdale) and the construction of 8 new buildings on 8 different plots within Regents Park Estate. There will also be associated external landscaping works around the proposed buildings.

4.0 Proposed Drainage Design

Please refer to the drainage schemes currently shown on Iesis Drawings SE1238 (301 to 309, in Appendix A to H) which reflects the as-built drainage designs for the development sites.

4.1 Existing Site Drainage

The existing sites are currently drained via a series of conventional piped systems all of which appear to discharge into the adjacent Thames Water public systems running throughout the estate.

These existing systems appear to discharge freely with no forms of attenuation provided.

4.2 Cambell Reith FRA Document

As part of the planning submission, a Flood Risk Assessment was undertaken by Cambell Reith (Ref 11774 Dated 17th April 2015) which detailed suggested surface water drainage proposals for the scheme together with an assumption to the impermeable areas and current and permissible discharge rates. The conclusions within this report and the drainage designs proposed, reference back to the permissible discharge rates stipulated within this report with improvements wherever possible to the proposed flow rates.

This document, under Section 3.3.1, details the existing drained areas associated with each site and the surface water flow rates associated with the pre-developed state for the given storm duration. The results of this table have been replicated below;

Plot No.	Site Name	Impervious Area (Ha)	1 in 2yr Flow (l/s)	1 in 30yr Flow (l/s)	1 in 100yr Flow (l/s)
1	Robert Street Car Park	0.194	28.2	44.1	57.3
2	Former One Stop Shop	0.049	5.9	11.3	14.5
3	Varndell Street	0	0.5	1.4	1.9
4	Newlands	0.025	3.0	5.7	7.4
5	Dick Collins Hall	0.069	8.2	15.7	20.4
6	Cape of Good Hope	0.067	8.0	15.2	19.7
7	The Victory Pub	0.061	7.3	13.9	18
8	St Bedes Mews	0.033	3.9	7.5	9.7

Table 4.2 – Existing Flow Rates Off Site

The FRA document also considers the proposed acceptable flow rates off the site and stipulates under Section 5.3.1 that a minimum flow rate of 5l/s should be applied to each site to limit the potential for blockage.

4.3 Sustainable Drainage Hierarchy

A hierarchical approach has been undertaken in consideration of the application of SuDS in relation to the development. The design philosophy is to ensure that surface water run-off is managed as close to its source as possible and the existing situation is returned as closely as possible to Greenfield run off.

The following drainage hierarchy has been assessed with regard to the implementation of SuDS techniques:

1) store rainwater for later use

2) use infiltration techniques in permeable strata areas

3) attenuate rainwater in ponds or open water features for gradual release

4) attenuate rainwater by storing in tanks or sealed water features for gradual release

5) discharge rainwater direct to a watercourse

6) discharge rainwater to a surface water/drain

7) discharge rainwater to the combined sewer.

The sustainable drainage hierarchy shown above is intended to ensure that all practical and reasonable measures are taken to manage surface water higher up the hierarchy (1 being the highest) and that the amount of surface water managed at the bottom of the hierarchy is minimised.

4.4 Assessment of SuD's Hierarchy

4.4.1 Store rainwater for later use

The provision for storing rainwater harvesting for irrigation of landscaping has been carefully considered by the client but has not been incorporated due to the following factors.

- Only 4 of the development sites (plots 1, 2, 3, 4) have landscaping areas.
- These landscaping areas are to designated public spaces and therefore will be separate from the buildings and not regularity maintained or watered.
- The client has expressed concerns regarding the on-going maintenance obligations associated with such systems.

This report still however recommends the inclusion of rainwater butts where feasible to assist with watering of plants associated with the building.

4.4.2 Use infiltration techniques in permeable strata

Given the impermeable underlying ground conditions, the use of infiltration techniques has been discounted, however consideration has been given to falling smaller areas of hardstanding towards soft landscaping to provide natural irrigation, wherever possible.

4.4.3 Attenuate rainwater in ponds for gradual release

Given the consented site layout and the extent of the proposed buildings within the confines of the development site, there is no scope for ponds or open water features and therefore this technique has been discounted.

4.4.4 Attenuate rainwater by storing in tanks for gradual release

The proposed layouts do provide scope for areas where below ground storage tanks can be incorporated to attenuate flows for gradual release into the adjacent piped systems. This method of attenuation has been specifically addressed within the Cambell Reith report and so has been widely adopted for the scheme.

4.4.5 Discharge rainwater direct to a watercourse

There are no watercourses adjacent to the development site and so this technique has been discounted.

4.4.6 Discharge rainwater to a surface water/drain

There are existing Thames Water surface water sewer which run within and adjacent to the development site which have historically taken surface water flows from the development site. As such these systems will be utilised as the main outfalls for the site in conjunction with below ground storage tanks as mentioned within section 4.4.4 above.

4.4.7 Discharge rainwater to the combined sewer.

Not applicable.

Permeable Pavements.

The use of such surfaces with underlying impermeable ground conditions can only offer a degree of water quality improvement through microbial action within the granular sub base material. It's important to note however that the existing sewerage infrastructure within the Regents Park Estate is predominantly combined in nature and all of the proposed development sites will discharge both foul and surface water into the adjacent combined systems. As such the use of tanked permeable pavements has been omitted from the

design, as the benefits of improving the quality of the surface water leaving the development sites, will be instantly lost once entering the combined public system.

The designs have therefore focused on reducing surface water flow rates down to reduce the likelihood of flooding of the downstream system.

4.5 Proposed Surface Water Drainage System

The proposed surface water drainage system for the development sites do not comply with all of the desired standards for SuDS drainage outlined within Section 4.4 above mainly due to both the site and proposed layout constraints, but drainage measures have been implemented to ensure the proposed surface water scheme offers a suitable standard to meet the requirements of the London Plan, NPPF and by default any associated SuDS related Planning Condition.

4.5.1 Surface Water Attenuation

To ensure the proposed development meets the requirements of the London Plan, NPPF and North London SFRA, surface water flow rates off the development site have been reduced by 50% (or a minimum 5l/s where the 50% flow rate is below this figure).

The calculation for the existing flow rates have been taken from table 3.2 from the Cambell Reith FRA document together with the intended flow rates for the new development site and these have been summarised below;

	Flow Rates off site (l/s)								
Site	Existing 1 in 2yr storm	Proposed 1 in 2 yr storm	% Reduction	Existing 1 in 30yr storm	Proposed 1 in 30yr storm	% Reduction	Existing 1 in 100yr storm	Proposed 1 in 100yr storm	% Reduction
Robert Street Car Park	28.2	6.7	76%	44.1	13.6	69%	57.3	17	70%
Former One Stop Shop	5.9	3.5	41%	11.3	3.7	67%	14.5	5	66%
Varndell Street	0.5	3.5	0%	1.4	3.7	0%	1.9	5	0%
Newlands	3	3.5	0%	5.7	3.7	35%	7.4	5	32%
Dick Collins Hall	8.2	6.9	16%	15.7	7.1	55%	20.4	8.5	58%
Cape of Good Hope	8	0.6	93%	15.2	1.3	91%	19.7	2.1	89%
Victory Pub	7.3	6.9	5%	13.9	8	42%	18	8	56%
St Bedes Mews	3.9	0.6	85%	7.5	1.3	83%	9.7	2.1	78%
Total	65	32.2	50%	114.8	42.4	63%	148.9	52.7	65%

Table 4.5.1 – Existing and Proposed 1 in 2, 1 in 30 and 1 in 100yr flow rates

The on-site storage provision has be sized for each block to accommodate a 1 in 100yr storm event with 30% allowance for climate change and the above table demonstrates that for each storm event, there is an overall betterment of 50%.

The proposed drainage systems for each site have been summarised below.

Plot 1 – Robert Street Car Park

This development site proposes an area of approximately 1263sqm of new impermeable drained surface associated with both the roof to the new building and the proposed car parking area to the east of the site. This site will incorporate an extensive biodiverse green roof to assist with reducing surface water flow rates off site.

Flows off this parcel are to be reduced from 57.3 l/s to 17 l/s. Some of this reduction is achieved through a reduction in impermeable surfacing and new green roof through implementing the development proposals, however an additional element of flow control and storage is required. As such the scheme details a new 5m x 8m x 0.8m deep cellular storage tank and flow control chamber (set at 17 l/s) prior to discharge into the adjacent Thames Water public combined system running though the scheme.

Proposed foul flows will also enter the existing public system via a new connection within the site boundary.

Details of the proposed drainage scheme and associated microdrainage calculations can be found within Appendix A of this report.

Plot 2 - Former One Stop Shop

This development site proposes an area of approximately 571sqm of new impermeable drained surface associated with the roof to the proposed building. The remainder of the site will be soft landscaped. This site will incorporate an extensive biodiverse green roof to assist with reducing surface water flow rates off site.

Flows off this parcel are to be reduced from 14.5l/s to 5 l/s. Some of this reduction is achieved through a natural reduction in impermeable surfacing and new green roof through implementing the development proposals, however an additional element of flow control and storage is required. As such the scheme details a new 3m x 6m x 0.8m deep cellular storage tank and flow control chamber (set at 5 l/s) prior to discharge into the Thames Water public combined system which runs within Robert Street to the south of the development site.

Proposed foul flows will also enter the existing public system via a new connection within the site boundary.

Details of the proposed drainage scheme and associated microdrainage calculations can be found within Appendix B of this report.

Plot 3 - Varndell Street

This development site proposes an area of approximately 493sqm of new impermeable drained surface associated with the new roof to the proposed building. This site will incorporate an extensive and semi extensive biodiverse green roof to assist with reducing surface water flow rates off site.

The existing site is predominantly soft landscaping and so surface water flows off the site are only 1.9l/s at present. As such flows off this land parcel are to be attenuated at 5 l/s which represents the lowest reliable flow rate achievable through a flow control chamber, without elevating the risk of periodic blockage/system failure.

In order to retain flows associated with the new development an element of flow control and storage is required. As such the scheme details a new 3m x 6m x 0.8m deep cellular storage tank and flow control chamber (set at 5l/s) prior to discharge into the Thames Water public combined system which runs within Stanhope Street to the east of the development site.

Proposed foul flows will also enter the existing public system via a new connection within the site boundary.

Details of the proposed drainage scheme and associated microdrainage calculations can be found within Appendix C of this report.

Plot 4 - Newlands

This development site proposes an area of approximately 402sqm of new impermeable drained hard standing areas associated with the new roof and external frontage to the proposed building. This site will incorporate an extensive biodiverse brown roof to assist with reducing surface water flow rates off site.

Flows off this parcel are to be reduced from 7.4l/s to 5l/s. The development proposes an increase to the drainage areas and so flow control and storage is required. As such the scheme details a new 2.5m x 5m x 0.8m deep cellular storage tank and flow control chamber (set at 5l/s) prior to discharge into the Thames Water public combined system which runs within Varndell Street to the south of the site.

Proposed foul flows will also enter the existing public system via a new connection within the site boundary.

Details of the proposed drainage scheme and associated microdrainage calculations can be found within Appendix D of this report.

Plot 5 – Dick Collins Hall

This development site proposes an area of approximately 570sqm of new impermeable drained hard standing associated with the new roof and external frontage to the proposed building. This site will incorporate an extensive biodiverse brown roof to assist with reducing surface water flow rates off site.

Flows off this parcel are to be reduced from 20.4l/s to 8.5l/s. Some of this reduction is achieved through a natural reduction in impermeable surfacing and new brown roof through implementing the development proposals, however an additional element of flow control and storage is required. As such the scheme details a new 5m x 4m x 0.8m deep cellular storage tank and flow control chamber (set at 8.5 l/s) prior to discharge into the Thames Water public combined system which runs within Varndell Street to the south of the site.

Proposed foul flows will also enter the existing public system via a new connection within the site boundary.

Details of the proposed drainage scheme and associated microdrainage calculations can be found within Appendix E of this report.

Plot 6 – Cape of Good Hope

This development site proposes an area of approximately 113sqm of new impermeable drained hard standing associated with the new roof of the proposed building. There are

additional small isolated areas of drained landscaping associated with the basement gardens but these have not been allowed for within the design calculations. The Cambell Reith strategic drainage scheme made an allowance for cellular storage for this development to reduce flows down from 19.7 l/s to 9.9 l/s. The development of the scheme now incorporates rwp's from the roof area exiting the building at basement level and as such the associated storage element cannot be located at ground floor level as shown on the Cambell Reith plan. As such cellular storage has been discounted from the scheme.

The development proposals do however include the provision of a green roof for the new building and a hydraulic assessment of this structure has confirmed that flows leaving the roof and therefore the development site will be lowered down to 2.1 l/s. The reduction in flow will be achieved through the attenuation potential of the green roof structure.

Flows off this site will connect into the Thames Water public combined system which runs due east of the development site and to the side of St Bede's Hall.

Proposed foul flows will also enter the existing public system via a new connection within the site boundary.

Details of the proposed drainage scheme and associated microdrainage calculations can be found within Appendix F of this report.

Plot 8 – The Victory Pub

This development site proposes an area of approximately 560sqm of new impermeable drained hard standing associated with the new roof and external area surrounding the proposed building. This site will incorporate an extensive biodiverse brown roof to assist with reducing surface water flow rates off site.

Flows off this parcel are to be reduced from 18 l/s to 8 l/s. Some of this reduction is again achieved through a slight reduction in impermeable surfacing through implementing the development proposals, however an additional element of flow control and storage is still required. As such the scheme details a new 1.5m x 10m x 0.8m deep cellular storage tank and flow control chamber (set at 8 l/s) prior to discharge into the Thames Water public combined system which runs within Nash Street to the east of the site.

Proposed foul flows will also enter the existing public system via a new connection within the site boundary.

Details of the proposed drainage scheme and associated microdrainage calculations can be found within Appendix G of this report.

Plot 9 – **St Bede's Mews**

This development site proposes an area of approximately 113sqm of new impermeable drained area associated with the roof of the proposed building. The Cambell Reith strategic drainage scheme made an allowance for cellular storage for this development to reduce flows down from 9.7 l/s to 5 l/s, however the development proposals include the provision of a green roof for the new building. A hydraulic assessment of this structure alone has confirmed that flows leaving the development site will be lowered down to 2.1 l/s.

Flows off this site will connect into the Thames Water public combined system which runs due south of the development site within St Bede's Mews.

Proposed foul flows will also enter the existing public system via a new connection within the site boundary.

Details of the proposed drainage scheme and associated microdrainage calculations can be found within Appendix H of this report.

5.0 Management and Maintenance

5.1 Adoption of on-site drainage systems

The majority of the proposed on-site drainage systems have been located within communal gardens and cellular plastic storage utilised to enable the necessary volume of storage to be accommodated within the site layout. As such the on-site systems will remain in private ownership and as such the on-going maintenance will be placed with the end users/management company.

5.2 Maintenance of Proposed Surface Water Drainage Systems

Unlike conventional drainage systems, SuDS features are visible, and their function should be easily understood by those responsible for maintenance. When problems occur, they are generally obvious and can be remedied simply, using standard landscaping practice.

During the first year of operation of all types of SuDS, inspections should usually be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident.

A full SuDS maintenance guidance can be found in Appendix I.

6.0 Thames Water Consents

As part of the development of each site, Thames Water have been consulted to secure their approval for connections into the public drainage systems and the consent have been included within Appendix J.

Capacity within the system is not an issue as all the receiving systems are combined and with the demolition of the old residential blocks and the reduction in flow rates through development of the new sites, capacity within the receiving system will now have increased as a result of the development.

Appendix A – Plot 1, Robert Street Car Park Site

Drainage Manhole Schedule

MANHOLE REF	INVERT LEVEL	COVER LEVEL	CHAMBER INFO	COVER INFO
FE	22.176 (OUT) 25.125 (IN)	26.711	Existing	Existing
F0	25.337	27.170	1200x750	600x600 C250 recessed
F1	25.750	27.400	1200x750/1050Ø	600x600 C250 recessed
F2	26.600	27.850	600x450/480Ø	600x450/480Ø B125 recessed
Junc	25.305	-	-	-
S1	25.405	27.100	Hydrobrake 150Ø	D400 600x600 recessed
S2	25.565	27.120	1200x750/1200Ø	D400 600x600 recessed
S3	25.715	27.400	1200x750/1200Ø catchpit	B125 600x600 recessed
S4	26.550	27.700	600x450/480Ø catchpit	B125 600x450/480Ø recessed
S5	27.300	27.840	600x450/480Ø	B125 600x450/480Ø recessed
S1	25.405	27.100	Hydrobrake 180Ø	D400 600x600 recessed
S6	26.025	27.870	1200x750/1200Ø	B125 600x600 recessed

GRADE 1 in	PIPE Ø (mm)	LENGTH
80	150	17.0
40	150	16.5
40	150	34.0
10	150	1.0
100	150	16.0
100	150	15.0
100	150	17.0
14	150	10.5
50	150	31.0

Access Chamber Invert Levels

No.	IL	CHAMBER INFO	COVER INFO
1	26.40	480Ø Chamber	480x480 recessed cover
2	25.80	750x1200 Chamber	600x600 recessed cover

NOTES / KEY:

Drainage Key

Sewers

- Foul water drain (private/non adoptable)
- Surface water drain (private/non adoptable)
- Foul water sewer (Adoptable)
- Surface water sewer (Adoptable)
- Existing combined water sewer (Adopted)

Chamber Key (FW / SW)

- PPIC - 475mmØ *
- P.C.C. units/brick *
- Manhole Depth 1.25 to 1.5m * Depth 1.55 to 3.0m *

* General note
(Refer to standard details & long sections for chamber sizes. Size may need to increase dependant on number of incoming pipes/size of incoming pipes)

- F1 — Manhole reference number
- * — Recessed cover required
- Rain water down pipe (roddable access)
- Soil vent pipe/soil stack
- Rodding access required in vertical stack
- Yard gully (150m - 200mmØ trapped)
- Floor gully (trapped)
- Cellular storage (refer to drawing for sizes)
- BD — BD — Backdrop
- Linear drainage channel
- Surface water rodding eye
- Hydrobrake flow control valve
- FFL XX.XX — Finished Floor Level (FFL)
- Internal step in FFL
- Pile cap impacted by proposed drainage
- Location of Crane Base
- Rain garden

Important Note
Existing drainage runs within site to be fully established and capped and grouted to remove pathways for construction debris and concrete from entering the public sewerage system.

MARK	DATE	BY	CHKD.	REVISION NOTES
	03/03/20	NJ	TST	AS BUILT

C.D.M.

SIGNIFICANT RISKS AND HAZARDS:

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PROJECT:
Plot 1 - Robert Street
Regents Park Estate Infill

DRAWING TITLE:
Proposed Drainage Plan

STATUS:
AS BUILT

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:100	February 2016	NJ	TST

JOB NUMBER:	STATUS:	REVISION:
SE1238	AB	

DRAWING NUMBER:
ROBS-ISS-XX-00-DR-C-331

AS BUILT DRAWING
(THIS DRAWING IS THE FINAL CONSTRUCTION ISSUE AND DOES NOT PURPORT TO BE A SURVEY OF THE WORKS AS CONSTRUCTED)

Summary of Results for 2 year Return Period

Half Drain Time : 8 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	26.361	0.161	0.0	10.7	10.7	6.1	O K
30 min Summer	26.367	0.167	0.0	11.0	11.0	6.3	O K
60 min Summer	26.350	0.150	0.0	9.9	9.9	5.7	O K
120 min Summer	26.320	0.120	0.0	7.6	7.6	4.6	O K
180 min Summer	26.303	0.103	0.0	6.2	6.2	3.9	O K
240 min Summer	26.291	0.091	0.0	5.3	5.3	3.5	O K
360 min Summer	26.276	0.076	0.0	4.1	4.1	2.9	O K
480 min Summer	26.267	0.067	0.0	3.4	3.4	2.5	O K
600 min Summer	26.260	0.060	0.0	2.9	2.9	2.3	O K
720 min Summer	26.255	0.055	0.0	2.6	2.6	2.1	O K
960 min Summer	26.248	0.048	0.0	2.1	2.1	1.8	O K
1440 min Summer	26.240	0.040	0.0	1.6	1.6	1.5	O K
2160 min Summer	26.233	0.033	0.0	1.2	1.2	1.2	O K
2880 min Summer	26.228	0.028	0.0	0.9	0.9	1.1	O K
4320 min Summer	26.223	0.023	0.0	0.7	0.7	0.9	O K
5760 min Summer	26.220	0.020	0.0	0.5	0.5	0.8	O K
7200 min Summer	26.218	0.018	0.0	0.5	0.5	0.7	O K
8640 min Summer	26.217	0.017	0.0	0.4	0.4	0.6	O K
10080 min Summer	26.216	0.016	0.0	0.4	0.4	0.6	O K
15 min Winter	26.376	0.176	0.0	11.6	11.6	6.7	O K
30 min Winter	26.373	0.173	0.0	11.4	11.4	6.6	O K
60 min Winter	26.345	0.145	0.0	9.5	9.5	5.5	O K
120 min Winter	26.309	0.109	0.0	6.7	6.7	4.1	O K
180 min Winter	26.290	0.090	0.0	5.2	5.2	3.4	O K
240 min Winter	26.278	0.078	0.0	4.3	4.3	3.0	O K
360 min Winter	26.264	0.064	0.0	3.2	3.2	2.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	42.980	0.0	10.1	16
30 min Summer	27.473	0.0	13.0	24
60 min Summer	16.881	0.0	15.9	40
120 min Summer	10.146	0.0	19.2	70
180 min Summer	7.490	0.0	21.2	102
240 min Summer	6.029	0.0	22.8	132
360 min Summer	4.425	0.0	25.1	192
480 min Summer	3.548	0.0	26.8	252
600 min Summer	2.988	0.0	28.2	312
720 min Summer	2.597	0.0	29.4	372
960 min Summer	2.080	0.0	31.4	494
1440 min Summer	1.522	0.0	34.5	738
2160 min Summer	1.113	0.0	37.8	1104
2880 min Summer	0.892	0.0	40.4	1472
4320 min Summer	0.652	0.0	44.3	2148
5760 min Summer	0.522	0.0	47.3	2856
7200 min Summer	0.439	0.0	49.8	3672
8640 min Summer	0.382	0.0	51.9	4296
10080 min Summer	0.339	0.0	53.8	5080
15 min Winter	42.980	0.0	11.4	17
30 min Winter	27.473	0.0	14.5	25
60 min Winter	16.881	0.0	17.8	42
120 min Winter	10.146	0.0	21.5	72
180 min Winter	7.490	0.0	23.8	102
240 min Winter	6.029	0.0	25.5	132
360 min Winter	4.425	0.0	28.1	194

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	26.255	0.055	0.0	2.6	2.6	2.1	O K
600 min Winter	26.250	0.050	0.0	2.2	2.2	1.9	O K
720 min Winter	26.245	0.045	0.0	1.9	1.9	1.7	O K
960 min Winter	26.239	0.039	0.0	1.5	1.5	1.5	O K
1440 min Winter	26.232	0.032	0.0	1.1	1.1	1.2	O K
2160 min Winter	26.227	0.027	0.0	0.8	0.8	1.0	O K
2880 min Winter	26.223	0.023	0.0	0.7	0.7	0.9	O K
4320 min Winter	26.219	0.019	0.0	0.5	0.5	0.7	O K
5760 min Winter	26.217	0.017	0.0	0.4	0.4	0.6	O K
7200 min Winter	26.215	0.015	0.0	0.3	0.3	0.6	O K
8640 min Winter	26.214	0.014	0.0	0.3	0.3	0.5	O K
10080 min Winter	26.213	0.013	0.0	0.3	0.3	0.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	3.548	0.0	30.0	254
600 min Winter	2.988	0.0	31.6	312
720 min Winter	2.597	0.0	33.0	374
960 min Winter	2.080	0.0	35.2	496
1440 min Winter	1.522	0.0	38.6	740
2160 min Winter	1.113	0.0	42.4	1104
2880 min Winter	0.892	0.0	45.3	1432
4320 min Winter	0.652	0.0	49.7	2224
5760 min Winter	0.522	0.0	53.0	2848
7200 min Winter	0.439	0.0	55.8	3584
8640 min Winter	0.382	0.0	58.2	4376
10080 min Winter	0.339	0.0	60.2	5128

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.126

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	4	8	0.126

Model Details

Storage is Online Cover Level (m) 28.100

Cellular Storage Structure

Invert Level (m) 26.200 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	40.0	40.0	0.800	40.0	60.2	0.900	0.0	61.5

Hydro-Brake® Outflow Control

Design Head (m) 0.800 Hydro-Brake® Type Md5 SW Only Invert Level (m) 26.200
Design Flow (l/s) 17.0 Diameter (mm) 174

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.0	0.800	16.8	2.000	25.8	4.000	36.4	7.000	48.2
0.200	12.9	1.000	18.4	2.200	27.0	4.500	38.7	7.500	49.9
0.300	15.5	1.200	20.0	2.400	28.2	5.000	40.7	8.000	51.5
0.400	15.8	1.400	21.6	2.600	29.4	5.500	42.7	8.500	53.1
0.500	15.6	1.600	23.1	3.000	31.6	6.000	44.6	9.000	54.7
0.600	15.7	1.800	24.4	3.500	34.1	6.500	46.5	9.500	56.2

Summary of Results for 30 year Return Period

Half Drain Time : 10 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	26.518	0.318	0.0	15.7	15.7	12.1	O K
30 min Summer	26.533	0.333	0.0	15.8	15.8	12.6	O K
60 min Summer	26.490	0.290	0.0	15.4	15.4	11.0	O K
120 min Summer	26.415	0.215	0.0	13.6	13.6	8.2	O K
180 min Summer	26.373	0.173	0.0	11.5	11.5	6.6	O K
240 min Summer	26.348	0.148	0.0	9.8	9.8	5.6	O K
360 min Summer	26.319	0.119	0.0	7.5	7.5	4.5	O K
480 min Summer	26.302	0.102	0.0	6.2	6.2	3.9	O K
600 min Summer	26.291	0.091	0.0	5.3	5.3	3.4	O K
720 min Summer	26.282	0.082	0.0	4.6	4.6	3.1	O K
960 min Summer	26.270	0.070	0.0	3.7	3.7	2.7	O K
1440 min Summer	26.257	0.057	0.0	2.7	2.7	2.2	O K
2160 min Summer	26.246	0.046	0.0	2.0	2.0	1.7	O K
2880 min Summer	26.240	0.040	0.0	1.6	1.6	1.5	O K
4320 min Summer	26.232	0.032	0.0	1.1	1.1	1.2	O K
5760 min Summer	26.228	0.028	0.0	0.9	0.9	1.0	O K
7200 min Summer	26.225	0.025	0.0	0.7	0.7	0.9	O K
8640 min Summer	26.223	0.023	0.0	0.6	0.6	0.9	O K
10080 min Summer	26.221	0.021	0.0	0.6	0.6	0.8	O K
15 min Winter	26.557	0.357	0.0	15.8	15.8	13.6	O K
30 min Winter	26.559	0.359	0.0	15.9	15.9	13.6	O K
60 min Winter	26.485	0.285	0.0	15.3	15.3	10.8	O K
120 min Winter	26.388	0.188	0.0	12.3	12.3	7.1	O K
180 min Winter	26.347	0.147	0.0	9.7	9.7	5.6	O K
240 min Winter	26.323	0.123	0.0	7.9	7.9	4.7	O K
360 min Winter	26.298	0.098	0.0	5.8	5.8	3.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	81.719	0.0	19.3	17
30 min Summer	52.383	0.0	24.7	25
60 min Summer	32.061	0.0	30.3	42
120 min Summer	19.041	0.0	36.0	72
180 min Summer	13.895	0.0	39.4	102
240 min Summer	11.067	0.0	41.8	132
360 min Summer	8.018	0.0	45.4	192
480 min Summer	6.376	0.0	48.2	252
600 min Summer	5.334	0.0	50.4	312
720 min Summer	4.609	0.0	52.3	372
960 min Summer	3.659	0.0	55.3	494
1440 min Summer	2.640	0.0	59.9	738
2160 min Summer	1.903	0.0	64.7	1096
2880 min Summer	1.507	0.0	68.3	1456
4320 min Summer	1.085	0.0	73.8	2192
5760 min Summer	0.858	0.0	77.9	2912
7200 min Summer	0.716	0.0	81.1	3608
8640 min Summer	0.617	0.0	83.9	4384
10080 min Summer	0.544	0.0	86.3	5136
15 min Winter	81.719	0.0	21.6	18
30 min Winter	52.383	0.0	27.7	27
60 min Winter	32.061	0.0	33.9	44
120 min Winter	19.041	0.0	40.3	74
180 min Winter	13.895	0.0	44.1	102
240 min Winter	11.067	0.0	46.8	132
360 min Winter	8.018	0.0	50.9	192

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	26.283	0.083	0.0	4.7	4.7	3.2	O K
600 min Winter	26.274	0.074	0.0	4.0	4.0	2.8	O K
720 min Winter	26.267	0.067	0.0	3.4	3.4	2.5	O K
960 min Winter	26.257	0.057	0.0	2.7	2.7	2.2	O K
1440 min Winter	26.246	0.046	0.0	2.0	2.0	1.7	O K
2160 min Winter	26.237	0.037	0.0	1.4	1.4	1.4	O K
2880 min Winter	26.232	0.032	0.0	1.1	1.1	1.2	O K
4320 min Winter	26.226	0.026	0.0	0.8	0.8	1.0	O K
5760 min Winter	26.223	0.023	0.0	0.6	0.6	0.9	O K
7200 min Winter	26.220	0.020	0.0	0.5	0.5	0.8	O K
8640 min Winter	26.219	0.019	0.0	0.5	0.5	0.7	O K
10080 min Winter	26.217	0.017	0.0	0.4	0.4	0.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	6.376	0.0	54.0	252
600 min Winter	5.334	0.0	56.4	312
720 min Winter	4.609	0.0	58.5	372
960 min Winter	3.659	0.0	61.9	494
1440 min Winter	2.640	0.0	67.0	738
2160 min Winter	1.903	0.0	72.5	1104
2880 min Winter	1.507	0.0	76.6	1428
4320 min Winter	1.085	0.0	82.6	2132
5760 min Winter	0.858	0.0	87.2	2888
7200 min Winter	0.716	0.0	90.9	3544
8640 min Winter	0.617	0.0	94.0	4312
10080 min Winter	0.544	0.0	96.7	5032

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.126

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	4	8	0.126

Model Details

Storage is Online Cover Level (m) 28.100

Cellular Storage Structure

Invert Level (m) 26.200 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	40.0	40.0	0.800	40.0	60.2	0.900	0.0	61.5

Hydro-Brake® Outflow Control

Design Head (m) 0.800 Hydro-Brake® Type Md5 SW Only Invert Level (m) 26.200
Design Flow (l/s) 17.0 Diameter (mm) 174

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.0	0.800	16.8	2.000	25.8	4.000	36.4	7.000	48.2
0.200	12.9	1.000	18.4	2.200	27.0	4.500	38.7	7.500	49.9
0.300	15.5	1.200	20.0	2.400	28.2	5.000	40.7	8.000	51.5
0.400	15.8	1.400	21.6	2.600	29.4	5.500	42.7	8.500	53.1
0.500	15.6	1.600	23.1	3.000	31.6	6.000	44.6	9.000	54.7
0.600	15.7	1.800	24.4	3.500	34.1	6.500	46.5	9.500	56.2

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 17 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	26.805	0.605	0.0	15.9	15.9	23.0	O K
30 min Summer	26.861	0.661	0.0	16.0	16.0	25.1	O K
60 min Summer	26.818	0.618	0.0	15.9	15.9	23.5	O K
120 min Summer	26.663	0.463	0.0	15.9	15.9	17.6	O K
180 min Summer	26.537	0.337	0.0	15.8	15.8	12.8	O K
240 min Summer	26.462	0.262	0.0	14.9	14.9	10.0	O K
360 min Summer	26.390	0.190	0.0	12.4	12.4	7.2	O K
480 min Summer	26.356	0.156	0.0	10.3	10.3	5.9	O K
600 min Summer	26.335	0.135	0.0	8.8	8.8	5.1	O K
720 min Summer	26.321	0.121	0.0	7.7	7.7	4.6	O K
960 min Summer	26.302	0.102	0.0	6.2	6.2	3.9	O K
1440 min Summer	26.281	0.081	0.0	4.5	4.5	3.1	O K
2160 min Summer	26.264	0.064	0.0	3.2	3.2	2.4	O K
2880 min Summer	26.255	0.055	0.0	2.5	2.5	2.1	O K
4320 min Summer	26.244	0.044	0.0	1.8	1.8	1.7	O K
5760 min Summer	26.238	0.038	0.0	1.4	1.4	1.4	O K
7200 min Summer	26.233	0.033	0.0	1.2	1.2	1.3	O K
8640 min Summer	26.230	0.030	0.0	1.0	1.0	1.1	O K
10080 min Summer	26.228	0.028	0.0	0.9	0.9	1.1	O K
15 min Winter	26.892	0.692	0.0	16.1	16.1	26.3	O K
30 min Winter	26.946	0.746	0.0	16.4	16.4	28.4	O K
60 min Winter	26.869	0.669	0.0	16.0	16.0	25.4	O K
120 min Winter	26.626	0.426	0.0	15.9	15.9	16.2	O K
180 min Winter	26.471	0.271	0.0	15.1	15.1	10.3	O K
240 min Winter	26.403	0.203	0.0	13.1	13.1	7.7	O K
360 min Winter	26.349	0.149	0.0	9.8	9.8	5.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.220	0.0	32.6	19
30 min Summer	89.266	0.0	42.2	27
60 min Summer	54.817	0.0	51.8	44
120 min Summer	32.511	0.0	61.4	76
180 min Summer	23.643	0.0	67.0	106
240 min Summer	18.757	0.0	70.9	134
360 min Summer	13.517	0.0	76.6	192
480 min Summer	10.710	0.0	80.9	252
600 min Summer	8.935	0.0	84.4	312
720 min Summer	7.702	0.0	87.3	372
960 min Summer	6.089	0.0	92.0	494
1440 min Summer	4.367	0.0	99.0	738
2160 min Summer	3.127	0.0	106.4	1104
2880 min Summer	2.465	0.0	111.8	1472
4320 min Summer	1.761	0.0	119.8	2148
5760 min Summer	1.387	0.0	125.8	2872
7200 min Summer	1.151	0.0	130.5	3672
8640 min Summer	0.988	0.0	134.5	4336
10080 min Summer	0.869	0.0	137.9	5032
15 min Winter	138.220	0.0	36.6	19
30 min Winter	89.266	0.0	47.2	29
60 min Winter	54.817	0.0	58.0	48
120 min Winter	32.511	0.0	68.8	80
180 min Winter	23.643	0.0	75.1	108
240 min Winter	18.757	0.0	79.4	134
360 min Winter	13.517	0.0	85.8	194

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	26.323	0.123	0.0	7.9	7.9	4.7	O K
600 min Winter	26.307	0.107	0.0	6.6	6.6	4.1	O K
720 min Winter	26.296	0.096	0.0	5.7	5.7	3.6	O K
960 min Winter	26.281	0.081	0.0	4.5	4.5	3.1	O K
1440 min Winter	26.264	0.064	0.0	3.2	3.2	2.4	O K
2160 min Winter	26.252	0.052	0.0	2.3	2.3	2.0	O K
2880 min Winter	26.244	0.044	0.0	1.8	1.8	1.7	O K
4320 min Winter	26.236	0.036	0.0	1.3	1.3	1.4	O K
5760 min Winter	26.231	0.031	0.0	1.0	1.0	1.2	O K
7200 min Winter	26.227	0.027	0.0	0.9	0.9	1.0	O K
8640 min Winter	26.225	0.025	0.0	0.7	0.7	0.9	O K
10080 min Winter	26.223	0.023	0.0	0.6	0.6	0.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	10.710	0.0	90.7	252
600 min Winter	8.935	0.0	94.5	312
720 min Winter	7.702	0.0	97.8	374
960 min Winter	6.089	0.0	103.1	494
1440 min Winter	4.367	0.0	110.9	740
2160 min Winter	3.127	0.0	119.1	1104
2880 min Winter	2.465	0.0	125.2	1452
4320 min Winter	1.761	0.0	134.2	2168
5760 min Winter	1.387	0.0	140.9	2872
7200 min Winter	1.151	0.0	146.2	3736
8640 min Winter	0.988	0.0	150.6	4360
10080 min Winter	0.869	0.0	154.5	4984

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.126

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.000	4	8	0.126

Model Details

Storage is Online Cover Level (m) 28.100

Cellular Storage Structure

Invert Level (m) 26.200 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	40.0	40.0	0.800	40.0	60.2	0.900	0.0	61.5

Hydro-Brake® Outflow Control

Design Head (m) 0.800 Hydro-Brake® Type Md5 SW Only Invert Level (m) 26.200
Design Flow (l/s) 17.0 Diameter (mm) 174

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.0	0.800	16.8	2.000	25.8	4.000	36.4	7.000	48.2
0.200	12.9	1.000	18.4	2.200	27.0	4.500	38.7	7.500	49.9
0.300	15.5	1.200	20.0	2.400	28.2	5.000	40.7	8.000	51.5
0.400	15.8	1.400	21.6	2.600	29.4	5.500	42.7	8.500	53.1
0.500	15.6	1.600	23.1	3.000	31.6	6.000	44.6	9.000	54.7
0.600	15.7	1.800	24.4	3.500	34.1	6.500	46.5	9.500	56.2

Appendix B – Plot 2, Former One Stop Shop

Drainage Manhole Schedule

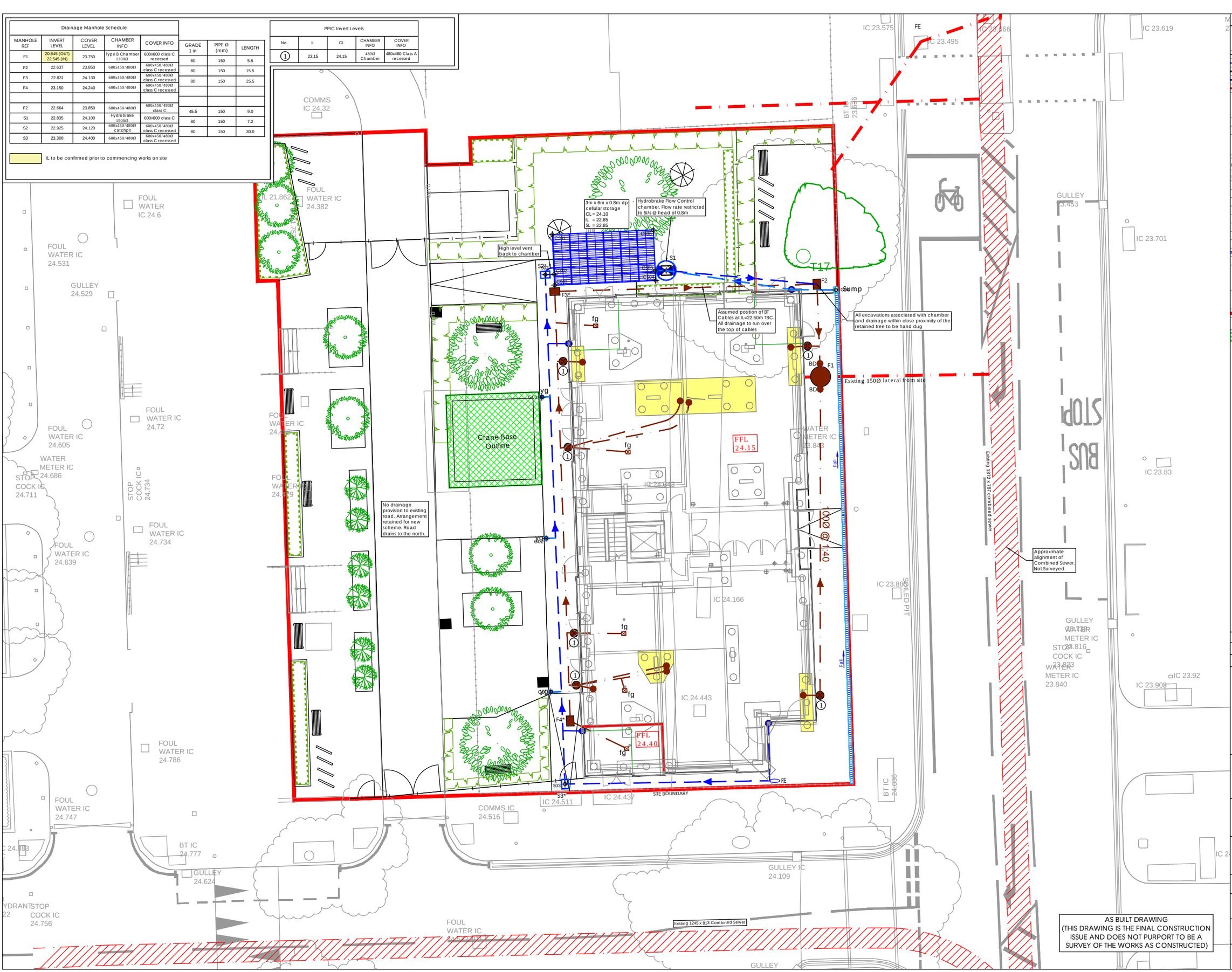
MANHOLE REF	INVERT LEVEL	COVER LEVEL	CHAMBER INFO	COVER INFO
F1	20.645 (OUT) 22.545 (IN)	23.750	Type B Chamber 1200Ø	600x600 class C recessed
F2	22.637	23.850	600x450/480Ø	600x450/480Ø class C recessed
F3	22.831	24.130	600x450/480Ø	600x450/480Ø class C recessed
F4	23.150	24.240	600x450/480Ø	600x450/480Ø class C recessed
F2	22.664	23.850	600x450/480Ø	600x450/480Ø class C
S1	22.835	24.100	Hydrobrake 150Ø	600x600 class C
S2	22.925	24.120	600x450/480Ø catchpit	600x450/480Ø class C recessed
S3	23.300	24.400	600x450/480Ø	600x450/480Ø class C recessed

IL to be confirmed prior to commencing works on site

GRADE 1 in	PIPE Ø (mm)	LENGTH
60	150	5.5
80	150	15.5
80	150	25.5
45.5	150	9.0
80	150	7.2
80	150	30.0

PPIC Invert Levels

No.	IL	CL	CHAMBER INFO	COVER INFO
1	23.15	24.15	480Ø Chamber	480x480 Class A recessed



NOTES / KEY:

Drainage Key

Sewers

- Foul water drain (private/non adoptable)
- Surface water drain (private/non adoptable)
- Foul water sewer (Adoptable)
- Surface water sewer (Adoptable)
- Existing combined water sewer (Adopted)

Chamber Key

FW SW

- PPIC - 475mmØ *
- P.C.C. units/brick *
- Manhole Depth 1.25 to 1.5m * Depth 1.55 to 3.0m *

* General note
(Refer to standard details & long sections for chamber sizes. Size may need to increase dependant on number of incoming pipes/size of incoming pipes)

- F1 — Manhole reference number
- * — Recessed cover required
- Rain water down pipe (roddable access)
- Soil vent pipe/soil stack
- Rodding access required in vertical stack
- yg — Yard gully (150m - 200mmØ trapped)
- fg — Floor gully (trapped) - Refer to architects details
- Cellular storage (refer to drawing for sizes)
- Linear drainage channel
- Surface water rodding eye
- Hydrobrake flow control valve
- FFL XX.XX — Finished Floor Level (FFL)
- Internal step in FFL
- Pile cap impacted by drainage
- Location of Crane Base

MARK	DATE	BY	CHKD.	REVISION NOTES
	03/03/20	NJ	TST	AS BUILT

C.D.M.

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PROJECT:
Plot 2 - Rydal Water Open Space
Regents Park Estate Infill

DRAWING TITLE:
Proposed Drainage Plan

STATUS:
AS BUILT

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:100	Nov 2015	NJ	TST

JOB NUMBER:	STATUS:	REVISION:
SE1238	AB	

DRAWING NUMBER:
RWOS-ISS-XX-00-DR-C-336

AS BUILT DRAWING
(THIS DRAWING IS THE FINAL CONSTRUCTION ISSUE AND DOES NOT PURPORT TO BE A SURVEY OF THE WORKS AS CONSTRUCTED)

Summary of Results for 2 year Return Period

Half Drain Time : 6 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	22.651	0.151	0.0	3.4	3.4	1.7	O K
30 min Summer	22.651	0.151	0.0	3.4	3.4	1.7	O K
60 min Summer	22.626	0.126	0.0	3.2	3.2	1.4	O K
120 min Summer	22.593	0.093	0.0	2.5	2.5	1.1	O K
180 min Summer	22.577	0.077	0.0	2.1	2.1	0.9	O K
240 min Summer	22.566	0.066	0.0	1.7	1.7	0.8	O K
360 min Summer	22.554	0.054	0.0	1.3	1.3	0.6	O K
480 min Summer	22.547	0.047	0.0	1.1	1.1	0.5	O K
600 min Summer	22.542	0.042	0.0	0.9	0.9	0.5	O K
720 min Summer	22.538	0.038	0.0	0.8	0.8	0.4	O K
960 min Summer	22.533	0.033	0.0	0.7	0.7	0.4	O K
1440 min Summer	22.527	0.027	0.0	0.5	0.5	0.3	O K
2160 min Summer	22.522	0.022	0.0	0.4	0.4	0.3	O K
2880 min Summer	22.519	0.019	0.0	0.3	0.3	0.2	O K
4320 min Summer	22.516	0.016	0.0	0.2	0.2	0.2	O K
5760 min Summer	22.514	0.014	0.0	0.2	0.2	0.2	O K
7200 min Summer	22.512	0.012	0.0	0.1	0.1	0.1	O K
8640 min Summer	22.511	0.011	0.0	0.1	0.1	0.1	O K
10080 min Summer	22.511	0.011	0.0	0.1	0.1	0.1	O K
15 min Winter	22.667	0.167	0.0	3.5	3.5	1.9	O K
30 min Winter	22.656	0.156	0.0	3.5	3.5	1.8	O K
60 min Winter	22.617	0.117	0.0	3.0	3.0	1.3	O K
120 min Winter	22.580	0.080	0.0	2.2	2.2	0.9	O K
180 min Winter	22.564	0.064	0.0	1.7	1.7	0.7	O K
240 min Winter	22.555	0.055	0.0	1.3	1.3	0.6	O K
360 min Winter	22.544	0.044	0.0	1.0	1.0	0.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	42.980	0.0	3.1	16
30 min Summer	27.473	0.0	4.0	24
60 min Summer	16.881	0.0	4.9	40
120 min Summer	10.146	0.0	5.9	70
180 min Summer	7.490	0.0	6.6	100
240 min Summer	6.029	0.0	7.0	130
360 min Summer	4.425	0.0	7.8	190
480 min Summer	3.548	0.0	8.3	250
600 min Summer	2.988	0.0	8.7	312
720 min Summer	2.597	0.0	9.1	372
960 min Summer	2.080	0.0	9.7	494
1440 min Summer	1.522	0.0	10.7	738
2160 min Summer	1.113	0.0	11.7	1096
2880 min Summer	0.892	0.0	12.5	1464
4320 min Summer	0.652	0.0	13.7	2156
5760 min Summer	0.522	0.0	14.6	2848
7200 min Summer	0.439	0.0	15.4	3600
8640 min Summer	0.382	0.0	16.1	4352
10080 min Summer	0.339	0.0	16.6	5112
15 min Winter	42.980	0.0	3.5	17
30 min Winter	27.473	0.0	4.5	25
60 min Winter	16.881	0.0	5.5	42
120 min Winter	10.146	0.0	6.6	72
180 min Winter	7.490	0.0	7.4	100
240 min Winter	6.029	0.0	7.9	132
360 min Winter	4.425	0.0	8.7	190

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	22.538	0.038	0.0	0.8	0.8	0.4	O K
600 min Winter	22.534	0.034	0.0	0.7	0.7	0.4	O K
720 min Winter	22.531	0.031	0.0	0.6	0.6	0.4	O K
960 min Winter	22.527	0.027	0.0	0.5	0.5	0.3	O K
1440 min Winter	22.522	0.022	0.0	0.3	0.3	0.2	O K
2160 min Winter	22.518	0.018	0.0	0.3	0.3	0.2	O K
2880 min Winter	22.516	0.016	0.0	0.2	0.2	0.2	O K
4320 min Winter	22.513	0.013	0.0	0.2	0.2	0.1	O K
5760 min Winter	22.511	0.011	0.0	0.1	0.1	0.1	O K
7200 min Winter	22.510	0.010	0.0	0.1	0.1	0.1	O K
8640 min Winter	22.509	0.009	0.0	0.1	0.1	0.1	O K
10080 min Winter	22.509	0.009	0.0	0.1	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	3.548	0.0	9.3	252
600 min Winter	2.988	0.0	9.8	314
720 min Winter	2.597	0.0	10.2	374
960 min Winter	2.080	0.0	10.9	480
1440 min Winter	1.522	0.0	12.0	740
2160 min Winter	1.113	0.0	13.1	1108
2880 min Winter	0.892	0.0	14.0	1472
4320 min Winter	0.652	0.0	15.4	2124
5760 min Winter	0.522	0.0	16.4	2936
7200 min Winter	0.439	0.0	17.3	3544
8640 min Winter	0.382	0.0	18.0	4296
10080 min Winter	0.339	0.0	18.6	4864

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.039

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	4	8	0.039

Model Details

Storage is Online Cover Level (m) 24.150

Cellular Storage Structure

Invert Level (m) 22.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	12.0	12.0	0.800	12.0	23.1	0.900	0.0	23.8

Hydro-Brake® Outflow Control

Design Head (m) 0.800 Hydro-Brake® Type Md5 SW Only Invert Level (m) 22.500
Design Flow (l/s) 5.0 Diameter (mm) 96

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	0.800	5.0	2.000	7.8	4.000	11.1	7.000	14.7
0.200	3.6	1.000	5.5	2.200	8.2	4.500	11.8	7.500	15.2
0.300	3.5	1.200	6.1	2.400	8.6	5.000	12.4	8.000	15.7
0.400	3.7	1.400	6.6	2.600	8.9	5.500	13.0	8.500	16.2
0.500	4.0	1.600	7.0	3.000	9.6	6.000	13.6	9.000	16.6
0.600	4.3	1.800	7.4	3.500	10.4	6.500	14.1	9.500	17.1

Summary of Results for 30 year Return Period

Half Drain Time : 12 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	22.839	0.339	0.0	3.6	3.6	3.9	O K
30 min Summer	22.856	0.356	0.0	3.6	3.6	4.1	O K
60 min Summer	22.811	0.311	0.0	3.6	3.6	3.5	O K
120 min Summer	22.709	0.209	0.0	3.6	3.6	2.4	O K
180 min Summer	22.648	0.148	0.0	3.4	3.4	1.7	O K
240 min Summer	22.617	0.117	0.0	3.0	3.0	1.3	O K
360 min Summer	22.588	0.088	0.0	2.4	2.4	1.0	O K
480 min Summer	22.573	0.073	0.0	1.9	1.9	0.8	O K
600 min Summer	22.564	0.064	0.0	1.7	1.7	0.7	O K
720 min Summer	22.558	0.058	0.0	1.4	1.4	0.7	O K
960 min Summer	22.549	0.049	0.0	1.2	1.2	0.6	O K
1440 min Summer	22.539	0.039	0.0	0.8	0.8	0.4	O K
2160 min Summer	22.531	0.031	0.0	0.6	0.6	0.4	O K
2880 min Summer	22.527	0.027	0.0	0.5	0.5	0.3	O K
4320 min Summer	22.522	0.022	0.0	0.3	0.3	0.2	O K
5760 min Summer	22.519	0.019	0.0	0.3	0.3	0.2	O K
7200 min Summer	22.517	0.017	0.0	0.2	0.2	0.2	O K
8640 min Summer	22.515	0.015	0.0	0.2	0.2	0.2	O K
10080 min Summer	22.514	0.014	0.0	0.2	0.2	0.2	O K
15 min Winter	22.888	0.388	0.0	3.7	3.7	4.4	O K
30 min Winter	22.898	0.398	0.0	3.7	3.7	4.5	O K
60 min Winter	22.824	0.324	0.0	3.6	3.6	3.7	O K
120 min Winter	22.673	0.173	0.0	3.5	3.5	2.0	O K
180 min Winter	22.614	0.114	0.0	3.0	3.0	1.3	O K
240 min Winter	22.591	0.091	0.0	2.5	2.5	1.0	O K
360 min Winter	22.569	0.069	0.0	1.8	1.8	0.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	81.719	0.0	6.0	18
30 min Summer	52.383	0.0	7.7	26
60 min Summer	32.061	0.0	9.4	44
120 min Summer	19.041	0.0	11.1	74
180 min Summer	13.895	0.0	12.2	102
240 min Summer	11.067	0.0	12.9	132
360 min Summer	8.018	0.0	14.1	190
480 min Summer	6.376	0.0	14.9	250
600 min Summer	5.334	0.0	15.6	312
720 min Summer	4.609	0.0	16.2	372
960 min Summer	3.659	0.0	17.1	494
1440 min Summer	2.640	0.0	18.5	738
2160 min Summer	1.903	0.0	20.0	1080
2880 min Summer	1.507	0.0	21.2	1472
4320 min Summer	1.085	0.0	22.8	2204
5760 min Summer	0.858	0.0	24.1	2936
7200 min Summer	0.716	0.0	25.1	3632
8640 min Summer	0.617	0.0	26.0	4400
10080 min Summer	0.544	0.0	26.7	4968
15 min Winter	81.719	0.0	6.7	19
30 min Winter	52.383	0.0	8.6	28
60 min Winter	32.061	0.0	10.5	46
120 min Winter	19.041	0.0	12.5	76
180 min Winter	13.895	0.0	13.7	102
240 min Winter	11.067	0.0	14.5	132
360 min Winter	8.018	0.0	15.8	190

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	22.558	0.058	0.0	1.5	1.5	0.7	O K
600 min Winter	22.551	0.051	0.0	1.2	1.2	0.6	O K
720 min Winter	22.546	0.046	0.0	1.1	1.1	0.5	O K
960 min Winter	22.539	0.039	0.0	0.8	0.8	0.4	O K
1440 min Winter	22.531	0.031	0.0	0.6	0.6	0.4	O K
2160 min Winter	22.525	0.025	0.0	0.4	0.4	0.3	O K
2880 min Winter	22.522	0.022	0.0	0.3	0.3	0.2	O K
4320 min Winter	22.518	0.018	0.0	0.3	0.3	0.2	O K
5760 min Winter	22.515	0.015	0.0	0.2	0.2	0.2	O K
7200 min Winter	22.514	0.014	0.0	0.2	0.2	0.2	O K
8640 min Winter	22.513	0.013	0.0	0.2	0.2	0.1	O K
10080 min Winter	22.512	0.012	0.0	0.1	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	6.376	0.0	16.7	252
600 min Winter	5.334	0.0	17.5	312
720 min Winter	4.609	0.0	18.1	372
960 min Winter	3.659	0.0	19.2	488
1440 min Winter	2.640	0.0	20.7	738
2160 min Winter	1.903	0.0	22.4	1080
2880 min Winter	1.507	0.0	23.7	1428
4320 min Winter	1.085	0.0	25.6	2184
5760 min Winter	0.858	0.0	27.0	2864
7200 min Winter	0.716	0.0	28.1	3720
8640 min Winter	0.617	0.0	29.1	4304
10080 min Winter	0.544	0.0	29.9	5168

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.039

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	4	8	0.039

Model Details

Storage is Online Cover Level (m) 24.150

Cellular Storage Structure

Invert Level (m) 22.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	12.0	12.0	0.800	12.0	23.1	0.900	0.0	23.8

Hydro-Brake® Outflow Control

Design Head (m) 0.800 Hydro-Brake® Type Md5 SW Only Invert Level (m) 22.500
Design Flow (l/s) 5.0 Diameter (mm) 96

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	0.800	5.0	2.000	7.8	4.000	11.1	7.000	14.7
0.200	3.6	1.000	5.5	2.200	8.2	4.500	11.8	7.500	15.2
0.300	3.5	1.200	6.1	2.400	8.6	5.000	12.4	8.000	15.7
0.400	3.7	1.400	6.6	2.600	8.9	5.500	13.0	8.500	16.2
0.500	4.0	1.600	7.0	3.000	9.6	6.000	13.6	9.000	16.6
0.600	4.3	1.800	7.4	3.500	10.4	6.500	14.1	9.500	17.1

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 18 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	23.139	0.639	0.0	4.4	4.4	7.3	O K
30 min Summer	23.195	0.695	0.0	4.6	4.6	7.9	O K
60 min Summer	23.162	0.662	0.0	4.5	4.5	7.5	O K
120 min Summer	23.038	0.538	0.0	4.1	4.1	6.1	O K
180 min Summer	22.920	0.420	0.0	3.7	3.7	4.8	O K
240 min Summer	22.815	0.315	0.0	3.6	3.6	3.6	O K
360 min Summer	22.675	0.175	0.0	3.5	3.5	2.0	O K
480 min Summer	22.625	0.125	0.0	3.2	3.2	1.4	O K
600 min Summer	22.602	0.102	0.0	2.8	2.8	1.2	O K
720 min Summer	22.589	0.089	0.0	2.4	2.4	1.0	O K
960 min Summer	22.573	0.073	0.0	1.9	1.9	0.8	O K
1440 min Summer	22.556	0.056	0.0	1.4	1.4	0.6	O K
2160 min Summer	22.544	0.044	0.0	1.0	1.0	0.5	O K
2880 min Summer	22.537	0.037	0.0	0.8	0.8	0.4	O K
4320 min Summer	22.530	0.030	0.0	0.6	0.6	0.3	O K
5760 min Summer	22.526	0.026	0.0	0.5	0.5	0.3	O K
7200 min Summer	22.523	0.023	0.0	0.4	0.4	0.3	O K
8640 min Summer	22.521	0.021	0.0	0.3	0.3	0.2	O K
10080 min Summer	22.519	0.019	0.0	0.3	0.3	0.2	O K
15 min Winter	23.229	0.729	0.0	4.7	4.7	8.3	O K
30 min Winter	23.290	0.790	0.0	4.9	4.9	9.0	O K
60 min Winter	23.232	0.732	0.0	4.7	4.7	8.3	O K
120 min Winter	23.043	0.543	0.0	4.1	4.1	6.2	O K
180 min Winter	22.872	0.372	0.0	3.6	3.6	4.2	O K
240 min Winter	22.718	0.218	0.0	3.6	3.6	2.5	O K
360 min Winter	22.616	0.116	0.0	3.0	3.0	1.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.220	0.0	10.1	19
30 min Summer	89.266	0.0	13.0	28
60 min Summer	54.817	0.0	16.0	44
120 min Summer	32.511	0.0	19.0	78
180 min Summer	23.643	0.0	20.7	110
240 min Summer	18.757	0.0	21.9	142
360 min Summer	13.517	0.0	23.7	196
480 min Summer	10.710	0.0	25.1	252
600 min Summer	8.935	0.0	26.1	312
720 min Summer	7.702	0.0	27.0	372
960 min Summer	6.089	0.0	28.5	494
1440 min Summer	4.367	0.0	30.6	738
2160 min Summer	3.127	0.0	32.9	1088
2880 min Summer	2.465	0.0	34.6	1440
4320 min Summer	1.761	0.0	37.1	2196
5760 min Summer	1.387	0.0	38.9	2896
7200 min Summer	1.151	0.0	40.4	3648
8640 min Summer	0.988	0.0	41.6	4288
10080 min Summer	0.869	0.0	42.7	4960
15 min Winter	138.220	0.0	11.3	19
30 min Winter	89.266	0.0	14.6	29
60 min Winter	54.817	0.0	18.0	48
120 min Winter	32.511	0.0	21.3	84
180 min Winter	23.643	0.0	23.2	116
240 min Winter	18.757	0.0	24.6	144
360 min Winter	13.517	0.0	26.6	194

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	22.590	0.090	0.0	2.4	2.4	1.0	O K
600 min Winter	22.576	0.076	0.0	2.0	2.0	0.9	O K
720 min Winter	22.568	0.068	0.0	1.8	1.8	0.8	O K
960 min Winter	22.556	0.056	0.0	1.4	1.4	0.6	O K
1440 min Winter	22.544	0.044	0.0	1.0	1.0	0.5	O K
2160 min Winter	22.535	0.035	0.0	0.7	0.7	0.4	O K
2880 min Winter	22.530	0.030	0.0	0.6	0.6	0.3	O K
4320 min Winter	22.524	0.024	0.0	0.4	0.4	0.3	O K
5760 min Winter	22.521	0.021	0.0	0.3	0.3	0.2	O K
7200 min Winter	22.518	0.018	0.0	0.3	0.3	0.2	O K
8640 min Winter	22.517	0.017	0.0	0.2	0.2	0.2	O K
10080 min Winter	22.515	0.015	0.0	0.2	0.2	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	10.710	0.0	28.1	252
600 min Winter	8.935	0.0	29.3	312
720 min Winter	7.702	0.0	30.3	370
960 min Winter	6.089	0.0	31.9	494
1440 min Winter	4.367	0.0	34.3	738
2160 min Winter	3.127	0.0	36.9	1104
2880 min Winter	2.465	0.0	38.8	1456
4320 min Winter	1.761	0.0	41.5	2148
5760 min Winter	1.387	0.0	43.6	2800
7200 min Winter	1.151	0.0	45.2	3544
8640 min Winter	0.988	0.0	46.6	4392
10080 min Winter	0.869	0.0	47.8	5136

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.039

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.000	4	8	0.039

Model Details

Storage is Online Cover Level (m) 24.150

Cellular Storage Structure

Invert Level (m) 22.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

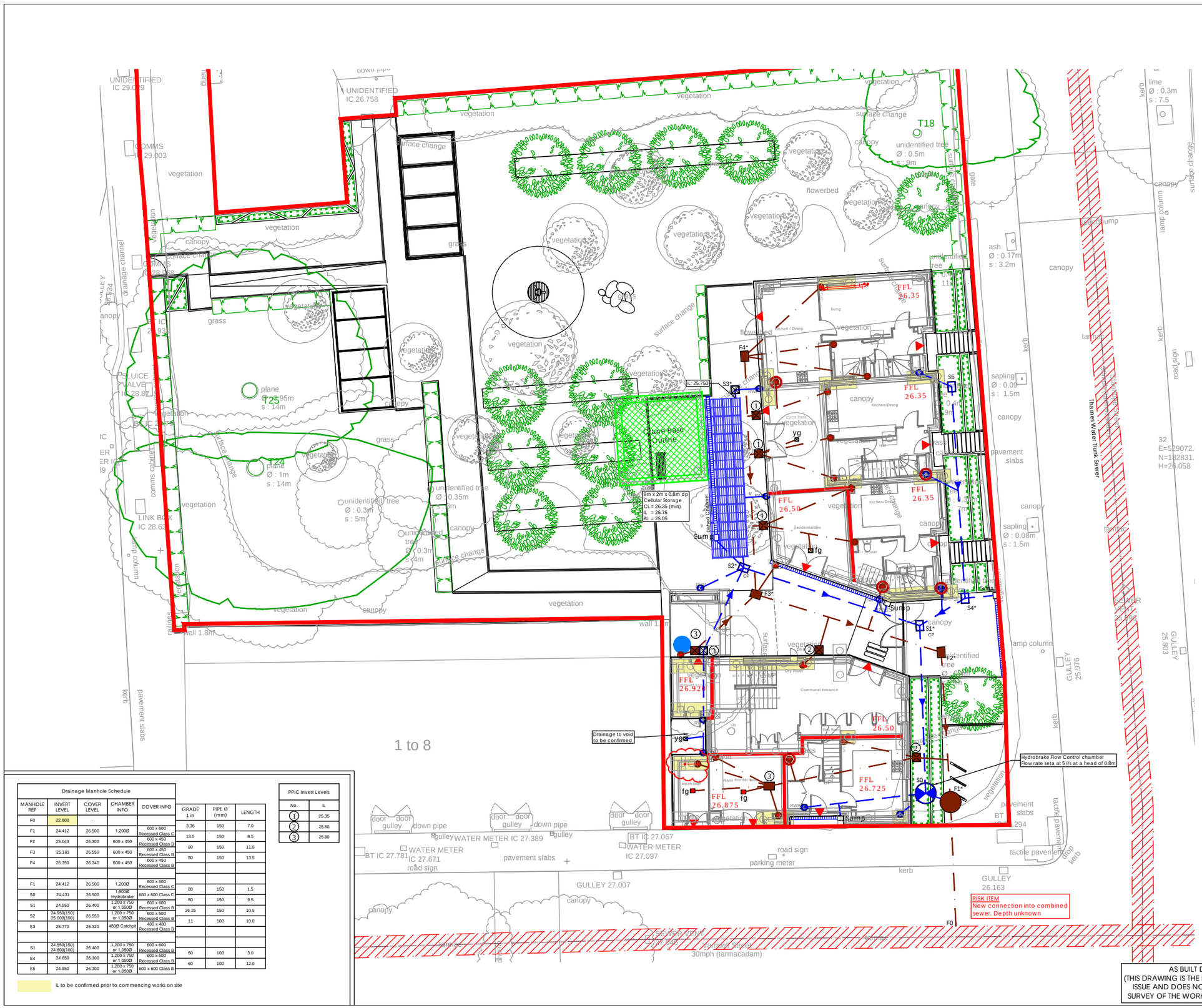
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	12.0	12.0	0.800	12.0	23.1	0.900	0.0	23.8

Hydro-Brake® Outflow Control

Design Head (m) 0.800 Hydro-Brake® Type Md5 SW Only Invert Level (m) 22.500
Design Flow (l/s) 5.0 Diameter (mm) 96

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	0.800	5.0	2.000	7.8	4.000	11.1	7.000	14.7
0.200	3.6	1.000	5.5	2.200	8.2	4.500	11.8	7.500	15.2
0.300	3.5	1.200	6.1	2.400	8.6	5.000	12.4	8.000	15.7
0.400	3.7	1.400	6.6	2.600	8.9	5.500	13.0	8.500	16.2
0.500	4.0	1.600	7.0	3.000	9.6	6.000	13.6	9.000	16.6
0.600	4.3	1.800	7.4	3.500	10.4	6.500	14.1	9.500	17.1

Appendix C – Plot 3, Varndell Street Corner



Drainage Manhole Schedule							
MANHOLE REF	INVERT LEVEL	COVER LEVEL	CHAMBER INFO	COVER INFO	GRADE 1 in	PIPE Ø (mm)	LENGTH
F0	22.600	-			3.36	150	7.0
F1	24.412	26.500	1,200Ø	600 x 600 Recessed Class C	13.5	150	8.5
F2	25.043	26.300	600 x 450	600 x 450 Recessed Class B	80	150	11.0
F3	25.181	26.550	600 x 450	600 x 450 Recessed Class B	80	150	13.5
F4	25.350	26.340	600 x 450	600 x 450 Recessed Class B			
F1	24.412	26.500	1,200Ø	600 x 600 Recessed Class C			
S0	24.431	26.500	1,500Ø Hydrobrake	600 x 600 Class C	80	150	1.5
S1	24.550	26.400	1,200 x 750 or 1,050Ø	600 x 600 Recessed Class B	80	150	9.5
S2	24.950(150) 25.000(100)	26.550	1,200 x 750 or 1,050Ø	600 x 600 Recessed Class B	26.25	150	10.5
S3	25.770	26.320	480Ø Catchpit	480 x 480 Recessed Class B	11	100	10.0
S1	24.550(150) 24.600(100)	26.400	1,200 x 750 or 1,050Ø	600 x 600 Recessed Class B			
S4	24.650	26.300	1,200 x 750 or 1,050Ø	600 x 600 Recessed Class B	60	100	3.0
S5	24.850	26.300	1,200 x 750 or 1,050Ø	600 x 600 Class B	60	100	12.0

IL to be confirmed prior to commencing works on site

PPIC Invert Levels	
No.	IL
1	25.35
2	25.50
3	25.80

AS BUILT DRAWING
(THIS DRAWING IS THE FINAL CONSTRUCTION ISSUE AND DOES NOT PURPORT TO BE A SURVEY OF THE WORKS AS CONSTRUCTED)

NOTES / KEY:

Drainage Key

Sewers

- Foul water drain (private/non adoptable)
- Surface water drain (private/non adoptable)
- Foul water sewer (Adoptable)
- Surface water sewer (Adoptable)
- Existing combined water sewer (Adopted)

Chamber Key

FW SW

- PPIC - 475mmØ *
- P.C.C. units/brick *
- Manhole Depth 1.25 to 1.5m * Depth 1.55 to 3.0m *

* General note
(Refer to standard details & long sections for chamber sizes. Site may need to increase dependant on number of incoming pipes/size of incoming pipes)

- F1 — Manhole reference number
- * — Recessed cover required
- Rain water down pipe (roddable access)
- Soil vent pipe/soil stack
- Rodding access required in vertical stack
- Hydrobrake Manhole Chamber
- Yard gully (150m - 200mmØ trapped)
- Floor gully (trapped)
- Cellular storage (refer to drawing for sizes)
- Linear drainage channel
- Surface water rodding eye
- FFL XX.XX — Finished Floor Level (FFL)
- Internal step in FFL
- Pile cap impacted by proposed drainage
- Location of Crane Base

MARK	DATE	BY	CHKD.	REVISION NOTES
	03/03/20	NJ	TST	AS BUILT

C.D.M.

SIGNIFICANT RISKS AND HAZARDS:

iesis SPECIAL STRUCTURES
IESIS SPECIAL STRUCTURES
20 IRONMONGER LANE
LONDON
EC2V 8EP
T: +44 (0)207 6002912
www.iesis.net

PROJECT:
Plot 3 - Varndell Street Corner Regents Park Estate Infill

DRAWING TITLE:
Proposed Drainage Plan

STATUS:
AS BUILT

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:100	Nov 2015	NJ	TST

JOB NUMBER:	STATUS:	REVISION:
SE1238	AB	

DRAWING NUMBER:
VARS-ISS-XX-00-DR-C-341

Summary of Results for 2 year Return Period

Half Drain Time : 10 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	25.545	0.145	0.0	3.4	3.4	2.5	O K
30 min Summer	25.552	0.152	0.0	3.4	3.4	2.6	O K
60 min Summer	25.535	0.135	0.0	3.3	3.3	2.3	O K
120 min Summer	25.505	0.105	0.0	2.8	2.8	1.8	O K
180 min Summer	25.488	0.088	0.0	2.4	2.4	1.5	O K
240 min Summer	25.476	0.076	0.0	2.0	2.0	1.3	O K
360 min Summer	25.462	0.062	0.0	1.6	1.6	1.1	O K
480 min Summer	25.454	0.054	0.0	1.3	1.3	0.9	O K
600 min Summer	25.448	0.048	0.0	1.1	1.1	0.8	O K
720 min Summer	25.444	0.044	0.0	1.0	1.0	0.8	O K
960 min Summer	25.438	0.038	0.0	0.8	0.8	0.7	O K
1440 min Summer	25.431	0.031	0.0	0.6	0.6	0.5	O K
2160 min Summer	25.426	0.026	0.0	0.5	0.5	0.4	O K
2880 min Summer	25.422	0.022	0.0	0.4	0.4	0.4	O K
4320 min Summer	25.418	0.018	0.0	0.3	0.3	0.3	O K
5760 min Summer	25.416	0.016	0.0	0.2	0.2	0.3	O K
7200 min Summer	25.414	0.014	0.0	0.2	0.2	0.2	O K
8640 min Summer	25.413	0.013	0.0	0.2	0.2	0.2	O K
10080 min Summer	25.412	0.012	0.0	0.1	0.1	0.2	O K
15 min Winter	25.562	0.162	0.0	3.5	3.5	2.8	O K
30 min Winter	25.563	0.163	0.0	3.5	3.5	2.8	O K
60 min Winter	25.533	0.133	0.0	3.3	3.3	2.3	O K
120 min Winter	25.494	0.094	0.0	2.5	2.5	1.6	O K
180 min Winter	25.475	0.075	0.0	2.0	2.0	1.3	O K
240 min Winter	25.464	0.064	0.0	1.7	1.7	1.1	O K
360 min Winter	25.452	0.052	0.0	1.3	1.3	0.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	42.980	0.0	3.9	17
30 min Summer	27.473	0.0	5.0	25
60 min Summer	16.881	0.0	6.2	42
120 min Summer	10.146	0.0	7.4	72
180 min Summer	7.490	0.0	8.2	102
240 min Summer	6.029	0.0	8.9	132
360 min Summer	4.425	0.0	9.7	192
480 min Summer	3.548	0.0	10.4	252
600 min Summer	2.988	0.0	11.0	312
720 min Summer	2.597	0.0	11.4	372
960 min Summer	2.080	0.0	12.2	494
1440 min Summer	1.522	0.0	13.4	738
2160 min Summer	1.113	0.0	14.7	1100
2880 min Summer	0.892	0.0	15.7	1460
4320 min Summer	0.652	0.0	17.2	2156
5760 min Summer	0.522	0.0	18.4	2936
7200 min Summer	0.439	0.0	19.4	3664
8640 min Summer	0.382	0.0	20.2	4392
10080 min Summer	0.339	0.0	20.9	5040
15 min Winter	42.980	0.0	4.4	18
30 min Winter	27.473	0.0	5.6	26
60 min Winter	16.881	0.0	6.9	42
120 min Winter	10.146	0.0	8.3	74
180 min Winter	7.490	0.0	9.2	104
240 min Winter	6.029	0.0	9.9	134
360 min Winter	4.425	0.0	10.9	194

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	25.444	0.044	0.0	1.0	1.0	0.8	O K
600 min Winter	25.440	0.040	0.0	0.9	0.9	0.7	O K
720 min Winter	25.436	0.036	0.0	0.7	0.7	0.6	O K
960 min Winter	25.431	0.031	0.0	0.6	0.6	0.5	O K
1440 min Winter	25.425	0.025	0.0	0.4	0.4	0.4	O K
2160 min Winter	25.421	0.021	0.0	0.3	0.3	0.4	O K
2880 min Winter	25.418	0.018	0.0	0.3	0.3	0.3	O K
4320 min Winter	25.415	0.015	0.0	0.2	0.2	0.2	O K
5760 min Winter	25.413	0.013	0.0	0.2	0.2	0.2	O K
7200 min Winter	25.412	0.012	0.0	0.1	0.1	0.2	O K
8640 min Winter	25.411	0.011	0.0	0.1	0.1	0.2	O K
10080 min Winter	25.410	0.010	0.0	0.1	0.1	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	3.548	0.0	11.7	254
600 min Winter	2.988	0.0	12.3	314
720 min Winter	2.597	0.0	12.8	378
960 min Winter	2.080	0.0	13.7	494
1440 min Winter	1.522	0.0	15.0	738
2160 min Winter	1.113	0.0	16.5	1072
2880 min Winter	0.892	0.0	17.6	1500
4320 min Winter	0.652	0.0	19.3	2160
5760 min Winter	0.522	0.0	20.6	2936
7200 min Winter	0.439	0.0	21.7	3624
8640 min Winter	0.382	0.0	22.6	4336
10080 min Winter	0.339	0.0	23.4	5144

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.049

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	4	8	0.049

Model Details

Storage is Online Cover Level (m) 26.500

Cellular Storage Structure

Invert Level (m) 25.400 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	18.0	18.0	0.800	18.0	31.6	0.900	0.0	32.4

Hydro-Brake® Outflow Control

Design Head (m) 0.800 Hydro-Brake® Type Md5 SW Only Invert Level (m) 25.400
Design Flow (l/s) 5.0 Diameter (mm) 96

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	0.800	5.0	2.000	7.8	4.000	11.1	7.000	14.7
0.200	3.6	1.000	5.5	2.200	8.2	4.500	11.8	7.500	15.2
0.300	3.5	1.200	6.1	2.400	8.6	5.000	12.4	8.000	15.7
0.400	3.7	1.400	6.6	2.600	8.9	5.500	13.0	8.500	16.2
0.500	4.0	1.600	7.0	3.000	9.6	6.000	13.6	9.000	16.6
0.600	4.3	1.800	7.4	3.500	10.4	6.500	14.1	9.500	17.1

Summary of Results for 30 year Return Period

Half Drain Time : 18 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	25.713	0.313	0.0	3.6	3.6	5.3	O K
30 min Summer	25.740	0.340	0.0	3.6	3.6	5.8	O K
60 min Summer	25.720	0.320	0.0	3.6	3.6	5.5	O K
120 min Summer	25.643	0.243	0.0	3.6	3.6	4.2	O K
180 min Summer	25.581	0.181	0.0	3.6	3.6	3.1	O K
240 min Summer	25.544	0.144	0.0	3.4	3.4	2.5	O K
360 min Summer	25.505	0.105	0.0	2.8	2.8	1.8	O K
480 min Summer	25.487	0.087	0.0	2.4	2.4	1.5	O K
600 min Summer	25.476	0.076	0.0	2.0	2.0	1.3	O K
720 min Summer	25.468	0.068	0.0	1.8	1.8	1.2	O K
960 min Summer	25.458	0.058	0.0	1.4	1.4	1.0	O K
1440 min Summer	25.446	0.046	0.0	1.1	1.1	0.8	O K
2160 min Summer	25.436	0.036	0.0	0.8	0.8	0.6	O K
2880 min Summer	25.431	0.031	0.0	0.6	0.6	0.5	O K
4320 min Summer	25.425	0.025	0.0	0.4	0.4	0.4	O K
5760 min Summer	25.422	0.022	0.0	0.3	0.3	0.4	O K
7200 min Summer	25.419	0.019	0.0	0.3	0.3	0.3	O K
8640 min Summer	25.418	0.018	0.0	0.3	0.3	0.3	O K
10080 min Summer	25.416	0.016	0.0	0.2	0.2	0.3	O K
15 min Winter	25.758	0.358	0.0	3.6	3.6	6.1	O K
30 min Winter	25.785	0.385	0.0	3.7	3.7	6.6	O K
60 min Winter	25.746	0.346	0.0	3.6	3.6	5.9	O K
120 min Winter	25.626	0.226	0.0	3.6	3.6	3.9	O K
180 min Winter	25.549	0.149	0.0	3.4	3.4	2.5	O K
240 min Winter	25.513	0.113	0.0	3.0	3.0	1.9	O K
360 min Winter	25.483	0.083	0.0	2.3	2.3	1.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	81.719	0.0	7.5	19
30 min Summer	52.383	0.0	9.6	27
60 min Summer	32.061	0.0	11.8	44
120 min Summer	19.041	0.0	14.0	76
180 min Summer	13.895	0.0	15.3	106
240 min Summer	11.067	0.0	16.3	134
360 min Summer	8.018	0.0	17.7	192
480 min Summer	6.376	0.0	18.7	252
600 min Summer	5.334	0.0	19.6	312
720 min Summer	4.609	0.0	20.3	372
960 min Summer	3.659	0.0	21.5	494
1440 min Summer	2.640	0.0	23.3	738
2160 min Summer	1.903	0.0	25.2	1104
2880 min Summer	1.507	0.0	26.6	1456
4320 min Summer	1.085	0.0	28.7	2200
5760 min Summer	0.858	0.0	30.3	2896
7200 min Summer	0.716	0.0	31.6	3600
8640 min Summer	0.617	0.0	32.6	4376
10080 min Summer	0.544	0.0	33.6	5032
15 min Winter	81.719	0.0	8.4	19
30 min Winter	52.383	0.0	10.8	29
60 min Winter	32.061	0.0	13.2	48
120 min Winter	19.041	0.0	15.7	80
180 min Winter	13.895	0.0	17.1	108
240 min Winter	11.067	0.0	18.2	136
360 min Winter	8.018	0.0	19.8	194

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	25.469	0.069	0.0	1.8	1.8	1.2	O K
600 min Winter	25.460	0.060	0.0	1.5	1.5	1.0	O K
720 min Winter	25.454	0.054	0.0	1.3	1.3	0.9	O K
960 min Winter	25.446	0.046	0.0	1.1	1.1	0.8	O K
1440 min Winter	25.437	0.037	0.0	0.8	0.8	0.6	O K
2160 min Winter	25.429	0.029	0.0	0.5	0.5	0.5	O K
2880 min Winter	25.425	0.025	0.0	0.4	0.4	0.4	O K
4320 min Winter	25.420	0.020	0.0	0.3	0.3	0.4	O K
5760 min Winter	25.418	0.018	0.0	0.3	0.3	0.3	O K
7200 min Winter	25.416	0.016	0.0	0.2	0.2	0.3	O K
8640 min Winter	25.414	0.014	0.0	0.2	0.2	0.2	O K
10080 min Winter	25.413	0.013	0.0	0.2	0.2	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	6.376	0.0	21.0	252
600 min Winter	5.334	0.0	21.9	312
720 min Winter	4.609	0.0	22.8	376
960 min Winter	3.659	0.0	24.1	494
1440 min Winter	2.640	0.0	26.1	738
2160 min Winter	1.903	0.0	28.2	1104
2880 min Winter	1.507	0.0	29.8	1432
4320 min Winter	1.085	0.0	32.1	2208
5760 min Winter	0.858	0.0	33.9	2864
7200 min Winter	0.716	0.0	35.3	3656
8640 min Winter	0.617	0.0	36.5	4312
10080 min Winter	0.544	0.0	37.6	5096

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.049

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	4	8	0.049

Model Details

Storage is Online Cover Level (m) 26.500

Cellular Storage Structure

Invert Level (m) 25.400 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	18.0	18.0	0.800	18.0	31.6	0.900	0.0	32.4

Hydro-Brake® Outflow Control

Design Head (m) 0.800 Hydro-Brake® Type Md5 SW Only Invert Level (m) 25.400
Design Flow (l/s) 5.0 Diameter (mm) 96

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	0.800	5.0	2.000	7.8	4.000	11.1	7.000	14.7
0.200	3.6	1.000	5.5	2.200	8.2	4.500	11.8	7.500	15.2
0.300	3.5	1.200	6.1	2.400	8.6	5.000	12.4	8.000	15.7
0.400	3.7	1.400	6.6	2.600	8.9	5.500	13.0	8.500	16.2
0.500	4.0	1.600	7.0	3.000	9.6	6.000	13.6	9.000	16.6
0.600	4.3	1.800	7.4	3.500	10.4	6.500	14.1	9.500	17.1

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 26 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	25.980	0.580	0.0	4.2	4.2	9.9	O K
30 min Summer	26.047	0.647	0.0	4.5	4.5	11.1	O K
60 min Summer	26.044	0.644	0.0	4.5	4.5	11.0	O K
120 min Summer	25.959	0.559	0.0	4.2	4.2	9.6	O K
180 min Summer	25.870	0.470	0.0	3.9	3.9	8.0	O K
240 min Summer	25.786	0.386	0.0	3.7	3.7	6.6	O K
360 min Summer	25.648	0.248	0.0	3.6	3.6	4.2	O K
480 min Summer	25.568	0.168	0.0	3.5	3.5	2.9	O K
600 min Summer	25.530	0.130	0.0	3.2	3.2	2.2	O K
720 min Summer	25.510	0.110	0.0	2.9	2.9	1.9	O K
960 min Summer	25.488	0.088	0.0	2.4	2.4	1.5	O K
1440 min Summer	25.467	0.067	0.0	1.7	1.7	1.1	O K
2160 min Summer	25.452	0.052	0.0	1.3	1.3	0.9	O K
2880 min Summer	25.444	0.044	0.0	1.0	1.0	0.7	O K
4320 min Summer	25.435	0.035	0.0	0.7	0.7	0.6	O K
5760 min Summer	25.430	0.030	0.0	0.6	0.6	0.5	O K
7200 min Summer	25.426	0.026	0.0	0.5	0.5	0.4	O K
8640 min Summer	25.424	0.024	0.0	0.4	0.4	0.4	O K
10080 min Summer	25.422	0.022	0.0	0.3	0.3	0.4	O K
15 min Winter	26.059	0.659	0.0	4.5	4.5	11.3	O K
30 min Winter	26.139	0.739	0.0	4.8	4.8	12.6	O K
60 min Winter	26.125	0.725	0.0	4.7	4.7	12.4	O K
120 min Winter	25.995	0.595	0.0	4.3	4.3	10.2	O K
180 min Winter	25.864	0.464	0.0	3.9	3.9	7.9	O K
240 min Winter	25.742	0.342	0.0	3.6	3.6	5.8	O K
360 min Winter	25.567	0.167	0.0	3.5	3.5	2.9	O K
480 min Winter	25.515	0.115	0.0	3.0	3.0	2.0	O K
600 min Winter	25.494	0.094	0.0	2.5	2.5	1.6	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	138.220	20
30 min Summer	89.266	29
60 min Summer	54.817	46
120 min Summer	32.511	80
180 min Summer	23.643	114
240 min Summer	18.757	146
360 min Summer	13.517	204
480 min Summer	10.710	260
600 min Summer	8.935	316
720 min Summer	7.702	374
960 min Summer	6.089	494
1440 min Summer	4.367	738
2160 min Summer	3.127	1104
2880 min Summer	2.465	1464
4320 min Summer	1.761	2156
5760 min Summer	1.387	2872
7200 min Summer	1.151	3576
8640 min Summer	0.988	4392
10080 min Summer	0.869	5128
15 min Winter	138.220	20
30 min Winter	89.266	31
60 min Winter	54.817	50
120 min Winter	32.511	86
180 min Winter	23.643	122
240 min Winter	18.757	154
360 min Winter	13.517	204
480 min Winter	10.710	258
600 min Winter	8.935	316

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
720 min Winter	25.482	0.082	0.0	2.2	2.2	1.4	O K
960 min Winter	25.467	0.067	0.0	1.8	1.8	1.1	O K
1440 min Winter	25.452	0.052	0.0	1.3	1.3	0.9	O K
2160 min Winter	25.441	0.041	0.0	0.9	0.9	0.7	O K
2880 min Winter	25.435	0.035	0.0	0.7	0.7	0.6	O K
4320 min Winter	25.428	0.028	0.0	0.5	0.5	0.5	O K
5760 min Winter	25.424	0.024	0.0	0.4	0.4	0.4	O K
7200 min Winter	25.421	0.021	0.0	0.3	0.3	0.4	O K
8640 min Winter	25.419	0.019	0.0	0.3	0.3	0.3	O K
10080 min Winter	25.418	0.018	0.0	0.3	0.3	0.3	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
720 min Winter	7.702	374
960 min Winter	6.089	494
1440 min Winter	4.367	728
2160 min Winter	3.127	1084
2880 min Winter	2.465	1468
4320 min Winter	1.761	2192
5760 min Winter	1.387	2936
7200 min Winter	1.151	3672
8640 min Winter	0.988	4312
10080 min Winter	0.869	4968

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time / Area Diagram

Total Area (ha) 0.049

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.000	4-8	0.049

Model Details

Storage is Online Cover Level (m) 26.500

Cellular Storage Structure

Invert Level (m) 25.400 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

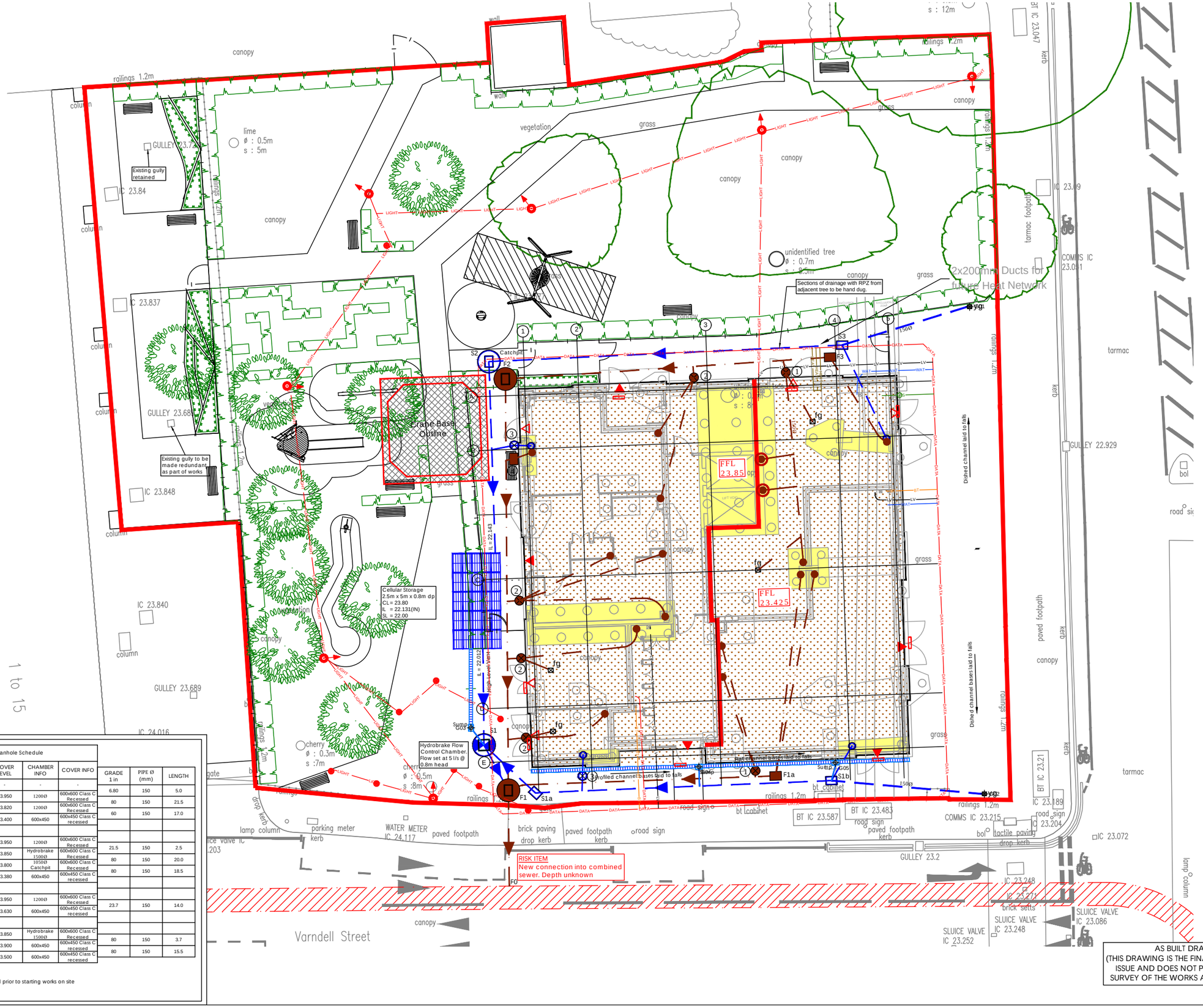
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	18.0	18.0	0.800	18.0	31.6	0.900	0.0	32.4

Hydro-Brake® Outflow Control

Design Head (m) 0.800 Hydro-Brake® Type Md5 SW Only Invert Level (m) 25.400
Design Flow (l/s) 5.0 Diameter (mm) 96

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	0.800	5.0	2.000	7.8	4.000	11.1	7.000	14.7
0.200	3.6	1.000	5.5	2.200	8.2	4.500	11.8	7.500	15.2
0.300	3.5	1.200	6.1	2.400	8.6	5.000	12.4	8.000	15.7
0.400	3.7	1.400	6.6	2.600	8.9	5.500	13.0	8.500	16.2
0.500	4.0	1.600	7.0	3.000	9.6	6.000	13.6	9.000	16.6
0.600	4.3	1.800	7.4	3.500	10.4	6.500	14.1	9.500	17.1

Appendix D – Plot 4, Newlands



N

NOTES / KEY:

Drainage Key

Sewers

	Foul water drain (private/non adoptable)
	Surface water drain (private/non adoptable)
	Foul water sewer (Adoptable)
	Surface water sewer (Adoptable)
	Existing combined water sewer (Adopted)

Chamber Key

FW	SW	
		PPIC - 475mmØ *
		P.C.C. units/brick *
		Manhole Depth 1.25 to 1.5m * Depth 1.55 to 3.0m *

* General note
(Refer to standard details & long sections for chamber sizes. Size may need to increase dependant on number of incoming pipes/size of incoming pipes)

F1	Manhole reference number
*	Recessed cover required
	Rain water down pipe (roddable access)
	Soil vent pipe/soil stack
	Rodding access required in vertical stack
yg	Yard gully (150m - 200mmØ trapped)
fg	Floor gully (trapped)
	Cellular storage (refer to drawing for sizes)
	Linear drainage channel
	Surface water rodding eye
	Hydrobrake flow control valve
FFL XX.XX	Finished Floor Level (FFL)
	Internal step in FFL
	Brown Roof
	Pile cap impacted by proposed drainage
	Location of Crane Base

Note:

SVP and RWP locations taken from Ingleton Wood M&E Drawing. Subject to confirmation once M&E Construction Drawings received.

PPIC Invert Levels

No.	IL	CHAMBER INFO	COVER INFO
1	22.40	480Ø Chamber	480x480 Class A recessed
2	22.85	480Ø Chamber	480x480 Class A recessed
3	23.10	480Ø Chamber	480x480 Class A recessed
4	22.35	450 x 600 Chamber	450x600 Class A recessed

Drainage Manhole Schedule

MANHOLE REF	INVERT LEVEL	COVER LEVEL	CHAMBER INFO	COVER INFO	GRADE 1 in	PIPE Ø (mm)	LENGTH
F0	21.100	-	-	-			
F1	21.834	23.950	1200Ø	600x600 Class C Recessed	6.80	150	5.0
F2	22.102	23.820	1200Ø	600x600 Class C Recessed	80	150	21.5
F3	22.386	23.400	600x450	600x450 Class C recessed	60	150	17.0
F1	21.834	23.950	1200Ø	600x600 Class C Recessed			
S1	21.950	23.850	Hydrobrake 150Ø	600x600 Class C Recessed	21.5	150	2.5
S2	22.268	23.800	1050Ø Catchpit	600x600 Class C Recessed	80	150	20.0
S3	22.500	23.380	600x450	600x450 Class C recessed	80	150	18.5
F1	21.834	23.950	1200Ø	600x600 Class C Recessed			
F1a	22.425	23.630	600x450	600x450 Class C recessed	23.7	150	14.0
S1	21.95(OUT) 22.360(IN)	23.850	Hydrobrake 150Ø	600x600 Class C Recessed			
S1a	22.406	23.900	600x450	600x450 Class C recessed	80	150	3.7
S1b	22.600	23.500	600x450	600x450 Class C recessed	80	150	15.5

IL to be confirmed prior to starting works on site

MARK	DATE	BY	CHKD.	REVISION NOTES
	21/02/20	NJ	TST	AS BUILT

C.D.M.

SIGNIFICANT RISKS AND HAZARDS:

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20 IRONMONGER LANE
LONDON
EC2V 8EP
T: +44 (0)207 6002912
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PROJECT:
Plot 4 - Newlands
Regents Park Estate Infill

DRAWING TITLE:
Proposed Drainage Plan

STATUS:
AS BUILT

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:100	Dec 2015	NJ	TST

JOB NUMBER:	STATUS:	REVISION:
SE1238	AB	

DRAWING NUMBER:
NL-ISS-XX-00-DR-C-346

AS BUILT DRAWING
(THIS DRAWING IS THE FINAL CONSTRUCTION ISSUE AND DOES NOT PURPORT TO BE A SURVEY OF THE WORKS AS CONSTRUCTED)

Summary of Results for 2 year Return Period

Half Drain Time : 7 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	21.801	0.151	0.0	3.4	3.4	1.8	O K
30 min Summer	21.802	0.152	0.0	3.4	3.4	1.8	O K
60 min Summer	21.777	0.127	0.0	3.2	3.2	1.5	O K
120 min Summer	21.745	0.095	0.0	2.6	2.6	1.1	O K
180 min Summer	21.728	0.078	0.0	2.1	2.1	0.9	O K
240 min Summer	21.718	0.068	0.0	1.8	1.8	0.8	O K
360 min Summer	21.705	0.055	0.0	1.4	1.4	0.7	O K
480 min Summer	21.698	0.048	0.0	1.1	1.1	0.6	O K
600 min Summer	21.692	0.042	0.0	0.9	0.9	0.5	O K
720 min Summer	21.689	0.039	0.0	0.8	0.8	0.5	O K
960 min Summer	21.684	0.034	0.0	0.7	0.7	0.4	O K
1440 min Summer	21.677	0.027	0.0	0.5	0.5	0.3	O K
2160 min Summer	21.672	0.022	0.0	0.4	0.4	0.3	O K
2880 min Summer	21.670	0.020	0.0	0.3	0.3	0.2	O K
4320 min Summer	21.666	0.016	0.0	0.2	0.2	0.2	O K
5760 min Summer	21.664	0.014	0.0	0.2	0.2	0.2	O K
7200 min Summer	21.663	0.013	0.0	0.2	0.2	0.1	O K
8640 min Summer	21.662	0.012	0.0	0.1	0.1	0.1	O K
10080 min Summer	21.661	0.011	0.0	0.1	0.1	0.1	O K
15 min Winter	21.817	0.167	0.0	3.5	3.5	2.0	O K
30 min Winter	21.808	0.158	0.0	3.5	3.5	1.9	O K
60 min Winter	21.769	0.119	0.0	3.1	3.1	1.4	O K
120 min Winter	21.732	0.082	0.0	2.2	2.2	1.0	O K
180 min Winter	21.715	0.065	0.0	1.7	1.7	0.8	O K
240 min Winter	21.706	0.056	0.0	1.4	1.4	0.7	O K
360 min Winter	21.695	0.045	0.0	1.0	1.0	0.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	42.980	0.0	3.2	16
30 min Summer	27.473	0.0	4.1	24
60 min Summer	16.881	0.0	5.1	40
120 min Summer	10.146	0.0	6.1	70
180 min Summer	7.490	0.0	6.7	100
240 min Summer	6.029	0.0	7.2	130
360 min Summer	4.425	0.0	8.0	190
480 min Summer	3.548	0.0	8.5	250
600 min Summer	2.988	0.0	9.0	312
720 min Summer	2.597	0.0	9.3	372
960 min Summer	2.080	0.0	10.0	494
1440 min Summer	1.522	0.0	11.0	738
2160 min Summer	1.113	0.0	12.0	1104
2880 min Summer	0.892	0.0	12.8	1460
4320 min Summer	0.652	0.0	14.1	2172
5760 min Summer	0.522	0.0	15.0	2936
7200 min Summer	0.439	0.0	15.8	3632
8640 min Summer	0.382	0.0	16.5	4336
10080 min Summer	0.339	0.0	17.1	5096
15 min Winter	42.980	0.0	3.6	17
30 min Winter	27.473	0.0	4.6	26
60 min Winter	16.881	0.0	5.7	42
120 min Winter	10.146	0.0	6.8	72
180 min Winter	7.490	0.0	7.5	102
240 min Winter	6.029	0.0	8.1	132
360 min Winter	4.425	0.0	8.9	192

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	21.689	0.039	0.0	0.8	0.8	0.5	O K
600 min Winter	21.685	0.035	0.0	0.7	0.7	0.4	O K
720 min Winter	21.681	0.031	0.0	0.6	0.6	0.4	O K
960 min Winter	21.677	0.027	0.0	0.5	0.5	0.3	O K
1440 min Winter	21.672	0.022	0.0	0.4	0.4	0.3	O K
2160 min Winter	21.668	0.018	0.0	0.3	0.3	0.2	O K
2880 min Winter	21.666	0.016	0.0	0.2	0.2	0.2	O K
4320 min Winter	21.663	0.013	0.0	0.2	0.2	0.2	O K
5760 min Winter	21.661	0.011	0.0	0.1	0.1	0.1	O K
7200 min Winter	21.660	0.010	0.0	0.1	0.1	0.1	O K
8640 min Winter	21.659	0.009	0.0	0.1	0.1	0.1	O K
10080 min Winter	21.659	0.009	0.0	0.1	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	3.548	0.0	9.5	250
600 min Winter	2.988	0.0	10.0	312
720 min Winter	2.597	0.0	10.5	374
960 min Winter	2.080	0.0	11.2	494
1440 min Winter	1.522	0.0	12.3	716
2160 min Winter	1.113	0.0	13.5	1092
2880 min Winter	0.892	0.0	14.4	1408
4320 min Winter	0.652	0.0	15.8	2188
5760 min Winter	0.522	0.0	16.8	2936
7200 min Winter	0.439	0.0	17.7	3560
8640 min Winter	0.382	0.0	18.5	4408
10080 min Winter	0.339	0.0	19.1	5088

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.040

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	4	8	0.040

Model Details

Storage is Online Cover Level (m) 23.850

Cellular Storage Structure

Invert Level (m) 21.650 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	12.5	12.5	0.800	12.5	23.8	0.900	0.0	24.5

Hydro-Brake® Outflow Control

Design Head (m) 0.800 Hydro-Brake® Type Md5 SW Only Invert Level (m) 21.650
Design Flow (l/s) 5.0 Diameter (mm) 96

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	0.800	5.0	2.000	7.8	4.000	11.1	7.000	14.7
0.200	3.6	1.000	5.5	2.200	8.2	4.500	11.8	7.500	15.2
0.300	3.5	1.200	6.1	2.400	8.6	5.000	12.4	8.000	15.7
0.400	3.7	1.400	6.6	2.600	8.9	5.500	13.0	8.500	16.2
0.500	4.0	1.600	7.0	3.000	9.6	6.000	13.6	9.000	16.6
0.600	4.3	1.800	7.4	3.500	10.4	6.500	14.1	9.500	17.1

Summary of Results for 30 year Return Period

Half Drain Time : 13 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	21.988	0.338	0.0	3.6	3.6	4.0	O K
30 min Summer	22.006	0.356	0.0	3.6	3.6	4.2	O K
60 min Summer	21.964	0.314	0.0	3.6	3.6	3.7	O K
120 min Summer	21.864	0.214	0.0	3.6	3.6	2.5	O K
180 min Summer	21.802	0.152	0.0	3.4	3.4	1.8	O K
240 min Summer	21.770	0.120	0.0	3.1	3.1	1.4	O K
360 min Summer	21.740	0.090	0.0	2.4	2.4	1.1	O K
480 min Summer	21.725	0.075	0.0	2.0	2.0	0.9	O K
600 min Summer	21.715	0.065	0.0	1.7	1.7	0.8	O K
720 min Summer	21.709	0.059	0.0	1.5	1.5	0.7	O K
960 min Summer	21.700	0.050	0.0	1.2	1.2	0.6	O K
1440 min Summer	21.690	0.040	0.0	0.9	0.9	0.5	O K
2160 min Summer	21.682	0.032	0.0	0.6	0.6	0.4	O K
2880 min Summer	21.677	0.027	0.0	0.5	0.5	0.3	O K
4320 min Summer	21.672	0.022	0.0	0.4	0.4	0.3	O K
5760 min Summer	21.669	0.019	0.0	0.3	0.3	0.2	O K
7200 min Summer	21.667	0.017	0.0	0.2	0.2	0.2	O K
8640 min Summer	21.666	0.016	0.0	0.2	0.2	0.2	O K
10080 min Summer	21.664	0.014	0.0	0.2	0.2	0.2	O K
15 min Winter	22.036	0.386	0.0	3.7	3.7	4.6	O K
30 min Winter	22.049	0.399	0.0	3.7	3.7	4.7	O K
60 min Winter	21.978	0.328	0.0	3.6	3.6	3.9	O K
120 min Winter	21.829	0.179	0.0	3.6	3.6	2.1	O K
180 min Winter	21.767	0.117	0.0	3.1	3.1	1.4	O K
240 min Winter	21.743	0.093	0.0	2.5	2.5	1.1	O K
360 min Winter	21.721	0.071	0.0	1.9	1.9	0.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	81.719	0.0	6.1	18
30 min Summer	52.383	0.0	7.9	26
60 min Summer	32.061	0.0	9.6	44
120 min Summer	19.041	0.0	11.4	74
180 min Summer	13.895	0.0	12.5	102
240 min Summer	11.067	0.0	13.3	132
360 min Summer	8.018	0.0	14.4	190
480 min Summer	6.376	0.0	15.3	250
600 min Summer	5.334	0.0	16.0	312
720 min Summer	4.609	0.0	16.6	372
960 min Summer	3.659	0.0	17.6	494
1440 min Summer	2.640	0.0	19.0	736
2160 min Summer	1.903	0.0	20.5	1104
2880 min Summer	1.507	0.0	21.7	1436
4320 min Summer	1.085	0.0	23.4	2180
5760 min Summer	0.858	0.0	24.7	2936
7200 min Summer	0.716	0.0	25.8	3624
8640 min Summer	0.617	0.0	26.6	4376
10080 min Summer	0.544	0.0	27.4	5096
15 min Winter	81.719	0.0	6.9	19
30 min Winter	52.383	0.0	8.8	28
60 min Winter	32.061	0.0	10.8	46
120 min Winter	19.041	0.0	12.8	76
180 min Winter	13.895	0.0	14.0	104
240 min Winter	11.067	0.0	14.9	132
360 min Winter	8.018	0.0	16.2	190

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	21.709	0.059	0.0	1.5	1.5	0.7	O K
600 min Winter	21.702	0.052	0.0	1.3	1.3	0.6	O K
720 min Winter	21.697	0.047	0.0	1.1	1.1	0.6	O K
960 min Winter	21.690	0.040	0.0	0.9	0.9	0.5	O K
1440 min Winter	21.682	0.032	0.0	0.6	0.6	0.4	O K
2160 min Winter	21.676	0.026	0.0	0.5	0.5	0.3	O K
2880 min Winter	21.672	0.022	0.0	0.4	0.4	0.3	O K
4320 min Winter	21.668	0.018	0.0	0.3	0.3	0.2	O K
5760 min Winter	21.666	0.016	0.0	0.2	0.2	0.2	O K
7200 min Winter	21.664	0.014	0.0	0.2	0.2	0.2	O K
8640 min Winter	21.663	0.013	0.0	0.2	0.2	0.1	O K
10080 min Winter	21.662	0.012	0.0	0.1	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	6.376	0.0	17.1	250
600 min Winter	5.334	0.0	17.9	312
720 min Winter	4.609	0.0	18.6	370
960 min Winter	3.659	0.0	19.7	484
1440 min Winter	2.640	0.0	21.3	740
2160 min Winter	1.903	0.0	23.0	1080
2880 min Winter	1.507	0.0	24.3	1456
4320 min Winter	1.085	0.0	26.2	2200
5760 min Winter	0.858	0.0	27.7	2912
7200 min Winter	0.716	0.0	28.9	3648
8640 min Winter	0.617	0.0	29.8	4256
10080 min Winter	0.544	0.0	30.7	5040

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.040

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	4	8	0.040

Model Details

Storage is Online Cover Level (m) 23.850

Cellular Storage Structure

Invert Level (m) 21.650 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	12.5	12.5	0.800	12.5	23.8	0.900	0.0	24.5

Hydro-Brake® Outflow Control

Design Head (m) 0.800 Hydro-Brake® Type Md5 SW Only Invert Level (m) 21.650
Design Flow (l/s) 5.0 Diameter (mm) 96

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	0.800	5.0	2.000	7.8	4.000	11.1	7.000	14.7
0.200	3.6	1.000	5.5	2.200	8.2	4.500	11.8	7.500	15.2
0.300	3.5	1.200	6.1	2.400	8.6	5.000	12.4	8.000	15.7
0.400	3.7	1.400	6.6	2.600	8.9	5.500	13.0	8.500	16.2
0.500	4.0	1.600	7.0	3.000	9.6	6.000	13.6	9.000	16.6
0.600	4.3	1.800	7.4	3.500	10.4	6.500	14.1	9.500	17.1

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 19 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	22.285	0.635	0.0	4.4	4.4	7.5	O K
30 min Summer	22.342	0.692	0.0	4.6	4.6	8.2	O K
60 min Summer	22.312	0.662	0.0	4.5	4.5	7.9	O K
120 min Summer	22.193	0.543	0.0	4.1	4.1	6.4	O K
180 min Summer	22.078	0.428	0.0	3.8	3.8	5.1	O K
240 min Summer	21.976	0.326	0.0	3.6	3.6	3.9	O K
360 min Summer	21.832	0.182	0.0	3.6	3.6	2.2	O K
480 min Summer	21.778	0.128	0.0	3.2	3.2	1.5	O K
600 min Summer	21.755	0.105	0.0	2.8	2.8	1.2	O K
720 min Summer	21.741	0.091	0.0	2.5	2.5	1.1	O K
960 min Summer	21.724	0.074	0.0	2.0	2.0	0.9	O K
1440 min Summer	21.707	0.057	0.0	1.4	1.4	0.7	O K
2160 min Summer	21.695	0.045	0.0	1.0	1.0	0.5	O K
2880 min Summer	21.688	0.038	0.0	0.8	0.8	0.5	O K
4320 min Summer	21.680	0.030	0.0	0.6	0.6	0.4	O K
5760 min Summer	21.676	0.026	0.0	0.5	0.5	0.3	O K
7200 min Summer	21.673	0.023	0.0	0.4	0.4	0.3	O K
8640 min Summer	21.671	0.021	0.0	0.3	0.3	0.2	O K
10080 min Summer	21.669	0.019	0.0	0.3	0.3	0.2	O K
15 min Winter	22.374	0.724	0.0	4.7	4.7	8.6	O K
30 min Winter	22.438	0.788	0.0	4.9	4.9	9.4	O K
60 min Winter	22.385	0.735	0.0	4.8	4.8	8.7	O K
120 min Winter	22.202	0.552	0.0	4.2	4.2	6.6	O K
180 min Winter	22.035	0.385	0.0	3.7	3.7	4.6	O K
240 min Winter	21.883	0.233	0.0	3.6	3.6	2.8	O K
360 min Winter	21.770	0.120	0.0	3.1	3.1	1.4	O K
480 min Winter	21.742	0.092	0.0	2.5	2.5	1.1	O K
600 min Winter	21.728	0.078	0.0	2.1	2.1	0.9	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	138.220	19
30 min Summer	89.266	28
60 min Summer	54.817	46
120 min Summer	32.511	78
180 min Summer	23.643	112
240 min Summer	18.757	142
360 min Summer	13.517	196
480 min Summer	10.710	254
600 min Summer	8.935	312
720 min Summer	7.702	372
960 min Summer	6.089	494
1440 min Summer	4.367	738
2160 min Summer	3.127	1088
2880 min Summer	2.465	1460
4320 min Summer	1.761	2160
5760 min Summer	1.387	2936
7200 min Summer	1.151	3616
8640 min Summer	0.988	4368
10080 min Summer	0.869	5056
15 min Winter	138.220	19
30 min Winter	89.266	29
60 min Winter	54.817	48
120 min Winter	32.511	84
180 min Winter	23.643	118
240 min Winter	18.757	144
360 min Winter	13.517	194
480 min Winter	10.710	252
600 min Winter	8.935	310

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
720 min Winter	21.719	0.069	0.0	1.8	1.8	0.8	O K
960 min Winter	21.707	0.057	0.0	1.4	1.4	0.7	O K
1440 min Winter	21.695	0.045	0.0	1.0	1.0	0.5	O K
2160 min Winter	21.686	0.036	0.0	0.7	0.7	0.4	O K
2880 min Winter	21.681	0.031	0.0	0.6	0.6	0.4	O K
4320 min Winter	21.675	0.025	0.0	0.4	0.4	0.3	O K
5760 min Winter	21.671	0.021	0.0	0.3	0.3	0.3	O K
7200 min Winter	21.669	0.019	0.0	0.3	0.3	0.2	O K
8640 min Winter	21.667	0.017	0.0	0.2	0.2	0.2	O K
10080 min Winter	21.666	0.016	0.0	0.2	0.2	0.2	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
720 min Winter	7.702	374
960 min Winter	6.089	494
1440 min Winter	4.367	724
2160 min Winter	3.127	1076
2880 min Winter	2.465	1436
4320 min Winter	1.761	2160
5760 min Winter	1.387	2896
7200 min Winter	1.151	3592
8640 min Winter	0.988	4352
10080 min Winter	0.869	5000

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time / Area Diagram

Total Area (ha) 0.040

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.000	4-8	0.040

Model Details

Storage is Online Cover Level (m) 23.850

Cellular Storage Structure

Invert Level (m) 21.650 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	12.5	12.5	0.800	12.5	23.8	0.900	0.0	24.5

Hydro-Brake® Outflow Control

Design Head (m) 0.800 Hydro-Brake® Type Md5 SW Only Invert Level (m) 21.650
Design Flow (l/s) 5.0 Diameter (mm) 96

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	0.800	5.0	2.000	7.8	4.000	11.1	7.000	14.7
0.200	3.6	1.000	5.5	2.200	8.2	4.500	11.8	7.500	15.2
0.300	3.5	1.200	6.1	2.400	8.6	5.000	12.4	8.000	15.7
0.400	3.7	1.400	6.6	2.600	8.9	5.500	13.0	8.500	16.2
0.500	4.0	1.600	7.0	3.000	9.6	6.000	13.6	9.000	16.6
0.600	4.3	1.800	7.4	3.500	10.4	6.500	14.1	9.500	17.1

Appendix E – Plot 5, Dick Collins Hall

Drainage Manhole Schedule

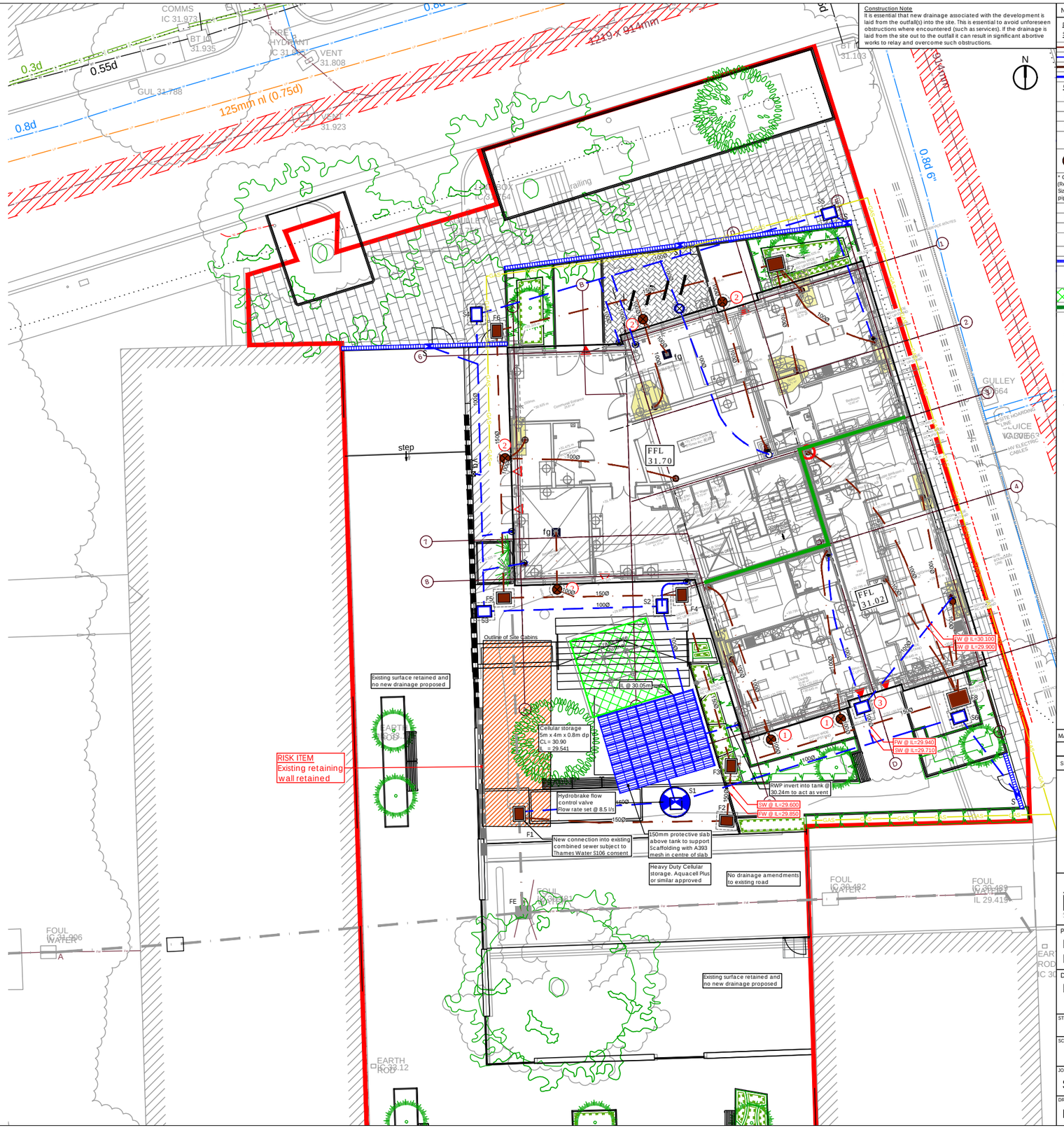
MANHOLE REF	INVERT LEVEL	COVER LEVEL	CHAMBER DETAILS	COVER DETAILS
FE	29.312	30.48	Existing	Existing
F1	29.367	30.65	450 x 600	450 x 600 B125 recessed
F2	29.816	30.65	450 x 600	450 x 600 B125 recessed
F3	29.850	30.95	450 x 600	450 x 600 B125
F4	30.237	31.68	750 x 1200	450 x 600 B125 recessed
F5	30.350	31.68	450 x 600	450 x 600 B125 recessed
F6	30.518	31.90	450 x 600	450 x 600 B125 recessed
F7	30.700	31.70	600 x 750	450 x 600 B125
F3	29.850	30.95	450 x 600	450 x 600 B125
F8	30.000	30.95	600 x 750	450 x 600 B125 recessed
F1	29.367	30.65	450 x 600	450 x 600 B125 recessed
S1	29.500	30.70	Hydrobrake 150ØD	600 x 600 B125 recessed
S2	30.131	31.66	750 x 1200	450 x 600 B125 recessed
S3	30.281	31.70	450 x 600	450 x 600 B125 recessed
S4	30.468	31.82	450 x 600	450 x 600 B125 recessed
S5	30.700	31.20	480Ø	480Ø B125
S1	29.500	30.70	Hydrobrake 150ØD	600 x 600 B125 recessed
S6	29.800	30.90	450 x 600	450 x 600 B125 recessed

IL to be confirmed prior to commencing works on site

GRADE 1 in	PIPE Ø (mm)	LENGTH
90.0	150	5.0
21.6	150	10.5
80.0	150	2.7
23.2	150	9.0
80.0	150	9.0
80.0	150	13.5
80.0	150	14.5
80.0	150	12.0
52.6	150	8.0
60.0	100	10.0
60.0	100	9.0
80.0	100	15.0
80.0	100	18.5
50.0	100	15.0

PPIC Invert Levels

NO	IL
1	30.000
2	30.700
3	29.750



Construction Note
It is essential that new drainage associated with the development is laid from the outfall(s) into the site. This is essential to avoid unforeseen obstructions where encountered (such as services). If the drainage is laid from the site out to the outfall it can result in significant abortive works to relay and overcome such obstructions.

NOTES / KEY:

Drainage Key

Sewers

- Foul water drain (private/non adoptable)
- Surface water drain (private/non adoptable)
- Foul water sewer (Adoptable)
- Surface water sewer (Adoptable)

Chamber Key

FW	SW	
		Mini access chamber (mac) - 300mmØ *
		PPIC - 475mmØ *
		P.C.C. units/brick *
FW	SW	Adoptable demarcation manhole within 1m of boundary *
		Manhole Depth 1.25 to 1.5m * Depth 1.55 to 3.0m *

* General note
(Refer to standard details & long sections for chamber sizes. Size may need to increase dependant on number of incoming pipes/size of incoming pipes)

F1	Manhole reference number
	Rain water down pipe (roddable access)
	Soil vent pipe/soil stack
	Soil vent pipe/soil stack with rodding access
	Floor gully (trapped)
	Linear drainage channel
FFL XX.XX	Finished Floor Level (FFL)
	Location of Crane Base (TBC)
	Internal step in FFL

Note:

SVP and RWP locations taken from Bates FMC Drawing; 17052-DCH-PH200 Rev C1

Surface Water

Flow rates reduced to those detailed within planning approved FRA produced by Campbell Reith with storage to cater for 1:100 year +30% climate change in line with planning condition 28.

Foul Water

Scheme assumes sufficient capacity with system for increased foul flows.

MARK	DATE	BY	CHKD.	REVISION NOTES
	21/02/20	NJ	TST	AS BUILT

C.D.M.

SIGNIFICANT RISKS AND HAZARDS:

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EC2V 8EP
T: +44 (0)207 6002912
www.iesis.net

PROJECT:
Plot 5 - Dick Collins Hall
Regents Park Estate Infill

DRAWING TITLE:
Proposed Drainage Plan

STATUS:
AS BUILT

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:100	July 2017	NJ	TST

JOB NUMBER:	STATUS:	REVISION:
SE1238	AB	

DRAWING NUMBER:
DCH-ISS-XX-00-DR-C-351

AS BUILT DRAWING
(THIS DRAWING IS THE FINAL CONSTRUCTION ISSUE AND DOES NOT PURPORT TO BE A SURVEY OF THE WORKS AS CONSTRUCTED)

Summary of Results for 2 year Return Period

Half Drain Time : 2 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	29.647	0.047	0.0	6.9	6.9	0.9	O K
30 min Summer	29.628	0.028	0.0	6.9	6.9	0.5	O K
60 min Summer	29.600	0.000	0.0	6.9	6.9	0.0	O K
120 min Summer	29.600	0.000	0.0	4.6	4.6	0.0	O K
180 min Summer	29.600	0.000	0.0	3.5	3.5	0.0	O K
240 min Summer	29.600	0.000	0.0	2.8	2.8	0.0	O K
360 min Summer	29.600	0.000	0.0	2.1	2.1	0.0	O K
480 min Summer	29.600	0.000	0.0	1.7	1.7	0.0	O K
600 min Summer	29.600	0.000	0.0	1.4	1.4	0.0	O K
720 min Summer	29.600	0.000	0.0	1.2	1.2	0.0	O K
960 min Summer	29.600	0.000	0.0	1.0	1.0	0.0	O K
1440 min Summer	29.600	0.000	0.0	0.7	0.7	0.0	O K
2160 min Summer	29.600	0.000	0.0	0.5	0.5	0.0	O K
2880 min Summer	29.600	0.000	0.0	0.4	0.4	0.0	O K
4320 min Summer	29.600	0.000	0.0	0.3	0.3	0.0	O K
5760 min Summer	29.600	0.000	0.0	0.2	0.2	0.0	O K
7200 min Summer	29.600	0.000	0.0	0.2	0.2	0.0	O K
8640 min Summer	29.600	0.000	0.0	0.2	0.2	0.0	O K
10080 min Summer	29.600	0.000	0.0	0.2	0.2	0.0	O K
15 min Winter	29.652	0.052	0.0	6.9	6.9	1.0	O K
30 min Winter	29.619	0.019	0.0	6.9	6.9	0.4	O K
60 min Winter	29.600	0.000	0.0	5.6	5.6	0.0	O K
120 min Winter	29.600	0.000	0.0	3.4	3.4	0.0	O K
180 min Winter	29.600	0.000	0.0	2.5	2.5	0.0	O K
240 min Winter	29.600	0.000	0.0	2.0	2.0	0.0	O K
360 min Winter	29.600	0.000	0.0	1.5	1.5	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	42.980	0.0	4.5	16
30 min Summer	27.473	0.0	5.8	23
60 min Summer	16.881	0.0	7.2	0
120 min Summer	10.146	0.0	8.7	0
180 min Summer	7.490	0.0	9.6	0
240 min Summer	6.029	0.0	10.3	0
360 min Summer	4.425	0.0	11.4	0
480 min Summer	3.548	0.0	12.1	0
600 min Summer	2.988	0.0	12.8	0
720 min Summer	2.597	0.0	13.3	0
960 min Summer	2.080	0.0	14.2	0
1440 min Summer	1.522	0.0	15.6	0
2160 min Summer	1.113	0.0	17.1	0
2880 min Summer	0.892	0.0	18.3	0
4320 min Summer	0.652	0.0	20.1	0
5760 min Summer	0.522	0.0	21.4	0
7200 min Summer	0.439	0.0	22.5	0
8640 min Summer	0.382	0.0	23.5	0
10080 min Summer	0.339	0.0	24.3	0
15 min Winter	42.980	0.0	5.0	16
30 min Winter	27.473	0.0	6.7	24
60 min Winter	16.881	0.0	8.1	0
120 min Winter	10.146	0.0	9.7	0
180 min Winter	7.490	0.0	10.8	0
240 min Winter	6.029	0.0	11.5	0
360 min Winter	4.425	0.0	12.7	0

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	29.600	0.000	0.0	1.2	1.2	0.0	O K
600 min Winter	29.600	0.000	0.0	1.0	1.0	0.0	O K
720 min Winter	29.600	0.000	0.0	0.9	0.9	0.0	O K
960 min Winter	29.600	0.000	0.0	0.7	0.7	0.0	O K
1440 min Winter	29.600	0.000	0.0	0.5	0.5	0.0	O K
2160 min Winter	29.600	0.000	0.0	0.4	0.4	0.0	O K
2880 min Winter	29.600	0.000	0.0	0.3	0.3	0.0	O K
4320 min Winter	29.600	0.000	0.0	0.2	0.2	0.0	O K
5760 min Winter	29.600	0.000	0.0	0.2	0.2	0.0	O K
7200 min Winter	29.600	0.000	0.0	0.1	0.1	0.0	O K
8640 min Winter	29.600	0.000	0.0	0.1	0.1	0.0	O K
10080 min Winter	29.600	0.000	0.0	0.1	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	3.548	0.0	13.6	0
600 min Winter	2.988	0.0	14.3	0
720 min Winter	2.597	0.0	14.9	0
960 min Winter	2.080	0.0	15.9	0
1440 min Winter	1.522	0.0	17.5	0
2160 min Winter	1.113	0.0	19.2	0
2880 min Winter	0.892	0.0	20.5	0
4320 min Winter	0.652	0.0	22.5	0
5760 min Winter	0.522	0.0	24.0	0
7200 min Winter	0.439	0.0	25.2	0
8640 min Winter	0.382	0.0	26.3	0
10080 min Winter	0.339	0.0	27.3	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.057

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	4	8	0.057

Model Details

Storage is Online Cover Level (m) 30.900

Cellular Storage Structure

Invert Level (m) 29.600 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	20.0	20.0	0.800	20.0	34.3	0.900	0.0	35.2

Hydro-Brake® Outflow Control

Design Head (m) 0.800 Hydro-Brake® Type Md5 SW Only Invert Level (m) 29.330
Design Flow (l/s) 8.5 Diameter (mm) 125

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.0	0.800	8.4	2.000	13.3	4.000	18.8	7.000	24.9
0.200	6.7	1.000	9.4	2.200	13.9	4.500	19.9	7.500	25.8
0.300	6.9	1.200	10.3	2.400	14.6	5.000	21.0	8.000	26.6
0.400	6.8	1.400	11.1	2.600	15.2	5.500	22.1	8.500	27.4
0.500	7.1	1.600	11.9	3.000	16.3	6.000	23.0	9.000	28.2
0.600	7.5	1.800	12.6	3.500	17.6	6.500	24.0	9.500	29.0

Summary of Results for 30 year Return Period

Half Drain Time : 6 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	29.798	0.198	0.0	7.0	7.0	3.8	O K
30 min Summer	29.785	0.185	0.0	6.9	6.9	3.5	O K
60 min Summer	29.723	0.123	0.0	6.9	6.9	2.3	O K
120 min Summer	29.624	0.024	0.0	6.9	6.9	0.5	O K
180 min Summer	29.600	0.000	0.0	6.4	6.4	0.0	O K
240 min Summer	29.600	0.000	0.0	5.2	5.2	0.0	O K
360 min Summer	29.600	0.000	0.0	3.7	3.7	0.0	O K
480 min Summer	29.600	0.000	0.0	3.0	3.0	0.0	O K
600 min Summer	29.600	0.000	0.0	2.5	2.5	0.0	O K
720 min Summer	29.600	0.000	0.0	2.1	2.1	0.0	O K
960 min Summer	29.600	0.000	0.0	1.7	1.7	0.0	O K
1440 min Summer	29.600	0.000	0.0	1.2	1.2	0.0	O K
2160 min Summer	29.600	0.000	0.0	0.9	0.9	0.0	O K
2880 min Summer	29.600	0.000	0.0	0.7	0.7	0.0	O K
4320 min Summer	29.600	0.000	0.0	0.5	0.5	0.0	O K
5760 min Summer	29.600	0.000	0.0	0.4	0.4	0.0	O K
7200 min Summer	29.600	0.000	0.0	0.3	0.3	0.0	O K
8640 min Summer	29.600	0.000	0.0	0.3	0.3	0.0	O K
10080 min Summer	29.600	0.000	0.0	0.3	0.3	0.0	O K
15 min Winter	29.834	0.234	0.0	7.1	7.1	4.4	O K
30 min Winter	29.806	0.206	0.0	7.0	7.0	3.9	O K
60 min Winter	29.703	0.103	0.0	6.9	6.9	1.9	O K
120 min Winter	29.600	0.000	0.0	6.4	6.4	0.0	O K
180 min Winter	29.600	0.000	0.0	4.7	4.7	0.0	O K
240 min Winter	29.600	0.000	0.0	3.7	3.7	0.0	O K
360 min Winter	29.600	0.000	0.0	2.7	2.7	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	81.719	0.0	8.7	17
30 min Summer	52.383	0.0	11.0	25
60 min Summer	32.061	0.0	13.8	42
120 min Summer	19.041	0.0	16.2	70
180 min Summer	13.895	0.0	17.8	0
240 min Summer	11.067	0.0	18.9	0
360 min Summer	8.018	0.0	20.6	0
480 min Summer	6.376	0.0	21.8	0
600 min Summer	5.334	0.0	22.8	0
720 min Summer	4.609	0.0	23.6	0
960 min Summer	3.659	0.0	25.0	0
1440 min Summer	2.640	0.0	27.1	0
2160 min Summer	1.903	0.0	29.3	0
2880 min Summer	1.507	0.0	30.9	0
4320 min Summer	1.085	0.0	33.4	0
5760 min Summer	0.858	0.0	35.2	0
7200 min Summer	0.716	0.0	36.7	0
8640 min Summer	0.617	0.0	38.0	0
10080 min Summer	0.544	0.0	39.1	0
15 min Winter	81.719	0.0	9.7	18
30 min Winter	52.383	0.0	12.4	27
60 min Winter	32.061	0.0	15.6	44
120 min Winter	19.041	0.0	18.2	0
180 min Winter	13.895	0.0	20.0	0
240 min Winter	11.067	0.0	21.2	0
360 min Winter	8.018	0.0	23.0	0

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	29.600	0.000	0.0	2.1	2.1	0.0	O K
600 min Winter	29.600	0.000	0.0	1.8	1.8	0.0	O K
720 min Winter	29.600	0.000	0.0	1.6	1.6	0.0	O K
960 min Winter	29.600	0.000	0.0	1.2	1.2	0.0	O K
1440 min Winter	29.600	0.000	0.0	0.9	0.9	0.0	O K
2160 min Winter	29.600	0.000	0.0	0.6	0.6	0.0	O K
2880 min Winter	29.600	0.000	0.0	0.5	0.5	0.0	O K
4320 min Winter	29.600	0.000	0.0	0.4	0.4	0.0	O K
5760 min Winter	29.600	0.000	0.0	0.3	0.3	0.0	O K
7200 min Winter	29.600	0.000	0.0	0.2	0.2	0.0	O K
8640 min Winter	29.600	0.000	0.0	0.2	0.2	0.0	O K
10080 min Winter	29.600	0.000	0.0	0.2	0.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	6.376	0.0	24.4	0
600 min Winter	5.334	0.0	25.5	0
720 min Winter	4.609	0.0	26.5	0
960 min Winter	3.659	0.0	28.0	0
1440 min Winter	2.640	0.0	30.3	0
2160 min Winter	1.903	0.0	32.8	0
2880 min Winter	1.507	0.0	34.6	0
4320 min Winter	1.085	0.0	37.4	0
5760 min Winter	0.858	0.0	39.5	0
7200 min Winter	0.716	0.0	41.1	0
8640 min Winter	0.617	0.0	42.5	0
10080 min Winter	0.544	0.0	43.7	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.057

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	4	8	0.057

Model Details

Storage is Online Cover Level (m) 30.900

Cellular Storage Structure

Invert Level (m) 29.600 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	20.0	20.0	0.800	20.0	34.3	0.900	0.0	35.2

Hydro-Brake® Outflow Control

Design Head (m) 0.800 Hydro-Brake® Type Md5 SW Only Invert Level (m) 29.330
Design Flow (l/s) 8.5 Diameter (mm) 125

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.0	0.800	8.4	2.000	13.3	4.000	18.8	7.000	24.9
0.200	6.7	1.000	9.4	2.200	13.9	4.500	19.9	7.500	25.8
0.300	6.9	1.200	10.3	2.400	14.6	5.000	21.0	8.000	26.6
0.400	6.8	1.400	11.1	2.600	15.2	5.500	22.1	8.500	27.4
0.500	7.1	1.600	11.9	3.000	16.3	6.000	23.0	9.000	28.2
0.600	7.5	1.800	12.6	3.500	17.6	6.500	24.0	9.500	29.0

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 13 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	30.047	0.447	0.0	8.0	8.0	8.5	O K
30 min Summer	30.060	0.460	0.0	8.1	8.1	8.7	O K
60 min Summer	30.003	0.403	0.0	7.8	7.8	7.7	O K
120 min Summer	29.859	0.259	0.0	7.2	7.2	4.9	O K
180 min Summer	29.735	0.135	0.0	6.9	6.9	2.6	O K
240 min Summer	29.647	0.047	0.0	6.9	6.9	0.9	O K
360 min Summer	29.600	0.000	0.0	6.3	6.3	0.0	O K
480 min Summer	29.600	0.000	0.0	5.0	5.0	0.0	O K
600 min Summer	29.600	0.000	0.0	4.2	4.2	0.0	O K
720 min Summer	29.600	0.000	0.0	3.6	3.6	0.0	O K
960 min Summer	29.600	0.000	0.0	2.8	2.8	0.0	O K
1440 min Summer	29.600	0.000	0.0	2.0	2.0	0.0	O K
2160 min Summer	29.600	0.000	0.0	1.5	1.5	0.0	O K
2880 min Summer	29.600	0.000	0.0	1.1	1.1	0.0	O K
4320 min Summer	29.600	0.000	0.0	0.8	0.8	0.0	O K
5760 min Summer	29.600	0.000	0.0	0.6	0.6	0.0	O K
7200 min Summer	29.600	0.000	0.0	0.5	0.5	0.0	O K
8640 min Summer	29.600	0.000	0.0	0.5	0.5	0.0	O K
10080 min Summer	29.600	0.000	0.0	0.4	0.4	0.0	O K
15 min Winter	30.127	0.527	0.0	8.4	8.4	10.0	O K
30 min Winter	30.133	0.533	0.0	8.5	8.5	10.1	O K
60 min Winter	30.038	0.438	0.0	8.0	8.0	8.3	O K
120 min Winter	29.819	0.219	0.0	7.0	7.0	4.2	O K
180 min Winter	29.642	0.042	0.0	6.9	6.9	0.8	O K
240 min Winter	29.600	0.000	0.0	6.3	6.3	0.0	O K
360 min Winter	29.600	0.000	0.0	4.5	4.5	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.220	0.0	14.9	18
30 min Summer	89.266	0.0	19.1	27
60 min Summer	54.817	0.0	23.0	44
120 min Summer	32.511	0.0	27.6	76
180 min Summer	23.643	0.0	30.1	106
240 min Summer	18.757	0.0	32.1	134
360 min Summer	13.517	0.0	34.7	0
480 min Summer	10.710	0.0	36.6	0
600 min Summer	8.935	0.0	38.2	0
720 min Summer	7.702	0.0	39.5	0
960 min Summer	6.089	0.0	41.6	0
1440 min Summer	4.367	0.0	44.8	0
2160 min Summer	3.127	0.0	48.1	0
2880 min Summer	2.465	0.0	50.6	0
4320 min Summer	1.761	0.0	54.2	0
5760 min Summer	1.387	0.0	56.9	0
7200 min Summer	1.151	0.0	59.1	0
8640 min Summer	0.988	0.0	60.8	0
10080 min Summer	0.869	0.0	62.4	0
15 min Winter	138.220	0.0	16.6	19
30 min Winter	89.266	0.0	21.6	28
60 min Winter	54.817	0.0	26.1	46
120 min Winter	32.511	0.0	31.0	80
180 min Winter	23.643	0.0	33.9	106
240 min Winter	18.757	0.0	35.9	0
360 min Winter	13.517	0.0	38.8	0

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	29.600	0.000	0.0	3.6	3.6	0.0	O K
600 min Winter	29.600	0.000	0.0	3.0	3.0	0.0	O K
720 min Winter	29.600	0.000	0.0	2.6	2.6	0.0	O K
960 min Winter	29.600	0.000	0.0	2.0	2.0	0.0	O K
1440 min Winter	29.600	0.000	0.0	1.5	1.5	0.0	O K
2160 min Winter	29.600	0.000	0.0	1.1	1.1	0.0	O K
2880 min Winter	29.600	0.000	0.0	0.8	0.8	0.0	O K
4320 min Winter	29.600	0.000	0.0	0.6	0.6	0.0	O K
5760 min Winter	29.600	0.000	0.0	0.5	0.5	0.0	O K
7200 min Winter	29.600	0.000	0.0	0.4	0.4	0.0	O K
8640 min Winter	29.600	0.000	0.0	0.3	0.3	0.0	O K
10080 min Winter	29.600	0.000	0.0	0.3	0.3	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	10.710	0.0	41.0	0
600 min Winter	8.935	0.0	42.8	0
720 min Winter	7.702	0.0	44.3	0
960 min Winter	6.089	0.0	46.6	0
1440 min Winter	4.367	0.0	50.2	0
2160 min Winter	3.127	0.0	53.9	0
2880 min Winter	2.465	0.0	56.7	0
4320 min Winter	1.761	0.0	60.7	0
5760 min Winter	1.387	0.0	63.7	0
7200 min Winter	1.151	0.0	66.1	0
8640 min Winter	0.988	0.0	68.1	0
10080 min Winter	0.869	0.0	69.9	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.057

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.000	4	8	0.057

Model Details

Storage is Online Cover Level (m) 30.900

Cellular Storage Structure

Invert Level (m) 29.600 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

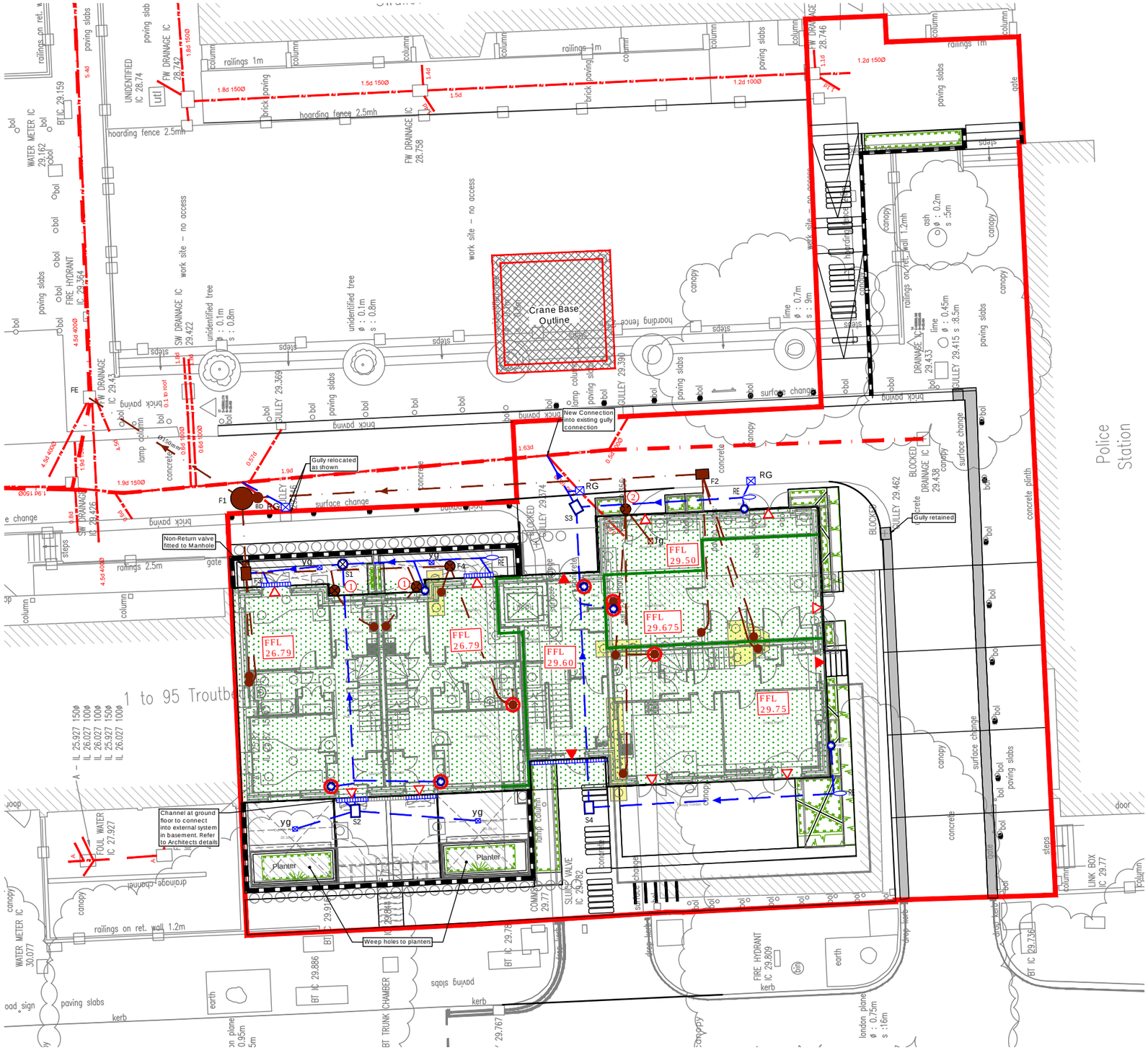
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	20.0	20.0	0.800	20.0	34.3	0.900	0.0	35.2

Hydro-Brake® Outflow Control

Design Head (m) 0.800 Hydro-Brake® Type Md5 SW Only Invert Level (m) 29.330
Design Flow (l/s) 8.5 Diameter (mm) 125

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.0	0.800	8.4	2.000	13.3	4.000	18.8	7.000	24.9
0.200	6.7	1.000	9.4	2.200	13.9	4.500	19.9	7.500	25.8
0.300	6.9	1.200	10.3	2.400	14.6	5.000	21.0	8.000	26.6
0.400	6.8	1.400	11.1	2.600	15.2	5.500	22.1	8.500	27.4
0.500	7.1	1.600	11.9	3.000	16.3	6.000	23.0	9.000	28.2
0.600	7.5	1.800	12.6	3.500	17.6	6.500	24.0	9.500	29.0

Appendix F – Plot 6, Cape of Good Hope



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Manhole Schedule								
MANHOLE REF	INVERT LEVEL	COVER LEVEL	CHAMBER DETAILS	COVER TYPE	GRADE 1 in	PIPE Ø (mm)	LENGTH
FE	24.950(450ØD) 25.180(150ØD)	29.430	EXISTING	-	18.5	150	8.5
F1	25.637(OUT) 28.231(IN)	29.400	Type B 1200Ø	600x600 Class D	80.0	150	21.5
F2	28.500	29.400	600x450mm	600x450 Class D			
F1	25.637	29.400	Type B 1200Ø	600x600 Class D			
F3	25.681	26.790	600x450mm	600x450 Class B Recessed Bolt Down, Double Sealed	80.0	150	3.5
F4	25.800	26.790	600x450 / 480Ø	600x450/480Ø Class B Recessed Bolt Down, Double Sealed	80.0	150	9.5
F3	25.681	26.750	600x450mm	600x450 Class B Recessed Bolt Down, Double Sealed			
S1	25.993	26.790	600x450 / 480Ø	600x450/480Ø Class B Recessed Bolt Down, Double Sealed	14.4	150	4.5
S2	26.136	26.790	600x450 / 480Ø	600x450/480Ø Class B Recessed Bolt Down, Double Sealed	80.0	150	11.5
JUNCTION	27.820	-	-	-			
S3	28.775	29.470	600x450mm	600x450 Class C	3	150	2.8
S4	28.950	29.670	600x450 / 480Ø	600x450/480Ø Class C Recessed Bolt Down	80	150	14.0

Check invert prior to starting works on site

NOTES / KEY:

Drainage Key

Sewers

- Foul water drain (private/non adoptable)
- Surface water drain (private/non adoptable)
- Foul water sewer (Adoptable)
- Surface water sewer (Adoptable)
- Existing combined water sewer (Adopted)

Chamber Key

FW / SW

- PPIC - 475mmØ *
- P.C.C. units/brick *
- Manhole Depth 1.25 to 1.5m * Depth 1.55 to 3.0m *

* General note
(Refer to standard details & long sections for chamber sizes. Size may need to increase dependant on number of incoming pipes/size of incoming pipes)

- F1 — Manhole reference number
- * — Recessed cover required
- Rain water down pipe (roddable access)
- Soil vent pipe/soil stack
- Rodding access required in vertical stack
- yg — Yard gully (150m - 200mmØ trapped)
- fg — Floor gully (trapped)
- Cellular storage (refer to drawing for sizes)
- Linear drainage channel
- Surface water rodding eye
- FFL XX.XX — Finished Floor Level (FFL)
- Internal step in FFL
- Green Roof
- Pile cap impacted by proposed drainage
- Location of Crane Base

PPIC Invert Levels	
NO	IL
1	25.80
2	28.70

MARK	DATE	BY	CHKD.	REVISION NOTES
	03/03/20	NJ	TST	AS BUILT

C.D.M.

SIGNIFICANT RISKS AND HAZARDS:

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PROJECT:
Plot 6 - Cape Of Good Hope
Regents Park Estate Infill

DRAWING TITLE:
Proposed Drainage Plan

STATUS:
AS BUILT

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:100	Dec 2015	NJ	TST

JOB NUMBER:	STATUS:	REVISION:
SE1238	AB	

DRAWING NUMBER:
COGH-ISS-XX-00-DR-C-356

AS BUILT DRAWING
(THIS DRAWING IS THE FINAL CONSTRUCTION ISSUE AND DOES NOT PURPORT TO BE A SURVEY OF THE WORKS AS CONSTRUCTED)

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	25.719	0.019	0.2	0.0	O K
30 min Summer	25.727	0.027	0.4	0.0	O K
60 min Summer	25.731	0.031	0.6	0.0	O K
120 min Summer	25.730	0.030	0.5	0.0	O K
180 min Summer	25.727	0.027	0.4	0.0	O K
240 min Summer	25.725	0.025	0.4	0.0	O K
360 min Summer	25.723	0.023	0.3	0.0	O K
480 min Summer	25.721	0.021	0.3	0.0	O K
600 min Summer	25.719	0.019	0.2	0.0	O K
720 min Summer	25.718	0.018	0.2	0.0	O K
960 min Summer	25.716	0.016	0.2	0.0	O K
1440 min Summer	25.714	0.014	0.1	0.0	O K
2160 min Summer	25.712	0.012	0.1	0.0	O K
2880 min Summer	25.711	0.011	0.1	0.0	O K
4320 min Summer	25.710	0.010	0.1	0.0	O K
5760 min Summer	25.709	0.009	0.0	0.0	O K
7200 min Summer	25.708	0.008	0.0	0.0	O K
8640 min Summer	25.707	0.007	0.0	0.0	O K
10080 min Summer	25.707	0.007	0.0	0.0	O K
15 min Winter	25.723	0.023	0.3	0.0	O K
30 min Winter	25.730	0.030	0.5	0.0	O K
60 min Winter	25.732	0.032	0.6	0.0	O K
120 min Winter	25.729	0.029	0.5	0.0	O K
180 min Winter	25.726	0.026	0.4	0.0	O K
240 min Winter	25.724	0.024	0.4	0.0	O K
360 min Winter	25.721	0.021	0.3	0.0	O K
480 min Winter	25.718	0.018	0.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	42.980	0.0	0.3	31
30 min Summer	27.473	0.0	0.6	32
60 min Summer	16.881	0.0	0.8	44
120 min Summer	10.146	0.0	1.1	70
180 min Summer	7.490	0.0	1.3	96
240 min Summer	6.029	0.0	1.4	136
360 min Summer	4.425	0.0	1.6	194
480 min Summer	3.548	0.0	1.7	256
600 min Summer	2.988	0.0	1.8	320
720 min Summer	2.597	0.0	1.9	374
960 min Summer	2.080	0.0	2.0	500
1440 min Summer	1.522	0.0	2.2	744
2160 min Summer	1.113	0.0	2.3	1088
2880 min Summer	0.892	0.0	2.4	1460
4320 min Summer	0.652	0.0	2.4	2176
5760 min Summer	0.522	0.0	2.3	2904
7200 min Summer	0.439	0.0	2.2	3656
8640 min Summer	0.382	0.0	2.2	4352
10080 min Summer	0.339	0.0	2.1	5064
15 min Winter	42.980	0.0	0.4	27
30 min Winter	27.473	0.0	0.7	30
60 min Winter	16.881	0.0	1.0	42
120 min Winter	10.146	0.0	1.3	74
180 min Winter	7.490	0.0	1.5	96
240 min Winter	6.029	0.0	1.7	142
360 min Winter	4.425	0.0	1.9	194
480 min Winter	3.548	0.0	2.0	254

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
600 min Winter	25.717	0.017	0.2	0.0	O K
720 min Winter	25.715	0.015	0.2	0.0	O K
960 min Winter	25.714	0.014	0.1	0.0	O K
1440 min Winter	25.712	0.012	0.1	0.0	O K
2160 min Winter	25.711	0.011	0.1	0.0	O K
2880 min Winter	25.710	0.010	0.1	0.0	O K
4320 min Winter	25.708	0.008	0.0	0.0	O K
5760 min Winter	25.707	0.007	0.0	0.0	O K
7200 min Winter	25.706	0.006	0.0	0.0	O K
8640 min Winter	25.706	0.006	0.0	0.0	O K
10080 min Winter	25.706	0.006	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
600 min Winter	2.988	0.0	2.1	308
720 min Winter	2.597	0.0	2.2	380
960 min Winter	2.080	0.0	2.4	476
1440 min Winter	1.522	0.0	2.6	740
2160 min Winter	1.113	0.0	2.7	1144
2880 min Winter	0.892	0.0	2.8	1448
4320 min Winter	0.652	0.0	2.9	2204
5760 min Winter	0.522	0.0	2.9	2752
7200 min Winter	0.439	0.0	2.8	3680
8640 min Winter	0.382	0.0	2.7	4408
10080 min Winter	0.339	0.0	2.6	5128

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Green Roof

Area (m^3)	113	Evaporation (mm/day)	3
Depression Storage (mm)	5	Decay Coefficient	0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.002053	24	28	0.000618	48	52	0.000186	72	76	0.000056	96	100	0.000017
4	8	0.001681	28	32	0.000506	52	56	0.000153	76	80	0.000046	100	104	0.000014
8	12	0.001376	32	36	0.000415	56	60	0.000125	80	84	0.000038	104	108	0.000011
12	16	0.001127	36	40	0.000339	60	64	0.000102	84	88	0.000031	108	112	0.000009
16	20	0.000923	40	44	0.000278	64	68	0.000084	88	92	0.000025	112	116	0.000008
20	24	0.000755	44	48	0.000228	68	72	0.000069	92	96	0.000021	116	120	0.000006

Model Details

Storage is Online Cover Level (m) 26.600

Pipe Structure

Diameter (m) 0.150 Slope (1:X) 80.000 Length (m) 10.000 Invert Level (m) 25.700

Pipe Outflow Control

Diameter (m)	0.150	Roughness k (mm)	0.600	Upstream Invert Level (m)	25.700
Slope (1:X)	60.0	Entry Loss Coefficient	0.500		
Length (m)	10.000	Coefficient of Contraction	0.600		

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	25.739	0.039	0.9	0.0	O K
30 min Summer	25.744	0.044	1.1	0.1	O K
60 min Summer	25.746	0.046	1.2	0.1	O K
120 min Summer	25.740	0.040	1.0	0.0	O K
180 min Summer	25.737	0.037	0.8	0.0	O K
240 min Summer	25.735	0.035	0.7	0.0	O K
360 min Summer	25.732	0.032	0.6	0.0	O K
480 min Summer	25.729	0.029	0.5	0.0	O K
600 min Summer	25.727	0.027	0.4	0.0	O K
720 min Summer	25.725	0.025	0.4	0.0	O K
960 min Summer	25.723	0.023	0.3	0.0	O K
1440 min Summer	25.719	0.019	0.2	0.0	O K
2160 min Summer	25.716	0.016	0.2	0.0	O K
2880 min Summer	25.714	0.014	0.1	0.0	O K
4320 min Summer	25.712	0.012	0.1	0.0	O K
5760 min Summer	25.711	0.011	0.1	0.0	O K
7200 min Summer	25.710	0.010	0.1	0.0	O K
8640 min Summer	25.710	0.010	0.1	0.0	O K
10080 min Summer	25.709	0.009	0.1	0.0	O K
15 min Winter	25.742	0.042	1.0	0.0	O K
30 min Winter	25.747	0.047	1.3	0.1	O K
60 min Winter	25.745	0.045	1.1	0.1	O K
120 min Winter	25.740	0.040	0.9	0.0	O K
180 min Winter	25.736	0.036	0.8	0.0	O K
240 min Winter	25.733	0.033	0.7	0.0	O K
360 min Winter	25.729	0.029	0.5	0.0	O K
480 min Winter	25.726	0.026	0.4	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	81.719	0.0	1.1	18
30 min Summer	52.383	0.0	1.6	23
60 min Summer	32.061	0.0	2.1	36
120 min Summer	19.041	0.0	2.6	68
180 min Summer	13.895	0.0	2.9	102
240 min Summer	11.067	0.0	3.1	134
360 min Summer	8.018	0.0	3.4	190
480 min Summer	6.376	0.0	3.6	254
600 min Summer	5.334	0.0	3.8	306
720 min Summer	4.609	0.0	3.9	370
960 min Summer	3.659	0.0	4.2	492
1440 min Summer	2.640	0.0	4.5	736
2160 min Summer	1.903	0.0	4.7	1100
2880 min Summer	1.507	0.0	4.9	1460
4320 min Summer	1.085	0.0	5.0	2176
5760 min Summer	0.858	0.0	5.1	2936
7200 min Summer	0.716	0.0	5.0	3696
8640 min Summer	0.617	0.0	4.9	4384
10080 min Summer	0.544	0.0	4.8	5088
15 min Winter	81.719	0.0	1.3	17
30 min Winter	52.383	0.0	1.9	22
60 min Winter	32.061	0.0	2.4	40
120 min Winter	19.041	0.0	3.0	72
180 min Winter	13.895	0.0	3.3	106
240 min Winter	11.067	0.0	3.6	140
360 min Winter	8.018	0.0	3.9	196
480 min Winter	6.376	0.0	4.2	262

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
600 min Winter	25.724	0.024	0.3	0.0	O K
720 min Winter	25.722	0.022	0.3	0.0	O K
960 min Winter	25.719	0.019	0.2	0.0	O K
1440 min Winter	25.716	0.016	0.2	0.0	O K
2160 min Winter	25.713	0.013	0.1	0.0	O K
2880 min Winter	25.712	0.012	0.1	0.0	O K
4320 min Winter	25.710	0.010	0.1	0.0	O K
5760 min Winter	25.710	0.010	0.1	0.0	O K
7200 min Winter	25.709	0.009	0.0	0.0	O K
8640 min Winter	25.708	0.008	0.0	0.0	O K
10080 min Winter	25.707	0.007	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
600 min Winter	5.334	0.0	4.3	330
720 min Winter	4.609	0.0	4.5	376
960 min Winter	3.659	0.0	4.8	498
1440 min Winter	2.640	0.0	5.1	742
2160 min Winter	1.903	0.0	5.4	1072
2880 min Winter	1.507	0.0	5.6	1444
4320 min Winter	1.085	0.0	5.8	2180
5760 min Winter	0.858	0.0	5.9	2888
7200 min Winter	0.716	0.0	5.9	3776
8640 min Winter	0.617	0.0	5.9	4304
10080 min Winter	0.544	0.0	5.8	5112

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Green Roof

Area (m³)	113	Evaporation (mm/day)	3
Depression Storage (mm)	5	Decay Coefficient	0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.002053	24	28	0.000618	48	52	0.000186	72	76	0.000056	96	100	0.000017
4	8	0.001681	28	32	0.000506	52	56	0.000153	76	80	0.000046	100	104	0.000014
8	12	0.001376	32	36	0.000415	56	60	0.000125	80	84	0.000038	104	108	0.000011
12	16	0.001127	36	40	0.000339	60	64	0.000102	84	88	0.000031	108	112	0.000009
16	20	0.000923	40	44	0.000278	64	68	0.000084	88	92	0.000025	112	116	0.000008
20	24	0.000755	44	48	0.000228	68	72	0.000069	92	96	0.000021	116	120	0.000006

Model Details

Storage is Online Cover Level (m) 26.600

Pipe Structure

Diameter (m) 0.150 Slope (1:X) 80.000 Length (m) 10.000 Invert Level (m) 25.700

Pipe Outflow Control

Diameter (m)	0.150	Roughness k (mm)	0.600	Upstream Invert Level (m)	25.700
Slope (1:X)	60.0	Entry Loss Coefficient	0.500		
Length (m)	10.000	Coefficient of Contraction	0.600		

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m^3)	Status
15 min Summer	25.755	0.055	1.8	0.1	O K
30 min Summer	25.758	0.058	1.9	0.1	O K
60 min Summer	25.757	0.057	1.9	0.1	O K
120 min Summer	25.753	0.053	1.6	0.1	O K
180 min Summer	25.749	0.049	1.4	0.1	O K
240 min Summer	25.746	0.046	1.2	0.1	O K
360 min Summer	25.741	0.041	1.0	0.0	O K
480 min Summer	25.737	0.037	0.8	0.0	O K
600 min Summer	25.735	0.035	0.7	0.0	O K
720 min Summer	25.733	0.033	0.6	0.0	O K
960 min Summer	25.730	0.030	0.5	0.0	O K
1440 min Summer	25.725	0.025	0.4	0.0	O K
2160 min Summer	25.722	0.022	0.3	0.0	O K
2880 min Summer	25.718	0.018	0.2	0.0	O K
4320 min Summer	25.715	0.015	0.2	0.0	O K
5760 min Summer	25.714	0.014	0.1	0.0	O K
7200 min Summer	25.713	0.013	0.1	0.0	O K
8640 min Summer	25.712	0.012	0.1	0.0	O K
10080 min Summer	25.711	0.011	0.1	0.0	O K
15 min Winter	25.760	0.060	2.1	0.1	O K
30 min Winter	25.761	0.061	2.1	0.1	O K
60 min Winter	25.759	0.059	2.0	0.1	O K
120 min Winter	25.752	0.052	1.6	0.1	O K
180 min Winter	25.747	0.047	1.3	0.1	O K
240 min Winter	25.743	0.043	1.1	0.0	O K
360 min Winter	25.738	0.038	0.8	0.0	O K
480 min Winter	25.734	0.034	0.7	0.0	O K
600 min Winter	25.732	0.032	0.6	0.0	O K
720 min Winter	25.729	0.029	0.5	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	138.220	14
30 min Summer	89.266	19
60 min Summer	54.817	38
120 min Summer	32.511	68
180 min Summer	23.643	102
240 min Summer	18.757	128
360 min Summer	13.517	192
480 min Summer	10.710	256
600 min Summer	8.935	316
720 min Summer	7.702	368
960 min Summer	6.089	496
1440 min Summer	4.367	732
2160 min Summer	3.127	1112
2880 min Summer	2.465	1476
4320 min Summer	1.761	2140
5760 min Summer	1.387	2928
7200 min Summer	1.151	3584
8640 min Summer	0.988	4384
10080 min Summer	0.869	5080
15 min Winter	138.220	13
30 min Winter	89.266	22
60 min Winter	54.817	40
120 min Winter	32.511	72
180 min Winter	23.643	104
240 min Winter	18.757	136
360 min Winter	13.517	204
480 min Winter	10.710	256
600 min Winter	8.935	320
720 min Winter	7.702	384

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m^3)	Status
960 min Winter	25.726	0.026	0.4	0.0	O K
1440 min Winter	25.722	0.022	0.3	0.0	O K
2160 min Winter	25.718	0.018	0.2	0.0	O K
2880 min Winter	25.715	0.015	0.2	0.0	O K
4320 min Winter	25.713	0.013	0.1	0.0	O K
5760 min Winter	25.712	0.012	0.1	0.0	O K
7200 min Winter	25.711	0.011	0.1	0.0	O K
8640 min Winter	25.710	0.010	0.1	0.0	O K
10080 min Winter	25.710	0.010	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
960 min Winter	6.089	496
1440 min Winter	4.367	736
2160 min Winter	3.127	1144
2880 min Winter	2.465	1488
4320 min Winter	1.761	2264
5760 min Winter	1.387	3000
7200 min Winter	1.151	3392
8640 min Winter	0.988	4096
10080 min Winter	0.869	5208

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Green Roof

Roof Area (m²)	113	Evapo-transpiration (mm/day)	3
Depression Storage (mm)	5	Decay Coefficient - k	0.050

Time / Area Diagram

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.002053	20-24	0.000755	40-44	0.000278	60-64	0.000102	80-84	0.000038	100-104	0.000014
4-8	0.001681	24-28	0.000618	44-48	0.000228	64-68	0.000084	84-88	0.000031	104-108	0.000011
8-12	0.001376	28-32	0.000506	48-52	0.000186	68-72	0.000069	88-92	0.000025	108-112	0.000009
12-16	0.001127	32-36	0.000415	52-56	0.000153	72-76	0.000056	92-96	0.000021	112-116	0.000008
16-20	0.000923	36-40	0.000339	56-60	0.000125	76-80	0.000046	96-100	0.000017	116-120	0.000006

Model Details

Storage is Online Cover Level (m) 26.600

Pipe Structure

Diameter (m) 0.150 Slope (1:X) 80.000 Length (m) 10.000 Invert Level (m) 25.700

Pipe Outflow Control

Diameter (m)	0.150	Roughness k (mm)	0.600	Upstream Invert Level (m)	25.700
Slope (1:X)	60.0	Entry Loss Coefficient	0.500		
Length (m)	10.000	Coefficient of Contraction	0.600		

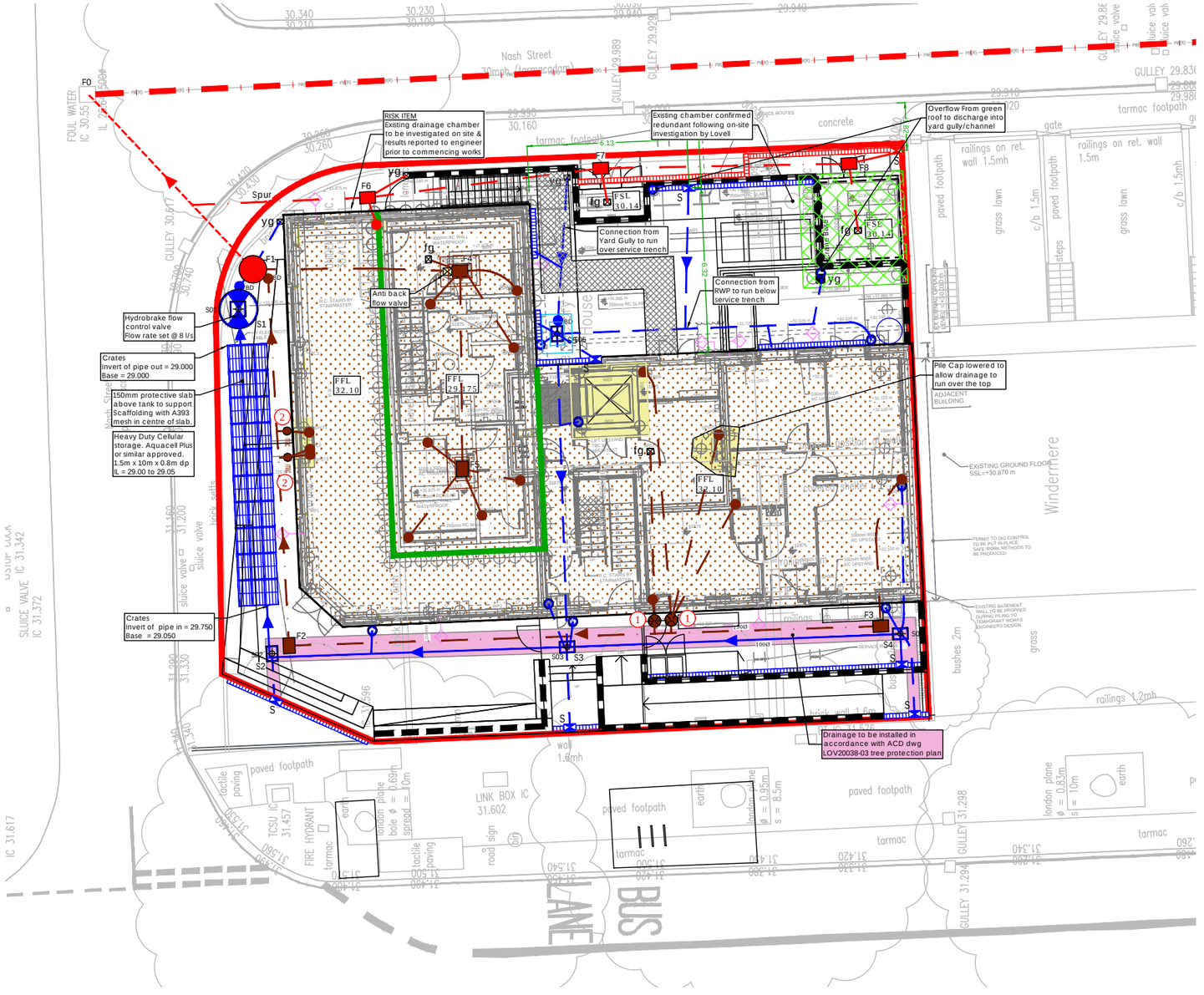
Appendix G – Plot 8, The Victory Pub

Manhole Schedule							
MANHOLE REF	INVERT LEVEL	COVER LEVEL	CHAMBER DETAILS	COVER DETAILS	GRADE 1 in	I E Ø (mm)	LENGTH
F0	26.640(500) 26.990(150)	30.55	Existing	Existing	9.7	150	9.0
F1	27.916(OUT) 29.984(IN)	30.65	1200Ø	600 x 600 C250	15.0	150	14.0
F2	30.918	32.05	600 x 450	600 x 450 B125 recessed	80.0	150	22.5
F3	31.200	32.09	600 x 450	600 x 450 B125 recessed			
F1	27.916	30.65	1200Ø	600 x 600 C250			
F4	28.050	29.17	450 x 900	600 x 450 B125 recessed *	60.0	150	8.0
F5	28.175	29.17	450 x 900	600 x 450 B125 recessed *	60.0	150	7.5
Spur	27.580(150) 27.630(100)	-	-	-			
F6	29.019	30.29	600x450	600 x 450 B125 recessed	3.2	100	4.5
F7	29.241	30.16	600x450	600 x 450 B125 recessed	60	100	9.0
F8	29.400	30.07	600x450	600 x 450 B125 recessed	60	100	9.5
F1	27.916(OUT) 28.975(IN)	30.65	1200Ø	600 x 600 C250			
S1	29.000	30.80	Hydrobrake 1500Ø	600 x 600 C250	60.0	150	1.5
S2	30.600	32.00	750 x 1200	600 x 450 B125 recessed	200.0	Crates	13.5
S3	30.783	32.06	750 x 1200	600 x 450 B125 recessed	60.0	150	11.0
S4	31.000	32.07	600 x 450	600 x 450 B125 recessed	60.0	150	13.0
S3	30.783	32.06	750 x 1200	600 x 450 B125 recessed			
S5	31.000	32.08	600 x 450	600 x 450 B125 recessed	55.0	150	12.0

IL to be confirmed prior to commencing works on site

* Double sealed bolt down cover

PPIC Invert Levels	
NO	IL
1	31.150
2	31.000



AS BUILT DRAWING
(THIS DRAWING IS THE FINAL CONSTRUCTION ISSUE AND DOES NOT PURPORT TO BE A SURVEY OF THE WORKS AS CONSTRUCTED)

Construction Note
It is essential that new drainage associated with the development is laid from the outfall(s) into the site. This is essential to avoid unforeseen obstructions where encountered (such as services). If the drainage is laid from the site out to the outfall it can result in significant abortive works to relay and overcome such obstructions.

NOTES / KEY:

Drainage Key

Sewers

- Foul water drain (private/non adoptable)
- Surface water drain (private/non adoptable)
- Foul water sewer (Adoptable)
- Surface water sewer (Adoptable)
- Combined sewer

Chamber Key

FW	SW	
FW	SW	Mini access chamber (mac) - 300mmØ *
		PPIC - 475mmØ *
		P.C.C. units/brick *
FW	SW	Adoptable demarcation manhole within 1m of boundary *
		Manhole Depth 1.25 to 1.5m * Depth 1.55 to 3.0m *

* General note
(Refer to standard details & long sections for chamber sizes. Size may need to increase dependant on number of incoming pipes/size of incoming pipes)

- F1 — Manhole reference number
- Rain water down pipe (roddable access)
- Soil vent pipe/soil stack
- Floor gully (trapped)
- Anti back flow valve
- Linear drainage channel
- FFL XX.XX — Finished Floor Level (FFL)
- Brown Roof
- Foundation impacted by Drainage
- Location of Crane Base (TBC)
- Internal step in FFL
- BD BD — Backdrop
- Hydrobrake flow control valve
- Service trench

Note:

SVP and RWP locations taken from Ingleton Wood M&E Drawing. Subject to confirmation.

Surface Water

Flow rates reduced to those detailed within planning approved FRA produced by Campbell Reith with storage to cater for 1:100 year +30% climate change in line with planning condition 28.

Foul Water

Scheme assumes sufficient capacity with system for increased foul flows.

MARK	DATE	BY	CHKD.	REVISION NOTES
	03/03/20	NJ	TST	AS BUILT

C.D.M.

SIGNIFICANT RISKS AND HAZARDS:

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PROJECT:
Plot 8 - The Victory Pub
Regents Park Estate Infill

DRAWING TITLE:
Proposed Drainage Plan

STATUS:
AS BUILT

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:100	July 17	NJ	TST

JOB NUMBER:	STATUS:	REVISION:
SE1238	AB	

DRAWING NUMBER:
TVP-ISS-XX-00-DR-C-361

Summary of Results for 2 year Return Period

Half Drain Time : 6 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	29.556	0.156	0.0	6.5	6.5	2.2	O K
30 min Summer	29.552	0.152	0.0	6.4	6.4	2.2	O K
60 min Summer	29.526	0.126	0.0	5.2	5.2	1.8	O K
120 min Summer	29.498	0.098	0.0	3.8	3.8	1.4	O K
180 min Summer	29.482	0.082	0.0	3.0	3.0	1.2	O K
240 min Summer	29.473	0.073	0.0	2.5	2.5	1.0	O K
360 min Summer	29.460	0.060	0.0	1.9	1.9	0.9	O K
480 min Summer	29.453	0.053	0.0	1.6	1.6	0.8	O K
600 min Summer	29.448	0.048	0.0	1.3	1.3	0.7	O K
720 min Summer	29.444	0.044	0.0	1.2	1.2	0.6	O K
960 min Summer	29.438	0.038	0.0	0.9	0.9	0.5	O K
1440 min Summer	29.432	0.032	0.0	0.7	0.7	0.5	O K
2160 min Summer	29.426	0.026	0.0	0.5	0.5	0.4	O K
2880 min Summer	29.423	0.023	0.0	0.4	0.4	0.3	O K
4320 min Summer	29.419	0.019	0.0	0.3	0.3	0.3	O K
5760 min Summer	29.417	0.017	0.0	0.2	0.2	0.2	O K
7200 min Summer	29.415	0.015	0.0	0.2	0.2	0.2	O K
8640 min Summer	29.414	0.014	0.0	0.2	0.2	0.2	O K
10080 min Summer	29.413	0.013	0.0	0.2	0.2	0.2	O K
15 min Winter	29.567	0.167	0.0	6.9	6.9	2.4	O K
30 min Winter	29.551	0.151	0.0	6.3	6.3	2.2	O K
60 min Winter	29.517	0.117	0.0	4.8	4.8	1.7	O K
120 min Winter	29.485	0.085	0.0	3.2	3.2	1.2	O K
180 min Winter	29.470	0.070	0.0	2.4	2.4	1.0	O K
240 min Winter	29.461	0.061	0.0	2.0	2.0	0.9	O K
360 min Winter	29.450	0.050	0.0	1.4	1.4	0.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	42.980	0.0	4.5	16
30 min Summer	27.473	0.0	5.8	24
60 min Summer	16.881	0.0	7.1	40
120 min Summer	10.146	0.0	8.5	70
180 min Summer	7.490	0.0	9.4	100
240 min Summer	6.029	0.0	10.1	130
360 min Summer	4.425	0.0	11.1	190
480 min Summer	3.548	0.0	11.9	250
600 min Summer	2.988	0.0	12.5	310
720 min Summer	2.597	0.0	13.1	372
960 min Summer	2.080	0.0	14.0	494
1440 min Summer	1.522	0.0	15.3	738
2160 min Summer	1.113	0.0	16.8	1104
2880 min Summer	0.892	0.0	18.0	1472
4320 min Summer	0.652	0.0	19.7	2204
5760 min Summer	0.522	0.0	21.0	2936
7200 min Summer	0.439	0.0	22.1	3592
8640 min Summer	0.382	0.0	23.1	4352
10080 min Summer	0.339	0.0	23.9	5096
15 min Winter	42.980	0.0	5.0	16
30 min Winter	27.473	0.0	6.5	24
60 min Winter	16.881	0.0	7.9	40
120 min Winter	10.146	0.0	9.5	70
180 min Winter	7.490	0.0	10.6	100
240 min Winter	6.029	0.0	11.3	130
360 min Winter	4.425	0.0	12.5	190

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	29.444	0.044	0.0	1.2	1.2	0.6	O K
600 min Winter	29.439	0.039	0.0	1.0	1.0	0.6	O K
720 min Winter	29.436	0.036	0.0	0.9	0.9	0.5	O K
960 min Winter	29.432	0.032	0.0	0.7	0.7	0.4	O K
1440 min Winter	29.426	0.026	0.0	0.5	0.5	0.4	O K
2160 min Winter	29.422	0.022	0.0	0.4	0.4	0.3	O K
2880 min Winter	29.419	0.019	0.0	0.3	0.3	0.3	O K
4320 min Winter	29.416	0.016	0.0	0.2	0.2	0.2	O K
5760 min Winter	29.414	0.014	0.0	0.2	0.2	0.2	O K
7200 min Winter	29.413	0.013	0.0	0.1	0.1	0.2	O K
8640 min Winter	29.412	0.012	0.0	0.1	0.1	0.2	O K
10080 min Winter	29.411	0.011	0.0	0.1	0.1	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	3.548	0.0	13.3	250
600 min Winter	2.988	0.0	14.0	312
720 min Winter	2.597	0.0	14.6	372
960 min Winter	2.080	0.0	15.6	492
1440 min Winter	1.522	0.0	17.2	738
2160 min Winter	1.113	0.0	18.8	1076
2880 min Winter	0.892	0.0	20.1	1452
4320 min Winter	0.652	0.0	22.1	2200
5760 min Winter	0.522	0.0	23.6	2880
7200 min Winter	0.439	0.0	24.8	3664
8640 min Winter	0.382	0.0	25.8	4320
10080 min Winter	0.339	0.0	26.8	5144

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.056

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	4	8	0.056

Model Details

Storage is Online Cover Level (m) 30.800

Cellular Storage Structure

Invert Level (m) 29.400 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	15.0	15.0	0.800	15.0	27.4	0.900	0.0	28.2

Hydro-Brake® Outflow Control

Design Head (m) 0.800 Hydro-Brake® Type Md6 SW Only Invert Level (m) 29.400
Design Flow (l/s) 8.0 Diameter (mm) 123

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.0	0.800	7.9	2.000	12.2	4.000	17.3	7.000	22.8
0.200	7.6	1.000	8.7	2.200	12.8	4.500	18.3	7.500	23.6
0.300	8.0	1.200	9.5	2.400	13.4	5.000	19.3	8.000	24.4
0.400	7.6	1.400	10.2	2.600	13.9	5.500	20.2	8.500	25.2
0.500	7.4	1.600	10.9	3.000	15.0	6.000	21.1	9.000	25.9
0.600	7.4	1.800	11.6	3.500	16.1	6.500	22.0	9.500	26.6

Summary of Results for 30 year Return Period

Half Drain Time : 7 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	29.730	0.330	0.0	8.0	8.0	4.7	O K
30 min Summer	29.729	0.329	0.0	8.0	8.0	4.7	O K
60 min Summer	29.656	0.256	0.0	8.0	8.0	3.6	O K
120 min Summer	29.570	0.170	0.0	7.0	7.0	2.4	O K
180 min Summer	29.534	0.134	0.0	5.6	5.6	1.9	O K
240 min Summer	29.514	0.114	0.0	4.7	4.7	1.6	O K
360 min Summer	29.492	0.092	0.0	3.5	3.5	1.3	O K
480 min Summer	29.479	0.079	0.0	2.8	2.8	1.1	O K
600 min Summer	29.470	0.070	0.0	2.4	2.4	1.0	O K
720 min Summer	29.464	0.064	0.0	2.1	2.1	0.9	O K
960 min Summer	29.455	0.055	0.0	1.7	1.7	0.8	O K
1440 min Summer	29.445	0.045	0.0	1.2	1.2	0.6	O K
2160 min Summer	29.437	0.037	0.0	0.9	0.9	0.5	O K
2880 min Summer	29.432	0.032	0.0	0.7	0.7	0.5	O K
4320 min Summer	29.426	0.026	0.0	0.5	0.5	0.4	O K
5760 min Summer	29.423	0.023	0.0	0.4	0.4	0.3	O K
7200 min Summer	29.420	0.020	0.0	0.3	0.3	0.3	O K
8640 min Summer	29.419	0.019	0.0	0.3	0.3	0.3	O K
10080 min Summer	29.417	0.017	0.0	0.2	0.2	0.2	O K
15 min Winter	29.772	0.372	0.0	8.0	8.0	5.3	O K
30 min Winter	29.749	0.349	0.0	8.0	8.0	5.0	O K
60 min Winter	29.632	0.232	0.0	7.9	7.9	3.3	O K
120 min Winter	29.541	0.141	0.0	5.9	5.9	2.0	O K
180 min Winter	29.510	0.110	0.0	4.5	4.5	1.6	O K
240 min Winter	29.493	0.093	0.0	3.6	3.6	1.3	O K
360 min Winter	29.474	0.074	0.0	2.6	2.6	1.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	81.719	0.0	8.6	17
30 min Summer	52.383	0.0	11.0	25
60 min Summer	32.061	0.0	13.5	40
120 min Summer	19.041	0.0	16.0	70
180 min Summer	13.895	0.0	17.5	100
240 min Summer	11.067	0.0	18.6	130
360 min Summer	8.018	0.0	20.2	190
480 min Summer	6.376	0.0	21.4	250
600 min Summer	5.334	0.0	22.4	310
720 min Summer	4.609	0.0	23.2	372
960 min Summer	3.659	0.0	24.6	492
1440 min Summer	2.640	0.0	26.6	724
2160 min Summer	1.903	0.0	28.8	1084
2880 min Summer	1.507	0.0	30.4	1452
4320 min Summer	1.085	0.0	32.8	2192
5760 min Summer	0.858	0.0	34.6	2848
7200 min Summer	0.716	0.0	36.1	3552
8640 min Summer	0.617	0.0	37.3	4376
10080 min Summer	0.544	0.0	38.4	5024
15 min Winter	81.719	0.0	9.6	18
30 min Winter	52.383	0.0	12.3	26
60 min Winter	32.061	0.0	15.1	42
120 min Winter	19.041	0.0	17.9	70
180 min Winter	13.895	0.0	19.6	100
240 min Winter	11.067	0.0	20.8	130
360 min Winter	8.018	0.0	22.6	190

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	29.464	0.064	0.0	2.1	2.1	0.9	O K
600 min Winter	29.457	0.057	0.0	1.8	1.8	0.8	O K
720 min Winter	29.452	0.052	0.0	1.5	1.5	0.7	O K
960 min Winter	29.445	0.045	0.0	1.2	1.2	0.6	O K
1440 min Winter	29.437	0.037	0.0	0.9	0.9	0.5	O K
2160 min Winter	29.430	0.030	0.0	0.6	0.6	0.4	O K
2880 min Winter	29.426	0.026	0.0	0.5	0.5	0.4	O K
4320 min Winter	29.422	0.022	0.0	0.4	0.4	0.3	O K
5760 min Winter	29.419	0.019	0.0	0.3	0.3	0.3	O K
7200 min Winter	29.417	0.017	0.0	0.2	0.2	0.2	O K
8640 min Winter	29.416	0.016	0.0	0.2	0.2	0.2	O K
10080 min Winter	29.414	0.014	0.0	0.2	0.2	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	6.376	0.0	24.0	252
600 min Winter	5.334	0.0	25.1	312
720 min Winter	4.609	0.0	26.0	372
960 min Winter	3.659	0.0	27.5	494
1440 min Winter	2.640	0.0	29.8	732
2160 min Winter	1.903	0.0	32.2	1080
2880 min Winter	1.507	0.0	34.0	1472
4320 min Winter	1.085	0.0	36.7	2176
5760 min Winter	0.858	0.0	38.8	2840
7200 min Winter	0.716	0.0	40.4	3640
8640 min Winter	0.617	0.0	41.8	4296
10080 min Winter	0.544	0.0	43.0	5040

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.056

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	4	8	0.056

Model Details

Storage is Online Cover Level (m) 30.800

Cellular Storage Structure

Invert Level (m) 29.400 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	15.0	15.0	0.800	15.0	27.4	0.900	0.0	28.2

Hydro-Brake® Outflow Control

Design Head (m) 0.800 Hydro-Brake® Type Md6 SW Only Invert Level (m) 29.400
Design Flow (l/s) 8.0 Diameter (mm) 123

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.0	0.800	7.9	2.000	12.2	4.000	17.3	7.000	22.8
0.200	7.6	1.000	8.7	2.200	12.8	4.500	18.3	7.500	23.6
0.300	8.0	1.200	9.5	2.400	13.4	5.000	19.3	8.000	24.4
0.400	7.6	1.400	10.2	2.600	13.9	5.500	20.2	8.500	25.2
0.500	7.4	1.600	10.9	3.000	15.0	6.000	21.1	9.000	25.9
0.600	7.4	1.800	11.6	3.500	16.1	6.500	22.0	9.500	26.6

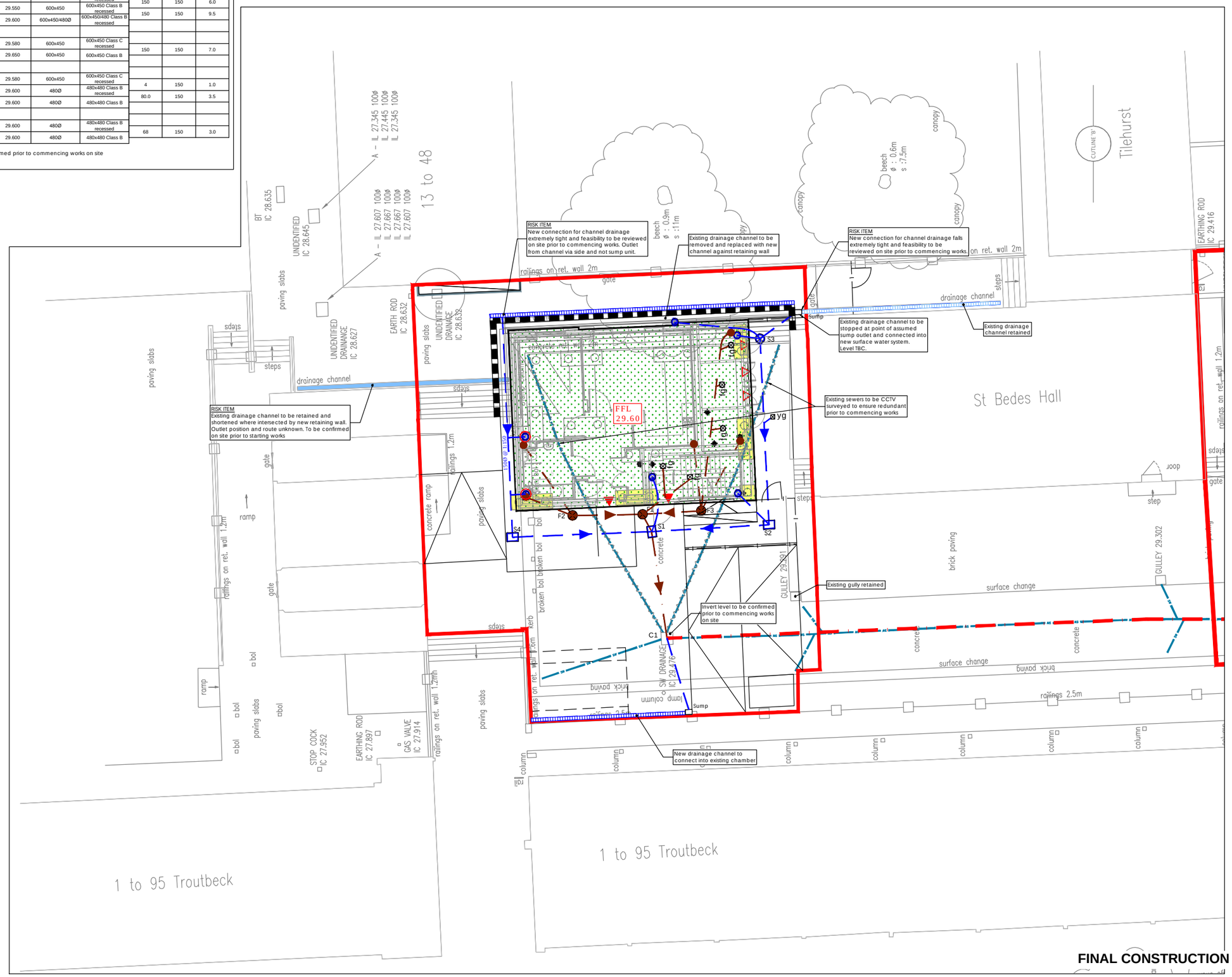
Appendix H – Plot 9, St Bed's Mews

Drainage Manhole Schedule

MANHOLE REF	INVERT LEVEL	COVER LEVEL	CHAMBER TYPE	COVER TYPE
C1	28.270	29.47	Existing	Existing
S1	28.306	29.580	600x450	600x450 Class C recessed
S2	28.346	29.550	600x450	600x450 Class B recessed
S3	28.410	29.600	600x450/480Ø	600x450/480 Class B recessed
S1	28.306	29.580	600x450	600x450 Class C recessed
S4	28.352	29.650	600x450	600x450 Class B
S1	28.306	29.580	600x450	600x450 Class C recessed
F1	28.556	29.600	480Ø	480x480 Class B recessed
F2	28.600	29.600	480Ø	480x480 Class B
F1	28.556	29.600	480Ø	480x480 Class B recessed
F3	28.600	29.600	480Ø	480x480 Class B

GRADE 1 in	PIPE Ø (mm)	LENGTH
150	150	5.5
150	150	6.0
150	150	9.5
150	150	7.0
4	150	1.0
80.0	150	3.5
68	150	3.0

IL to be confirmed prior to commencing works on site



FINAL CONSTRUCTION ISSUE

AS BUILT DRAWING
(THIS DRAWING IS THE FINAL CONSTRUCTION ISSUE AND DOES NOT PURPORT TO BE A SURVEY OF THE WORKS AS CONSTRUCTED)

N

NOTES:

Drainage Key

Sewers

- Foul water drain (private/non adoptable)
- Surface water drain (private/non adoptable)
- Foul water sewer (Adoptable)
- Surface water sewer (Adoptable)
- Existing combined water sewer (Adopted)
- Redundant sewer

Chamber Key

FW	SW	
		PPIC - 475mmØ *
		P.C.C. units/brick *
		Manhole Depth 1.25 to 1.5m * Depth 1.55 to 3.0m *

* General note
(Refer to standard details & long sections for chamber sizes. Size may need to increase dependant on number of incoming pipes/size of incoming pipes)

F1	Manhole reference number
*	Recessed cover required
	Rain water down pipe (roddable access)
	Soil vent pipe/soil stack
	Rodding access required in vertical stack
yg	Yard gully (150m - 200mmØ trapped)
fg	Floor gully (trapped)
	Cellular storage (refer to drawing for sizes)
	Linear drainage channel
	Surface water rodding eye
FFL XX.XX	Finished Floor Level (FFL)
	Internal step in FFL
	Green Roof
	Pile cap impacted by proposed drainage

MARK	DATE	BY	CHKD.	REVISION NOTES
AC1	03/05/18	ER	TST	As-Constructed Issue
FC1	23/06/17	NJ	TST	FINAL CONSTRUCTION ISSUE
C4	15/07/16	NJ	TST	Updated M&E, Drainage amended
C3	27/05/16	NJ	TST	Updated M&E, Drainage amended
C2	14/03/16	NJ	TST	Updated Layout, Drainage amended
C1	05/02/16	SNN	TST	Updated Layout, Drainage amended
P2	21/12/15	TST	DJ	RWP's updated
P1	30/11/15	TST	DJ	Initial issue

C.D.M.

SIGNIFICANT RISKS AND HAZARDS:

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PROJECT:

Plot 9 - St Bede's Mews
Regents Park Estate Infill

DRAWING TITLE:

Proposed Drainage Plan

STATUS: AS-CONSTRUCTED

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:100	Dec 2015	T.Trotman	DJ

JOB NUMBER:	DRAWING NUMBER:	REVISION:
SE1238	366	AC1

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	28.839	0.019	0.2	0.0	O K
30 min Summer	28.847	0.027	0.4	0.0	O K
60 min Summer	28.851	0.031	0.6	0.0	O K
120 min Summer	28.850	0.030	0.5	0.0	O K
180 min Summer	28.847	0.027	0.4	0.0	O K
240 min Summer	28.845	0.025	0.4	0.0	O K
360 min Summer	28.843	0.023	0.3	0.0	O K
480 min Summer	28.841	0.021	0.3	0.0	O K
600 min Summer	28.839	0.019	0.2	0.0	O K
720 min Summer	28.838	0.018	0.2	0.0	O K
960 min Summer	28.836	0.016	0.2	0.0	O K
1440 min Summer	28.834	0.014	0.1	0.0	O K
2160 min Summer	28.832	0.012	0.1	0.0	O K
2880 min Summer	28.831	0.011	0.1	0.0	O K
4320 min Summer	28.830	0.010	0.1	0.0	O K
5760 min Summer	28.829	0.009	0.0	0.0	O K
7200 min Summer	28.828	0.008	0.0	0.0	O K
8640 min Summer	28.827	0.007	0.0	0.0	O K
10080 min Summer	28.827	0.007	0.0	0.0	O K
15 min Winter	28.843	0.023	0.3	0.0	O K
30 min Winter	28.850	0.030	0.5	0.0	O K
60 min Winter	28.852	0.032	0.6	0.0	O K
120 min Winter	28.849	0.029	0.5	0.0	O K
180 min Winter	28.846	0.026	0.4	0.0	O K
240 min Winter	28.844	0.024	0.4	0.0	O K
360 min Winter	28.841	0.021	0.3	0.0	O K
480 min Winter	28.838	0.018	0.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	42.980	0.0	0.3	31
30 min Summer	27.473	0.0	0.6	32
60 min Summer	16.881	0.0	0.8	44
120 min Summer	10.146	0.0	1.1	70
180 min Summer	7.490	0.0	1.3	96
240 min Summer	6.029	0.0	1.4	132
360 min Summer	4.425	0.0	1.6	192
480 min Summer	3.548	0.0	1.7	250
600 min Summer	2.988	0.0	1.8	312
720 min Summer	2.597	0.0	1.9	374
960 min Summer	2.080	0.0	2.0	502
1440 min Summer	1.522	0.0	2.2	736
2160 min Summer	1.113	0.0	2.3	1088
2880 min Summer	0.892	0.0	2.4	1460
4320 min Summer	0.652	0.0	2.4	2176
5760 min Summer	0.522	0.0	2.3	2904
7200 min Summer	0.439	0.0	2.2	3656
8640 min Summer	0.382	0.0	2.2	4352
10080 min Summer	0.339	0.0	2.1	5064
15 min Winter	42.980	0.0	0.4	27
30 min Winter	27.473	0.0	0.7	30
60 min Winter	16.881	0.0	1.0	44
120 min Winter	10.146	0.0	1.3	68
180 min Winter	7.490	0.0	1.5	108
240 min Winter	6.029	0.0	1.7	140
360 min Winter	4.425	0.0	1.9	202
480 min Winter	3.548	0.0	2.0	256

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
600 min Winter	28.837	0.017	0.2	0.0	O K
720 min Winter	28.835	0.015	0.2	0.0	O K
960 min Winter	28.834	0.014	0.1	0.0	O K
1440 min Winter	28.832	0.012	0.1	0.0	O K
2160 min Winter	28.831	0.011	0.1	0.0	O K
2880 min Winter	28.830	0.010	0.1	0.0	O K
4320 min Winter	28.828	0.008	0.0	0.0	O K
5760 min Winter	28.827	0.007	0.0	0.0	O K
7200 min Winter	28.826	0.006	0.0	0.0	O K
8640 min Winter	28.826	0.006	0.0	0.0	O K
10080 min Winter	28.826	0.006	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
600 min Winter	2.988	0.0	2.1	306
720 min Winter	2.597	0.0	2.2	384
960 min Winter	2.080	0.0	2.4	482
1440 min Winter	1.522	0.0	2.6	754
2160 min Winter	1.113	0.0	2.7	1108
2880 min Winter	0.892	0.0	2.8	1448
4320 min Winter	0.652	0.0	2.9	2228
5760 min Winter	0.522	0.0	2.9	2752
7200 min Winter	0.439	0.0	2.8	3680
8640 min Winter	0.382	0.0	2.7	4408
10080 min Winter	0.339	0.0	2.6	4824

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Green Roof

Area (m^3)	113	Evaporation (mm/day)	3
Depression Storage (mm)	5	Decay Coefficient	0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.002053	24	28	0.000618	48	52	0.000186	72	76	0.000056	96	100	0.000017
4	8	0.001681	28	32	0.000506	52	56	0.000153	76	80	0.000046	100	104	0.000014
8	12	0.001376	32	36	0.000415	56	60	0.000125	80	84	0.000038	104	108	0.000011
12	16	0.001127	36	40	0.000339	60	64	0.000102	84	88	0.000031	108	112	0.000009
16	20	0.000923	40	44	0.000278	64	68	0.000084	88	92	0.000025	112	116	0.000008
20	24	0.000755	44	48	0.000228	68	72	0.000069	92	96	0.000021	116	120	0.000006

Model Details

Storage is Online Cover Level (m) 29.600

Pipe Structure

Diameter (m) 0.150 Slope (1:X) 60.000 Length (m) 5.000 Invert Level (m) 28.820

Pipe Outflow Control

Diameter (m)	0.150	Roughness k (mm)	0.600	Upstream Invert Level (m)	28.820
Slope (1:X)	60.0	Entry Loss Coefficient	0.500		
Length (m)	5.000	Coefficient of Contraction	0.600		

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	28.859	0.039	0.9	0.0	O K
30 min Summer	28.864	0.044	1.1	0.0	O K
60 min Summer	28.866	0.046	1.2	0.1	O K
120 min Summer	28.860	0.040	0.9	0.0	O K
180 min Summer	28.857	0.037	0.8	0.0	O K
240 min Summer	28.855	0.035	0.7	0.0	O K
360 min Summer	28.851	0.031	0.6	0.0	O K
480 min Summer	28.849	0.029	0.5	0.0	O K
600 min Summer	28.847	0.027	0.4	0.0	O K
720 min Summer	28.845	0.025	0.4	0.0	O K
960 min Summer	28.843	0.023	0.3	0.0	O K
1440 min Summer	28.839	0.019	0.2	0.0	O K
2160 min Summer	28.836	0.016	0.2	0.0	O K
2880 min Summer	28.834	0.014	0.1	0.0	O K
4320 min Summer	28.832	0.012	0.1	0.0	O K
5760 min Summer	28.831	0.011	0.1	0.0	O K
7200 min Summer	28.830	0.010	0.1	0.0	O K
8640 min Summer	28.830	0.010	0.1	0.0	O K
10080 min Summer	28.829	0.009	0.1	0.0	O K
15 min Winter	28.862	0.042	1.0	0.0	O K
30 min Winter	28.867	0.047	1.3	0.1	O K
60 min Winter	28.865	0.045	1.2	0.0	O K
120 min Winter	28.860	0.040	0.9	0.0	O K
180 min Winter	28.856	0.036	0.8	0.0	O K
240 min Winter	28.853	0.033	0.7	0.0	O K
360 min Winter	28.849	0.029	0.5	0.0	O K
480 min Winter	28.846	0.026	0.4	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	81.719	0.0	1.1	18
30 min Summer	52.383	0.0	1.6	23
60 min Summer	32.061	0.0	2.1	36
120 min Summer	19.041	0.0	2.6	72
180 min Summer	13.895	0.0	2.9	102
240 min Summer	11.067	0.0	3.1	130
360 min Summer	8.018	0.0	3.4	196
480 min Summer	6.376	0.0	3.6	252
600 min Summer	5.334	0.0	3.8	314
720 min Summer	4.609	0.0	3.9	374
960 min Summer	3.659	0.0	4.2	498
1440 min Summer	2.640	0.0	4.5	740
2160 min Summer	1.903	0.0	4.7	1100
2880 min Summer	1.507	0.0	4.9	1432
4320 min Summer	1.085	0.0	5.0	2188
5760 min Summer	0.858	0.0	5.1	2936
7200 min Summer	0.716	0.0	5.0	3696
8640 min Summer	0.617	0.0	4.9	4384
10080 min Summer	0.544	0.0	4.8	5088
15 min Winter	81.719	0.0	1.3	17
30 min Winter	52.383	0.0	1.9	22
60 min Winter	32.061	0.0	2.4	40
120 min Winter	19.041	0.0	3.0	72
180 min Winter	13.895	0.0	3.3	106
240 min Winter	11.067	0.0	3.6	136
360 min Winter	8.018	0.0	3.9	206
480 min Winter	6.376	0.0	4.2	264

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
600 min Winter	28.844	0.024	0.3	0.0	O K
720 min Winter	28.842	0.022	0.3	0.0	O K
960 min Winter	28.839	0.019	0.2	0.0	O K
1440 min Winter	28.836	0.016	0.2	0.0	O K
2160 min Winter	28.833	0.013	0.1	0.0	O K
2880 min Winter	28.832	0.012	0.1	0.0	O K
4320 min Winter	28.830	0.010	0.1	0.0	O K
5760 min Winter	28.830	0.010	0.1	0.0	O K
7200 min Winter	28.829	0.009	0.0	0.0	O K
8640 min Winter	28.828	0.008	0.0	0.0	O K
10080 min Winter	28.827	0.007	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
600 min Winter	5.334	0.0	4.3	308
720 min Winter	4.609	0.0	4.5	380
960 min Winter	3.659	0.0	4.8	494
1440 min Winter	2.640	0.0	5.1	732
2160 min Winter	1.903	0.0	5.4	1116
2880 min Winter	1.507	0.0	5.6	1472
4320 min Winter	1.085	0.0	5.8	2180
5760 min Winter	0.858	0.0	5.9	2888
7200 min Winter	0.716	0.0	5.9	3440
8640 min Winter	0.617	0.0	5.9	4296
10080 min Winter	0.544	0.0	5.8	5112

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Green Roof

Area (m^3)	113	Evaporation (mm/day)	3
Depression Storage (mm)	5	Decay Coefficient	0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.002053	24	28	0.000618	48	52	0.000186	72	76	0.000056	96	100	0.000017
4	8	0.001681	28	32	0.000506	52	56	0.000153	76	80	0.000046	100	104	0.000014
8	12	0.001376	32	36	0.000415	56	60	0.000125	80	84	0.000038	104	108	0.000011
12	16	0.001127	36	40	0.000339	60	64	0.000102	84	88	0.000031	108	112	0.000009
16	20	0.000923	40	44	0.000278	64	68	0.000084	88	92	0.000025	112	116	0.000008
20	24	0.000755	44	48	0.000228	68	72	0.000069	92	96	0.000021	116	120	0.000006

Model Details

Storage is Online Cover Level (m) 29.600

Pipe Structure

Diameter (m) 0.150 Slope (1:X) 60.000 Length (m) 5.000 Invert Level (m) 28.820

Pipe Outflow Control

Diameter (m)	0.150	Roughness k (mm)	0.600	Upstream Invert Level (m)	28.820
Slope (1:X)	60.0	Entry Loss Coefficient	0.500		
Length (m)	5.000	Coefficient of Contraction	0.600		

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m^3)	Status
15 min Summer	28.876	0.056	1.8	0.1	O K
30 min Summer	28.879	0.059	2.0	0.1	O K
60 min Summer	28.878	0.058	1.9	0.1	O K
120 min Summer	28.873	0.053	1.6	0.1	O K
180 min Summer	28.869	0.049	1.4	0.1	O K
240 min Summer	28.866	0.046	1.2	0.1	O K
360 min Summer	28.861	0.041	1.0	0.0	O K
480 min Summer	28.857	0.037	0.8	0.0	O K
600 min Summer	28.855	0.035	0.7	0.0	O K
720 min Summer	28.853	0.033	0.6	0.0	O K
960 min Summer	28.850	0.030	0.5	0.0	O K
1440 min Summer	28.845	0.025	0.4	0.0	O K
2160 min Summer	28.842	0.022	0.3	0.0	O K
2880 min Summer	28.838	0.018	0.2	0.0	O K
4320 min Summer	28.835	0.015	0.2	0.0	O K
5760 min Summer	28.833	0.013	0.1	0.0	O K
7200 min Summer	28.833	0.013	0.1	0.0	O K
8640 min Summer	28.832	0.012	0.1	0.0	O K
10080 min Summer	28.831	0.011	0.1	0.0	O K
15 min Winter	28.881	0.061	2.1	0.1	O K
30 min Winter	28.881	0.061	2.1	0.1	O K
60 min Winter	28.879	0.059	2.0	0.1	O K
120 min Winter	28.872	0.052	1.6	0.1	O K
180 min Winter	28.868	0.048	1.3	0.1	O K
240 min Winter	28.863	0.043	1.1	0.0	O K
360 min Winter	28.857	0.037	0.8	0.0	O K
480 min Winter	28.854	0.034	0.7	0.0	O K
600 min Winter	28.851	0.031	0.6	0.0	O K
720 min Winter	28.849	0.029	0.5	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	138.220	14
30 min Summer	89.266	19
60 min Summer	54.817	38
120 min Summer	32.511	68
180 min Summer	23.643	102
240 min Summer	18.757	132
360 min Summer	13.517	196
480 min Summer	10.710	252
600 min Summer	8.935	312
720 min Summer	7.702	384
960 min Summer	6.089	504
1440 min Summer	4.367	730
2160 min Summer	3.127	1096
2880 min Summer	2.465	1444
4320 min Summer	1.761	2140
5760 min Summer	1.387	2896
7200 min Summer	1.151	3584
8640 min Summer	0.988	4336
10080 min Summer	0.869	5080
15 min Winter	138.220	13
30 min Winter	89.266	21
60 min Winter	54.817	40
120 min Winter	32.511	72
180 min Winter	23.643	98
240 min Winter	18.757	136
360 min Winter	13.517	200
480 min Winter	10.710	266
600 min Winter	8.935	324
720 min Winter	7.702	374

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
960 min Winter	28.846	0.026	0.4	0.0	O K
1440 min Winter	28.842	0.022	0.3	0.0	O K
2160 min Winter	28.838	0.018	0.2	0.0	O K
2880 min Winter	28.835	0.015	0.2	0.0	O K
4320 min Winter	28.833	0.013	0.1	0.0	O K
5760 min Winter	28.832	0.012	0.1	0.0	O K
7200 min Winter	28.831	0.011	0.1	0.0	O K
8640 min Winter	28.830	0.010	0.1	0.0	O K
10080 min Winter	28.830	0.010	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
960 min Winter	6.089	508
1440 min Winter	4.367	734
2160 min Winter	3.127	1092
2880 min Winter	2.465	1516
4320 min Winter	1.761	2264
5760 min Winter	1.387	3000
7200 min Winter	1.151	3768
8640 min Winter	0.988	4096
10080 min Winter	0.869	5208

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Green Roof

Roof Area (m²)	113	Evapo-transpiration (mm/day)	3
Depression Storage (mm)	5	Decay Coefficient - k	0.050

Time / Area Diagram

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.002053	20-24	0.000755	40-44	0.000278	60-64	0.000102	80-84	0.000038	100-104	0.000014
4-8	0.001681	24-28	0.000618	44-48	0.000228	64-68	0.000084	84-88	0.000031	104-108	0.000011
8-12	0.001376	28-32	0.000506	48-52	0.000186	68-72	0.000069	88-92	0.000025	108-112	0.000009
12-16	0.001127	32-36	0.000415	52-56	0.000153	72-76	0.000056	92-96	0.000021	112-116	0.000008
16-20	0.000923	36-40	0.000339	56-60	0.000125	76-80	0.000046	96-100	0.000017	116-120	0.000006

Model Details

Storage is Online Cover Level (m) 29.600

Pipe Structure

Diameter (m) 0.150 Slope (1:X) 60.000 Length (m) 5.000 Invert Level (m) 28.820

Pipe Outflow Control

Diameter (m)	0.150	Roughness k (mm)	0.600	Upstream Invert Level (m)	28.820
Slope (1:X)	60.0	Entry Loss Coefficient	0.500		
Length (m)	5.000	Coefficient of Contraction	0.600		

Appendix I – Maintenance Manual

Infrastruct CS Ltd
The Stables
High Cogges Farm
High Cogges
Nr Witney
Oxon
OX29 6UN

SuDS MAINTENANCE GUIDE

OWNERS MANUAL

Scheme name: Regents Park Estate

Document reference SE1238-07.010

Report Prepared By:
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On behalf of Infrastruct CS Ltd

October 2020
Project Number: SE1238/ICS15-1872

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1.0 Introduction

This guidance provides best practice guidance on the maintenance of Sustainable Drainage Systems (SuDS) to facilitate their effective implementation within the Regents Park Estate Redevelopment.

Unlike conventional drainage systems, SuDS features are often visible and their function should be easily understood by those responsible for maintenance. When problems occur, they are generally obvious and can be remedied simply, using standard landscaping practice. If systems are properly monitored and maintained, any deterioration in performance can often be managed out.

Like any drainage system maintenance is a necessary and important consideration of SuDS design and sufficient thought should be given to long-term maintenance and its funding during feasibility and planning stages. In particular, the following requirements should be given full consideration:

1.1 Who is responsible for maintenance of the suds features used for this scheme

All SuDS measures will be the responsibility of Camden Council.

Following construction but prior to the completion/handover, the responsibility for maintenance shall lie with the developer.

1.2 **Owner's manual**

SuDS are different from conventional drainage and require different maintenance regimes. This manual details the following:

- location of all SuDS techniques in a site
- brief summary of how the techniques work, their purpose and how they can be damaged
- maintenance requirements (a maintenance plan) and a maintenance record
- explanation of the consequences of not carrying out the maintenance that is specified
- identification of areas where certain activities are prohibited (for example stockpiling materials on pervious surfaces)
- an action plan for dealing with accidental spillages
- advice on what to do if alterations are to be made to a development, if service companies undertake excavations or other similar works carried out that could affect the SuDS.

1.3 LOCATION OF SUDS TECHNIQUES USED ON THE SCHEME

The location of the SuDS features are shown on drawings included within the SUDS Report for the estate.

1.4 SUDS techniques used on this scheme:

- Green Roofs
- Geocellular/Modular Systems
- Silt traps and catchpits
- Flow control devices

1.5 Summary of how the techniques work for the scheme

Details of how the drainage has been designed for each site can be found within the SuDS drainage report under section 4.5.

1.6 Maintenance requirements

These are detailed in the appropriate section of this document.

1.7 Areas where activities are prohibited

Heavy loads should not be allowed in areas where cellular soakaways are located. Failure to do so may cause structural damage and collapse of the cellular limits.

1.8 Accidental spillages

Health and safety consideration are a priority and addressing accidental spillages should only be attempted if the nature of the spillage is known and it potential hazardous properties understood. The source of the spillage should be stopped and excess surface spillage removed by suction tank or absorption matts. Silt traps and sumps should be emptied by suction tanker. Areas of affected permeable paving should have the surface and laying course removed. The surfacing blocks should be cleaned and re-laid on new bedding material. Heavy pollution of the sub-base will require removal and replacement of the sub-base.

1.9 Alterations

If any alterations are proposed to the development, the design Engineer must be notified so that the impact/implications of the work can be assessed. Utilities should be restricted in the designated service zone areas.

1.10 Health and safety

To comply with the Construction (Design and Management) Regulations (CDM) 2015, designers must assess all foreseeable risks during construction and maintenance and the design must minimise them by the following (in order of preference):

1. Avoid.
2. Reduce.
3. Identify and mitigate residual risks.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

2.0 Operation and maintenance activity categories

There are likely to be three categories of maintenance activities:

1. Regular maintenance (including inspections and monitoring).
2. Occasional maintenance.
3. Remedial maintenance.

Regular maintenance consists of basic tasks done on a frequent and predictable schedule, including vegetation management, litter and debris removal, and inspections.

Occasional maintenance comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the regular tasks (e.g. sediment removal or filter replacement). Table 2 summarises the likely maintenance activities required for each SuDS component and guidance on specific maintenance activities is given in the following sections.

Remedial maintenance describes the intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised by good design, construction and regular maintenance activities. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and so timings are difficult to predict. Remedial maintenance can comprise activities such as:

- inlet/outlet repairs
- erosion repairs
- reinstatement or realignment of edgings, barriers, rip-rap or other erosion control
- infiltration surface rehabilitation
- replacement of blocked filter fabrics
- construction stage sediment removal (although this activity should have been undertaken before the start of the maintenance contract)
- system rehabilitation immediately following a pollution event.

It is important to note that these remedial activities will not be required for all systems, but for the purpose of estimating whole life maintenance costs, a contingency sum of 15-20% should be

added to the annual regular and occasional maintenance costs to cover the risk of these activities being required.

Table 2 - *Typical key SuDS components operation and maintenance activities*
For full specifications, see individual chapters.

O & M activity	SuDS component																
	Pond/wetland	Detention basin	Infiltration basin	Silt traps and catchpits	Soakaway	Infiltration trench	Filter trench	Modular storage	Pervious pavement	Swale/bioretention/green roofs	Filter strip	Sand filter	Pre-treatment systems	Perforated ring soakaways	Bio retention areas	Rain gardens	Oil interceptors	Flow control devices
Regular maintenance																		
Inspection				■				■		■								■
Litter/debris removal				□				□		■								□
Grass cutting				□				□		■								□
Weed/invasive plant control										□								
Shrub management										□								
Shoreline vegetation management																		
Aquatic vegetation managment																		
Irregular maintenance																		
Sediment management (*)				■				■		■								■
Vegetation/plant replacement										□								
Vacumn sweeping and brushing																		
Remedial maintenance																		
Structure rehabilitation/repair				□				□		□								□
Infiltration surface reconditioning										□								

■ Will be required

□ May be required

* Sediment should be collected and managed in pre-treatment systems, upstream of the main device.

The maintenance regime of a site also needs to consider the response to extreme pollution events. A response action plan should be developed and communicated to all those involved in the operation of a site, so that if a spillage occurs it can be prevented from causing pollution to receiving waters.

2.1 Regular maintenance activities

Inspections and reporting

Regular SuDS scheme inspections will:

- help determine optimum future maintenance activities
- confirm hydraulic, water quality, amenity and ecological performance
- allow identification of potential system failures, e.g. blockage, poor infiltration, poor water quality etc.

Inspections can generally be required at monthly site visits (e.g. for grass cutting) for little additional cost, and should, therefore, be subsumed into regular maintenance requirements. During the first year of operation, inspections should ideally be carried out after every significant storm event to ensure proper functioning, but in practice this may be difficult or impractical to arrange.
Typical routine inspection questions that will indicate when occasional or remedial maintenance activities are required, and/or when water quality requires investigation include:

- are inlets or outlets blocked?
- does any part of the system appear to be leaking (especially ponds and wetlands)?
- is the vegetation healthy?
- is there evidence of poor water quality (e.g. algae, oils, milky froth, odour, unusual colourings)?
- is there evidence of sediment build-up?
- is there evidence of ponding above an infiltration surface?
- is there any evidence of structural damage that requires repair?
- are there areas of erosion or channelling over vegetated surfaces?

Litter/debris removal
This is an integral part of SuDS maintenance and reduces the risks of inlet and outlet blockages, retains amenity value and minimises pollution risks. High litter removal frequencies may be required at high profile commercial/retail parks where aesthetics are a major driver.

Grass cutting
It is recommended that grass cutting be minimised around SuDS facilities, apart from swales and filter strips and structural embankments where a height of 100–150 mm is recommended to prevent the plants falling over, or "lodging", when water flows across the surface. In general, allowing grass to grow tends to enhance water quality performance. Short grass around a wet system such as pond or wetland provides an ideal habitat for nuisance species such as geese; allowing the grass to grow is an effective means of discouraging them. Grass around wet pond or wetland systems should not be cut to the edge of the permanent water.

Grass cutting is an activity undertaken primarily to enhance the perceived aesthetics of the facility. The frequency of cutting will tend to depend on surrounding land uses, and public requirements. Therefore, grass cutting should be done as infrequently as possible, recognising the aesthetic concerns of local residents. However, grass around inlet and outlet infrastructure should be strimmed closely to reduce risks to system performance. If a manicured, parkland effect is required, then cutting will need to be undertaken more regularly than for meadow type grass areas, which aim to maximise habitat and biodiversity potential.

Weed/invasive plant control
Weeds are generally defined as vegetation types that are unwanted in a particular area.
For SuDS, weeds are often alien or invasive species, which do not enhance the technical performance or aesthetic value of the system, or non-native species and the spread of which is undesirable.

In some places, weeding has to be done by hand to prevent the destruction of surrounding vegetation (hand weeding should generally be required only during the first year, i.e. during plant establishment). However, over grassed surfaces, mowing can be an effective management measure. The use of herbicides and pesticides should be prohibited since they cause water quality deterioration. The use of fertilisers should also be limited or prohibited to minimise nutrient loadings which are damaging to water bodies.

Shrub management
Shrubs tend to be densely planted and are likely to require weeding at the base, especially during the first year to ensure that they get enough water. Shrubs should be selected so they can grow to their maximum natural height without pruning.

Management of green waste
Appropriate methods should be implemented to dispose of green waste, including:

1 The development of wildlife piles
These provide refuges, hibernation shelter, food and egg laying sites for a large number of animals. When rotted down at the end of 3–5 years they provide compost that can be used as fertiliser for planting areas outside of the SuDS system.

In general:

- wildlife piles should be located in sunny or semi-shaded areas away from direct access by people
- their bases should be constructed using substantial prunings or other branch material laid in a criss-cross pattern
- seasonal shrub and other woody prunings should be added through the winter
- non-woody and grass cuttings should be added through the summer
- wildlife piles should comprise tidy piles up to 1.2 m high
- new wildlife piles should be constructed each year and old wildlife piles should be used as compost to plant beds after 3–5 years
- wildlife piles should be located above normal flood level of watercourses and be protected by hedges or similar features.

A schematic of a typical wildlife pile structure is shown in Figure 1.1.

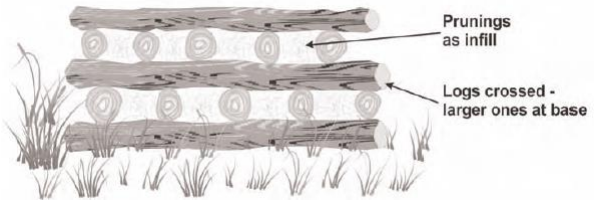

Figure 1.1 *Schematic of a wildlife pile (courtesy of Steve Wilson and Robert Bray of Sustainable Drainage Associates)*

2 On- or off-site composting
A compost facility allows all green waste, particularly grass cuttings and prunings to be recycled and provide compost for mulching ornamental plant beds. The following process should be followed for composting:

- shred all arisings from site
- combine all arisings in active compost bin with grass cuttings not exceeding 70%
- turn and mix active compost when bin is >50% full, at weekly intervals for at least four weeks
- turn and mix full bin every 28 days until used
- combine adjacent compost bins/bays when contents are settled to 50% volume reduction
- Use compost after 3–4 months.

A schematic/photo of a typical composting structure is given in Figure 1.2.

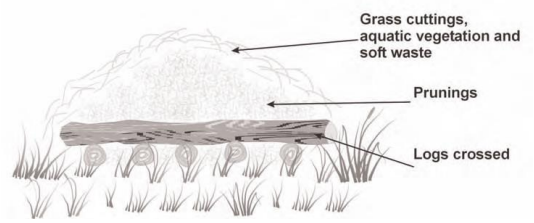

Figure 1.2 *Schematic of a composting structure (courtesy Steve Wilson and Robert Bray of Sustainable Drainage Associates)*

3 Disposal to landfill
As a last resort, green waste can be disposed of to some approved tips or landfill sites, although it is only accepted at certain locations.

2.2 Irregular maintenance activities

Sediment removal
To ensure long-term effectiveness, the sediment that accumulates in SuDS should be removed periodically. The required frequency of sediment removal is dependent on many factors including:

- design of upstream drainage system
- type of system
- design storage volume
- characteristics of upstream catchment area (eg land use, level of imperviousness, upstream construction activities, erosion control management and effectiveness of upstream pre-treatment).

Sediment accumulation will typically be rapid for the entire construction period (including time required for the building, turfing and landscaping of all upstream development plots). Once a catchment is completely developed and all vegetation is well-established, sediment mobility and accumulation is likely to drop significantly.

Vegetation/plant replacement
Some replacement of plants may be required in the first 12 months after installation, especially after storm events. Dead or damaged plants should be removed and replaced to restore the prescribed number of living plants per hectare.

Inspection programmes should identify areas of filtration, or infiltration surfaces where vegetation growth is poor and likely to cause a reduced level of system performance.
Such areas can then be rehabilitated and plant growth repaired.

2.3 Remedial maintenance

Structure rehabilitation/repair
There will come a time with most SuDS techniques when a major overhaul of the system is required to remove clogged filters, geotextiles, gravel etc. This will typically be between 10 and 25 years, depending on the technique and factors such as the type of catchment and sediment load. The SuDS design allows for vehicle access to undertake this work and consider the need for the overhaul without causing major disruption. For example, the use of geotextiles close to the surface in pervious surfaces traps the majority of sediment in a relatively easily accessible location. Reconstruction of the surface layer and bedding layer is all that is required, rather than reconstruction of the whole pavement depth.

Major overhaul is most likely to be required on techniques that rely on filtration through soils or aggregates, such as sand filters and infiltration devices. Other SuDS techniques are unlikely to need major overhaul if routine maintenance is undertaken as required (for example ponds and wetlands). Rehabilitation activities for each SuDS component are described in the individual component chapters. The requirements should be identified in the owner's manual.

Infiltration surface rehabilitation
In the event that grassed surface permeability has reduced, there are a number of landscape techniques that can be used to open the surface to encourage infiltration.
Such activities are not commonplace and are likely to be required only in circumstances where silt has not been effectively managed upstream.

1. Scarifying to remove "thatch". Thatch is a tightly intermingled organic layer of dead and living shoots, stems and roots, developing between the zone of green vegetation and the soil surface. Scarifying with tractor-drawn or self-propelled equipment to a depth of at least 50 mm breaks up silt deposits, removes dead grass and other organic matter and relieves compaction of the soil surface.
2. Spiking or tining the soil, using aerating equipment to encourage water percolation. This is particularly effective if followed by top dressing with a medium to fine sand and is best undertaken when the soil is moist. Spiking or tining with tractor drawn or self-propelled equipment penetrates and perforates soil layers to a depth of at least 100 mm (at 100 mm centres) and allows the entry of air, water, nutrients and top-dressing materials.
3. As a last resort, it may be necessary to remove and replace the grass and topsoil by:
    - removing accumulated silt and (subject to a toxicity test) applying to land or dispose of to landfill
    - removing damaged turf which should be composted
    - cultivating remaining topsoil to required levels

- re-turfing (using turf of a quality and appearance to match existing) or reseeding (to BS 7370: Part 3, Clause 12.6 (BSI, 1991) using seed to match existing turf) area to required levels. It may be necessary to supply and fix fully biodegradable coir blanket to protect seeded soil. Turf and seeded areas should be top dressed with fine sieved topsoil to BS 3882 (BSI, 1994) to achieve final design levels. Watering will be required to promote successful germination and/or establishment.

3.0 Applications of the principles of landscape maintenance

In contrast to conventional drainage, which comprises mainly sub-surface pipework and associated infrastructure, SuDS are predominantly surface systems. A key feature of SuDS is their integration within the local landscape and their amenity contribution, and it is appropriate therefore that landscape maintenance practice is applied to their management.

Landscape maintenance documentation

Typical landscape maintenance documentation and its potential relevance to SuDS systems is summarised below:

(A) Management plan – describing the management objectives for a site over time, and the management strategies that should be employed to realise these objectives and reconcile any potential conflicts that may arise.

Management plans are most appropriate for application in major parks and open spaces, wherever there are alternative choices for future action, and potential conflicts of purpose and priorities that need to be resolved. The following extract from *A guide to management plans for parks and open spaces* (Barber, 1991) sets out the types of management plans that can be prepared:

(i) Management plan

This predicts a degree of physical change, and therefore should present design proposals in its recommendations. It puts the emphasis on the presentation of anticipated physical change with much of the documentation being in support.

(ii) Outline plan

This is generally accepted as a more appropriate title for a management plan that wishes to establish the guiding principles, without providing detailed proposals which might constrain future options for achieving the outline objectives.

(iii) Maintenance plan

This is appropriate if the principal interest is in establishing the best way of maintaining an area, or where there is a need to match maintenance aspirations to a secure financial base. Planned maintenance programmes over longer timescales can be made more secure by the more public exposure of the need and the commitment that the Maintenance Plan should be able to guarantee. A Maintenance Plan can also establish changes in maintenance regimes that may be required to match a change in objectives e.g. the need to adapt operation and maintenance practices to accommodate specific wildlife habitats that may develop.

For a SuDS scheme, the maintenance plan will generally be the most appropriate type of management plan to use. The document should include an explanation of the function of the SuDS scheme and why it is being used on the site.

Where the drainage system has an impact on the wildlife value or public use of a site, it would be prudent to develop this simple explanation further to explain habitat enhancement goals, health and safety issues and long-term management implications.

Sites with special wildlife or amenity interest may require detailed management plans, which monitor habitat development, infrastructure changes or damage to sites and ensure rapid responses to such changes, should they occur.

It is common for smaller commercial, industrial and housing sites to have a simple maintenance statement. In this case, a single page explaining the site management (including the sustainable drainage system) would be useful for all parties involved in the care of the development.

(B) Conditions of contract – appropriate conditions will be required. Advice can be sought from the Landscape Institute. Guidance is also provided in CIRIA publication C625 (Shaffer *et al*, 2004).

(C) Specification – detailing the materials to be used and the standard of work required.
A specification, usually preceded by preliminaries, details how work shall be carried out and contains clauses that give general instructions to the contractor. Specific SuDS maintenance clauses may be included in a general specification or as a separate "Sustainable drainage maintenance specification" section.

(D) Schedule of work – itemising the tasks to be undertaken and the frequency at which they will be performed.

The tasks required to maintain the site and the frequency necessary to achieve an acceptable standard should be set out in the schedule of work.

Smaller sites will usually have simple specification notes given to a contractor as a basis for maintenance on a performance basis. Examples of performance criteria are items such as:

- length of grass
- tidiness
- extent of weed growth, etc.

This document will often form the basis of a pricing mechanism and can also act as a checklist to ensure the work has been carried out satisfactorily.

For additional information on the development of appropriate schedules, reference should be made to *the operation and maintenance of sustainable drainage systems* (HR Wallingford, 2004).

4.0 Frequency of maintenance tasks

Landscape maintenance contract periods are usually of one to three years' duration.
The three-year period is increasingly common to ensure continuity and commitment to long-term landscape care. The frequency of regular landscape maintenance tasks in a contract period can range from daily to once in the contract period. In practice most site tasks are based on monthly or fortnightly site visits, except where grass or weed growth requires a higher frequency of work. In many cases a performance specification is used with terms such as "beds shall be maintained weed-free" or "grass shall be cut to a height of 50 mm with a minimum height of 25 mm and a maximum height of 100 mm" to obtain the required standards.

Frequency can be specified within the schedule to include irregular items such as "'meadow grass' cut two times annually in July and September to a height of 50 mm, all arisings raked off and removed to wildlife features, compost facility or to tip", which provides flexibility for work that is not critical to the management of the site.

Maintenance tasks which suit a performance approach commonly include plant growth, grass cutting, pruning and tree maintenance. However, work tasks such as sweeping paths, regular litter collection and cleaning road surfaces will require work at an agreed frequency with more specific timings such as weekly, monthly or annually.

Where the frequency and timing of tasks is critical, a mixture of performance and frequency specification is necessary to provide effective maintenance.

SuDS maintenance generally tends towards a frequency requirement to ensure a predicable standard of care which can be recorded on site and which provides a reasonable basis for pricing work. A convenient frequency for many tasks is at a monthly inspection as this is the usual minimum site attendance required in a landscape specification. The monthly frequency should provide for an inspection of all SuDS features and checking all inlets and outlets.

Certain SuDS maintenance tasks however fall outside this monthly cycle and need to be accommodated in the contract. The two most obvious are:

- wetland vegetation maintenance
- silt management.

There are other tasks associated with ensuring the long-term performance of the systems that may be more difficult to predict and could even fall outside any contract period. It may therefore be more appropriate to review requirements for system rehabilitation at interim periods, when contracts are falling due for renewal.

5.0 References

- CIRIA C753 (2015) – The SuDS Manual
- Wildfowl & Wetlands Trust guidance (2012) – Maximising the potential for people and wildlife
- HR WALLINGFORD (2004). Whole Life Costing for Sustainable Drainage. Report SR 627.
- DEFRA (2010). Surface Water Management Plan Technical Guidance.
- Environment Agency (2015) - Cost estimation for SUDS. Summary of evidence.

GREEN ROOFS

DESCRIPTION

Green roofs are areas of living vegetation, installed on the top of buildings, for a range of reasons including visual benefit, ecological value, enhanced building performance and the reduction of surface water runoff.

OPERATION AND MAINTENANCE REQUIREMENTS

The most maintenance is generally required during the establishment stage (12 to 15 months), and this should usually be made the responsibility of the green roof provider. Maintenance contractors with specialist training in green roof care should be used, where possible.

Table below provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive and some actions may not always be required. Actual requirements will depend on the planting, the desired aesthetic and visual effect and the biodiversity objectives for the system. Maintenance specifications and schedules should therefore be specified for any individual green roof. If mechanical systems are located on the roof, then spill prevention measures should be exercised to ensure that roof runoff is not contaminated. The mechanical system area should be bunded and provided with separate drainage.

All maintenance actions carried out at roof level must be in full compliance with the appropriate health and safety regulations, and particularly those specifically dealing with working at height. Training and guidance information on operating and maintaining the roof should be provided to all property owners and tenants. Safety fastenings will be required for personnel working on the roof. Access routes to the roof should be designed and maintained to be safe and efficient, and walkways should always be kept clear of obstructions. Secure points for harness attachments should be provided when access near to the roof edges is required. Specific maintenance needs of the green roof should be monitored, and maintenance schedules adjusted to suit requirements.

Maintenance schedule	Required action	Frequency
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (i.e. year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment replace dead plants as required (where > 5% of coverage)	Annually (in autumn)
	Remove fallen leave and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting as required – clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled.	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

SILT TRAPS AND CATCHPITS

DESCRIPTION

Silt traps and catch pits are circular or rectangular manholes and /or chambers with a sump in them to collect suspended solids. Some chambers have removeable silt buckets to assist with the removal of accumulated silt deposits. Catch pits are usually concrete ring or segment structures and silt traps preformed plastic chambers.

OPERATION AND MAINTENANCE REQUIREMENTS

Regular inspection and maintenance is required to ensure the effective long-term operation of below ground silt traps and catch pits systems. Maintenance responsibility for systems should be placed with a responsible organization. Maintenance requirements are described in the table below. Maintenance plans and schedules should be developed during the design phase. Specific maintenance needs of the system should be monitored, and maintenance schedules adjusted to suit requirements.

Silt traps and catch pits – *operation and maintenance requirements*

Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly
	Debris removal from catchment surface (where may cause risks to performance)	Monthly
	Inspection of silt traps and catch pits to assess silt accumulation	Monthly (and after large storms)
	Removal of accumulated silt from silt trap and catch pit sumps	Annually, or as required
Remedial actions	Repair/rehabilitation of inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, and overflows to ensure that they are in good condition and operating as designed	Annually and after large storms

ATTENUATION STORAGE TANKS

DESCRIPTION

Attenuation storage tanks are used to create a below-ground void space for the temporary storage of surface water before infiltration, controlled release or use. The storage structure is usually formed using one of the following methods:

1. geo-cellular storage systems
2. plastic corrugated arch structures (constructed over and backfilled with an open-graded
3. aggregate base)
4. oversize concrete pipes
5. oversize plastic pipes
6. corrugated steel pipes
7. precast or/ *in situ* concrete box culvert sections and tanks (including flat-packed
8. concrete panels)
9. glass-reinforced plastic (GRP) tanks
10. hybrid structures using reinforced earth walls and concrete roof panels

OPERATION AND MAINTENANCE REQUIREMENTS

Regular inspect ion and maintenance is required to ensure the effective long-term operation of belowground storage systems. Maintenance responsibility for systems should be placed with a responsible organisation. The table below provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of act ions is not exhaustive, and some actions may not always be required.

Maintenance Plans and schedules should be developed during the design phase and will be specific to the type of tank that is adopted. Specific maintenance needs of the system should be monitored, and maintenance schedules adjusted to suit requirements. Further detail on the preparation of maintenance specifications and schedules of work is given in Chapter 32 of CIRIA C753.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

Attenuation Storage Tanks – *operation and maintenance requirements*

Maintenance schedule	Required action	Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Remedial Actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

FLOW CONTROL CHAMBERS AND DEVICES

Description

Flow control devices are usually installed in circular or rectangular manholes and are small orifice or vortex devices designed to hold back surface water and discharge at a low pre-specified rate. They are usually associated with up-stream storage tanks or modular storage that accommodates the peak flow volume until drain down at the attenuated discharge rate controlled by the flow control device.

OPERATION AND MAINTENANCE REQUIREMENTS

Regular inspection and maintenance is required to ensure the effective long-term operation of flow control devices. Maintenance responsibility for systems should be placed with a responsible organization. Maintenance requirements are described in the table below. Maintenance plans and schedules should be developed during the design phase. Specific maintenance needs of the system should be monitored, and maintenance schedules adjusted to suit requirements.

Silt traps and catchpits – *operation and maintenance requirements*

Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly
	Debris removal from catchment surface (where may cause risks to performance)	Monthly
	Inspection of flow control chamber to assess if system is draining down correctly and that the orifice or flow control device is not blocked. Assess if there are any silt accumulations in the chamber sump.	Monthly (and after large storms)
	Removal of accumulated silt from silt trap and catchpit sumps	Annually, or as required
Remedial actions	Repair/rehabilitation of inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, and overflows to ensure that they are in good condition and operating as designed	Annually and after large storms

APPENDIX A - MONITORING AND MAINTENANCE RECORD

You need to keep a record of the checks you have completed that are set out in the checklist below along with any additional checks you have made.
If you have a maintenance contract with a contractor, keep a record of any work carried out on your pond system by them. If invoices state the work carried out, these will be sufficient.
If you do the checks you should enter:

- The check or maintenance job
- Who did it;
- The result (for example when abnormal noise heard, called in specialist to investigate).

Action	Date and Time	Carried out by	Result
For example, inlet and outlet pipes checked	06/04/2012 09.30	Mr A N Other	Obstruction cleared.

APPENDIX B - ACCIDENT AND INCIDENT RECORD

You should record any accidents, other incidents or near misses relating to the operation of the SUDS system for example untreated sewage being released into the ponds. The form could also be used to record health and safety incidents.

"Other incidents" covers impacts on the environment that are not accidents, such as failing to maintain the system, or vandals causing damage to the detention pond.

Date and time of the incident	
What happened, what was it about?	
Was anyone else aware of this – other witnesses? If so who?	
What caused it?	
What action did you take to fix the problem?	
What have you done to make sure that it does not happen again?	
Was there any significant pollution – for example: untreated sewage being discharged into a drain, river or stream? Yes / No If yes, what pollution occurred?	
If there was significant pollution then you must notify the Environment Agency on 0800 807060 as soon as possible. Have you done so?	Yes/No/not applicable At what time did you phone? EA Incident reference no.
You must also write or send an email to confirm this to the local office (see your accident management plan for the address). Have you done so?	Yes/No/not applicable
Please print your name, sign and date.	

APPENDIX C - KEY SITE AND EMERGENCY CONTACTS

This table contains information and contacts you may need in an emergency

SITE DETAILS			
Address:			
Postcode:			
Site access grid reference:			
SITE CONTACTS		Office Hours (specify)	Out of hours
Owner:			
General manager:			
Site manager:			
Site supervisor:			
Security contact:			
Landowner / agent:			
EMERGENCY SERVICES		Office Hours	Out of hours
Emergency			
Medical:			
Police:			
Fire:			
REGULATORS		Office Hours	Out of hours
Health and Safety Executive (HSE):			
Local Authority:			
Environment Agency	General number:	08708 506 506	
	24 hour emergency hotline:	0800 80 70 60	0800 80 70 60
Natural England/Countryside Council for Wales			
OTHER KEY CONTACTS		Office Hours	Out of hours
Adjacent landowners:			
Neighbours:			
Specialist advisors:			

Appendix J – Thames Water Section 106 consents

Mr. Tim Trotman

Tasman House
The Waterfront
Elstree Road
Borehamwood
WD6 3BS

Your ref
Our ref
Name
Phone
Email

27 May 2016

Dear Mr. Tim Trotman,

Notice of consent to connect to a public sewer/public lateral drain under Section 106 of the Water Industry Act 1991
Site Address: Robert Street Car Park, Robert Street, London, NW1 3JS

Thank you for sending us your sewer connection application for the above address.

We're pleased to let you know that your application has received our conditional consent for the proposed connection(s) to the public sewer.

This does not guarantee capacity exists within our network and is given for the legal right of communication with the public sewer only in accordance with the description below. For capacity based enquiries and capacity checks within our network please make a Pre Development Enquiry application. Applications can be made on the Thames Water website. It does not infer any right to enter or cross third party land and must not be used for the discharge of any drainage related planning conditions.

You will be responsible for obtaining any necessary licenses and or permission from the Highway Authority, Planning Authority and or third party land owners

The connection to our sewer will need to be inspected by us before the trench is backfilled. We require at least five working days' notice before the connection works begin to ensure we can attend site. You can arrange our attendance by calling 0800 009 3921.

Please make sure that this Notice is to be available on site for inspection during the course of these works.

Our consent is subject to the conditions laid out in the enclosed Conditions of Consent.

LOCATION	DESCRIPTION
Robert Street Car Park, Robert Street, London, NW1 3JS	x1 new 150mm diameter direct connection into an existing manhole on a public sewer.

Thames Water
Developer Services
1st Floor West
Clearwater Court
Vastern Road
Reading
RG1 8DB

T 0800 009 3921
I www.thameswater.co.uk

The reference number for your application is 50082179; please quote this in any future correspondence.

If you have any questions please give the Helpdesk a call on 0800 009 3921. We're open 8am-5pm, Monday to Friday, or you can email us at developer.services@thameswater.co.uk.

Yours sincerely,

AdeOluwa Bankole
Technical Coordinator
Developer Services - Wastewater

Thames Water
Developer Services
1st Floor West
Clearwater Court
Vastern Road
Reading
RG1 8DB

T 0800 009 3921
I www.thameswater.co.uk

Developer Services

Your ref	50082150
Our ref	1013399798
Name	William Nodes
Phone	0800 009 3921
Email	developer.services@thameswater.co.uk

Mr Tim Trotman
Infrastruct CS
The Stables
High Cogges Farm
High Cogges
OX29 6UN

07 June 2016

Dear Mr Trotman,

Notice of consent to connect to a public sewer/public lateral drain under Section 106 of the Water Industry Act 1991
Site Address: Land adjacent, Rydal Water, Robert Street, Camden, NW1 3ED

Thank you for sending us your sewer connection application for the above address.

We're pleased to let you know that your application has received our conditional consent for the proposed connection(s) to the public sewer.

This does not guarantee capacity exists within our network and is given for the legal right of communication with the public sewer only in accordance with the description below. It does not infer any right to enter or cross third party land and must not be used for the discharge of any drainage related planning conditions.

You will be responsible for obtaining any necessary licenses and or permission from the Highway Authority, Planning Authority and or third party land owners

The connection to our sewer will need to be inspected by us before the trench is backfilled. We require at least five working days' notice before the connection works begin to ensure we can attend site. You can arrange our attendance by calling 0800 009 3921.

Please make sure that this Notice is to be available on site for inspection during the course of these works.

Our consent is subject to the conditions laid out in the enclosed Conditions of Consent.

LOCATION	DESCRIPTION
Land adjacent, Rydal Water, Robert Street, Camden, NW1 3ED	1 No. 150mm diameter indirect combined water connection to existing 1422mm by 940mm diameter public combined water sewer in Hampstead Road via existing lateral drain.

Thames Water
Developer Services
3rd Floor West
Clearwater Court
Vastern Road
Reading
RG1 8DB

T 0800 009 3921
I www.thameswater.co.uk

The reference number for your application is 50082150; please quote this in any future correspondence.

If you have any questions please give the Helpdesk a call on 0800 009 3921. We're open 8am-5pm, Monday to Friday, or you can email us at developer.services@thameswater.co.uk.

Yours sincerely,

Will Nodes – BSc, MSc, PhD
Project Engineer - Wastewater

Thames Water
Developer Services
3rd Floor West
Clearwater Court
Vastern Road
Reading
RG1 8DB

T 0800 009 3921
I www.thameswater.co.uk

Developer Services

Your ref 50082148
Our ref 1013399794
Name William Nodes
Phone 0800 009 3921
Email developer.services@thameswater.co.uk

Mr Tim Trotman
Infrastruct CS
The Stables
High Cogges Farm
High Cogges
OX29 6UN

23 December 2015

Dear Mr Trotman,

Notice of consent to connect to a public sewer/public lateral drain under Section 106 of the Water Industry Act 1991
Site Address: Varndell Street Corner, Varndell Street, Camden, NW1 3RG

Thank you for sending us your sewer connection application for the above address.

We're pleased to let you know that your application has received our conditional consent for the proposed connection(s) to the public sewer.

This does not guarantee capacity exists within our network and is given for the legal right of communication with the public sewer only in accordance with the description below. It does not infer any right to enter or cross third party land and must not be used for the discharge of any drainage related planning conditions.

You will be responsible for obtaining any necessary licenses and or permission from the Highway Authority, Planning Authority and or third party land owners

The connection to our sewer will need to be inspected by us before the trench is backfilled. We require at least five working days' notice before the connection works begin to ensure we can attend site. You can arrange our attendance by calling 0800 009 3921.

Please make sure that this Notice is to be available on site for inspection during the course of these works.

Our consent is subject to the conditions laid out in the enclosed Conditions of Consent.

LOCATION	DESCRIPTION
Varndell Street Corner, Varndell Street, Camden, NW1 3RG	1 No 150mm diameter direct combined water connection to existing 1143mm x 762mm diameter public combined water sewer in Varndell Street via core-drilled saddle connection. Connection to be made 380mm above existing sewer invert level. 150mm diameter lateral drain to demarcation chamber on property boundary.

Thames Water
Developer Services
3rd Floor West
Clearwater Court
Vastern Road
Reading
RG1 8DB

T 0800 009 3921
I www.thameswater.co.uk

The reference number for your application is 50082148; please quote this in any future correspondence.

If you have any questions please give the Helpdesk a call on 0800 009 3921. We're open 8am-5pm, Monday to Friday, or you can email us at developer.services@thameswater.co.uk.

Yours sincerely,

Will Nodes – BSc, MSc, PhD
Project Engineer - Wastewater

Thames Water
Developer Services
3rd Floor West
Clearwater Court
Vastern Road
Reading
RG1 8DB

T 0800 009 3921
I www.thameswater.co.uk

19 NOV 2015

Developer Services

Mr Tim Trotman
Infrastruct CS Ltd
The Stables
High Cogges Farm
High Cogges
OX29 6UN

Your ref	50062165
Our ref	1013399797
Name	William Nodes
Phone	0800 009 3921
Email	developer.services@thameswater.co.uk

18 November 2015

Dear Mr Trotman,

Notice of consent to connect to a public sewer/public lateral drain under Section 106 of the Water Industry Act 1991
Site Address: Newlands, Varndell Street, Camden, NW1 3SJ

Thank you for sending us your sewer connection application for the above address.

We're pleased to let you know that your application has received our conditional consent for the proposed connection(s) to the public sewer.

This does not guarantee capacity exists within our network and is given for the legal right of communication with the public sewer only in accordance with the description below. It does not infer any right to enter or cross third party land and must not be used for the discharge of any drainage related planning conditions.

You will be responsible for obtaining any necessary licenses and or permission from the Highway Authority, Planning Authority and or third party land owners

The connection to our sewer will need to be inspected by us before the trench is backfilled. We require at least five working days' notice before the connection works begin to ensure we can attend site. You can arrange our attendance by calling 0800 009 3921.

Please make sure that this Notice is to be available on site for inspection during the course of these works.

Our consent is subject to the conditions laid out in the enclosed Conditions of Consent.

LOCATION	DESCRIPTION
Newlands, Varndell Street, Camden, NW1 3SJ	1 No 150mm diameter direct combined water connection to existing 1168mm x 787mm diameter public combined water sewer in Varndell Street via core-drilled saddle connection. Connection to be made 390mm above existing sewer invert level.

Thames Water
Developer Services
3rd Floor West
Clearwater Court
Vastern Road
Reading
RG1 8DB

T 0800 009 3921
I www.thameswater.co.uk

The reference number for your application is 50082165; please quote this in any future correspondence.

If you have any questions please give the Helpdesk a call on 0800 009 3921. We're open 8am-5pm, Monday to Friday, or you can email us at developer.services@thameswater.co.uk.

Yours sincerely,

Will Nodes – BSc, MSc, PhD
Project Engineer - Wastewater

Thames Water
Developer Services
3rd Floor West
Clearwater Court
Vastern Road
Reading
RG1 8DB

T 0800 009 3921
I www.thameswater.co.uk

Developer Services

Your ref	50082145
Our ref	1013099795
Name	William Nodes
Phone	0800 009 3921
Email	developer.services@thameswater.co.uk

Mr Tim Trotman
Infrastruct CS Ltd
The Stables
High Cogges Farm
High Cogges
OX29 6UN

18 November 2015

Dear Mr Trotman,

Notice of consent to connect to a public sewer/public lateral drain under Section 106 of the Water Industry Act 1991
Site Address: The Cape of Good Hope, Albany Street, Camden, NW1 4EE

Thank you for sending us your sewer connection application for the above address.

We're pleased to let you know that your application has received our conditional consent for the proposed connection(s) to the public sewer.

This does not guarantee capacity exists within our network and is given for the legal right of communication with the public sewer only in accordance with the description below. It does not infer any right to enter or cross third party land and must not be used for the discharge of any drainage related planning conditions.

You will be responsible for obtaining any necessary licenses and or permission from the Highway Authority, Planning Authority and or third party land owners

The connection to our sewer will need to be inspected by us before the trench is backfilled. We require at least five working days' notice before the connection works begin to ensure we can attend site. You can arrange our attendance by calling 0800 009 3921.

Please make sure that this Notice is to be available on site for inspection during the course of these works.

Our consent is subject to the conditions laid out in the enclosed Conditions of Consent.

LOCATION	DESCRIPTION
The Cape of Good Hope, Albany Street, Camden, NW1 4EE	1 No. 150mm diameter direct combined water connection to existing public combined water sewer in Land adjacent to St. Bede's hall via existing manhole as per drawing 306 Rev. P01. 150mm diameter lateral drain to demarcation chamber on property boundary.

Thames Water
Developer Services
3rd Floor West
Clearwater Court
Vastern Road
Reading
RG1 8DB

T 0800 009 3921
I www.thameswater.co.uk

The reference number for your application is 50082145; please quote this in any future correspondence.

If you have any questions please give the Helpdesk a call on 0800 009 3921. We're open 8am-5pm, Monday to Friday, or you can email us at developer.services@thameswater.co.uk.

Yours sincerely,

Will Nodes – BSc, MSc, PhD
Project Engineer - Wastewater

Thames Water
Developer Services
3rd Floor West
Clearwater Court
Vastern Road
Reading
RG1 8DB

T 0800 009 3921
I www.thameswater.co.uk

Developer Services

Your ref 50082144
Our ref 1013399810
Name William Nodes
Phone 0800 009 3921
Email developer.services@thameswater.co.uk

Mr Tim Trotman
Infrastruct CS Ltd
The Stables
High Cogges Farm
High Cogges
OX29 6UN

18 November 2015

Dear Mr Trotman,

Notice of consent to connect to a public sewer/public lateral drain under Section 106 of the Water Industry Act 1991
Site Address: The Victory Pub, Nash Street, Camden, NW1 2DY

Thank you for sending us your sewer connection application for the above address.

We're pleased to let you know that your application has received our conditional consent for the proposed connection(s) to the public sewer.

This does not guarantee capacity exists within our network and is given for the legal right of communication with the public sewer only in accordance with the description below. It does not infer any right to enter or cross third party land and must not be used for the discharge of any drainage related planning conditions.

You will be responsible for obtaining any necessary licenses and or permission from the Highway Authority, Planning Authority and or third party land owners

The connection to our sewer will need to be inspected by us before the trench is backfilled. We require at least five working days' notice before the connection works begin to ensure we can attend site. You can arrange our attendance by calling 0800 009 3921.

Please make sure that this Notice is to be available on site for inspection during the course of these works.

Our consent is subject to the conditions laid out in the enclosed Conditions of Consent.

LOCATION	DESCRIPTION
The Victory Pub, Nash Street, Camden, NW1 2DY	1 No. 150mm diameter direct combined water connection to existing 305mm diameter public combined water sewer in Nash Street via preformed junction connection. 150mm diameter lateral drain to demarcation chamber on property boundary.

Thames Water
Developer Services
3rd Floor West
Clearwater Court
Vastern Road
Reading
RG1 8DB

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The reference number for your application is 50082144; please quote this in any future correspondence.

If you have any questions please give the Helpdesk a call on 0800 009 3921. We're open 8am-5pm, Monday to Friday, or you can email us at developer.services@thameswater.co.uk.

Yours sincerely,

Will Nodes – BSc, MSc, PhD
Project Engineer - Wastewater

Thames Water
Developer Services
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Developer Services

Your ref 50082147
Our ref 1013399799
Name William Nodes
Phone 0800 009 3921
Email developer.services@thameswater.co.uk

Mr Tim Trotman
Infrastruct CS
The Stables
High Cogges Farm
High Cogges
OX29 6UN

23 December 2015

Dear Mr Trotman,

Notice of consent to connect to a public sewer/public lateral drain under Section 106 of the Water Industry Act 1991
Site Address: St. Bedes Mews, Camden, NW1 4DY

Thank you for sending us your sewer connection application for the above address.

We're pleased to let you know that your application has received our conditional consent for the proposed connection(s) to the public sewer.

This does not guarantee capacity exists within our network and is given for the legal right of communication with the public sewer only in accordance with the description below. It does not infer any right to enter or cross third party land and must not be used for the discharge of any drainage related planning conditions.

You will be responsible for obtaining any necessary licenses and or permission from the Highway Authority, Planning Authority and or third party land owners

The connection to our sewer will need to be inspected by us before the trench is backfilled. We require at least five working days' notice before the connection works begin to ensure we can attend site. You can arrange our attendance by calling 0800 009 3921.

Please make sure that this Notice is to be available on site for inspection during the course of these works.

Our consent is subject to the conditions laid out in the enclosed Conditions of Consent.

LOCATION	DESCRIPTION
St. Bedes Mews, Camden, NW1 4DY	1 No. 150mm diameter direct combined water connection to existing 150mm diameter public combined water sewer in St. Bedes Mews via existing manhole reference TQ28828503. 150mm diameter lateral drain to demarcation chamber on property boundary.

Thames Water
Developer Services
3rd Floor West
Clearwater Court
Vastern Road
Reading
RG1 8DB

T 0800 009 3921
I www.thameswater.co.uk

The reference number for your application is 50082147; please quote this in any future correspondence.

If you have any questions please give the Helpdesk a call on 0800 009 3921. We're open 8am-5pm, Monday to Friday, or you can email us at developer.services@thameswater.co.uk.

Yours sincerely,

Will Nodes – BSc, MSc, PhD
Project Engineer - Wastewater

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