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OLDLANDS FARM PHASE 2 – DRAINAGE & MAINTENANCE STRATEGY

OLDLANDS FARM PHASE 2 – DRAINAGE & MAINTENANCE STRATEGY

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1. INTRODUCTION

Ramboll UK has been commissioned by Hanbury Properties Ltd to undertake a Drainage Strategy to facilitate Phase 2 Commercial Development at Oldlands Farm, Bognor Regis, West Sussex.

The site lies to the north-east of the approved Phase 1 commercial area and is bounded by the Bognor Northern Relief Road and the main Bognor Regis railway line. The commercial development area covers approximately 6.04ha of undeveloped agricultural farmland that has been subdivided into plots for 4 no. Units (3 no. B2 usage 1 no. B8).

The purpose of this report is to confirm that a satisfactory strategy for the disposal of storm and foul water within the proposed commercial development is achievable.

2. SITE CONDITIONS

The Phase 2 commercial development is accessed through the Phase 1 development from the A29 Trunk Road and lies to the north east of the Phase 1 development area. The approximate National Grid Reference of the site is OSGB 101787N 494435E.



Figure 1 - Existing Site Layout

The topographical survey of the site shows the existing ground generally falling from the Bognor Northern Relief Road in a typically south easterly direction towards the field ditches and the Oldlands Farm Ditch. The existing site levels range from 2.32m AOD to approximately 0.33m AOD at the watercourse and ditches.

The site has been agriculturally farmed over several years. The natural drainage regime is for surface water to run directly off the surface clay soil and directly to the local ditches on the south west boundary. The Oldlands Farm Ditch flows in a north west to south easterly direction along the boundary of the site and forms part of the Internal Drainage Board system. Two small field ditch or drainage channels which take runoff from the existing fields run under the railway and discharge to the Lidsey Rife.

The Phase 2 development comprises of 4 separate plots, estate road, access road and soft landscaping with the following catchment areas:

Unit 1 (B2) = 7,490m²
Unit 2 (B2) = 6,495m²
Unit 3 (B8) = 20,700m²
Unit 4 (B2) = 4,505m²
Estate Roads = 4,500m² (1,100m² side road, 3,400m² main access)
Soft Landscaped Areas¹ = 4,835m²
Access Road (From Phase 1 to Phase 2 area) = 1190 m²

The entire site is to be raised above the required 2.0m AOD flood level as part of the flood compensation works outlined within 'Flood Risk and Drainage Assessment' (FRA) document within Appendix 2. Cut and fill volumes required for flood compensation remain as per section 5.8.5 of the FRA document ensuring the site balances flood plain volumes before and after development, as per the strategy outlined in Appendix 2. The Drainage and SuDS strategy for the Phase 2 development outlined in this report supersedes the strategy within the FRA.

3. STORM WATER MANAGEMENT DESIGN PHILOSOPHY

3.1 Proposed Design

National Planning Policy Framework requires new developments to not exacerbate flood risk elsewhere and as such surface water drainage from the site is to be via controlled release. This will be achieved via the use of Sustainable Drainage Systems (SuDS) with the aim of mimicking as close as possible the natural drainage regime of the site.

Building Regulations Document Part H (2002) details the following hierarchy for disposal of surface water flows:

1. To soakaway/infiltration systems
2. To watercourse
3. To sewer

Site investigations have shown the site to be underlain by brickearth clay soils with a high groundwater content. Additionally, the site is being raised via made ground and as such infiltration is not a suitable solution for the site. The Oldlands Farm Ditch runs adjacent to the site and is therefore the best option for disposal of surface water under the aforementioned hierarchy for discharge.

The proposed development has 4 no. units of varying size from 1,042m² up to 10,610m² each unit includes service yard for deliveries, car parking facilities and associated hard standing infrastructure for pedestrian and vehicular access. Surface water will be generated because of replacing the existing farmland with an impermeable road construction. Allowance for 30% runoff from soft landscaping has been incorporated into the current drainage design.

It is proposed that collection of surface water run-off from external hard standing areas will be via permeable tanked pavement systems and traditional kerb and gully or linear channels within service yard or access points.

Roof drainage will be collected via standard rain water down pipes that will be connected into the surface water drainage networks.

Due to the large catchment areas, underground storage tanks will be required with an appropriate flow control device to hold back surface water flows to allow for gradual release back into the natural surface water regime at the Oldlands Farm ditch.

¹ Including soft landscaped depression areas and footprint of the proposed ditch.

To attenuate flows within the access roads an oversized pipe network will be utilised prior to outfall to the ditch.

The access road is proposed to be drain into oversized pipe network and discharge into the existing Oldlands Farm Ditch with a restricted rate (2.5l/s).

See Appendix 1 for Proposed Drainage Layout and detailed calculation for the proposed surface water drainage network.

3.2 Catchment Characteristics

The storm water runoff generated from the site will be managed using appropriate SUDS techniques up to the 1 in 100 year +40% storm event. This will ensure that the peak rate of storm water leaving the developed site is controlled and accounted for in the design.

As the intention is to discharge to a watercourse, the requirement specified is for the proposed peak storm water runoff rate (1 in 100 year, 6 hour rainfall event) and runoff volume not to exceed pre-development rates (DEFRA, 2015). The Greenfield runoff rate has been calculated using the Interim Code of Practice for Sustainable Drainage Systems (ICP SUDS) methodology using Micro Drainage software (Micro Drainage Limited., 2017). The input variables for the ICP SUDS methodology are the same as for the Institute of Hydrology Report 124 (IH124) method. Results are summarised below, full details are within Appendix 3.

ICP SUDS mean annual flood flow rate equation:

$$QBAR_{RURAL} = 0.00108 \times AREA_{0.89} \times SAAR_{1.17} \times SOIL_{2.17}$$

Unit No.	Q _{bar} (l/s)
Unit 1	2.7
Unit 2	2.4
Unit 3	7.5
Unit 4	1.6
Estate Roads	1.6
Soft Landscaping	1.8
Access Road	0.4

Based on the above, the runoff limitation should be based on a maximum discharge of Q_{bar} of 1.6 to 7.5l/s. The aspiration for the discharge of surface water runoff to be limited to Greenfield equivalent rates from the site provides a very onerous flow restriction, however, and would result in an elevated risk of blockage to a flow restriction device, increasing the maintenance burden. As such, Environment Agency (EA) guidance (Kellagher, 2013) stating a minimum value of 5.0l/s for flow devices will be adopted in this design.

To achieve flow rate above the 5.0l/s minimum outflow rate, it is proposed to split the Phase 2 site into 2 no. surface water drainage networks as follows:

Network 1

Unit 1 + Unit 2 + Estate Side Road. Q_{bar} = 2.7 + 2.4 + 0.4 = 5.5l/s (Proposed betterment on greenfield run-off Q=5.0 l/s)

Network 2

Unit 3 + Unit 4. + Estate Main Access + Soft Landscaping. $Q_{bar} = 7.5 + 1.6 + 1.2 + 1.8 = 12.1 \text{ l/s}$
(Proposed betterment on greenfield run-off $Q = 11.8 \text{ l/s}$)

Access Road

Restriction to greenfield runoff rate (0.4 l/s) is deemed unfeasible for this network due to increased risk of blockages. Following consultation with Arun District Council a runoff rate restriction of 2.5 l/s is achievable for this catchment.

3.3 Output Summary

It is intended that flows will be restricted by a combination of orifices and ultimately vortex flow control units at the final discharge points in all drainage networks.

The networks have been designed to contain water below ground to prevent flooding of the plots across the range of storm durations. This will be achieved through a combination of storage within attenuation tanks, oversized pipes and permeable paving subbase.

Table 1 below sets out the contributing catchment summary for both networks which is taken as the impermeable surface only: carriageway, footway, building footprint, car parks and service yards.

Table 1 – Drainage Network Summary

Network Reference	Catchment Area (ha)	Outfall Discharge Limit (l/s)	Proposed Flow Restriction	Proposed Peak Discharge (l/s)	Estimated Required Storage Volume (m ³)
1	1.51	5.0	Vortex	5.0	1,575
2	3.00 ²	11.8	Vortex	11.8	2,990
Access Road	0.12	2.5	Vortex	2.5	74
Total	4.63	19.3			

Due to the low-lying area and adjacent flood plain, all surface water outfalls discharging below the 2.0m AOD flood level will utilise non-return valves on the outfall pipes to prevent backflow from the watercourse into the drainage network. A freeboard above ditch invert level is to be provided where falls allow whilst maintaining minimum cover depths to pipework.

Hydraulic modelling outputs indicate that no flooding occurs within the drainage network for the 1 in 100 year winter events +40% CC (refer to Appendix 1).

The proposed drainage network is designed to attenuate peak runoff generated by the 1 in 100 year storm events within the site boundary.

3.4 Outfall Flow Restricting Device – Vortex Flow Control

The flow control at the outflow locations will be controlled using a vortex flow control device. This device is self-activated and delivers effective flow control to mitigate against adverse downstream affects. Under low flow conditions, the flow control behaves like an oversized

² Unit 3 + Unit 4. + Estate Main Access + 30% allowance for Soft Landscaping

orifice. As the water depth increases, a vortex begins to form within the unit which creates a back pressure and chokes the flow through the aperture restricting the flow during higher flow conditions.

The device will require periodic inspection and maintenance to ensure any build-up of blockage material is removed but has a lower risk of blockage than a traditional orifice.

3.5 Pollution Control

The car parks and services yards are considered as moderate risk in regard to fuel spillages and therefore oil/petrol interceptors will be employed prior to outfall to the natural watercourse. This will be in the form of a Class 1 Full Retention Separator.

4. FOUL WATER MANAGEMENT DESIGN PHILOSOPHY

The foul water discharge from each unit will be managed via standard gravity fed systems. Each network will culminate at a centralised private foul pumping station serving the Phase 2 site. This will discharge into the Enabling Works foul drainage network and ultimately to the existing foul network installed as part of the Phase 1 development.

The existing foul system drains via gravity within the access road to a public pumping station located at the entrance to the Oldlands Farm Estate adjacent to the A259, A29 roundabout. Acceptance of foul flows is subject to agreement with the sewer authority who have adopted the pumping station.

5. MAINTENANCE MANUAL

A key consideration of the drainage design is to ensure a minimum requirement level for maintenance to minimise the risk of the system failing and the cost and disruption associated with rectifying any issues caused by defects. The main issues associated with maintenance of drainage systems are sedimentation, root ingress and associated blockage of pipes, manholes and SUDS features.

The design incorporates measures to mitigate these issues through the use of sumps and trapped gullies to reduce sediment flows through the system. The correct installation of the specified pipe surround material will mitigate the risk of root infiltration into the underground drainage. Whilst these measures will reduce the risk of a reduction in performance, the access road drainage systems across will nevertheless require regular maintenance which should be incorporated within the maintenance regime for the development as a whole.

The table below provides details of the recommended maintenance measures for the access road drainage system:

Table 2 – Maintenance summary: Drainage pipes

Maintenance schedule	Required Action	Frequency
Regular Maintenance	Remove sediment and debris from inspection chambers and flow control chambers	6 months
	Cleaning of any filters and swales as below	Annually
	Remove any root ingress	As required
	Catchpits. Silt and debris should be removed using a gully sucker if required.	Manhole chambers should be inspected every 6 months and catchpits/catchpit chambers should be inspected every spring and autumn after leaf fall. Silt and debris should be removed using a gully sucker if required.
Occasional Maintenance	Ditches to be cleared of silt and vegetation	6 months. Inspected every spring and autumn after leaf fall.
	CCTV survey of drains to check alignment, cracking and joint displacement	10 year intervals
	Jetting of drains	5 year intervals or as required
Remedial Actions	Reconstruct cracked pipes or lengths of pipework with joint displacement	As required
	Filter drains - replacement of clogged geotextile	10 years or as required
	Replace damaged gully and inspection chamber covers	As required
Monitoring	Inspect silt traps and note rate of sedimentation accumulation	Monthly in the first year and then annually.
	Check gullies and remove silt or debris	Quarterly and after leaf fall

Ditch maintenance will be the responsibility of the landowner, not West Sussex County Council or its agent Arun District Council.

6. SUMMARY

Existing surface water runoff from farmland discharges to a number of receiving ditches. Surface water runoff from the new development will be discharged into the existing ditch network via a carrier pipe drainage system located within the carriageways and beneath the proposed hard standing areas.

In order to attenuate surface water discharge to the watercourses in order to mitigate downstream affects, flows will be restricted to greenfield run-off rates (Network 1, 5.0l/s, Network 2, 11.8l/s, access road, 2.5l/s) by use of vortex flow control device located at the final manhole preceding each outfall position. Attenuation storage has been incorporated into the carrier pipe design as online storage.

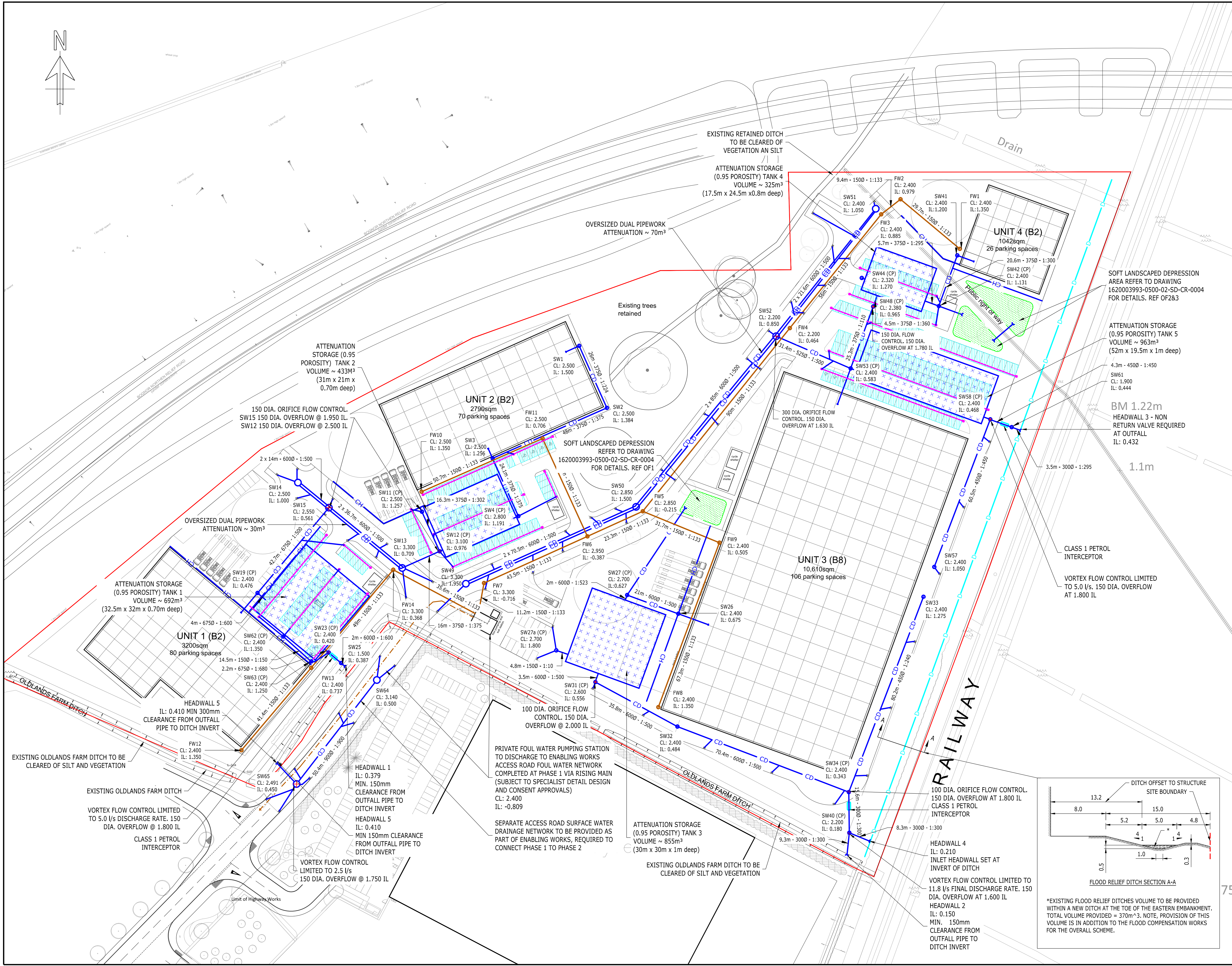
The drainage networks have been designed to prevent surface flooding for rainfall events up to the 1 in 100 year storm + climate change (applied as a 40% uplift in peak rainfall intensity).

Foul water will be drained via gravity connecting to centralised private pumping station. This will then discharge to the Enabling Works foul network and ultimately the public pumping station located at the entrance to the Oldlands Farm site.

7. WORKS CITED

- DEFRA. (2015). *Sustainable Drainage Systems, Non-statutory technical standards for sustainable drainage systems*. London: Department for Environment, Food and Rural Affairs.
- Hydro International. (2017, November 6th). *Hydro-Brake Optimum*. Retrieved from Hydro International: <https://www.hydro-int.com/en/products/hydro-brake-optimum-0>
- Kellagher, R. (2013). *Rainfall Runoff Management for Developments - Report SC030219*. Bristol: Environment Agency.
- Micro Drainage Limited. (2017). *Micro Drainage*. UK: XP Solutions.

APPENDIX 1
SURFACE WATER DRAINAGE LAYOUT & MICRODRAINAGE DESIGN
OUTPUT AND CATCHMENT AREA PLAN



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- NOTES
- DO NOT SCALE FROM THIS DRAWING.
 - ALL DIMENSIONS ARE IN METRES U.N.O.
 - ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM U.N.O.
 - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
 - CONNECTIONS FROM BUILDINGS TO BE INCORPORATED FOLLOWING DETAILED DESIGN OF RAIN WATER AND SEWER DOWN POINT LOCATIONS AND THEREFORE CONNECTIONS SHOWN ARE INDICATIVE ONLY.
 - ADDITIONAL GULLIES, LINEAR CHANNELS AND MANHOLES TO BE ADDED SUBJECT TO COORDINATION WITH DETAILED EXTERNAL LEVELS DESIGN AND ARE SHOWN INDICATIVELY AT THIS STAGE. ALL GULLIES TO BE TRAPPED.
 - ALL EXTERNAL DRAINAGE PIPE DIAMETER TO BE MIN. 150mm U.N.O.
 - ALL MANHOLE COVER LEVELS, LOCATION AND ORIENTATION ARE INDICATIVE AND TO BE LAID TO SUIT FINAL FINISHED GROUND LEVELS AND TO BE CONFIRMED BY CONTRACTOR.
 - REFER TO SEWERS FOR ADOPTION 7TH EDITION AND WSCC STANDARD CONSTRUCTION DETAILS FOR DRAINAGE RELATED ITEMS CONSTRUCTION REQUIREMENTS.
 - DRG. NO. S278/38/11 REV. B - DRAINAGE GULLY A - PRE-CAST CONCRETE
 - DRG. NO. S278/38/13 REV. C - DRAINAGE TYPE B CATCHPIT
 - DRG. NO. S278/38/14 REV. A - VORTEX FLOW CONTROL TYPE B MANHOLE
 - DRG. NO. S278/38/23 REV. A - HEADWALL DETAIL FOR PIPE SIZES UP TO 600 DIAM CONCRETE BAGWORK
 - DRG. NO. S278/38/24 REV. A - HEADWALL DETAIL FOR PIPE SIZES UP TO 600 DIAM ENGINEERING BRICKWORK
 - ALSO REFER TO DRAWING NO. RAM-0500-02-SC-CR-00001 FOR DRAINAGE MANHOLE, ATTENUATION TANK AND HEADWALL SCHEDULE.
 - DITCHES ARE TO BE CLEARED OF SILT AND VEGETATION.

KEY:

- SITE BOUNDARY
- ATTENUATION TANK/CRATES
- PERMEABLE PAVING
- SUDS ATTENUATION POND/OVERFLOW FLOOD STORAGE
- PROPOSED SURFACE WATER FLOOD RELIEF DITCH
- LINEAR CHANNEL
- SURFACE WATER CARRIER DRAIN
- PERMEABLE PAVING 150 DIA. COLLECTOR DRAIN AND 600 DEEP POLYPROPYLENE INSPECTION CHAMBERS (900 DIA.)
- FOUL WATER CARRIER DRAIN
- FOUL WATER RISING MAIN
- MANHOLE/CHAMBER
- FLOW CONTROL CHAMBER
- PETROL INTERCEPTOR
- HEADWALL
- GULLY

UPDATED TO SUIT LOCAL PLANNING AUTHORITY COMMENTS IN EMAIL DATED 03/10/2018		04/10 2018	CL	MRD
Rev	Description	Date	By	App
P07			CL	

PLANNING

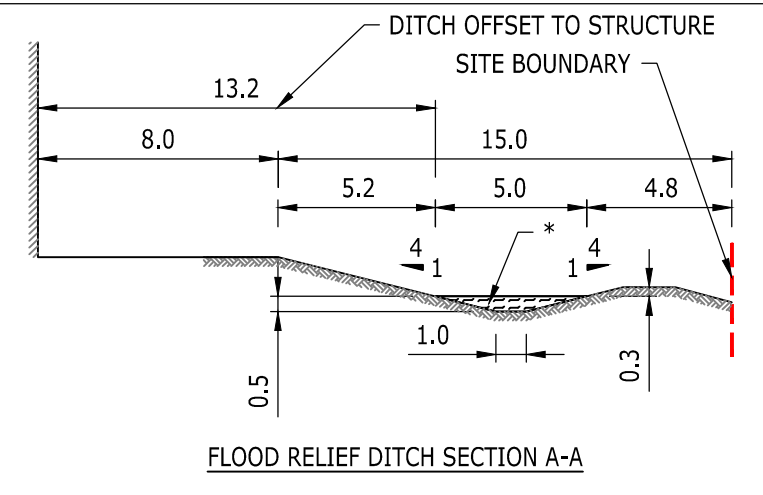
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DRAINAGE STRATEGY

Project No:	Scale (@A1):	Drawn:	Date:
1620003993	1:750	JAC	APR.18
Drawing No:	Rev:		
RAM-0500-02-DR-CR-00001	P07		



*EXISTING FLOOD RELIEF DITCHES VOLUME TO BE PROVIDED WITHIN A NEW DITCH AT THE TOE OF THE EASTERN EMBANKMENT. TOTAL VOLUME PROVIDED = 370m³. NOTE, PROVISION OF THIS VOLUME IS IN ADDITION TO THE FLOOD COMPENSATION WORKS FOR THE OVERALL SCHEME.

Ramboll UK Ltd		Page 1
240 Blackfriars Road London SE1 8NW	Oldlands Farm - Phase 2 SW Drainage Design	
Date 05/10/2018 09:16 File SW drainage model 181004.MDX	Designed by CCT Checked by CL	
Micro Drainage		Network 2018.1

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	2.000
M5-60 (mm)	19.000	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.350	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	50	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	26.007	0.116	224.2	0.051	4.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	4.36	1.500	0.051	0.0	0.0	0.0	1.21	133.2	7.0

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240 Blackfriars Road London SE1 8NW	Oldlands Farm - Phase 2 SW Drainage Design	
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Micro Drainage	Network 2018.1	

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.001	47.931	0.128	374.5	0.043	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.002	24.277	0.065	373.5	0.272	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.003	2.396	0.006	399.3	0.108	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.004	14.390	0.038	375.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.005	14.390	0.038	375.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.006	1.881	0.132	14.2	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.000	25.128	0.168	150.0	0.090	4.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	15.277	0.068	225.0	0.042	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	1.827	0.008	228.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.003	16.608	0.055	302.0	0.079	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.001	50.00	5.22	1.384	0.094	0.0	0.0	0.0	0.93	102.8	12.8
1.002	50.00	5.65	1.256	0.366	0.0	0.0	0.0	0.93	102.9	49.5
1.003	50.00	5.70	1.191	0.474	0.0	0.0	0.0	0.90	99.5	64.2
1.004	50.00	5.95	1.185	0.474	0.0	0.0	0.0	0.93	102.7	64.2
1.005	50.00	6.21	1.147	0.474	0.0	0.0	0.0	0.93	102.7	64.2
1.006	50.00	6.22	1.108	0.474	0.0	0.0	0.0	4.83	532.9	64.2
2.000	50.00	4.51	1.650	0.090	0.0	0.0	0.0	0.82	14.5	12.2
2.001	50.00	4.81	1.407	0.133	0.0	0.0	0.0	0.87	34.5	18.0
2.002	50.00	4.84	1.340	0.133	0.0	0.0	0.0	0.86	34.2	18.0
2.003	50.00	5.15	1.257	0.211	0.0	0.0	0.0	0.90	63.6	28.6

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240 Blackfriars Road London SE1 8NW	Oldlands Farm - Phase 2 SW Drainage Design	
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Micro Drainage		Network 2018.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.007	15.828	0.042	376.9	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.008	36.365	0.073	500.0	0.081	0.00	0.0	0.600	oo	45	Pipe/Conduit	
3.000	14.585	0.029	502.9	0.035	4.00	0.0	0.600	oo	45	Pipe/Conduit	
1.009	42.671	0.085	502.0	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	
4.000	36.595	0.244	150.0	0.050	4.00	0.0	0.600	o	150	Pipe/Conduit	
5.000	6.108	0.041	150.0	0.014	4.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.007	50.00	6.50	0.976	0.685	0.0	0.0	0.0	0.93	102.4	92.8
1.008	50.00	7.06	0.709	0.766	0.0	0.0	0.0	1.08	611.1	103.7
3.000	50.00	4.23	1.000	0.035	0.0	0.0	0.0	1.08	609.3	4.8
1.009	50.00	7.68	0.561	0.801	0.0	0.0	0.0	1.16	416.1	108.5
4.000	50.00	4.75	1.750	0.050	0.0	0.0	0.0	0.82	14.5	6.7
5.000	50.00	4.12	1.650	0.014	0.0	0.0	0.0	0.82	14.5	1.9

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240 Blackfriars Road London SE1 8NW	Oldlands Farm - Phase 2 SW Drainage Design	
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Micro Drainage	Network 2018.1	

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
4.001	2.727	0.012	227.3	0.089	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.010	8.879	0.015	591.9	0.510	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.011	9.173	0.016	573.3	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.012	9.516	0.016	594.7	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.013	5.502	0.009	611.3	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.014	4.096	0.006	682.7	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.015	1.638	0.027	60.7	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.016	4.804	0.008	600.5	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
4.001	50.00	4.80	1.431	0.153	0.0	0.0	0.0	0.86	34.3	20.7
1.010	50.00	7.81	0.476	1.464	0.0	0.0	0.0	1.07	382.9	198.3
1.011	50.00	7.95	0.461	1.464	0.0	0.0	0.0	1.09	389.1	198.3
1.012	50.00	8.10	0.445	1.464	0.0	0.0	0.0	1.07	382.0	198.3
1.013	50.00	8.19	0.429	1.464	0.0	0.0	0.0	1.05	376.7	198.3
1.014	50.00	8.26	0.420	1.464	0.0	0.0	0.0	1.00	356.2	198.3
1.015	50.00	8.27	0.414	1.464	0.0	0.0	0.0	3.37	1205.5	198.3
1.016	50.00	8.35	0.387	1.464	0.0	0.0	0.0	0.99	278.9	198.3

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Micro Drainage	Network 2018.1	

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
6.000	24.208	0.048	504.3	0.546	4.00	0.0	0.600	o	600	Pipe/Conduit	
6.001	3.667	0.007	523.9	0.437	0.00	0.0	0.600	o	600	Pipe/Conduit	
6.002	13.881	0.028	495.8	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
6.003	13.881	0.028	495.8	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
7.000	7.049	0.052	135.6	0.000	4.00	0.0	0.600	o	150	Pipe/Conduit	
7.001	12.857	0.734	17.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
6.004	4.130	0.008	516.3	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
6.005	35.814	0.072	497.4	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
6.006	70.406	0.141	499.3	0.051	0.00	0.0	0.600	o	525	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
6.000	50.00	4.37	0.675	0.546	0.0	0.0	0.0	1.08	304.7	73.9
6.001	50.00	4.43	0.627	0.983	0.0	0.0	0.0	1.06	298.9	133.1
6.002	50.00	4.65	0.620	0.983	0.0	0.0	0.0	1.09	307.3	133.1
6.003	50.00	4.86	0.592	0.983	0.0	0.0	0.0	1.09	307.3	133.1
7.000	50.00	4.14	1.800	0.000	0.0	0.0	0.0	0.86	15.2	0.0
7.001	50.00	4.23	1.748	0.000	0.0	0.0	0.0	2.42	42.7	0.0
6.004	50.00	4.92	0.564	0.983	0.0	0.0	0.0	1.06	301.1	133.1
6.005	50.00	5.47	0.556	0.983	0.0	0.0	0.0	1.09	306.8	133.1
6.006	50.00	6.65	0.484	1.034	0.0	0.0	0.0	1.00	215.5	140.0

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
8.000	80.422	0.435	184.9	0.057	4.00	0.0	0.600	o	450	Pipe/Conduit	
6.007	1.989	0.004	497.3	0.025	0.00	0.0	0.600	o	600	Pipe/Conduit	
6.008	1.698	0.003	566.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
6.009	2.398	0.005	479.6	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
6.010	9.851	0.151	65.2	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
9.000	1.110	0.002	555.0	0.129	4.00	0.0	0.600	o	600	Pipe/Conduit	
9.001	8.295	0.030	276.5	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
8.000	50.00	4.90	1.275	0.057	0.0	0.0	0.0	1.49	237.3	7.7
6.007	50.00	6.68	0.343	1.116	0.0	0.0	0.0	1.09	306.8	151.1
6.008	50.00	6.71	0.339	1.116	0.0	0.0	0.0	1.02	287.4	151.1
6.009	50.00	6.75	0.336	1.116	0.0	0.0	0.0	1.11	312.5	151.1
6.010	50.00	6.80	0.331	1.116	0.0	0.0	0.0	3.02	853.4	151.1
9.000	50.00	4.02	0.212	0.129	0.0	0.0	0.0	1.03	290.3	17.5
9.001	50.00	4.11	0.210	0.129	0.0	0.0	0.0	1.46	412.7	17.5

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
6.011	9.310	0.030	310.3	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
10.000	20.592	0.069	298.4	0.210	4.00	0.0	0.600	o	375	Pipe/Conduit	
10.001	6.502	0.022	295.5	0.095	0.00	0.0	0.600	o	375	Pipe/Conduit	
10.002	11.464	0.112	102.4	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
11.000	2.741	0.018	152.3	0.085	4.00	0.0	0.600	o	150	Pipe/Conduit	
11.001	10.908	0.029	376.1	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
10.003	7.161	0.019	376.9	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
10.004	4.730	0.013	363.8	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
6.011	50.00	6.91	0.180	1.245	0.0	0.0	0.0	1.38	389.3	168.6
10.000	50.00	4.33	1.200	0.210	0.0	0.0	0.0	1.04	115.3	28.4
10.001	50.00	4.43	1.131	0.305	0.0	0.0	0.0	1.05	115.8	41.3
10.002	50.00	4.54	1.109	0.305	0.0	0.0	0.0	1.79	197.8	41.3
11.000	50.00	4.06	1.270	0.085	0.0	0.0	0.0	0.81	14.3	11.5
11.001	50.00	4.25	1.027	0.085	0.0	0.0	0.0	0.93	102.5	11.5
10.003	50.00	4.67	0.997	0.390	0.0	0.0	0.0	0.93	102.4	52.8
10.004	50.00	4.75	0.978	0.390	0.0	0.0	0.0	0.94	104.3	52.8

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
10.005	25.233	0.232	108.8	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
12.000	70.949	0.142	499.6	0.113	4.00	0.0	0.600	oo	43	Pipe/Conduit	
12.001	84.665	0.169	501.0	0.110	0.00	0.0	0.600	oo	43	Pipe/Conduit	
13.000	61.418	0.123	499.3	0.104	4.00	0.0	0.600	oo	43	Pipe/Conduit	
12.002	31.357	0.063	497.7	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
10.006	3.052	0.006	508.7	0.545	0.00	0.0	0.600	o	525	Pipe/Conduit	
10.007	25.309	0.051	496.3	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
10.005	50.00	4.99	0.965	0.390	0.0	0.0	0.0	1.74	191.8	52.8
12.000	50.00	5.31	1.950	0.113	0.0	0.0	0.0	0.90	287.0	15.3
12.001	50.00	6.88	1.500	0.223	0.0	0.0	0.0	0.90	286.7	30.2
13.000	50.00	5.13	1.050	0.104	0.0	0.0	0.0	0.90	287.1	14.1
12.002	50.00	7.40	0.850	0.327	0.0	0.0	0.0	1.00	215.9	44.3
10.006	50.00	7.45	0.583	1.262	0.0	0.0	0.0	0.99	213.5	170.8
10.007	50.00	7.87	0.577	1.262	0.0	0.0	0.0	1.00	216.2	170.8

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
10.008	25.309	0.051	496.3	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	🟢
10.009	3.351	0.007	478.7	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	🟢
14.000	60.556	0.135	448.6	0.289	4.00	0.0	0.600	o	450	Pipe/Conduit	🟡
10.010	4.984	0.011	453.1	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	🔴
10.011	1.652	0.006	275.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	🔴
10.012	2.129	0.007	304.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	🔴
10.013	2.952	0.010	295.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	🔴
10.014	0.503	0.002	251.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	🔴

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
10.008	50.00	8.30	0.526	1.262	0.0	0.0	0.0	1.00	216.2	170.8
10.009	50.00	8.35	0.475	1.262	0.0	0.0	0.0	1.02	220.2	170.8
14.000	50.00	5.06	1.050	0.289	0.0	0.0	0.0	0.95	151.6	39.2
10.010	50.00	8.44	0.468	1.551	0.0	0.0	0.0	0.95	150.9	210.0
10.011	50.00	8.47	0.457	1.551	0.0	0.0	0.0	0.94	66.6	210.0
10.012	50.00	8.51	0.451	1.551	0.0	0.0	0.0	0.90	63.4	210.0
10.013	50.00	8.56	0.444	1.551	0.0	0.0	0.0	0.91	64.3	210.0
10.014	50.00	8.57	0.434	1.551	0.0	0.0	0.0	0.99	69.8	210.0

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
15.000	1.905	0.011	173.2	0.000	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
15.000	50.00	4.03	1.200	0.000	0.0	0.0	0.0	0.99	39.4	0.0

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SW1	2.500	1.000	Open Manhole	1800	1.000	1.500	375				
SW2	2.500	1.116	Open Manhole	1500	1.001	1.384	375	1.000	1.384	375	
SW3	2.500	1.244	Open Manhole	1200	1.002	1.256	375	1.001	1.256	375	
SW4 (CP)	2.800	1.609	Open Manhole	1200	1.003	1.191	375	1.002	1.191	375	
SW5: Tank 2 inlet (dummy)	2.950	1.765	Open Manhole	1200	1.004	1.185	375	1.003	1.185	375	
SW6: TANK 2 (dummy)	3.025	1.878	Open Manhole	1200	1.005	1.147	375	1.004	1.147	375	
SW7: Tank 2 outlet (dummy)	3.100	1.992	Open Manhole	1200	1.006	1.108	375	1.005	1.108	375	
SW8: CH	2.400	0.750	Junction		2.000	1.650	150				
SW9: CH	2.400	0.993	Junction		2.001	1.407	225	2.000	1.482	150	
SW10	2.500	1.160	Junction		2.002	1.340	225	2.001	1.340	225	
SW11 (CP)	2.500	1.243	Open Manhole	1050	2.003	1.257	300	2.002	1.332	225	
SW12 (CP)	3.100	2.124	Open Manhole	1200	1.007	0.976	375	1.006	0.976	375	
								2.003	1.202	300	151
SW13: oversized dual pipework	3.300	2.591	Open Manhole	3000	1.008	0.709	45	1.007	0.934	375	
SW14: oversized dual pipework	2.500	1.500	Open Manhole	3000	3.000	1.000	45				
SW15: Orifice Chamber	2.550	1.989	Open Manhole	3000	1.009	0.561	675	1.008	0.636	45	
								3.000	0.971	45	335
SW16: CH	2.500	0.750	Junction		4.000	1.750	150				
SW17: CH	2.400	0.750	Junction		5.000	1.650	150				
SW18	2.300	0.869	Junction		4.001	1.431	225	4.000	1.506	150	
								5.000	1.609	150	103

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SW19 (CP)	2.400	1.924	Open Manhole	1350	1.010	0.476	675	1.009	0.476	675	

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SW20: Tank 1 inlet (dummy)	2.400	1.939	Open Manhole	1350	1.011	0.461	675	4.001	1.419	225	493
SW21: TANK 1 (dummy)	2.400	1.955	Open Manhole	1500	1.012	0.445	675	1.010	0.461	675	
SW22: Tank 1 outlet (dummy)	2.400	1.971	Open Manhole	1500	1.013	0.429	675	1.011	0.445	675	
SW23 (CP): Hydrobrake Chamber	2.400	1.980	Open Manhole	1500	1.014	0.420	675	1.012	0.429	675	
SW24: PI inlet (dummy)	2.200	1.786	Open Manhole	1500	1.015	0.414	675	1.013	0.420	675	
SW25: PI outlet (dummy)	1.500	1.113	Open Manhole	1350	1.016	0.387	600	1.014	0.414	675	
SWHW1	1.100	0.721	Open Manhole	0		OUTFALL		1.015	0.387	675	
SW26	2.400	1.725	Open Manhole	1350	6.000	0.675	600	1.016	0.379	600	
SW27	2.700	2.073	Open Manhole	1350	6.001	0.627	600	6.000	0.627	600	
SW28: Tankk 3 inlet-a (dummy)	2.700	2.080	Open Manhole	1350	6.002	0.620	600	6.001	0.620	600	
SW29: TANK 3 (dummy)	2.650	2.058	Open Manhole	1350	6.003	0.592	600	6.002	0.592	600	
SW27a	2.700	0.900	Open Manhole	1050	7.000	1.800	150				
SW31 Tank 3 inlet-b (dummy)	2.600	0.852	Open Manhole	1050	7.001	1.748	150	7.000	1.748	150	
SW30: Tank 3 outlet (dummy)	2.600	2.036	Open Manhole	1350	6.004	0.564	600	6.003	0.564	600	
SW31	2.600	2.044	Open Manhole	1350	6.005	0.556	600	7.001	1.014	150	
SW32	2.400	1.916	Open Manhole	1350	6.006	0.484	525	6.004	0.556	600	
SW33	2.400	1.125	Open Manhole	1200	8.000	1.275	450	6.005	0.484	600	
SW34: Orifice Chamber	2.400	2.057	Open Manhole	1800	6.007	0.343	600	6.004	0.556	600	
								6.006	0.343	525	
								8.000	0.840	450	497

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SW35: PI inlet (dummy)	2.400	2.061	Open Manhole	1800	6.008	0.339	600	6.007	0.339	600	
SW36: PI outlet (dummy)	2.350	2.014	Open Manhole	1800	6.009	0.336	600	6.008	0.336	600	
SW37	2.300	1.969	Open Manhole	1800	6.010	0.331	600	6.009	0.331	600	
SW40	1.288	1.076	Junction		9.000	0.212	600				
SW41	1.494	1.284	Junction		9.001	0.210	600	9.000	0.210	600	
SW40: Hydrobrake HW2 (dummy)	2.200	2.020	Open Manhole	1800	6.011	0.180	600	6.010	0.180	600	
								9.001	0.180	600	
SWHW2	1.200	1.050	Open Manhole	0		OUTFALL		6.011	0.150	600	
SW41	2.400	1.200	Open Manhole	1200	10.000	1.200	375				
SW42	2.400	1.269	Open Manhole	1200	10.001	1.131	375	10.000	1.131	375	
SW43: Tank 4 inlet-a (dummy)	2.400	1.291	Open Manhole	1200	10.002	1.109	375	10.001	1.109	375	
SW44	2.320	1.050	Open Manhole	1050	11.000	1.270	150				
SW45: Tank 4 inlet-b (dummy)	2.400	1.373	Open Manhole	1200	11.001	1.027	375	11.000	1.252	150	
SW46: TANK 4 (dummy)	2.400	1.403	Open Manhole	1200	10.003	0.997	375	10.002	0.997	375	
								11.001	0.998	375	1
SW47: Tank 4 outlet (dummy)	2.400	1.422	Open Manhole	1200	10.004	0.978	375	10.003	0.978	375	
SW48: Orifice Chamber	2.380	1.415	Open Manhole	1200	10.005	0.965	375	10.004	0.965	375	
SW49	3.300	1.350	Open Manhole	3000	12.000	1.950	43				
SW50	2.850	1.350	Open Manhole	3000	12.001	1.500	43	12.000	1.808	43	308
SW51	2.400	1.350	Open Manhole	3000	13.000	1.050	43				
SW52: Orififce Chamber	2.200	1.350	Open Manhole	3000	12.002	0.850	525	12.001	1.331	43	406

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SW53	2.400	1.817	Open Manhole	1350	10.006	0.583	525	13.000	0.927	43	2
SW54: Tank 5 inlet (dummy)	2.400	1.823	Open Manhole	1350	10.007	0.577	525	10.005	0.733	375	204
SW55: TANK 5 (dummy)	2.400	1.874	Open Manhole	1350	10.008	0.526	525	12.002	0.787	525	
SW56: Tank 5 outlet (dummy)	2.400	1.925	Open Manhole	1350	10.009	0.475	525	10.006	0.577	525	447
SW57	2.400	1.350	Open Manhole	1200	10.008	0.475	525	10.007	0.526	525	
SW58: Orifice Chamber	2.400	1.932	Open Manhole	1350	10.009	0.475	525	10.008	0.475	525	
SW59: PI inlet (dummy)	2.300	1.843	Open Manhole	1200	14.000	1.050	450	10.009	0.468	525	
SW60: PI outlet (dummy)	2.100	1.649	Open Manhole	1350	10.010	0.468	450	14.000	0.915	450	
SW61	1.900	1.456	Open Manhole	1200	10.011	0.457	300	10.010	0.457	450	
SW62: Dummy HW3	1.700	1.266	Open Manhole	1050	10.012	0.451	300	10.011	0.451	300	
SWHW3	1.200	0.768	Open Manhole	1050	10.013	0.444	300	10.012	0.444	300	
SW63: Overflow Flood Storage	2.350	1.150	Open Manhole	1050	10.014	0.434	300	10.013	0.434	300	225
SWO overflow Pond	2.350	1.161	Open Manhole	0	15.000	1.200	225	10.014	0.432	300	
						OUTFALL		15.000	1.189	225	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	375	SW1	2.500	1.500	0.625	Open Manhole	1800
1.001	o	375	SW2	2.500	1.384	0.741	Open Manhole	1500
1.002	o	375	SW3	2.500	1.256	0.869	Open Manhole	1200
1.003	o	375	SW4 (CP)	2.800	1.191	1.234	Open Manhole	1200
1.004	o	375	SW5: Tank 2 inlet (dummy)	2.950	1.185	1.390	Open Manhole	1200
1.005	o	375	SW6: TANK 2 (dummy)	3.025	1.147	1.503	Open Manhole	1200
1.006	o	375	SW7: Tank 2 outlet (dummy)	3.100	1.108	1.617	Open Manhole	1200
2.000	o	150	SW8: CH	2.400	1.650	0.600	Junction	
2.001	o	225	SW9: CH	2.400	1.407	0.768	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	26.007	224.2	SW2	2.500	1.384	0.741	Open Manhole	1500
1.001	47.931	374.5	SW3	2.500	1.256	0.869	Open Manhole	1200
1.002	24.277	373.5	SW4 (CP)	2.800	1.191	1.234	Open Manhole	1200
1.003	2.396	399.3	SW5: Tank 2 inlet (dummy)	2.950	1.185	1.390	Open Manhole	1200
1.004	14.390	375.0	SW6: TANK 2 (dummy)	3.025	1.147	1.503	Open Manhole	1200
1.005	14.390	375.0	SW7: Tank 2 outlet (dummy)	3.100	1.108	1.617	Open Manhole	1200
1.006	1.881	14.2	SW12 (CP)	3.100	0.976	1.749	Open Manhole	1200
2.000	25.128	150.0	SW9: CH	2.400	1.482	0.768	Junction	
2.001	15.277	225.0	SW10	2.500	1.340	0.935	Junction	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
2.002	o	225	SW10	2.500	1.340	0.935	Junction	
2.003	o	300	SW11 (CP)	2.500	1.257	0.943	Open Manhole	1050
1.007	o	375	SW12 (CP)	3.100	0.976	1.749	Open Manhole	1200
1.008	oo	45	SW13: oversized dual pipework	3.300	0.709	1.991	Open Manhole	3000
3.000	oo	45	SW14: oversized dual pipework	2.500	1.000	0.900	Open Manhole	3000
1.009	o	675	SW15: Orifice Chamber	2.550	0.561	1.314	Open Manhole	3000

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
2.002	1.827	228.4	SW11 (CP)	2.500	1.332	0.943	Open Manhole	1050
2.003	16.608	302.0	SW12 (CP)	3.100	1.202	1.598	Open Manhole	1200
1.007	15.828	376.9	SW13: oversized dual pipework	3.300	0.934	1.991	Open Manhole	3000
1.008	36.365	500.0	SW15: Orifice Chamber	2.550	0.636	1.314	Open Manhole	3000
3.000	14.585	502.9	SW15: Orifice Chamber	2.550	0.971	0.979	Open Manhole	3000
1.009	42.671	502.0	SW19 (CP)	2.400	0.476	1.249	Open Manhole	1350

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.000	o	150	SW16: CH	2.500	1.750	0.600	Junction	
5.000	o	150	SW17: CH	2.400	1.650	0.600	Junction	
4.001	o	225	SW18	2.300	1.431	0.644	Junction	
1.010	o	675	SW19 (CP)	2.400	0.476	1.249	Open Manhole	1350
1.011	o	675	SW20: Tank 1 inlet (dummy)	2.400	0.461	1.264	Open Manhole	1350
1.012	o	675	SW21: TANK 1 (dummy)	2.400	0.445	1.280	Open Manhole	1500
1.013	o	675	SW22: Tank 1 outlet (dummy)	2.400	0.429	1.296	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.000	36.595	150.0	SW18	2.300	1.506	0.644	Junction	
5.000	6.108	150.0	SW18	2.300	1.609	0.541	Junction	
4.001	2.727	227.3	SW19 (CP)	2.400	1.419	0.756	Open Manhole	1350
1.010	8.879	591.9	SW20: Tank 1 inlet (dummy)	2.400	0.461	1.264	Open Manhole	1350
1.011	9.173	573.3	SW21: TANK 1 (dummy)	2.400	0.445	1.280	Open Manhole	1500
1.012	9.516	594.7	SW22: Tank 1 outlet (dummy)	2.400	0.429	1.296	Open Manhole	1500
1.013	5.502	611.3	SW23 (CP): Hydrobrake Chamber	2.400	0.420	1.305	Open Manhole	1500

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.014	o	675	SW23 (CP): Hydrobrake Chamber	2.400	0.420	1.305	Open Manhole	1500
1.015	o	675	SW24: PI inlet (dummy)	2.200	0.414	1.111	Open Manhole	1500
1.016	o	600	SW25: PI outlet (dummy)	1.500	0.387	0.513	Open Manhole	1350
6.000	o	600	SW26	2.400	0.675	1.125	Open Manhole	1350
6.001	o	600	SW27	2.700	0.627	1.473	Open Manhole	1350
6.002	o	600	SW28: Tankk 3 inlet-a (dummy)	2.700	0.620	1.480	Open Manhole	1350
6.003	o	600	SW29: TANK 3 (dummy)	2.650	0.592	1.458	Open Manhole	1350
7.000	o	150	SW27a	2.700	1.800	0.750	Open Manhole	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.014	4.096	682.7	SW24: PI inlet (dummy)	2.200	0.414	1.111	Open Manhole	1500
1.015	1.638	60.7	SW25: PI outlet (dummy)	1.500	0.387	0.438	Open Manhole	1350
1.016	4.804	600.5	SWHW1	1.100	0.379	0.121	Open Manhole	0
6.000	24.208	504.3	SW27	2.700	0.627	1.473	Open Manhole	1350
6.001	3.667	523.9	SW28: Tankk 3 inlet-a (dummy)	2.700	0.620	1.480	Open Manhole	1350
6.002	13.881	495.8	SW29: TANK 3 (dummy)	2.650	0.592	1.458	Open Manhole	1350
6.003	13.881	495.8	SW30: Tank 3 outlet (dummy)	2.600	0.564	1.436	Open Manhole	1350
7.000	7.049	135.6	SW31 Tank 3 inlet-b (dummy)	2.600	1.748	0.702	Open Manhole	1050

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
7.001	o	150	SW31 Tank 3 inlet-b (dummy)	2.600	1.748	0.702	Open Manhole	1050
6.004	o	600	SW30: Tank 3 outlet (dummy)	2.600	0.564	1.436	Open Manhole	1350
6.005	o	600	SW31	2.600	0.556	1.444	Open Manhole	1350
6.006	o	525	SW32	2.400	0.484	1.391	Open Manhole	1350
8.000	o	450	SW33	2.400	1.275	0.525	Open Manhole	1200
6.007	o	600	SW34: Orifice Chamber	2.400	0.343	1.457	Open Manhole	1800
6.008	o	600	SW35: PI inlet (dummy)	2.400	0.339	1.461	Open Manhole	1800

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
7.001	12.857	17.5	SW30: Tank 3 outlet (dummy)	2.600	1.014	1.436	Open Manhole	1350
6.004	4.130	516.3	SW31	2.600	0.556	1.444	Open Manhole	1350
6.005	35.814	497.4	SW32	2.400	0.484	1.316	Open Manhole	1350
6.006	70.406	499.3	SW34: Orifice Chamber	2.400	0.343	1.532	Open Manhole	1800
8.000	80.422	184.9	SW34: Orifice Chamber	2.400	0.840	0.960	Open Manhole	1800
6.007	1.989	497.3	SW35: PI inlet (dummy)	2.400	0.339	1.461	Open Manhole	1800
6.008	1.698	566.0	SW36: PI outlet (dummy)	2.350	0.336	1.414	Open Manhole	1800

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
6.009	o	600	SW36: PI outlet (dummy)	2.350	0.336	1.414	Open Manhole	1800
6.010	o	600	SW37	2.300	0.331	1.369	Open Manhole	1800
9.000	o	600	SW40	1.288	0.212	0.476	Junction	
9.001	o	600	SW41	1.494	0.210	0.684	Junction	
6.011	o	600	SW40: Hydrobrake HW2 (dummy)	2.200	0.180	1.420	Open Manhole	1800
10.000	o	375	SW41	2.400	1.200	0.825	Open Manhole	1200
10.001	o	375	SW42	2.400	1.131	0.894	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
6.009	2.398	479.6	SW37	2.300	0.331	1.369	Open Manhole	1800
6.010	9.851	65.2	SW40: Hydrobrake HW2 (dummy)	2.200	0.180	1.420	Open Manhole	1800
9.000	1.110	555.0	SW41	1.494	0.210	0.684	Junction	
9.001	8.295	276.5	SW40: Hydrobrake HW2 (dummy)	2.200	0.180	1.420	Open Manhole	1800
6.011	9.310	310.3	SWHW2	1.200	0.150	0.450	Open Manhole	0
10.000	20.592	298.4	SW42	2.400	1.131	0.894	Open Manhole	1200
10.001	6.502	295.5	SW43: Tank 4 inlet-a (dummy)	2.400	1.109	0.916	Open Manhole	1200

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
10.002	o	375	SW43: Tank 4 inlet-a (dummy)	2.400	1.109	0.916	Open Manhole	1200
11.000	o	150	SW44	2.320	1.270	0.900	Open Manhole	1050
11.001	o	375	SW45: Tank 4 inlet-b (dummy)	2.400	1.027	0.998	Open Manhole	1200
10.003	o	375	SW46: TANK 4 (dummy)	2.400	0.997	1.028	Open Manhole	1200
10.004	o	375	SW47: Tank 4 outlet (dummy)	2.400	0.978	1.047	Open Manhole	1200
10.005	o	375	SW48: Orifice Chamber	2.380	0.965	1.040	Open Manhole	1200
12.000	oo	43	SW49	3.300	1.950	0.900	Open Manhole	3000

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
10.002	11.464	102.4	SW46: TANK 4 (dummy)	2.400	0.997	1.028	Open Manhole	1200
11.000	2.741	152.3	SW45: Tank 4 inlet-b (dummy)	2.400	1.252	0.998	Open Manhole	1200
11.001	10.908	376.1	SW46: TANK 4 (dummy)	2.400	0.998	1.027	Open Manhole	1200
10.003	7.161	376.9	SW47: Tank 4 outlet (dummy)	2.400	0.978	1.047	Open Manhole	1200
10.004	4.730	363.8	SW48: Orifice Chamber	2.380	0.965	1.040	Open Manhole	1200
10.005	25.233	108.8	SW53	2.400	0.733	1.292	Open Manhole	1350
12.000	70.949	499.6	SW50	2.850	1.808	0.592	Open Manhole	3000

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
12.001	oo	43	SW50	2.850	1.500	0.900	Open Manhole	3000
13.000	oo	43	SW51	2.400	1.050	0.900	Open Manhole	3000
12.002	o	525	SW52: Orifce Chamber	2.200	0.850	0.825	Open Manhole	3000
10.006	o	525	SW53	2.400	0.583	1.292	Open Manhole	1350
10.007	o	525	SW54: Tank 5 inlet (dummy)	2.400	0.577	1.298	Open Manhole	1350
10.008	o	525	SW55: TANK 5 (dummy)	2.400	0.526	1.349	Open Manhole	1350
10.009	o	525	SW56: Tank 5 outlet (dummy)	2.400	0.475	1.400	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
12.001	84.665	501.0	SW52: Orifce Chamber	2.200	1.331	0.419	Open Manhole	3000
13.000	61.418	499.3	SW52: Orifce Chamber	2.200	0.927	0.823	Open Manhole	3000
12.002	31.357	497.7	SW53	2.400	0.787	1.088	Open Manhole	1350
10.006	3.052	508.7	SW54: Tank 5 inlet (dummy)	2.400	0.577	1.298	Open Manhole	1350
10.007	25.309	496.3	SW55: TANK 5 (dummy)	2.400	0.526	1.349	Open Manhole	1350
10.008	25.309	496.3	SW56: Tank 5 outlet (dummy)	2.400	0.475	1.400	Open Manhole	1350
10.009	3.351	478.7	SW58: Orifice Chamber	2.400	0.468	1.407	Open Manhole	1350

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
14.000	o	450	SW57	2.400	1.050	0.900	Open Manhole	1200
10.010	o	450	SW58: Orifice Chamber	2.400	0.468	1.482	Open Manhole	1350
10.011	o	300	SW59: PI inlet (dummy)	2.300	0.457	1.543	Open Manhole	1200
10.012	o	300	SW60: PI outlet (dummy)	2.100	0.451	1.349	Open Manhole	1050
10.013	o	300	SW61	1.900	0.444	1.156	Open Manhole	1050
10.014	o	300	SW62: Dummy HW3	1.700	0.434	0.966	Open Manhole	900
15.000	o	225	SW63: Overflow Flood Storage	2.350	1.200	0.925	Open Manhole	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
14.000	60.556	448.6	SW58: Orifice Chamber	2.400	0.915	1.035	Open Manhole	1350
10.010	4.984	453.1	SW59: PI inlet (dummy)	2.300	0.457	1.393	Open Manhole	1200
10.011	1.652	275.3	SW60: PI outlet (dummy)	2.100	0.451	1.349	Open Manhole	1050
10.012	2.129	304.1	SW61	1.900	0.444	1.156	Open Manhole	1050
10.013	2.952	295.2	SW62: Dummy HW3	1.700	0.434	0.966	Open Manhole	900
10.014	0.503	251.3	SWHW3	1.200	0.432	0.468	Open Manhole	0
15.000	1.905	173.2	SWOverflow Pond	2.350	1.189	0.936	Open Manhole	0

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Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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1.016	SWHW1	1.100	0.379	0.350	0	0
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Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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6.011	SWHW2	1.200	0.150	0.300	0	0
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Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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10.014	SWHW3	1.200	0.432	0.300	0	0
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Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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15.000	SWOverflow Pond	2.350	1.189	1.100	0	0
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Online Controls for Storm

Orifice Manhole: SW12 (CP), DS/PN: 1.007, Volume (m³): 3.6

Diameter (m) 0.150 Discharge Coefficient 0.600 Invert Level (m) 0.976

Orifice Manhole: SW15: Orifice Chamber, DS/PN: 1.009, Volume (m³): 39.5

Diameter (m) 0.150 Discharge Coefficient 0.600 Invert Level (m) 0.636

Hydro-Brake® Optimum Manhole: SW23 (CP): Hydrobrake Chamber, DS/PN: 1.014, Volume (m³): 4.9

Unit Reference	MD-SHE-0094-5000-1800-5000	Sump Available	Yes
Design Head (m)	1.800	Diameter (mm)	94
Design Flow (l/s)	5.0	Invert Level (m)	0.420
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	150
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.800	5.0	Kick-Flo®	0.838	3.5
Flush-Flo™	0.411	4.4	Mean Flow over Head Range	-	4.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

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)	Depth (m)	Flow (l/s)
0.100	3.0	0.300	4.3	0.500	4.4	0.800	3.7	1.200	4.1	1.600	4.7
0.200	4.0	0.400	4.4	0.600	4.3	1.000	3.8	1.400	4.4	1.800	5.0

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Hydro-Brake® Optimum Manhole: SW23 (CP): Hydrobrake Chamber, DS/PN: 1.014, Volume (m³): 4.9

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)	Depth (m)	Flow (l/s)
2.000	5.2	2.600	5.9	4.000	7.3	5.500	8.4	7.000	9.5	8.500	10.4
2.200	5.5	3.000	6.3	4.500	7.7	6.000	8.8	7.500	9.8	9.000	10.7
2.400	5.7	3.500	6.8	5.000	8.1	6.500	9.1	8.000	10.1	9.500	11.0

Orifice Manhole: SW31, DS/PN: 6.005, Volume (m³): 3.7

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 0.556

Orifice Manhole: SW34: Orifice Chamber, DS/PN: 6.007, Volume (m³): 32.7

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 0.343

Hydro-Brake® Optimum Manhole: SW40: Hydrobrake HW2 (dummy), DS/PN: 6.011, Volume (m³): 9.5

Unit Reference	MD-SCL-0140-1180-1600-1180	Sump Available	Yes
Design Head (m)	1.600	Diameter (mm)	140
Design Flow (l/s)	11.8	Invert Level (m)	0.180
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	225
Objective	Minimise blockage risk	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	11.8	Kick-Flo®	0.870	8.9
Flush-Flo™	0.364	11.8	Mean Flow over Head Range	-	10.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

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Hydro-Brake® Optimum Manhole: SW40: Hydrobrake HW2 (dummy), DS/PN: 6.011, Volume (m³): 9.5

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)	Depth (m)	Flow (l/s)
0.100	5.6	0.600	11.2	1.600	11.8	2.600	14.8	5.000	20.2	7.500	24.6
0.200	11.1	0.800	9.8	1.800	12.5	3.000	15.9	5.500	21.2	8.000	25.3
0.300	11.7	1.000	9.5	2.000	13.1	3.500	17.1	6.000	22.1	8.500	26.1
0.400	11.8	1.200	10.3	2.200	13.7	4.000	18.2	6.500	22.9	9.000	26.8
0.500	11.6	1.400	11.1	2.400	14.3	4.500	19.2	7.000	23.8	9.500	27.5

Orifice Manhole: SW48: Orifice Chamber, DS/PN: 10.005, Volume (m³): 2.0

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 0.965

Orifice Manhole: SW52: Orifice Chamber, DS/PN: 12.002, Volume (m³): 54.1

Diameter (m) 0.300 Discharge Coefficient 0.600 Invert Level (m) 0.850

Hydro-Brake® Optimum Manhole: SW58: Orifice Chamber, DS/PN: 10.010, Volume (m³): 12.6

Unit Reference	MD-SHE-0098-5000-1500-5000	Sump Available	Yes
Design Head (m)	1.500	Diameter (mm)	98
Design Flow (l/s)	5.0	Invert Level (m)	0.468
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	150
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	5.0	Kick-Flo®	0.878	3.9
Flush-Flo™	0.431	4.9	Mean Flow over Head Range	-	4.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type

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Hydro-Brake® Optimum Manhole: SW58: Orifice Chamber, DS/PN: 10.010, Volume (m³): 12.6

of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

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)	Depth (m)	Flow (l/s)
0.100	3.2	0.600	4.8	1.600	5.1	2.600	6.5	5.000	8.8	7.500	10.7
0.200	4.4	0.800	4.3	1.800	5.4	3.000	6.9	5.500	9.2	8.000	11.0
0.300	4.8	1.000	4.1	2.000	5.7	3.500	7.4	6.000	9.6	8.500	11.3
0.400	4.9	1.200	4.5	2.200	6.0	4.000	7.9	6.500	10.0	9.000	11.6
0.500	4.9	1.400	4.8	2.400	6.2	4.500	8.4	7.000	10.3	9.500	11.9

Orifice Manhole: SW62: Dummy HW3, DS/PN: 10.014, Volume (m³): 0.9

Diameter (m) 0.001 Discharge Coefficient 0.600 Invert Level (m) 0.434

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Micro Drainage Network 2018.1		
<u>Offline Controls for Storm</u>		
<u>Pipe Manhole: SW62: Dummy HW3, DS/PN: 10.014, Loop to PN: 9.000</u>		
Diameter (m) 40 Length (m) 2.500 Coefficient of Contraction 0.600		
Section Type Pipe/Conduit Roughness k (mm) 0.600 Upstream Invert Level (m) 0.284		
Slope (1:X) 1500.0 Entry Loss Coefficient 0.500		
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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.500
 Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coefficient 0.800
 Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 1 Number of Time/Area Diagrams 0
 Number of Online Controls 10 Number of Storage Structures 5 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.350 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DVD Status ON
 Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON
 DTS Status ON

Profile(s) Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 40

Water Surcharged Flooded

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)	Volume (m ³)	Flow / Overflow Cap. (l/s)
1.000		SW1 15 Winter	1	+0%	100/15 Winter				1.559	-0.316	0.000	0.06
1.001		SW2 15 Winter	1	+0%	30/15 Winter				1.486	-0.273	0.000	0.11
1.002		SW3 15 Winter	1	+0%	30/15 Winter				1.450	-0.181	0.000	0.40
1.003		SW4 (CP) 15 Winter	1	+0%	30/15 Winter				1.406	-0.160	0.000	0.52
1.004	SW5: Tank 2 inlet (dummy)	15 Winter	1	+0%	30/15 Winter				1.399	-0.161	0.000	0.62

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Pipe Flow (l/s)	Level	
			Status	Exceeded
1.000		SW1 6.8	OK	
1.001		SW2 10.4	OK	
1.002		SW3 35.5	OK	
1.003		SW4 (CP) 44.8	OK	
1.004	SW5: Tank 2 inlet (dummy)	45.0	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm												
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.005	SW6: TANK 2 (dummy)	240 Winter	1	+0%	100/60 Winter				1.220	-0.302	0.000	0.08
1.006	SW7: Tank 2 outlet (dummy)	15 Winter	1	+0%	30/15 Winter				1.239	-0.245	0.000	0.02
2.000	SW8: CH	15 Winter	1	+0%					1.756	-0.044	0.000	0.82
2.001	SW9: CH	15 Winter	1	+0%					1.517	-0.115	0.000	0.48
2.002	SW10	15 Winter	1	+0%					1.458	-0.106	0.000	0.54
2.003	SW11 (CP)	15 Winter	1	+0%	30/15 Winter				1.398	-0.158	0.000	0.45
1.007	SW12 (CP)	15 Winter	1	+0%	30/15 Winter				1.249	-0.102	0.000	0.27
1.008	SW13: oversized dual pipework	30 Winter	1	+0%	100/15 Winter				0.948	-0.361	0.000	0.04
3.000	SW14: oversized dual pipework	15 Winter	1	+0%	100/600 Winter				1.024	-0.576	0.000	0.01
1.009	SW15: Orifice Chamber	30 Winter	1	+0%	100/15 Winter				0.933	-0.303	0.000	0.06
4.000	SW16: CH	15 Winter	1	+0%					1.822	-0.078	0.000	0.44
5.000	SW17: CH	15 Winter	1	+0%					1.689	-0.111	0.000	0.15
4.001	SW18	15 Winter	1	+0%	30/15 Winter				1.557	-0.099	0.000	0.60
1.010	SW19 (CP)	15 Winter	1	+0%	100/15 Winter				0.760	-0.391	0.000	0.34
1.011	SW20: Tank 1 inlet (dummy)	15 Winter	1	+0%	100/180 Winter				0.735	-0.401	0.000	0.35
1.012	SW21: TANK 1 (dummy)	960 Winter	1	+0%	100/180 Winter				0.705	-0.416	0.000	0.03
1.013	SW22: Tank 1 outlet (dummy)	720 Winter	1	+0%	100/180 Winter				0.724	-0.380	0.000	0.02
1.014	SW23 (CP): Hydrobrake Chamber	720 Winter	1	+0%	100/180 Winter				0.726	-0.370	0.000	0.01
1.015	SW24: PI inlet (dummy)	960 Winter	1	+0%					0.455	-0.635	0.000	0.01
1.016	SW25: PI outlet (dummy)	960 Winter	1	+0%					0.450	-0.537	0.000	0.02
6.000	SW26	15 Winter	1	+0%	30/15 Winter				1.007	-0.268	0.000	0.29
6.001	SW27	15 Winter	1	+0%	30/15 Winter				0.985	-0.242	0.000	0.49
6.002	SW28: Tankk 3 inlet-a (dummy)	15 Winter	1	+0%	30/15 Winter				0.977	-0.243	0.000	0.66
6.003	SW29: TANK 3 (dummy)	480 Winter	1	+0%	100/120 Winter				0.737	-0.455	0.000	0.03
7.000	SW27a	600 Winter	1	+0%					1.800	-0.150	0.000	0.00
7.001	SW31 Tank 3 inlet-b (dummy)	600 Winter	1	+0%					1.748	-0.150	0.000	0.00
6.004	SW30: Tank 3 outlet (dummy)	480 Winter	1	+0%	100/120 Winter				0.735	-0.429	0.000	0.02
6.005	SW31	480 Winter	1	+0%	100/120 Winter				0.734	-0.422	0.000	0.02

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.005	SW6: TANK 2 (dummy)		6.2	OK	
1.006	SW7: Tank 2 outlet (dummy)		2.3	OK	
2.000	SW8: CH		11.8	OK*	
2.001	SW9: CH		16.4	OK*	
2.002	SW10		16.3	OK*	
2.003	SW11 (CP)		24.2	OK	
1.007	SW12 (CP)		20.8	OK	
1.008	SW13: oversized dual pipework		23.1	OK	
3.000	SW14: oversized dual pipework		4.6	OK	
1.009	SW15: Orifice Chamber		19.3	OK	
4.000	SW16: CH		6.4	OK*	
5.000	SW17: CH		1.9	OK*	
4.001	SW18		17.8	OK*	
1.010	SW19 (CP)		70.9	OK	
1.011	SW20: Tank 1 inlet (dummy)		71.2	OK	
1.012	SW21: TANK 1 (dummy)		5.8	OK	
1.013	SW22: Tank 1 outlet (dummy)		4.9	OK	
1.014	SW23 (CP): Hydrobrake Chamber		4.2	OK	
1.015	SW24: PI inlet (dummy)		4.2	OK	
1.016	SW25: PI outlet (dummy)		4.2	OK	
6.000	SW26		67.5	OK	
6.001	SW27		109.4	OK	
6.002	SW28: Tankk 3 inlet-a (dummy)		108.2	OK	
6.003	SW29: TANK 3 (dummy)		5.4	OK	
7.000	SW27a		0.0	OK	
7.001	SW31 Tank 3 inlet-b (dummy)		0.0	OK	
6.004	SW30: Tank 3 outlet (dummy)		5.3	OK	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
6.006		SW32	480 Winter	1	+0%	30/60 Winter			0.635	-0.374	0.000	0.03
8.000		SW33	15 Winter	1	+0%				1.329	-0.396	0.000	0.03
6.007	SW34: Orifice Chamber	480 Winter	1	+0%	30/30 Winter				0.632	-0.311	0.000	0.03
6.008	SW35: PI inlet (dummy)	60 Winter	1	+0%	100/15 Winter				0.548	-0.391	0.000	0.03
6.009	SW36: PI outlet (dummy)	60 Winter	1	+0%	30/30 Winter				0.547	-0.389	0.000	0.03
6.010		SW37	60 Winter	1	+0%	30/30 Winter			0.547	-0.384	0.000	0.02
9.000		SW40	60 Winter	1	+0%				0.547	-0.265	0.000	0.04
9.001		SW41	60 Winter	1	+0%				0.547	-0.263	0.000	0.04
6.011	SW40: Hydrobrake HW2 (dummy)	60 Winter	1	+0%	30/15 Winter				0.547	-0.233	0.000	0.05
10.000		SW41	15 Winter	1	+0%	30/15 Winter			1.359	-0.216	0.000	0.28
10.001		SW42	15 Winter	1	+0%	30/15 Winter			1.317	-0.189	0.000	0.49
10.002	SW43: Tank 4 inlet-a (dummy)	15 Winter	1	+0%	100/15 Winter				1.245	-0.239	0.000	0.29
11.000		SW44	15 Winter	1	+0%	30/15 Winter			1.411	-0.009	0.000	1.00
11.001	SW45: Tank 4 inlet-b (dummy)	15 Winter	1	+0%	100/120 Winter				1.126	-0.276	0.000	0.16
10.003	SW46: TANK 4 (dummy)	240 Winter	1	+0%	100/120 Winter				1.090	-0.282	0.000	0.07
10.004	SW47: Tank 4 outlet (dummy)	240 Winter	1	+0%	100/60 Winter				1.083	-0.270	0.000	0.06
10.005	SW48: Orifice Chamber	240 Winter	1	+0%	100/60 Winter				1.081	-0.259	0.000	0.03
12.000		SW49	15 Winter	1	+0%				2.015	-0.385	0.000	0.06
12.001		SW50	15 Winter	1	+0%				1.587	-0.363	0.000	0.10
13.000		SW51	15 Winter	1	+0%	100/15 Winter			1.113	-0.387	0.000	0.05
12.002	SW52: Orifice Chamber	15 Winter	1	+0%	100/15 Winter				1.058	-0.317	0.000	0.18
10.006		SW53	15 Winter	1	+0%	100/15 Winter			0.844	-0.264	0.000	0.49
10.007	SW54: Tank 5 inlet (dummy)	15 Winter	1	+0%	100/15 Winter				0.832	-0.270	0.000	0.48
10.008	SW55: TANK 5 (dummy)	960 Winter	1	+0%	30/480 Winter				0.754	-0.297	0.000	0.03
10.009	SW56: Tank 5 outlet (dummy)	15 Winter	1	+0%	30/15 Winter				0.757	-0.243	0.000	0.01
14.000		SW57	15 Winter	1	+0%	100/15 Winter			1.211	-0.289	0.000	0.28
10.010	SW58: Orifice Chamber	15 Winter	1	+0%	30/15 Winter				0.808	-0.110	0.000	0.04
10.011	SW59: PI inlet (dummy)	60 Winter	1	+0%	30/15 Winter				0.549	-0.208	0.000	0.08

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.006	SW32		5.8	OK	
8.000	SW33		7.7	OK	
6.007	SW34: Orifice Chamber		6.0	OK	
6.008	SW35: PI inlet (dummy)		6.4	OK	
6.009	SW36: PI outlet (dummy)		6.6	OK	
6.010	SW37		6.7	OK	
9.000	SW40		13.5	OK*	
9.001	SW41		13.0	OK*	
6.011	SW40: Hydrobrake HW2 (dummy)		11.7	OK	
10.000	SW41		27.5	OK	
10.001	SW42		37.4	OK	
10.002	SW43: Tank 4 inlet-a (dummy)		37.5	OK	
11.000	SW44		10.8	OK	
11.001	SW45: Tank 4 inlet-b (dummy)		10.8	OK	
10.003	SW46: TANK 4 (dummy)		4.7	OK	
10.004	SW47: Tank 4 outlet (dummy)		4.7	OK	
10.005	SW48: Orifice Chamber		4.7	OK	
12.000	SW49		15.2	OK	
12.001	SW50		26.5	OK	
13.000	SW51		13.2	OK	
12.002	SW52: Orifice Chamber		32.6	OK	
10.006	SW53		83.1	OK	
10.007	SW54: Tank 5 inlet (dummy)		83.8	OK	
10.008	SW55: TANK 5 (dummy)		6.1	OK	
10.009	SW56: Tank 5 outlet (dummy)		2.4	OK	
14.000	SW57		39.1	OK	
10.010	SW58: Orifice Chamber		4.7	OK	

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London		SW Drainage Design	
SE1 8NW			
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Micro Drainage		Network 2018.1	
<u>1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>			

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240 Blackfriars Road London SE1 8NW	Oldlands Farm - Phase 2 SW Drainage Design	
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Micro Drainage		Network 2018.1

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
10.012	SW60: PI outlet (dummy)	60 Winter	1	+0%	30/15 Winter				0.548	-0.203	0.000	0.08
10.013	SW61	60 Winter	1	+0%	30/15 Winter				0.548	-0.196	0.000	0.09
10.014	SW62: Dummy HW3	60 Winter	1	+0%	30/15 Winter		1/15 Winter	36	0.547	-0.187	0.000	0.00
15.000	SW63: Overflow Flood Storage	600 Winter	1	+0%					1.200	-0.225	0.000	0.00

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Level Status	Exceeded
10.012	SW60: PI outlet (dummy)		4.4	OK	
10.013	SW61		4.4	OK	
10.014	SW62: Dummy HW3	5.9	0.0	OK	
15.000	SW63: Overflow Flood Storage		0.0	OK	

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240 Blackfriars Road London SE1 8NW	Oldlands Farm - Phase 2 SW Drainage Design	
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Micro Drainage	Network 2018.1	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.500
 Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coefficient 0.800
 Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 1 Number of Time/Area Diagrams 0
 Number of Online Controls 10 Number of Storage Structures 5 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.350 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DVD Status ON
 Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON
 DTS Status ON

Profile(s) Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 40

Water Surcharged Flooded

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)	Volume (m ³)	Flow / Overflow Cap. (l/s)
1.000		SW1 15 Winter	30	+0%	100/15 Winter				1.802	-0.073	0.000	0.11
1.001		SW2 15 Winter	30	+0%	30/15 Winter				1.783	0.024	0.000	0.23
1.002		SW3 15 Winter	30	+0%	30/15 Winter				1.764	0.133	0.000	0.98
1.003	SW4 (CP)	15 Winter	30	+0%	30/15 Winter				1.688	0.122	0.000	1.36
1.004	SW5: Tank 2 inlet (dummy)	15 Winter	30	+0%	30/15 Winter				1.594	0.034	0.000	1.58

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
1.000		SW1 13.2		OK
1.001		SW2 21.3	SURCHARGED	
1.002		SW3 86.6	SURCHARGED	
1.003		SW4 (CP) 116.5	SURCHARGED	
1.004	SW5: Tank 2 inlet (dummy)	115.0	SURCHARGED	

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240 Blackfriars Road London SE1 8NW	Oldlands Farm - Phase 2 SW Drainage Design	
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Micro Drainage		Network 2018.1

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap.
1.005	SW6: TANK 2 (dummy)	120 Winter	30	+0%	100/60 Winter				1.351	-0.171	0.000	0.22
1.006	SW7: Tank 2 outlet (dummy)	15 Winter	30	+0%	30/15 Winter				1.516	0.033	0.000	0.12
2.000	SW8: CH	30 Winter	30	+0%					1.800	0.000	0.000	1.39
2.001	SW9: CH	30 Winter	30	+0%					1.632	0.000	0.000	0.83
2.002	SW10	30 Winter	30	+0%					1.565	0.000	0.000	0.90
2.003	SW11 (CP)	15 Winter	30	+0%	30/15 Winter				1.605	0.048	0.000	0.98
1.007	SW12 (CP)	15 Winter	30	+0%	30/15 Winter				1.531	0.180	0.000	0.34
1.008	SW13: oversized dual pipework	30 Winter	30	+0%	100/15 Winter				1.211	-0.098	0.000	0.07
3.000	SW14: oversized dual pipework	30 Winter	30	+0%	100/600 Winter				1.156	-0.444	0.000	0.02
1.009	SW15: Orifice Chamber	30 Winter	30	+0%	100/15 Winter				1.156	-0.081	0.000	0.08
4.000	SW16: CH	15 Winter	30	+0%					1.900	0.000	0.000	1.00
5.000	SW17: CH	15 Winter	30	+0%					1.755	-0.045	0.000	0.36
4.001	SW18	15 Winter	30	+0%	30/15 Winter				1.746	0.090	0.000	1.54
1.010	SW19 (CP)	1440 Winter	30	+0%	100/15 Winter				1.007	-0.144	0.000	0.11
1.011	SW20: Tank 1 inlet (dummy)	1440 Winter	30	+0%	100/180 Winter				1.007	-0.129	0.000	0.11
1.012	SW21: TANK 1 (dummy)	1440 Winter	30	+0%	100/180 Winter				1.007	-0.114	0.000	0.03
1.013	SW22: Tank 1 outlet (dummy)	1440 Winter	30	+0%	100/180 Winter				1.013	-0.091	0.000	0.02
1.014	SW23 (CP): Hydrobrake Chamber	1440 Winter	30	+0%	100/180 Winter				1.015	-0.081	0.000	0.02
1.015	SW24: PI inlet (dummy)	1440 Winter	30	+0%					0.455	-0.634	0.000	0.01
1.016	SW25: PI outlet (dummy)	960 Winter	30	+0%					0.450	-0.537	0.000	0.02
6.000	SW26	15 Winter	30	+0%	30/15 Winter				1.307	0.032	0.000	0.76
6.001	SW27	15 Winter	30	+0%	30/15 Winter				1.270	0.043	0.000	1.44
6.002	SW28: Tankk 3 inlet-a (dummy)	15 Winter	30	+0%	30/15 Winter				1.227	0.007	0.000	1.93
6.003	SW29: TANK 3 (dummy)	600 Winter	30	+0%	100/120 Winter				0.998	-0.194	0.000	0.03
7.000	SW27a	600 Winter	30	+0%					1.800	-0.150	0.000	0.00
7.001	SW31 Tank 3 inlet-b (dummy)	600 Winter	30	+0%					1.748	-0.150	0.000	0.00
6.004	SW30: Tank 3 outlet (dummy)	600 Winter	30	+0%	100/120 Winter				1.004	-0.160	0.000	0.02
6.005	SW31	600 Winter	30	+0%	100/120 Winter				1.004	-0.152	0.000	0.02

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Micro Drainage		Network 2018.1

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.005	SW6: TANK 2 (dummy)		16.2	OK	
1.006	SW7: Tank 2 outlet (dummy)		17.1	SURCHARGED	
2.000	SW8: CH		20.1	SURCHARGED*	
2.001	SW9: CH		28.7	SURCHARGED*	
2.002	SW10		27.0	SURCHARGED*	
2.003	SW11 (CP)		52.8	SURCHARGED	
1.007	SW12 (CP)		25.8	SURCHARGED	
1.008	SW13: oversized dual pipework		33.7	OK	
3.000	SW14: oversized dual pipework		7.9	OK	
1.009	SW15: Orifice Chamber		27.1	OK	
4.000	SW16: CH		14.4	SURCHARGED*	
5.000	SW17: CH		4.5	OK*	
4.001	SW18		46.0	SURCHARGED*	
1.010	SW19 (CP)		22.3	OK	
1.011	SW20: Tank 1 inlet (dummy)		22.2	OK	
1.012	SW21: TANK 1 (dummy)		6.0	OK	
1.013	SW22: Tank 1 outlet (dummy)		5.1	OK	
1.014	SW23 (CP): Hydrobrake Chamber		4.4	OK	
1.015	SW24: PI inlet (dummy)		4.4	OK	
1.016	SW25: PI outlet (dummy)		4.4	OK	
6.000	SW26		177.7	SURCHARGED	
6.001	SW27		320.9	SURCHARGED	
6.002	SW28: Tankk 3 inlet-a (dummy)		318.0	SURCHARGED	
6.003	SW29: TANK 3 (dummy)		5.4	OK	
7.000	SW27a		0.0	OK	
7.001	SW31 Tank 3 inlet-b (dummy)		0.0	OK	
6.004	SW30: Tank 3 outlet (dummy)		5.3	OK	

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240 Blackfriars Road London SE1 8NW	Oldlands Farm - Phase 2 SW Drainage Design				
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Micro Drainage	Network 2018.1				
<u>30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>					
PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.005		SW31	5.3	OK	
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240 Blackfriars Road London SE1 8NW	Oldlands Farm - Phase 2 SW Drainage Design	
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Micro Drainage		Network 2018.1

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
6.006		SW32	120	Winter	30	+0%	30/60	Winter	1.073	0.064	0.000	0.04
8.000		SW33	15	Winter	30	+0%			1.362	-0.363	0.000	0.08
6.007	SW34: Orifice Chamber	120	Winter	30	+0%	30/30	Winter		1.070	0.127	0.000	0.03
6.008	SW35: PI inlet (dummy)	30	Winter	30	+0%	100/15	Winter		0.938	-0.001	0.000	0.02
6.009	SW36: PI outlet (dummy)	30	Winter	30	+0%	30/30	Winter		0.938	0.002	0.000	0.03
6.010		SW37	30	Winter	30	+0%	30/30	Winter	0.938	0.007	0.000	0.02
9.000		SW40	120	Winter	30	+0%			0.812	0.000	0.000	0.05
9.001		SW41	180	Winter	30	+0%			0.810	0.000	0.000	0.04
6.011	SW40: Hydrobrake HW2 (dummy)	30	Winter	30	+0%	30/15	Winter		0.939	0.159	0.000	0.05
10.000		SW41	15	Winter	30	+0%	30/15	Winter	1.608	0.033	0.000	0.66
10.001		SW42	15	Winter	30	+0%	30/15	Winter	1.522	0.016	0.000	1.24
10.002	SW43: Tank 4 inlet-a (dummy)	15	Winter	30	+0%	100/15	Winter		1.353	-0.131	0.000	0.74
11.000		SW44	15	Winter	30	+0%	30/15	Winter	1.594	0.174	0.000	2.53
11.001	SW45: Tank 4 inlet-b (dummy)	180	Winter	30	+0%	100/120	Winter		1.208	-0.194	0.000	0.10
10.003	SW46: TANK 4 (dummy)	180	Winter	30	+0%	100/120	Winter		1.207	-0.165	0.000	0.15
10.004	SW47: Tank 4 outlet (dummy)	180	Winter	30	+0%	100/60	Winter		1.227	-0.126	0.000	0.12
10.005	SW48: Orifice Chamber	180	Winter	30	+0%	100/60	Winter		1.227	-0.113	0.000	0.05
12.000		SW49	15	Winter	30	+0%			2.056	-0.344	0.000	0.14
12.001		SW50	15	Winter	30	+0%			1.656	-0.294	0.000	0.26
13.000		SW51	15	Winter	30	+0%	100/15	Winter	1.379	-0.121	0.000	0.10
12.002	SW52: Orfifce Chamber	15	Winter	30	+0%	100/15	Winter		1.369	-0.006	0.000	0.37
10.006		SW53	960	Winter	30	+0%	100/15	Winter	1.096	-0.012	0.000	0.15
10.007	SW54: Tank 5 inlet (dummy)	960	Winter	30	+0%	100/15	Winter		1.094	-0.008	0.000	0.15
10.008	SW55: TANK 5 (dummy)	960	Winter	30	+0%	30/480	Winter		1.082	0.031	0.000	0.07
10.009	SW56: Tank 5 outlet (dummy)	960	Winter	30	+0%	30/15	Winter		1.085	0.085	0.000	0.06
14.000		SW57	15	Winter	30	+0%	100/15	Winter	1.324	-0.176	0.000	0.66
10.010	SW58: Orifice Chamber	15	Winter	30	+0%	30/15	Winter		1.101	0.183	0.000	0.04
10.011	SW59: PI inlet (dummy)	30	Winter	30	+0%	30/15	Winter		0.939	0.182	0.000	0.08

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.006		SW32	7.8	SURCHARGED	
8.000		SW33	18.7	OK	
6.007	SW34: Orifice Chamber		8.1	SURCHARGED	
6.008	SW35: PI inlet (dummy)		5.0	OK	
6.009	SW36: PI outlet (dummy)		6.0	SURCHARGED	
6.010		SW37	7.0	SURCHARGED	
9.000		SW40	15.8	SURCHARGED*	
9.001		SW41	12.8	SURCHARGED*	
6.011	SW40: Hydrobrake HW2 (dummy)		11.8	SURCHARGED	
10.000		SW41	63.9	SURCHARGED	
10.001		SW42	94.6	SURCHARGED	
10.002	SW43: Tank 4 inlet-a (dummy)		96.5	OK	
11.000		SW44	27.4	SURCHARGED	
11.001	SW45: Tank 4 inlet-b (dummy)		6.7	OK	
10.003	SW46: TANK 4 (dummy)		9.8	OK	
10.004	SW47: Tank 4 outlet (dummy)		9.4	OK	
10.005	SW48: Orifice Chamber		9.1	OK	
12.000		SW49	37.3	OK	
12.001		SW50	69.9	OK	
13.000		SW51	27.9	OK	
12.002	SW52: Orifice Chamber		67.6	OK	
10.006		SW53	25.9	OK	
10.007	SW54: Tank 5 inlet (dummy)		25.8	OK	
10.008	SW55: TANK 5 (dummy)		11.8	SURCHARGED	
10.009	SW56: Tank 5 outlet (dummy)		9.7	SURCHARGED	
14.000		SW57	92.4	OK	
10.010	SW58: Orifice Chamber		4.8	SURCHARGED	

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240 Blackfriars Road	Oldlands Farm - Phase 2	
London	SW Drainage Design	
SE1 8NW		
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Micro Drainage	Network 2018.1	
<u>30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>		
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240 Blackfriars Road London SE1 8NW	Oldlands Farm - Phase 2 SW Drainage Design	
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Micro Drainage		Network 2018.1

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap.
10.012	SW60: PI outlet (dummy)	30 Winter	30	+0%	30/15 Winter				0.940	0.189	0.000	0.08
10.013	SW61	30 Winter	30	+0%	30/15 Winter				0.940	0.196	0.000	0.09
10.014	SW62: Dummy HW3	30 Winter	30	+0%	30/15 Winter		1/15 Winter	36	0.941	0.207	0.000	0.00
15.000	SW63: Overflow Flood Storage	600 Winter	30	+0%					1.200	-0.225	0.000	0.00

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
10.012	SW60: PI outlet (dummy)		4.5	SURCHARGED	
10.013	SW61		4.5	SURCHARGED	
10.014	SW62: Dummy HW3	6.6	0.0	SURCHARGED	
15.000	SW63: Overflow Flood Storage		0.0	OK	

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240 Blackfriars Road London SE1 8NW	Oldlands Farm - Phase 2 SW Drainage Design	
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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.500
 Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coefficient 0.800
 Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 1 Number of Time/Area Diagrams 0
 Number of Online Controls 10 Number of Storage Structures 5 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.350 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DVD Status ON
 Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON
 DTS Status ON

Profile(s) Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 40

Water Surcharged Flooded

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)
1.000		SW1 15 Winter	100	+40%	100/15 Winter				2.490	0.615	0.000	0.22	
1.001		SW2 15 Winter	100	+40%	30/15 Winter				2.473	0.714	0.000	0.46	
1.002		SW3 15 Winter	100	+40%	30/15 Winter				2.393	0.762	0.000	1.88	
1.003	SW4 (CP)	15 Winter	100	+40%	30/15 Winter				2.153	0.587	0.000	2.58	
1.004	SW5: Tank 2 inlet (dummy)	15 Winter	100	+40%	30/15 Winter				1.827	0.267	0.000	2.99	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
1.000		SW1 25.2	FLOOD RISK	
1.001		SW2 43.8	FLOOD RISK	
1.002		SW3 166.7	FLOOD RISK	
1.003	SW4 (CP)	220.7	SURCHARGED	
1.004	SW5: Tank 2 inlet (dummy)	218.2	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.005	SW6: TANK 2 (dummy)	1440 Winter	100	+40%	100/60 Winter				1.743	0.221	0.000	0.13
1.006	SW7: Tank 2 outlet (dummy)	1440 Winter	100	+40%	30/15 Winter				1.744	0.261	0.000	0.07
2.000	SW8: CH	60 Winter	100	+40%					1.800	0.000	0.000	1.79
2.001	SW9: CH	1440 Winter	100	+40%					1.632	0.000	0.000	0.12
2.002	SW10	600 Winter	100	+40%					1.565	0.000	0.000	0.26
2.003	SW11 (CP)	1440 Winter	100	+40%	30/15 Winter				1.745	0.188	0.000	0.12
1.007	SW12 (CP)	1440 Winter	100	+40%	30/15 Winter				1.744	0.393	0.000	0.19
1.008	SW13: oversized dual pipework	1440 Winter	100	+40%	100/15 Winter				1.733	0.423	0.000	0.03
3.000	SW14: oversized dual pipework	1440 Winter	100	+40%	100/600 Winter				1.732	0.132	0.000	0.00
1.009	SW15: Orifice Chamber	1440 Winter	100	+40%	100/15 Winter				1.733	0.496	0.000	0.04
4.000	SW16: CH	60 Winter	100	+40%					1.900	0.000	0.000	1.03
5.000	SW17: CH	30 Winter	100	+40%					1.800	0.000	0.000	0.50
4.001	SW18	30 Winter	100	+40%	30/15 Winter				1.759	0.103	0.000	2.17
1.010	SW19 (CP)	1440 Winter	100	+40%	100/15 Winter				1.727	0.575	0.000	0.15
1.011	SW20: Tank 1 inlet (dummy)	1440 Winter	100	+40%	100/180 Winter				1.726	0.590	0.000	0.16
1.012	SW21: TANK 1 (dummy)	1440 Winter	100	+40%	100/180 Winter				1.726	0.606	0.000	0.07
1.013	SW22: Tank 1 outlet (dummy)	1440 Winter	100	+40%	100/180 Winter				1.726	0.622	0.000	0.03
1.014	SW23 (CP): Hydrobrake Chamber	1440 Winter	100	+40%	100/180 Winter				1.726	0.631	0.000	0.02
1.015	SW24: PI inlet (dummy)	1440 Winter	100	+40%					0.456	-0.634	0.000	0.01
1.016	SW25: PI outlet (dummy)	1440 Winter	100	+40%					0.450	-0.537	0.000	0.02
6.000	SW26	15 Winter	100	+40%	30/15 Winter				1.896	0.621	0.000	1.32
6.001	SW27	15 Winter	100	+40%	30/15 Winter				1.809	0.582	0.000	2.48
6.002	SW28: Tankk 3 inlet-a (dummy)	1440 Winter	100	+40%	30/15 Winter				1.512	0.292	0.000	0.17
6.003	SW29: TANK 3 (dummy)	1440 Winter	100	+40%	100/120 Winter				1.512	0.320	0.000	0.11
7.000	SW27a	600 Winter	100	+40%					1.800	-0.150	0.000	0.00
7.001	SW31 Tank 3 inlet-b (dummy)	600 Winter	100	+40%					1.748	-0.150	0.000	0.00
6.004	SW30: Tank 3 outlet (dummy)	1440 Winter	100	+40%	100/120 Winter				1.580	0.416	0.000	0.04
6.005	SW31	1440 Winter	100	+40%	100/120 Winter				1.586	0.430	0.000	0.02

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240 Blackfriars Road London SE1 8NW	Oldlands Farm - Phase 2 SW Drainage Design	
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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.005	SW6: TANK 2 (dummy)		9.4	SURCHARGED	
1.006	SW7: Tank 2 outlet (dummy)		9.4	SURCHARGED	
2.000	SW8: CH		25.8	SURCHARGED*	
2.001	SW9: CH		4.0	SURCHARGED*	
2.002	SW10		7.8	SURCHARGED*	
2.003	SW11 (CP)		6.3	SURCHARGED	
1.007	SW12 (CP)		14.5	SURCHARGED	
1.008	SW13: oversized dual pipework		16.1	SURCHARGED	
3.000	SW14: oversized dual pipework		0.9	SURCHARGED	
1.009	SW15: Orifice Chamber		15.4	SURCHARGED	
4.000	SW16: CH		14.9	SURCHARGED*	
5.000	SW17: CH		6.4	SURCHARGED*	
4.001	SW18		64.7	SURCHARGED*	
1.010	SW19 (CP)		32.1	SURCHARGED	
1.011	SW20: Tank 1 inlet (dummy)		31.9	SURCHARGED	
1.012	SW21: TANK 1 (dummy)		13.4	SURCHARGED	
1.013	SW22: Tank 1 outlet (dummy)		8.2	SURCHARGED	
1.014	SW23 (CP): Hydrobrake Chamber		4.4	SURCHARGED	
1.015	SW24: PI inlet (dummy)		4.4	OK	
1.016	SW25: PI outlet (dummy)		4.4	OK	
6.000	SW26		308.0	SURCHARGED	
6.001	SW27		552.0	SURCHARGED	
6.002	SW28: Tankk 3 inlet-a (dummy)		28.2	SURCHARGED	
6.003	SW29: TANK 3 (dummy)		18.3	SURCHARGED	
7.000	SW27a		0.0	OK	
7.001	SW31 Tank 3 inlet-b (dummy)		0.0	OK	
6.004	SW30: Tank 3 outlet (dummy)		9.5	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.005		SW31	5.4	SURCHARGED	

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Micro Drainage		Network 2018.1

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap.
6.006		SW32	60 Winter	100	+40%	30/60 Winter			1.573	0.564	0.000	0.02
8.000		SW33	60 Winter	100	+40%				1.587	-0.138	0.000	0.08
6.007	SW34: Orifice Chamber	60 Winter	100	+40%	30/30 Winter				1.582	0.639	0.000	0.02
6.008	SW35: PI inlet (dummy)	60 Winter	100	+40%	100/15 Winter				1.563	0.624	0.000	0.03
6.009	SW36: PI outlet (dummy)	60 Winter	100	+40%	30/30 Winter				1.563	0.627	0.000	0.03
6.010		SW37	60 Winter	100	+40%	30/30 Winter			1.563	0.632	0.000	0.02
9.000		SW40	600 Winter	100	+40%				0.812	0.000	0.000	0.03
9.001		SW41	600 Winter	100	+40%				0.810	0.000	0.000	0.03
6.011	SW40: Hydrobrake HW2 (dummy)	60 Winter	100	+40%	30/15 Winter				1.563	0.783	0.000	0.05
10.000		SW41	15 Winter	100	+40%	30/15 Winter			1.881	0.306	0.000	1.23
10.001		SW42	15 Winter	100	+40%	30/15 Winter			1.769	0.263	0.000	2.26
10.002	SW43: Tank 4 inlet-a (dummy)	1440 Winter	100	+40%	100/15 Winter				1.602	0.118	0.000	0.07
11.000		SW44	15 Winter	100	+40%	30/15 Winter			2.003	0.583	0.000	4.41
11.001	SW45: Tank 4 inlet-b (dummy)	1440 Winter	100	+40%	100/120 Winter				1.602	0.200	0.000	0.04
10.003	SW46: TANK 4 (dummy)	1440 Winter	100	+40%	100/120 Winter				1.602	0.230	0.000	0.11
10.004	SW47: Tank 4 outlet (dummy)	1440 Winter	100	+40%	100/60 Winter				1.648	0.295	0.000	0.09
10.005	SW48: Orifice Chamber	1440 Winter	100	+40%	100/60 Winter				1.658	0.318	0.000	0.04
12.000		SW49	15 Winter	100	+40%				2.101	-0.299	0.000	0.25
12.001		SW50	15 Winter	100	+40%				1.722	-0.228	0.000	0.44
13.000		SW51	15 Winter	100	+40%	100/15 Winter			1.631	0.131	0.000	0.16
12.002	SW52: Orifice Chamber	15 Winter	100	+40%	100/15 Winter				1.626	0.251	0.000	0.58
10.006		SW53	1440 Winter	100	+40%	100/15 Winter			1.592	0.484	0.000	0.20
10.007	SW54: Tank 5 inlet (dummy)	1440 Winter	100	+40%	100/15 Winter				1.591	0.489	0.000	0.19
10.008	SW55: TANK 5 (dummy)	1440 Winter	100	+40%	30/480 Winter				1.590	0.539	0.000	0.11
10.009	SW56: Tank 5 outlet (dummy)	960 Winter	100	+40%	30/15 Winter				1.596	0.596	0.000	0.09
14.000		SW57	1440 Winter	100	+40%	100/15 Winter			1.589	0.089	0.000	0.06
10.010	SW58: Orifice Chamber	960 Winter	100	+40%	30/15 Winter				1.598	0.680	0.000	0.04
10.011	SW59: PI inlet (dummy)	60 Winter	100	+40%	30/15 Winter				1.537	0.780	0.000	0.09

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.006	SW32		4.9	SURCHARGED	
8.000	SW33		17.5	OK	
6.007	SW34: Orifice Chamber		5.1	SURCHARGED	
6.008	SW35: PI inlet (dummy)		5.9	SURCHARGED	
6.009	SW36: PI outlet (dummy)		6.9	SURCHARGED	
6.010	SW37		8.0	SURCHARGED	
9.000	SW40		10.1	SURCHARGED*	
9.001	SW41		9.9	SURCHARGED*	
6.011	SW40: Hydrobrake HW2 (dummy)		11.8	SURCHARGED	
10.000	SW41		119.0	SURCHARGED	
10.001	SW42		172.8	SURCHARGED	
10.002	SW43: Tank 4 inlet-a (dummy)		9.0	SURCHARGED	
11.000	SW44		47.7	SURCHARGED	
11.001	SW45: Tank 4 inlet-b (dummy)		2.5	SURCHARGED	
10.003	SW46: TANK 4 (dummy)		6.9	SURCHARGED	
10.004	SW47: Tank 4 outlet (dummy)		6.9	SURCHARGED	
10.005	SW48: Orifice Chamber		6.9	SURCHARGED	
12.000	SW49		67.8	OK	
12.001	SW50		119.8	OK	
13.000	SW51		42.2	SURCHARGED	
12.002	SW52: Orifice Chamber		105.1	SURCHARGED	
10.006	SW53		33.3	SURCHARGED	
10.007	SW54: Tank 5 inlet (dummy)		33.6	SURCHARGED	
10.008	SW55: TANK 5 (dummy)		19.5	SURCHARGED	
10.009	SW56: Tank 5 outlet (dummy)		15.6	SURCHARGED	
14.000	SW57		8.6	SURCHARGED	
10.010	SW58: Orifice Chamber		4.7	SURCHARGED	

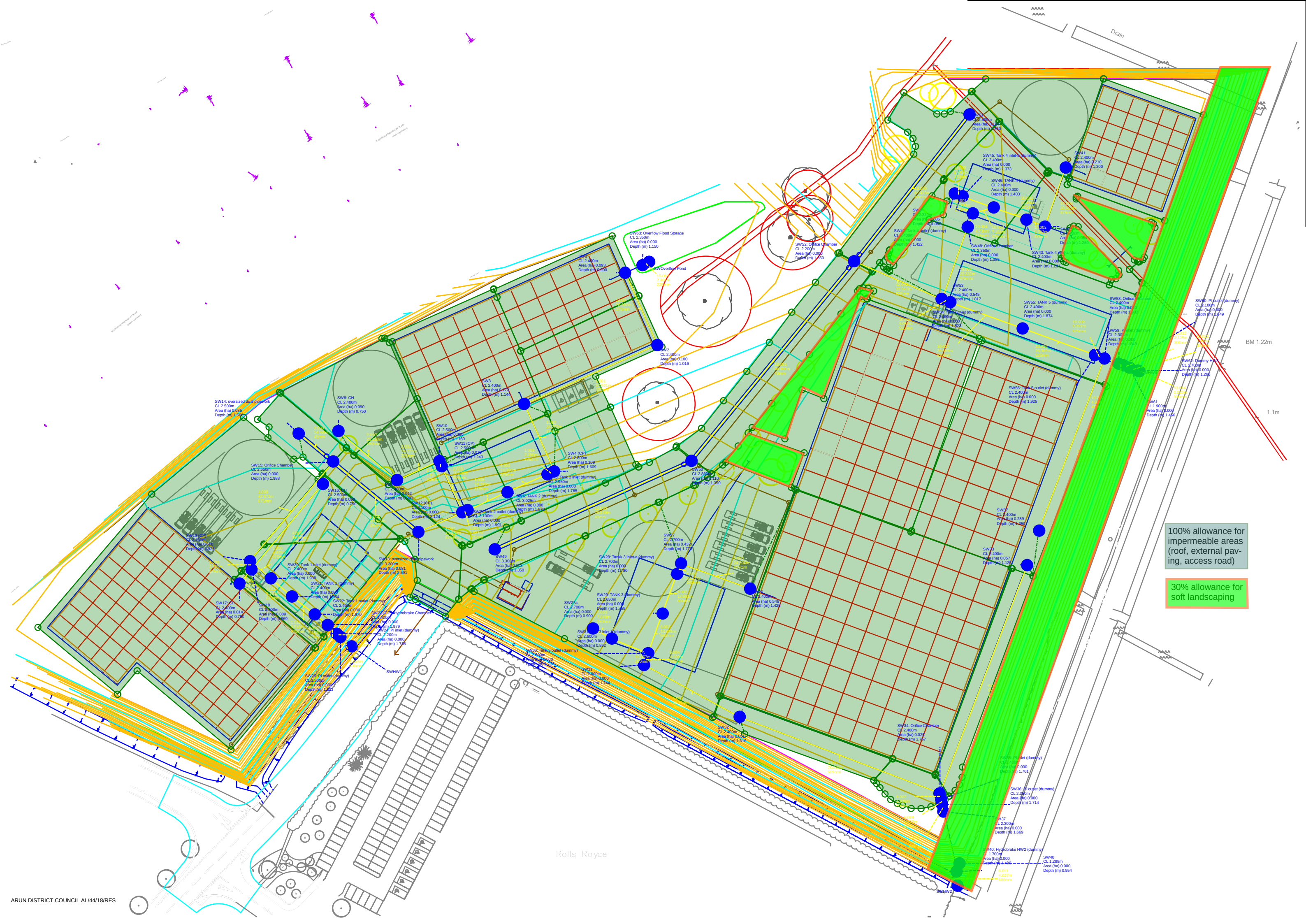
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Micro Drainage	Network 2018.1				
<u>100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>					
PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
10.011	SW59: PI inlet (dummy)		4.7	SURCHARGED	
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Micro Drainage		Network 2018.1

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap.
10.012	SW60: PI outlet (dummy)	60 Winter	100	+40%	30/15 Winter				1.541	0.790	0.000	0.09
10.013	SW61	60 Winter	100	+40%	30/15 Winter				1.546	0.802	0.000	0.09
10.014	SW62: Dummy HW3	60 Winter	100	+40%	30/15 Winter		1/15 Winter	36	1.551	0.817	0.000	0.00
15.000	SW63: Overflow Flood Storage	600 Winter	100	+40%					1.200	-0.225	0.000	0.00

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
10.012	SW60: PI outlet (dummy)		4.7	SURCHARGED	
10.013	SW61		4.8	SURCHARGED	
10.014	SW62: Dummy HW3	6.7	0.0	FLOOD RISK	
15.000	SW63: Overflow Flood Storage		0.0	OK	



100% allowance for impermeable areas (roof, external paving, access road)

30% allowance for soft landscaping

Rolls Royce

APPENDIX 2 FLOOD RISK AND DRAINAGE ASSESSMENT

**PHASE 2 COMMERCIAL DEVELOPMENT
OLDLANDS FARM,
BOGNOR REGIS
WEST SUSSEX**

FLOOD RISK & DRAINAGE ASSESSMENT

HANBURY PROPERTIES LIMITED

Date: May 2015
Ref: 15/0455/5130
Rev:



DOCUMENT CONTROL RECORD

Document Issue:

Rev	Issue Status	Prepared by	Checked by
-	First Issue for comment	A. McShane	P. Berrill



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APPENDICES:

Appendix A – Preliminary Site Layout

Appendix B – Topographical Survey

Appendix C – Existing Floodplain Plan

Appendix D – Floodplain Compensation Plans

Appendix E – Runoff calculations

Appendix F – Drainage Strategy

FIGURES:

Figure 1&2 - Site Location

Figure 3 - Development Site Boundary

Figure 4 - Extract from Environment Agency Flood Zone Map

REFERENCES

Environment Agency Flood Map Information © and database right www.environment-agency.gov.uk

Technical Guidance to the National Planning Policy Framework - NPPF (2012)

Department for Communities and Local Government ISBN: 978-1-4098-3410-6

Contains British Geological Survey materials © NERC (2014)

Arun District Council SFRA – Capita Symonds (February 2008)

Arun District Council Local Plan 2011-2031 Sequential & Exception Tests

1 Executive Summary

SITE INFORMATION	CLIENT	Hanbury Properties
	SITE NAME	Phase 2 Oldlands Farm, Bognor Regis
	SITE LOCATION	SU 94566 01825
	SITE AREA	6.00 ha
	CURRENT LAND USE	Undeveloped arable grazing farmland
	PROPOSED LAND USE	B2 & B8 Commercial Development
	SITE GEOLOGY	Brickearth clay over Raised Beach Deposits (chalk derived sand and gravel) and subsequently the Upper Chalk.
	SOIL INFILTRATION RATE	N/A
	GROUNDWATER LEVELS	TBC
	GROUNDWATER SPZ / AQUIFER	Not in SPZ / Secondary A Aquifer (Superficial Soils)
	GROUND CONTAMINATION	None identified
FLOOD RISK	ENVIRONMENT AGENCY FLOOD ZONE	Flood Zone 2 & 3. Flood compensation used to move site to FZ 1
	FLUVIAL (RIVERS & WATERCOURSES)	Flooding from Oldlands Farm Ditch & Lidsey Rife
	PLUVIAL (SURFACE WATER)	General ponding on existing surface
	GROUNDWATER	Not a risk
	EXISTING/PROPOSED SEWERS & MAINS	Not a risk
	ARTIFICIAL	Not a risk
	TIDAL	Not a risk
FOUL & SURFACE	SURFACE WATER STRATEGY	Outfall to existing watercourse
	PROPOSED SUDS TYPE	Permeable Block Paving with sealed base Attenuation Tanks
	EXISTING SW PEAK FLOW RATE	Greenfield QBar - 21.0 l/s
	PROPOSED SW PEAK FLOW RATE	Max 21.0 l/s (1:100+30%)
	FOUL WATER STRATEGY	Pumped to existing foul network
	EXISTING FW PEAK FLOW RATE	N/A
MISC	PROPOSED FW PEAK FLOW RATE	TBC pumped main
	FURTHER INVESTIGATIONS	

2 Introduction

2.1 Scope

2.1.1 MJA Consulting has been commissioned by Hanbury Properties Ltd to undertake a Flood Risk Assessment and Drainage Strategy to accompany an outline planning application for the Phase 2 Commercial Development at Oldlands Farm, Bognor Regis, West Sussex.

2.1.2 The land forms part of the commercial development of the Felpham Site 6 Housing Development. The commercial development area covers approximately 6.00Ha of undeveloped agricultural farmland.

The site lies to the north east of the approved Phase 1 commercial area and is bounded by the Bognor Northern Relief Road (BNRR) and the main Bognor Regis railway. Within the application an area of undeveloped agricultural farmland is included for floodplain compensation works located to the north of the Bognor Northern Relief Road (BNRR).

2.1.3 The proposed commercial development consists of the construction of a number of B2 & B8 units with associated access roads, hardstanding parking areas and soft landscaping. Refer to Appendix A for site preliminary site layouts & options.

2.2 Report Structure

2.2.1 The National Planning Policy Framework - *Department for Communities and Local Government (2012)* is the current guidance on development and flood risk in England and Wales.

The Flood Risk technical guidance for the National Planning Policy Framework requires a Flood Risk Assessment to be carried out to consider all potential forms of flooding including that from river, sea, estuarial, land drainage, groundwater, overland flow, surface water run-off, sewer systems, and artificial water bodies (lakes, reservoirs, canals etc).

A Flood Risk Assessment is required to consider the impact of all these potential forms flooding on both the development site and off site parties and land.

2.2.2 This report will take the structure of a 'Flood Risk Assessment' in accordance with the Environment Agency's Flood Risk Assessment Guidance, the National Planning Policy Framework and CIRIA Report 624 'Development and Flood Risk – Guidance for the Construction Industry.

2.2.3 The purposes of this report are:

- To confirm that the proposed development has a suitable strategy for dealing with potential flood risks.
- To confirm that a satisfactory strategy for the disposal of surface and foul water from the proposed development is achievable.
- This development will not increase the risk of flooding to any offsite parties and land.

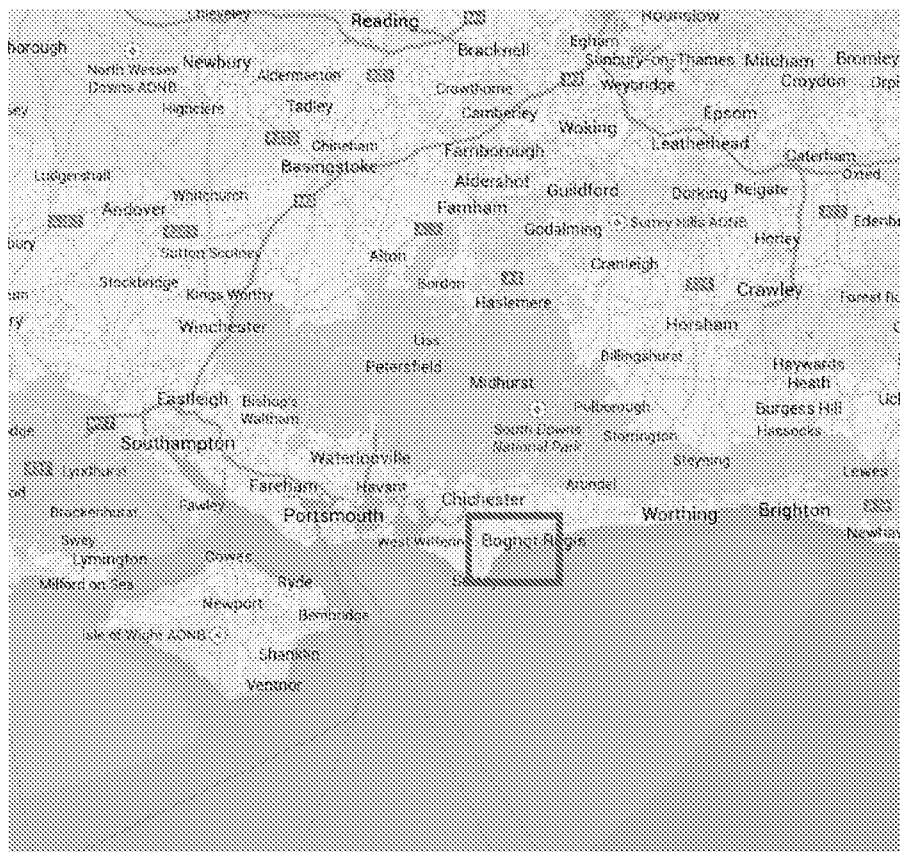
3 Existing Site

3.1 Site Location and Description

- 3.1.1 The proposed development covers an area of approximately 6.0 ha of undeveloped agricultural farmland and lies to the north east of the Phase 1 commercial development area accessed from the A29 Trunk Road and lies between the Bognor Regis Rail line and the Bognor Northern Relief Road, currently under construction.

The approximate National Grid Reference of the site is SU 94566 01825

Figure 1: Site Location



© 2011 Microsoft – Bing Maps



4. Topographical and Geological Information

4.1 Topography

4.1.1 The topographical survey of the site shows the existing ground generally falling from the Bognor Northern Relief Road (BNRR) in a typically south easterly direction towards the field ditches and the Oldlands Farm Ditch.

4.1.2 The site levels range from 2.75m AOD to approximately 0.85m AOD at the watercourse and ditches.

Refer to Appendix B for the existing Topographical Survey.

4.2 Geology & Hydrogeology

4.2.1 The Geological Survey map of the area indicates that the site is underlain by Aeolian Deposits (Brickearth clay) over Raised Beach Deposits (chalk derived sand and gravel) and subsequently the Upper Chalk. The area to the east of the site, in the vicinity of the Lidsey Rife, is shown to be underlain by a tract of Tidal River Deposits comprising silty and sandy clays with sand and gravel.

4.2.2 Ground investigations undertaken on Phase 1 encountered groundwater within a number of trial holes within the clay / silt layers. Consequently soakage testing was not carried out due to the nature of the sub strata.

Infiltration type drainage would not be suitable within this site.

4.2.3 As the existing site has been agriculturally farmed over a number of years the natural drainage regime is for surface water to run directly off the surface impermeable clay soils and directly to the local ditches and Oldlands Farm Ditch on the southern western boundary.

4.3 Catchment Information

Watercourses

4.3.1 The Oldlands Farm Ditch flows in a north west to southern easterly direction along the boundary of the site and forms part of the Internal Drainage Board (IDB) system.

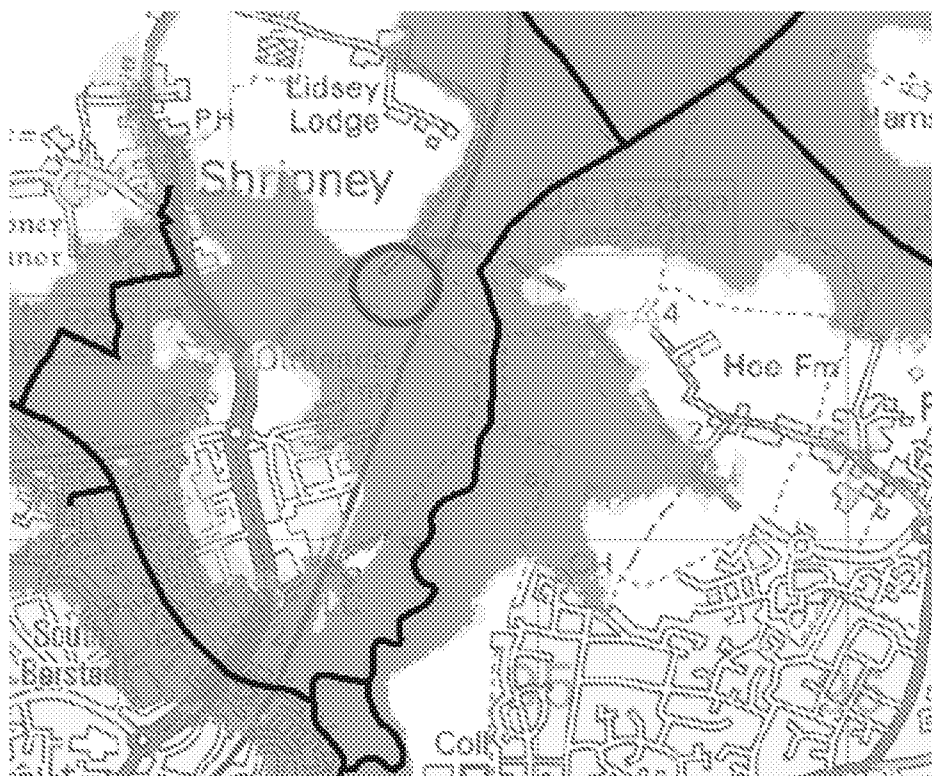
4.3.2 This watercourse takes runoff from an area of the village of Shripney together with direct runoff from the surrounding farmland. At the crossing point with the Bognor Northern Relief Road (BNRR) a new culvert together with flood arches has been installed. The ditch runs in open ditch before discharging to a culvert under the Bognor to Chichester railway line. The Oldlands Farm Ditch ultimately discharges to the Lidsey Rife approximately 300m to the east.

4.3.3 Two small field ditch or drainage channels which take runoff from the existing fields also run under the railway and discharge to the Lidsey Rife.

5 Flood Risk Assessment

5.1 Flood Zone Map

Figure 4: Extract from Environment Agency Flood Zone Map



© Environment Agency 2011

 Main Rivers

 Dark blue shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded:

- From the sea by a flood that has a 0.5 per cent (1 in 200) or greater chance of happening each year.
- From a river by a flood that has a 1 per cent (1 in 100) or greater chance of happening each year.

 Light blue shows the additional extent of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1 per cent (1 in 1000) chance of occurring each year.

5.2 The Environment Agency's indicative Flood Map shows the site to be currently located within Flood Zones 2 & 3.

Zone 2 is land assessed as having between a 1 in 100 year and 1 in 1000 annual probability of flooding, while Zone 3 is land assessed as having between a 1 in 100 year or greater annual probability of flooding from a river or stream in any year by the Environment Agency.

5.3 As stated the Environment Agency Flood Map is indicative only and takes no account of actual ground levels or features. These flood maps are derived from coarse scale JFLOW modelling which bases part of the results on assumptions of hydrology and topography. This does lead to inaccuracies in the plans and therefore cannot be used as an accurate guide to flooding. However, they are intended to be an indicative measure to flood risk.

5.4 The Environment Agency has confirmed the predicted flood level within this area which does alter the current flood maps.

Flood Levels:

The original 100 year fluvial flood level was 1.82m AOD however this was increased to a level of 2.0m AOD to include for climate change and following the results from the Strategic Flood Risk Assessment.

The Phase 1 Commercial Development land was lifted out of the floodplain by utilising flood compensation. The floodplain was then altered and moved north of the BNRR on existing agricultural land.

Appendix C shows the actual flood zone when based on the topographical survey

5.5 The flood risk technical Guidance to the National Planning Policy Framework Table 2: Flood Risk Vulnerability classification, classifies commercial developments as 'Less Vulnerable'.

NPPF Table 2 of technical Guidance: Flood Risk Vulnerability classification

Less vulnerable
• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in "more vulnerable", and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).

NPPF Table 3: Flood Risk Vulnerability and Flood Zone 'compatibility'

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

Key: ✓ Development is appropriate.
× Development should not be permitted.

5.6 Table 2 & 3 of the NPPF would indicate that commercial developments 'less vulnerable' can be located within Flood Zone 2 & 3a and are considered appropriate under the National Planning Policy Framework.

5.7 It is the developer's intention to lift the site out of flood zones 2 & 3 and into flood zone 1 above the 2.0m AOD contour. To do this they intend to provide floodplain compensation within the vicinity of the site.

5.8 Floodplain Compensation

5.8.1 As stated previously the proposed development currently lies partially within flood zones 2 & 3 with existing ground levels ranging from 2.75m AOD – circa 0.75m AOD. It is proposed to lift the site within Zones 2 & 3 to above the level of 2.0m AOD by using floodplain compensation and relocating the floodplain to the land to the north which currently lies above the 2.0m AOD contour adjacent to the existing flood compensation area.

5.8.2 The flood compensation has been designed in accordance with the normal Environment Agency policy and Appendix 3 of the CIRIA guide C624 entitled "Development and flood risk - guidance for the construction industry" where compensatory storage is provided on a "volume-for-volume" and "level-for-level" basis (e.g. for each 0.2 m slice of filling there is a slice of excavation at the same level and volume) to ensure no loss of floodplain occurs.

5.8.3 Floodplain compensation has been utilised on both the Bognor Northern Relief Road where the road crosses the Oldlands Farm Ditch and Oldlands Farm Phase 1 Commercial Development. The location of this on existing agricultural land to the north of the Bognor North Relief Road.

5.8.4 The proposed floodplain compensation area is to the north of the new Bognor Northern Relief Road (BNRR) the proposal is to extend the existing compensation area as shown in Appendix D.

5.8.5 Flood Compensation areas & volumes.

Existing site area:

Ex Ground Level m AOD	Area of fill (m ²)	Volume of fill (m ³)
2.00	46,844	4,626
1.90	45,677	4,527
1.80	44,855	4,444
1.70	44,030	4,354
1.60	43,054	4,231
1.50	41,573	4,043
1.40	39,296	3,785
1.30	36,397	3,389
1.20	31,104	2,683
1.10	22,292	1,150
1.00	6,011	301
0.90	712	36
Total fill volume		37,569m ³

Flood compensation areas:

Ex Ground Level m AOD	Area of cut (m ²)	Volume of cut (m ³)
2.00	53,600	5,350
1.90	53,400	5,310
1.80	52,800	5,233
1.70	51,850	5,110
1.60	51,700	4,965
1.50	50,500	4,790
1.40	48,800	4,495
1.30	47,000	3,758
1.20	42,900	1,661
1.10	32,250	1,010
1.00	20,200	48
0.90	960	
Total cut volume		46,906m ³

- 5.8.6 The floodplain compensation will link level for level with the Phase 1 development compensation area to allow a continuous floodplain which is linked by a new flood relief channel adjacent to the site boundary and the Oldlands Farm Ditch.
- 5.8.7 To ensure continuity between the existing flood compensation area to the north, the new compensation area and the Oldlands Farm ditch a new flood channel has been introduced on the south east boundary of the site adjacent to the railway. This will ensure that the flood compensation areas & Oldlands Farm ditch will link both north of the BNRR and south of the development prior to the ditch outfalling under the main rail line.

5.9 Tidal Flood Risk

- 5.9.1 The Tidal Flood Risk to the site is extremely low. Sea defences are well maintained and provide sufficient defence against the predicted 1:200 year tidal level. If a more extreme event or a localised breach occurred the risk to the site is minimal due to the distance to the sea defence.

5.10 Sequential Test

- 5.10.1 The National Planning Policy Framework Guidance states that Planning Authorities should complete a risk based 'Sequential Test' at all stages of the planning process, to steer new development to areas with the lowest probability of flooding.
- 5.10.2 Under the requirements of the 'sequential test' and as the proposed commercial development is to be located within an amended flood zone 1 (lowest risk), there are no more suitable, developable and deliverable alternative sites, better located from a flood risk perspective, which would accommodate the proposed development.

6 Impact of Development on Flood Risk

6.1 This section identifies sources of potential flood risk to the site.

The sources of flooding that could potentially affect the site include flooding from groundwater, rivers (fluvial), overland runoff (pluvial), artificial sources and flooding from overloaded existing and proposed sewer networks.

6.2 History of Flooding

Part of the site is currently within flood zones 2 & 3 and is known to flood from the adjacent watercourse. However, with the proposed flood compensation works the site will move to flood zone 1 with a low risk of flooding.

6.3 Existing Watercourses

6.3.1 Flood water from the watercourse known as the Oldlands Farm Ditch which runs along the south western boundary and is the main cause of the on-site flooding as well as an unnamed field ditch discharging under the rail line.

6.3.2 The Environment Agency have acknowledged that the catchment responds slowly and mirrors the flood levels on the Lidsey Rife.

6.3.3 The Lidsey Rife is located approximately 300m to the east and does not directly present a flood risk.

6.4 Waterbodies

An existing highway drainage pond associated with the Bognor Northern Relief Road lies to the west of the site but does not pose a flood risk to the site.

There are no reservoirs or canals or other artificial sources of flooding within a 500m radius of the development area.

6.5 Groundwater

From the Ground Investigation the Environment Agency has confirmed that they have no recorded incidents of flooding to this development site from groundwater.

6.6 Existing Sewers

Southern Water has indicated that there have been no recorded incidents of flooding from public sewers within a 500m radius of the site.

6.7 Tidal Flood Risk

The Tidal Flood Risk to the site is extremely low. Sea defences are well maintained and provide sufficient defence against the predicted 1:200 year tidal level. If a more extreme event or a localised breach occurred the risk to the site is minimal due to the distance to the sea defence.

6.8 Proposed Site Drainage

Artificial drainage systems and infrastructure within, or in close proximity to, the site may present a risk of flooding through the capacity of the systems being exceeded or the structural, hydraulic, mechanical or operational failure of the system occurring.

In the context of the proposed site there are likely to be installed as part of the development, the following systems which may present a flood risk:

- Piped gravity foul/ surface water sewers and a foul rising main.
- SUDS systems for the collection and conveyance of surface water runoff within the site boundary.

- 6.9 The surface water runoff generated on the site as a result of the development will be managed using appropriate SUDS techniques up to the 1 in 100 +30% storm event. This will ensure that the peak rate of surface water leaving the developed site

7 Existing and Proposed Site Runoff

- 7.1 This section aims to calculate the estimated peak runoff rate of surface water leaving the site, for the pre development conditions.
These discharge rates have then been used for the preliminary design of the surface water drainage strategy for the proposed development.

7.2 Existing Surface Water Runoff Rate

- 7.2.1 As the intention is to discharge to a watercourse the minimum requirement is for the proposed peak surface water runoff rate and runoff volume not to exceed pre-development rates. The Greenfield runoff rate has been calculated using the Institute of Hydrology Report 124 methodology to determine the level of acceptable rate of discharge from the site to the receiving watercourse.
- 7.3.2 The natural topography of the site is such that all surface runoff typically flows in a south easterly direction from the BNRR boundary towards the Oldlands Farm Ditch and the existing field ditch system.
- 7.3.5 An assessment of the estimated current Greenfield runoff rate has been carried out using the Institute of Hydrology Report 124 methodology using Micro Drainage software. Refer to Appendix E for a summary of results.
- 7.3.6 IH124 mean annual flood flow rate equation:

$$QBAR_{Rural} = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$$

Catchment: 6.0ha

1 in 1 year	18.1 l/sec
1 in 30 year	48.3 l/sec
1 in 100 year	68.0 l/sec
QBar	21.3 l/sec

Based on the above all discharge from the site will be restricted to a maximum discharge of 21 l/sec (QBar) for all storm events.

7.4 Proposed Development Surface Water Runoff Rate

- 7.4.1 The estimated peak runoff rate from the proposed site is based on 100% runoff from impermeable areas and 0% runoff from permeable areas, in accordance with CIRIA C697 The SUDS Manual & Preliminary rainfall runoff management for Developments (EA/DEFRA W5-074/A).

7.4.2 A suitable method for the estimation of peak flow is the *Rational method*,
 $Q = 2.78 CIA$.

Where:

Q = flow (l/s)

I = rainfall intensity (mm/hr), return period equal to time of concentration
(to include a 30% increase for predicted climate change)

A = Impermeable area drained (ha)

C = runoff coefficient, assumed to be 1.0

Catchment: 4.30ha

1 in 1 year	204 l/sec
1 in 30 year	495 l/sec
1 in 100 year	656 l/sec
1 in 100 year + 30% CC	853 l/sec

7.4.3 It can be seen that as a result of this development and the increase in impermeable areas, the peak rate and volume at which surface water could potentially runoff the site if not effectively managed, will be greater than in its Greenfield state.

To mitigate this increase in potential additional runoff due to development the discharge will be constrained to Q_{Bar} (mean annual peak rate of runoff for the Greenfield site), calculated for this site at 21 l/s.

8 Surface Water Drainage Strategy

- 8.1 The National Planning Policy Framework requires that new developments do not exacerbate flood risks elsewhere, which means there is a need to control drainage and runoff to ensure there are no increases in overland flow as a result of the development.

Sustainable Drainage Systems (SuDS) will be incorporated into the surface water drainage strategy to mitigate the additional runoff and reduce flood risk to downstream areas.

The philosophy of the SuDS will be to replicate as closely as possible the natural drainage regime from a site before development, reducing the impact on receiving watercourses.

- 8.2 The Building Regulations Document H (2002) details a hierarchy of potential methods of disposing of surface water from a site:
- An adequate soakaway or some other adequate infiltration system, or where that is not practicable,
 - A watercourse, or where that is not practicable,
 - A sewer
- 8.3 The site investigations on the adjacent site have shown that the site is underlain by Brickearth clay soils with a high groundwater content and would be unsuitable for infiltration type SUDS. Furthermore the site is being raised which would make it also unsuitable for an infiltration drainage solution.
- 8.4 Surface water runoff will be managed in accordance with current requirements to mimic the existing runoff to Oldlands Farm Ditch by incorporating Sustainable Urban Drainage (SUDs) into development. The suitability of various techniques has been assessed using the SUDS management train as stated in the CIRIA Manual C697. The various techniques will be reviewed as to their suitability in consideration of the characteristics of the development to manage runoff at source. The use of SUDS systems will provide an improvement to the biodiversity and water quality and a reduction in runoff peak runoff flows.
- 8.5 The surface water runoff from the development for all storm events including the 1-year, 30-year, 100-year and 100-year +30% climate change storms will be attenuated and discharged into the adjacent watercourses at no greater than the mean annual peak runoff rate QBar from the undeveloped Greenfield site of 21 l/sec.

8.6 Appendix F shows the preliminary drainage strategy for the site. Various SUDs features will be used within the storm water system before the attenuated runoff discharges to the watercourse.

8.7 Due to the proposed layouts the management of the surface water will be split into typically 3 catchments with the maximum discharge apportioned depending on percentage of site covered.

8.7.1 Access Road:

Due to the nature of the site with heavy traffic movements the road will be constructed as a standard industrial type road with runoff being drained via gullies. To attenuate flows it is intended to attenuate flows within a culvert or oversized pipe system under the access road prior to the ditch.

8.7.2 Employment Areas:

Runoff from the parking areas will drain via a permeable paved surface to the sub base below. Storm water will be stored temporarily within the voids before discharging to an attenuation tank allowing a controlled discharge to the watercourse.

The permeable type sub base will provide a first treatment to runoff and improve the downstream water quality.

Roof runoff will be collected by traditional guttering and downpipe system where it will be discharged to the sub base of the permeable paving structure within the parking areas via permavoid® diffuser cells or to adjacent swales.

Rainwater Harvesting will be considered for all buildings which will provide an opportunity to recycle rainwater for use in toilet flushing. This will be part of any detailed planning application for the proposed units.

8.8 Storm water catchments & typical discharge rates:

8.8.1 B2 Uses only (12 units):

Catchment Area	Area (Ha)	Max discharge rate l/sec	Impermeable area Ha (Approx)	Typical storage volume required
1 Units 1 – 5	2.0	7 l/sec	1.60	1350m ³
2 Units 6 – 10	2.5	8 l/sec	2.00	1700m ³
3 Units 11 – 12	1.5	6 l/sec	1.20	900m ³
Total	6.00	21 l/sec		

8.8.2 B2/B8 Uses only (8 units):

Catchment Area	Area (Ha)	Max discharge rate l/sec	Impermeable area Ha (Approx)	Typical storage volume required
1 Units 1 – 5	2.0	7 l/sec	1.60	1350m ³
2 Units 6 – 7	2.65	8 l/sec	2.00	1700m ³
3 Units 7 – 8	1.35	6 l/sec	1.20	900m ³
Total	6.00	21 l/sec		

The discharge from the total site will be restricted to a maximum discharge of 21 l/sec (QBar) to the Oldlands Farm Ditch. The above attenuation volumes have been assessed using the Micro Drainage suite of programs.

- 8.9 As the site is being raised above the fluvial floodplain with imported fill and due to the nature of the existing sub strata all SUDs features will be sealed with an impermeable membrane. This is to prevent site runoff infiltrating to the made ground and creating stability issues. This will also prevent groundwater entering the pond creating less capacity than required.

9 Foul water drainage strategy

- 9.1 It is proposed that the foul water discharge from each unit will drain via gravity through a piped network before discharging to a sewer system within the development road network.

This sewer will convey flow to a pumping station located within the middle of the site. The station will then pump via a rising main to a point on the existing foul sewer system within the Phase 1 development area.

10 Summary & Conclusions

- 10.1 The land forms part of the commercial development area for the Felpham Site 6 Housing Development. The proposed commercial development consists of the construction of a mixture of B2 & B8 units with associated access roads, hardstanding parking areas and soft landscaping.
- 10.2 The Environment Agency's indicative Flood Map shows the site to be currently located within Flood Zones 1, 2 & 3.
Zone 1 is land assessed as having a less than 1 in 1000 (<0.1%) annual probability of flooding, Zone 2 is land assessed as having between a 1 in 100 year and 1 in 1000 annual probability of flooding, while Zone 3 is land assessed as having between a 1 in 100 year or greater annual probability of flooding from a river or stream in any year by the Environment Agency.
- 10.3 No other sources of flooding were identified on or within the vicinity of the site including that from groundwater, tidal, overland runoff (pluvial), artificial sources and flooding from overloaded existing and proposed sewer networks.
- 10.4 The majority of the development area lies within flood zones 2 & 3 however it is intended to be lifted out of the known flood area and into flood zone 1 by using floodplain compensation and relocating the floodplain to adjacent land which currently lies above the 2.0m AOD contour.
- 10.5 The flood compensation has been designed in accordance with the normal Environment Agency policy and Appendix 3 of the CIRIA guide C624 entitled "Development and flood risk - guidance for the construction industry" where compensatory storage is provided on a "volume-for-volume" and "level-for-level" basis (e.g. for each 0.2 m slice of filling there is a slice of excavation at the same level and volume) to ensure no loss of floodplain occurs.
- 10.6 The existing sub strata consists on an impermeable clay with existing runoff discharging to the adjacent Oldlands Farm ditch. With infiltration techniques being unsuitable the runoff from the development will mimic the existing and will be restricted to a maximum Qbar discharge of 21 l/sec for all storm events.

- 10.7 Surface water runoff will be managed in accordance with current requirements to mimic the existing runoff to Oldlands Farm Ditch by incorporating Sustainable Urban Drainage (SUDs) into development. The suitability of various techniques has been assessed using the SUDS management train as stated in the CIRIA Manual C697. The various techniques will be reviewed as to their suitability in consideration of the characteristics of the development to manage runoff at source. The use of SUDS systems will provide an improvement to the biodiversity and water quality and a reduction in runoff peak runoff flows.
- 10.8 The surface water runoff from the development for all storm events including the 1-year, 30-year, 100-year and 100-year +30% climate change storms will be attenuated and discharged into the adjacent watercourse or flood relief channel.
- 10.9 This report concludes that:
- To confirm that the proposed development has a suitable strategy for dealing with potential flood risks.
 - To confirm that a satisfactory strategy for the disposal of surface and foul water from the proposed development is achievable.
 - This development will not increase the risk of flooding to any offsite parties and land.

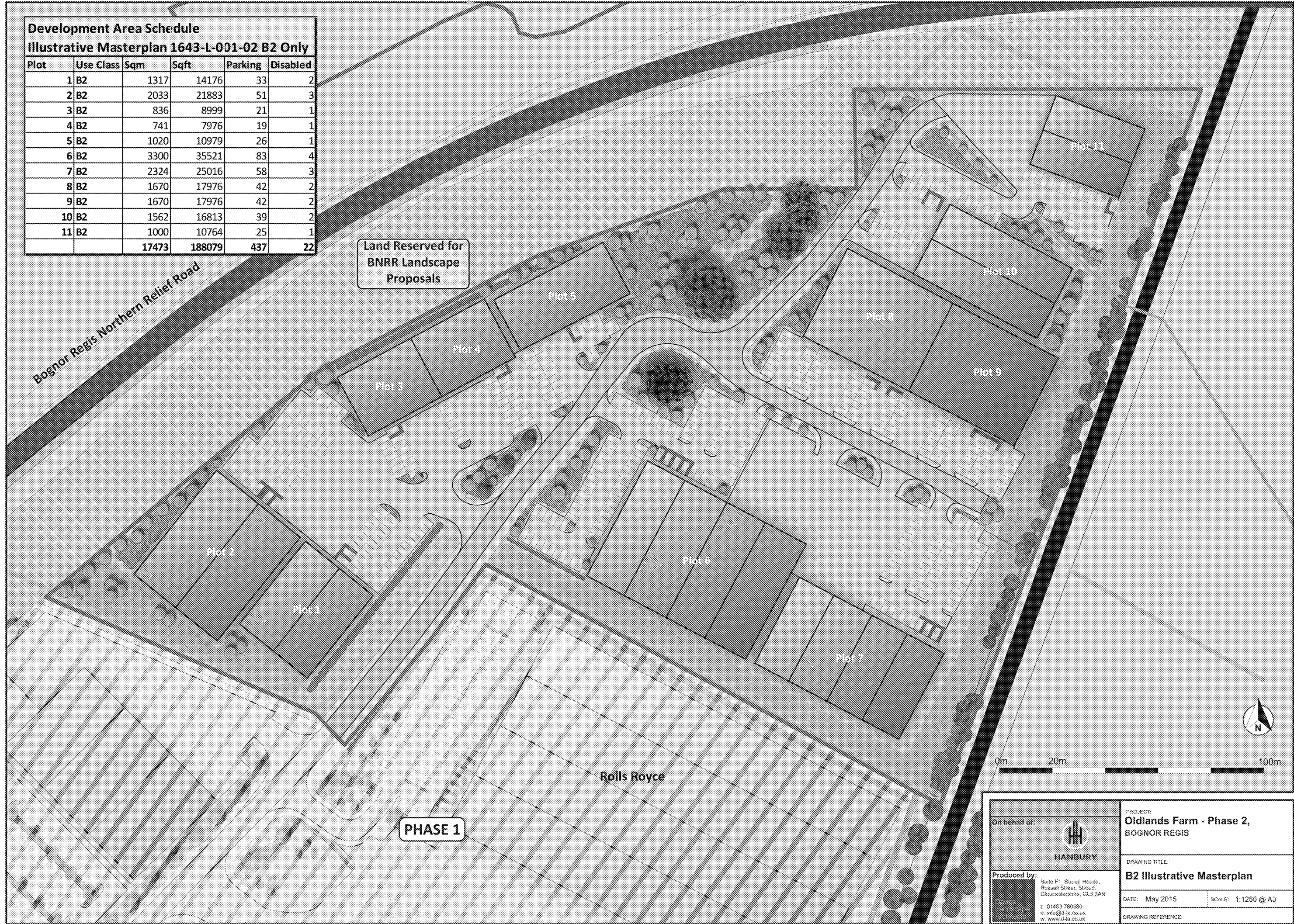


Appendix A

Site Layout Plans

Development Area Schedule
Illustrative Masterplan 1643-L-001-02 B2 Only

Plot	Use Class	Sqm	Sqft	Parking	Disabled
1	B2	1317	14176	33	2
2	B2	2033	21883	51	3
3	B2	836	8999	21	1
4	B2	741	7976	19	1
5	B2	1020	10979	26	1
6	B2	3300	35521	83	4
7	B2	2324	25016	58	3
8	B2	1670	17976	42	2
9	B2	1670	17976	42	2
10	B2	1562	16813	39	2
11	B2	1000	10764	25	1
		17473	188079	437	22



On behalf of:  HANBURY		PROJECT: Oldlands Farm - Phase 2, BOGNOR REGIS	
Produced by:  Suite P1, Stroud House, Russell Street, Stroud, Gloucestershire, GL5 3AN t: 01453 780389 e: info@h-b.co.uk w: www.h-b.co.uk		DRAWING TITLE: B2 Illustrative Masterplan	
DATE: May 2015		SCALE: 1:1250 @ A3	
DRAWING REFERENCE:			

Development Area Schedule					
Illustrative Masterplan 1643-L-001-02 B2/B8					
Plot	Use Class	Sqm	Sqft	Parking	Disabled
1	B2	1317	14176	33	2
2	B2	2033	21883	51	3
3	B2	836	8999	21	1
4	B2	741	7976	19	1
5	B2	1020	10979	26	1
6	B8	8000	86112	80	4
7	B8	5506	59267	55	3
8	B2	1000	10764	25	1
		20453	220156	309	15

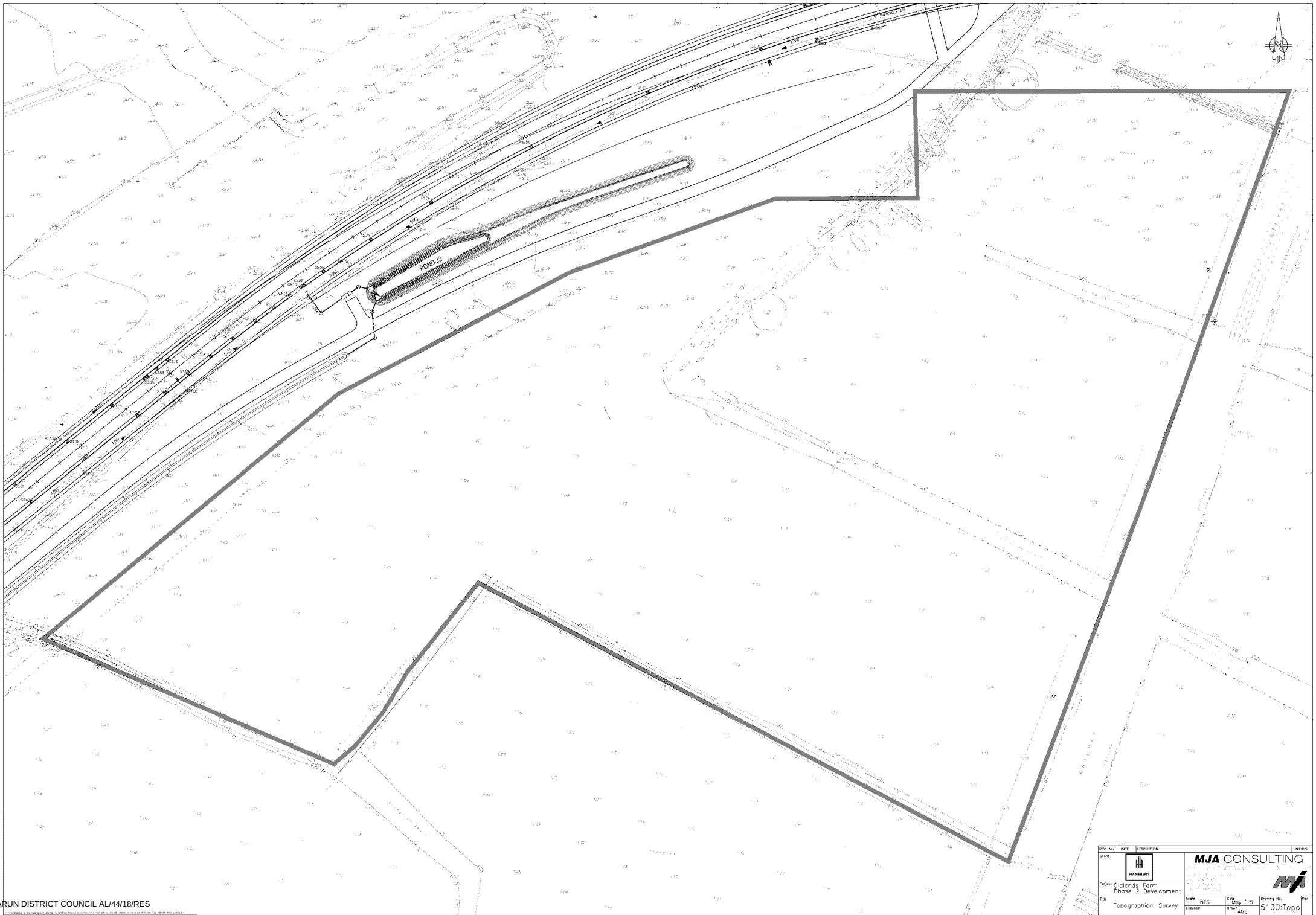


On behalf of:  HANBURY	PROJECT: Oldlands Farm - Phase 2, BOGNOR REGIS
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Appendix B

Topographical Survey



REV. No.	DATE	DESCRIPTION	DETAILS
01	11/05/18	Issue for comment	
02	11/05/18	Issue for comment	
03	11/05/18	Issue for comment	
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PROJ: Oldlands Farm Phase 2 Development

SITE: Topographical Survey

**MJA CONSULTING**



Scale: NTS

Date: May '18

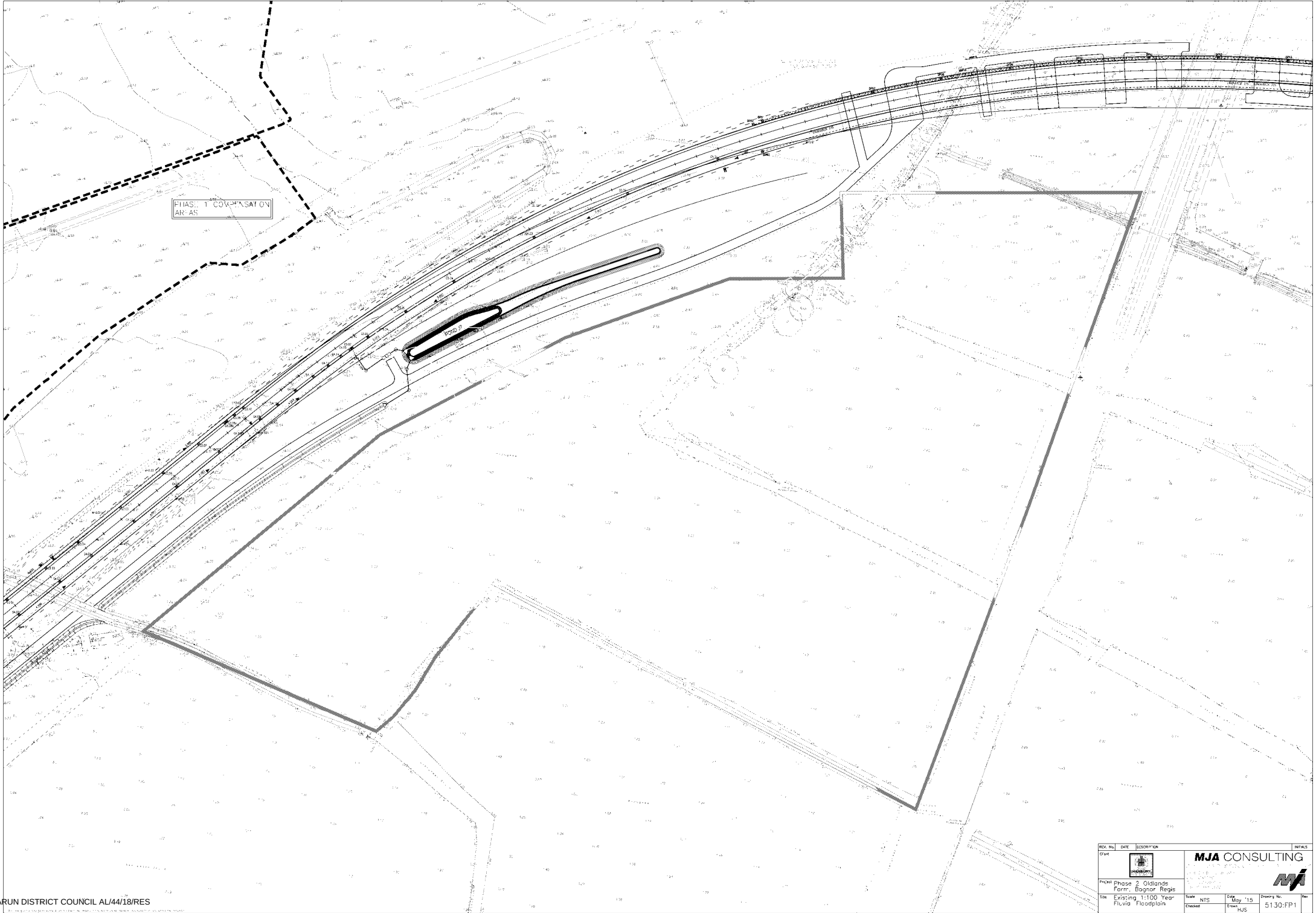
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Appendix C

Existing Floodplain Plan



PHASE 1 COVENANTS
AR-AS

VOID 1

REV. No.	DATE	DESCRIPTION	INITIALS
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85	15/05/2015	Issue for comment	
86	15/05/2015	Issue for comment	
87	15/05/2015	Issue for comment	
88	15/05/2015	Issue for comment	
89	15/05/2015	Issue for comment	
90	15/05/2015	Issue for comment	
91	15/05/2015	Issue for comment	
92	15/05/2015	Issue for comment	
93	15/05/2015	Issue for comment	
94	15/05/2015	Issue for comment	
95	15/05/2015	Issue for comment	
96	15/05/2015	Issue for comment	
97	15/05/2015	Issue for comment	
98	15/05/2015	Issue for comment	
99	15/05/2015	Issue for comment	
100	15/05/2015	Issue for comment	

Client	Project	Scale	Date	Drawn by	Check
ARUN DISTRICT COUNCIL	Phase 2 Oldlands Farm, Bognor Regis	1:100	15/05/2015	HJS	
Title				5130-FP1	



Appendix D

Floodplain Compensation Plans

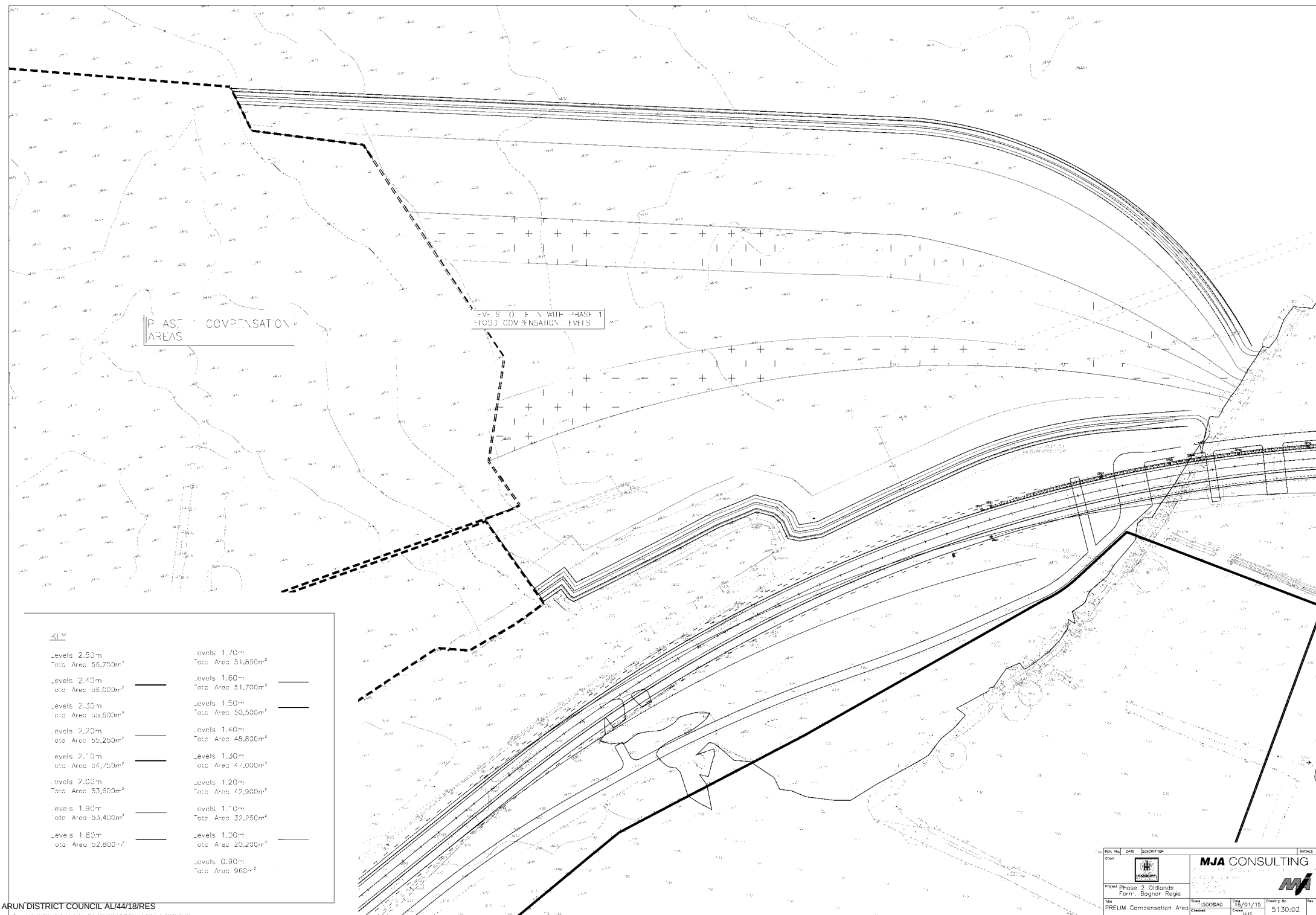


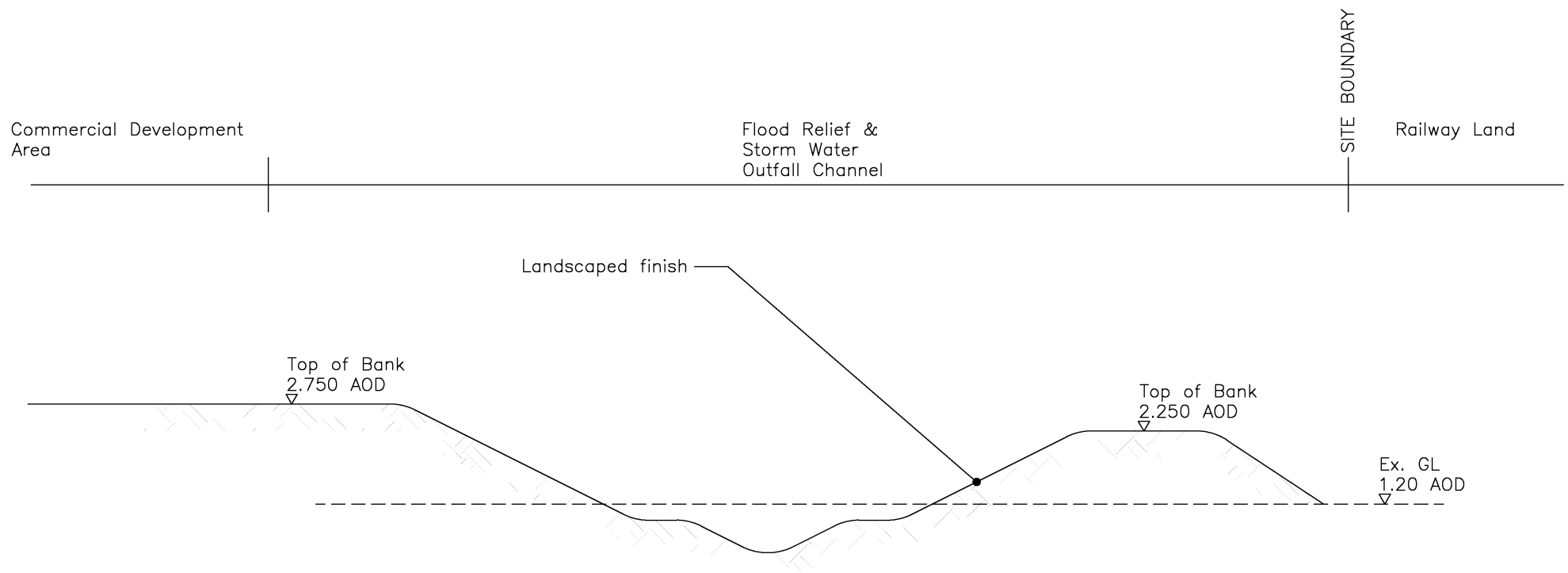
K:V

Leve s 2.50m Total Area 50,374m ²	Leve s 1.70m Total Area 44,030m ²
Leve s 2.40m Total Area 49,366m ²	Leve s 1.60m Total Area 43,054m ²
Leve s 2.30m Total Area 48,553m ²	Leve s 1.50m Total Area 41,573m ²
Leve s 2.20m Total Area 48,079m ²	Leve s 1.40m Total Area 39,296m ²
Leve s 2.10m Total Area 47,627m ²	Leve s 1.30m Total Area 36,397m ²
Leve s 2.00m Total Area 46,844m ²	Leve s 1.20m Total Area 31,104m ²
Leve s 1.90m Total Area 45,677m ²	Leve s 1.10m Total Area 27,292m ²
Leve s 1.80m Total Area 44,855m ²	Leve s 1.00m Total Area 26,311m ²
	Leve s 0.90m Total Area 21,200m ²

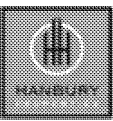
PLEASE NOTE: TOTAL AREA 97,288m²

REV. No.	DATE	DESCRIPTION	INITIALS
001			
Project Phase 2 Old and Farm, Bognor Regis			
Title Raised Levels Plan		Scale 1:500	Date 15/01/15
		Drawn MJS	Checked 5/30/01





TYPICAL SECTION THROUGH
FLOOD CHANNEL

REV. No.	DATE	DESCRIPTION	INITIALS
Client		MJA CONSULTING CIVIL AND STRUCTURAL ENGINEERS 58-62 Oak Street, Abingdon Oxon, OX14 5BZ Tel: 01235 555173 Fax: 01235 523226 	
Project	Oldlands Farm Phase 2 Development		
Title	Flood Relief Channel Typical Detail		Rev
Scale	NTS	Date	May '15
Checked		Drawn	AMc
		Drawing No.	5130:FC1



Appendix E

Runoff Calculations

MJA Consulting		Page 1
58-62 Ock Street Abingdon Oxon OX14 5BZ	Oldlands Farm Ph2	
Date 18/05/2015 16:00 File	Designed by mcshane Checked by	
Micro Drainage Source Control 2015.1		

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.400
Area (ha)	6.000	Urban	0.000
SAAR (mm)	726	Region Number	Region 7

Results 1/s

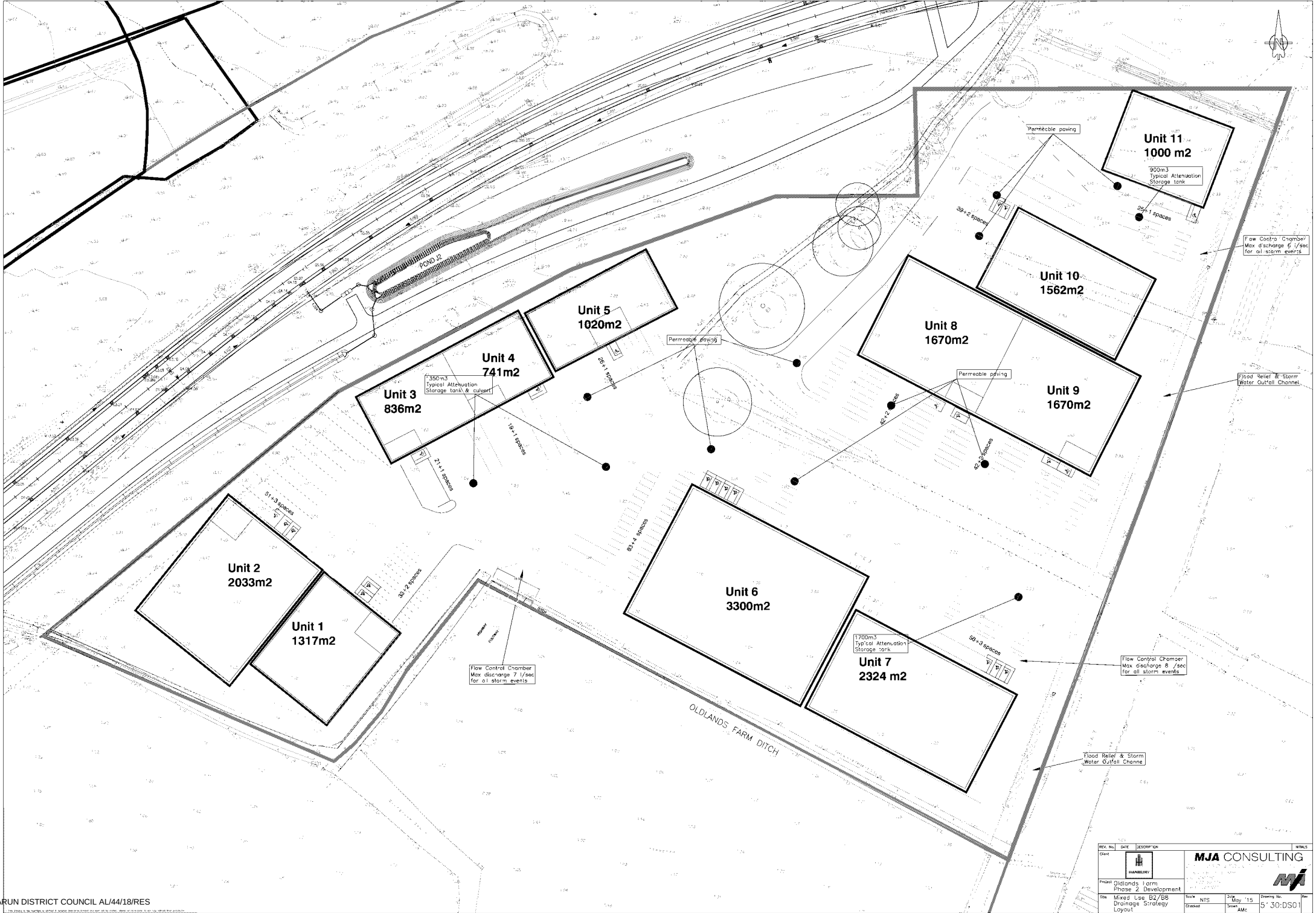
QBAR Rural	21.3
QBAR Urban	21.3
Q1 year	18.1
Q1 year	18.1
Q30 years	48.3
Q100 years	68.0

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Appendix F

Drainage Strategy



REV. No.	DATE	DESCRIPTION	INITIALS
1			

Client	HANBURY	MJA CONSULTING
Project	Oldlands Farm Phase 2 Development	
Site	Mixed Use B2/B8 Drainage Strategy Layout	
Scale	NTS	Site May '15
Drawn	AMC	5'30-DS01

MJA CONSULTING

Civil & Structural Engineers

Monarch House • Abingdon Science Park
Barton Lane • Abingdon • Oxon • OX14 3NB
• www.mjaconsulting.co.uk

APPENDIX 3 GREENFIELD RUNOFF CALCULATIONS

Ramboll UK Ltd		Page 1
240 Blackfriars Road London SE1 8NW		
Date 20/03/2018 09:07 File	Designed by cleig Checked by	
Micro Drainage		Source Control 2017.1
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 100 Soil 0.400 Area (ha) 0.749 Urban 0.000 SAAR (mm) 741 Region Number Region 7 Results 1/s QBAR Rural 2.7 QBAR Urban 2.7 Q100 years 8.7 Q1 year 2.3 Q30 years 6.2 Q100 years 8.7		
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Ramboll UK Ltd		Page 1
240 Blackfriars Road London SE1 8NW		
Date 20/03/2018 09:09 File	Designed by cleig Checked by	
Micro Drainage		Source Control 2017.1
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 100 Soil 0.400 Area (ha) 0.650 Urban 0.000 SAAR (mm) 741 Region Number Region 7 Results 1/s QBAR Rural 2.4 QBAR Urban 2.4 Q100 years 7.5 Q1 year 2.0 Q30 years 5.4 Q100 years 7.5		
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Ramboll UK Ltd		Page 1
240 Blackfriars Road London SE1 8NW		
Date 20/03/2018 09:12 File	Designed by cleig Checked by	
Micro Drainage		Source Control 2017.1
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 100 Soil 0.400 Area (ha) 2.070 Urban 0.000 SAAR (mm) 741 Region Number Region 7 Results l/s QBAR Rural 7.5 QBAR Urban 7.5 Q100 years 24.0 Q1 year 6.4 Q30 years 17.1 Q100 years 24.0		
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Ramboll UK Ltd		Page 1
240 Blackfriars Road London SE1 8NW		
Date 20/03/2018 09:14 File	Designed by cleig Checked by	
Micro Drainage		Source Control 2017.1
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 100 Soil 0.400 Area (ha) 0.451 Urban 0.000 SAAR (mm) 741 Region Number Region 7 Results 1/s QBAR Rural 1.6 QBAR Urban 1.6 Q100 years 5.2 Q1 year 1.4 Q30 years 3.7 Q100 years 5.2		
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Ramboll UK Ltd		Page 1
240 Blackfriars Road London SE1 8NW		
Date 22/03/2018 10:55 File	Designed by cleig Checked by	
Micro Drainage		Source Control 2017.1
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 100 Soil 0.400 Area (ha) 0.450 Urban 0.000 SAAR (mm) 741 Region Number Region 7 Results 1/s QBAR Rural 1.6 QBAR Urban 1.6 Q100 years 5.2 Q1 year 1.4 Q30 years 3.7 Q100 years 5.2		
©1982-2017 XP Solutions		

Ramboll UK Ltd		Page 1												
240 Blackfriars Road London SE1 8NW														
Date 14/08/2018 09:00 File	Designed by RHEGE Checked by													
Micro Drainage		Source Control 2017.1												
<u>ICP SUDS Mean Annual Flood</u> Input <table> <tr> <td>Return Period (years)</td> <td>100</td> <td>Soil</td> <td>0.400</td> </tr> <tr> <td>Area (ha)</td> <td>0.484</td> <td>Urban</td> <td>0.000</td> </tr> <tr> <td>SAAR (mm)</td> <td>741</td> <td>Region Number</td> <td>Region 7</td> </tr> </table> Results 1/s QBAR Rural 1.8 QBAR Urban 1.8 Q100 years 5.6 Q1 year 1.5 Q30 years 4.0 Q100 years 5.6			Return Period (years)	100	Soil	0.400	Area (ha)	0.484	Urban	0.000	SAAR (mm)	741	Region Number	Region 7
Return Period (years)	100	Soil	0.400											
Area (ha)	0.484	Urban	0.000											
SAAR (mm)	741	Region Number	Region 7											
©1982-2017 XP Solutions														

Ramboll UK Ltd		Page 1												
240 Blackfriars Road London SE1 8NW														
Date 14/08/2018 16:16 File	Designed by RHEGE Checked by													
Micro Drainage		Source Control 2017.1												
<u>ICP SUDS Mean Annual Flood</u> Input <table> <tr> <td>Return Period (years)</td> <td>100</td> <td>Soil</td> <td>0.400</td> </tr> <tr> <td>Area (ha)</td> <td>0.119</td> <td>Urban</td> <td>0.000</td> </tr> <tr> <td>SAAR (mm)</td> <td>741</td> <td>Region Number</td> <td>Region 7</td> </tr> </table> Results 1/s QBAR Rural 0.4 QBAR Urban 0.4 Q100 years 1.4 Q1 year 0.4 Q30 years 1.0 Q100 years 1.4			Return Period (years)	100	Soil	0.400	Area (ha)	0.119	Urban	0.000	SAAR (mm)	741	Region Number	Region 7
Return Period (years)	100	Soil	0.400											
Area (ha)	0.119	Urban	0.000											
SAAR (mm)	741	Region Number	Region 7											
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