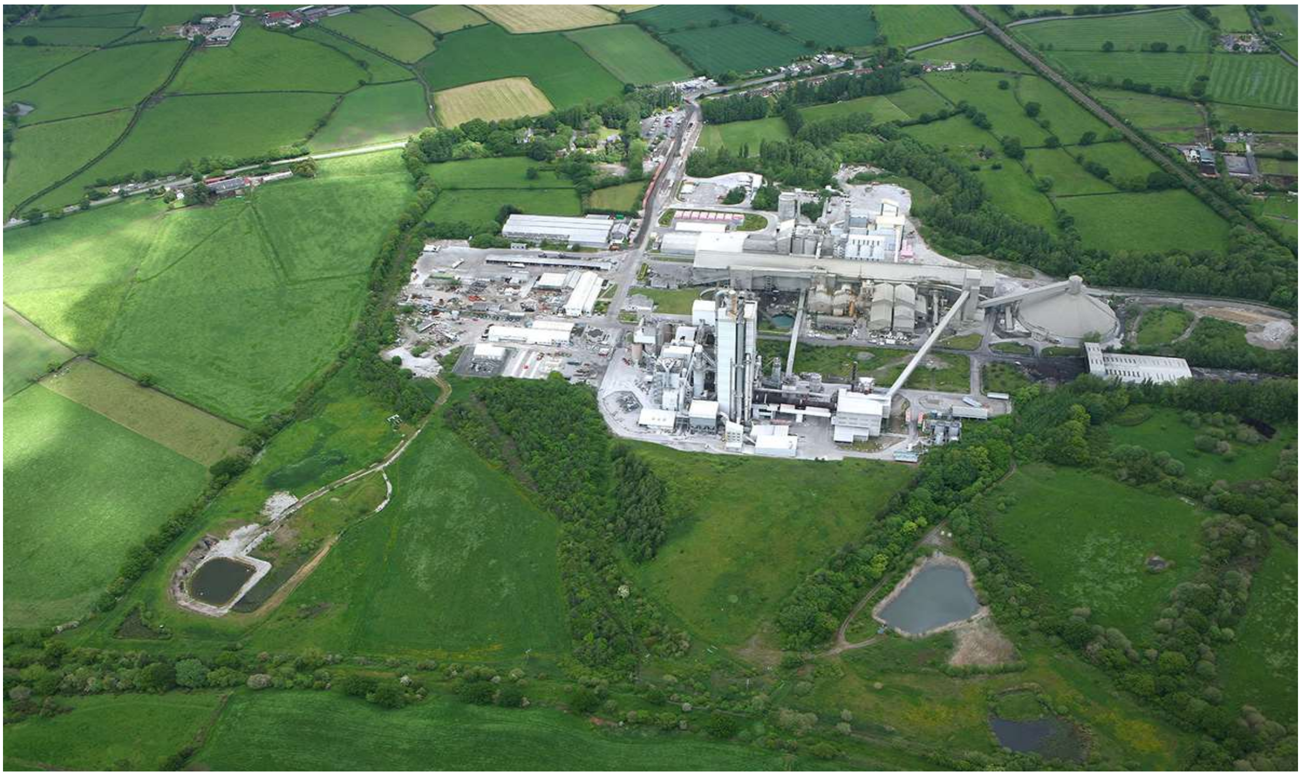
HEIDELBERG MATERIALS

Padeswood Carbon Capture Plant – FEED Phase

Site Drainage Technical Note

Document no. Rev B: 215000-00190-000-CI-TEN-00001



24 May 2024

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Rev	Description	Originator	Reviewer	Worley Approver	Revision Date
Rev A	Issued for IDC	A. Dunn	G. Kubacki	G. Kubacki	20 February 2024
Rev B	Issued for Review	Alexander Dunn (digitally signed) A. Dunn	(digitally signed) S. Siong	Andy George (digitally signed) A. George	24 May 2024

Revision History

Rev	Status	Section	Description of Change
A	IDC	All	Issued for Inter Discipline Check
B	IFR	All	Soakaway description amended and Microdrainage calcs added
B	IFR	All	Document updated to align with Drainage Philosophy, 215000-00190-000-PR-PHL-00004_Rev 0.
B	IFR	All	Document updated to include site drainage to Car Park area.
B	IFR	All	Document updated to align with Block Plan, 215000-00190-000-PI-PLN-00002_Rev D.

Holds

No	Section	Description	Input From	Planned Date

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1. Project Introduction

Heidelberg Materials (HM) has become a partner in the HyNet Northwest consortium, which aims to create the world's first low-carbon industrial cluster in the region of Northwest England. The proposed hydrogen and carbon capture and storage (CCS) industrial cluster will play a critical role in the UK's transition to net zero greenhouse gas emissions and the fight against climate change. As part of 'Making Net Zero Possible', Asset Improvement programme options to decarbonise COMPANY cement plant are being considered. Carbon Capture (CC) is one of the key technologies being developed as a route to decarbonisation. COMPANY cement plant located at Padeswood which currently produces about 110 ton per hour (tph) of clinker, has been selected by DESNZ as a track 1 phase 2 carbon capture project. The PROJECT will enable carbon capture from the existing cement kiln 4 and from a new Combined Heat and Power (CHP) plant designed to provide the heat and electricity required to operate the Carbon Capture and Compression (CCC) plant. Captured CO_2 will be transported by pipeline to the HyNet CO_2 main pipeline at Northop Hall AGI for onward transportation to storage offshore in depleted gas fields operated by Eni UK. The PROJECT will enable the production of net zero cement for use in the UK construction industry.

Ahead of this CONTRACTOR has been engaged by COMPANY to undertake a pre-FEED study for the carbon capture development. The pre-FEED study was completed in March 2023. Based on the pre-FEED study, an amine-based post combustion CO_2 capture technology has been selected as a suitable technology for capturing 95% of the CO_2 emissions from cement plant.

A consortium between Mitsubishi Heavy Industries (MHI) and Worley as the selected FEED contractor for the Heidelberg Material (HM) Padeswood CCS Project shall deliver an overall FEED package utilizing MHI's Carbon capture technology.

The capture plant can be considered a green field development, but some elements of the integration with the cement plant will be considered brown field. Green field elements will be developed by MHI and Worley, while brownfield elements will be developed by both HM and MHI/Worley.

2. Document Purpose

This technical note covers the storm water drainage system concept for the proposed Heidelberg Materials Padeswood Carbon Capture Plant site, including the proposed car park located towards the North of the plant.

This document shall be read in conjunction with the Drainage Philosophy, 215000-00190-000-PR-PHL-00004.

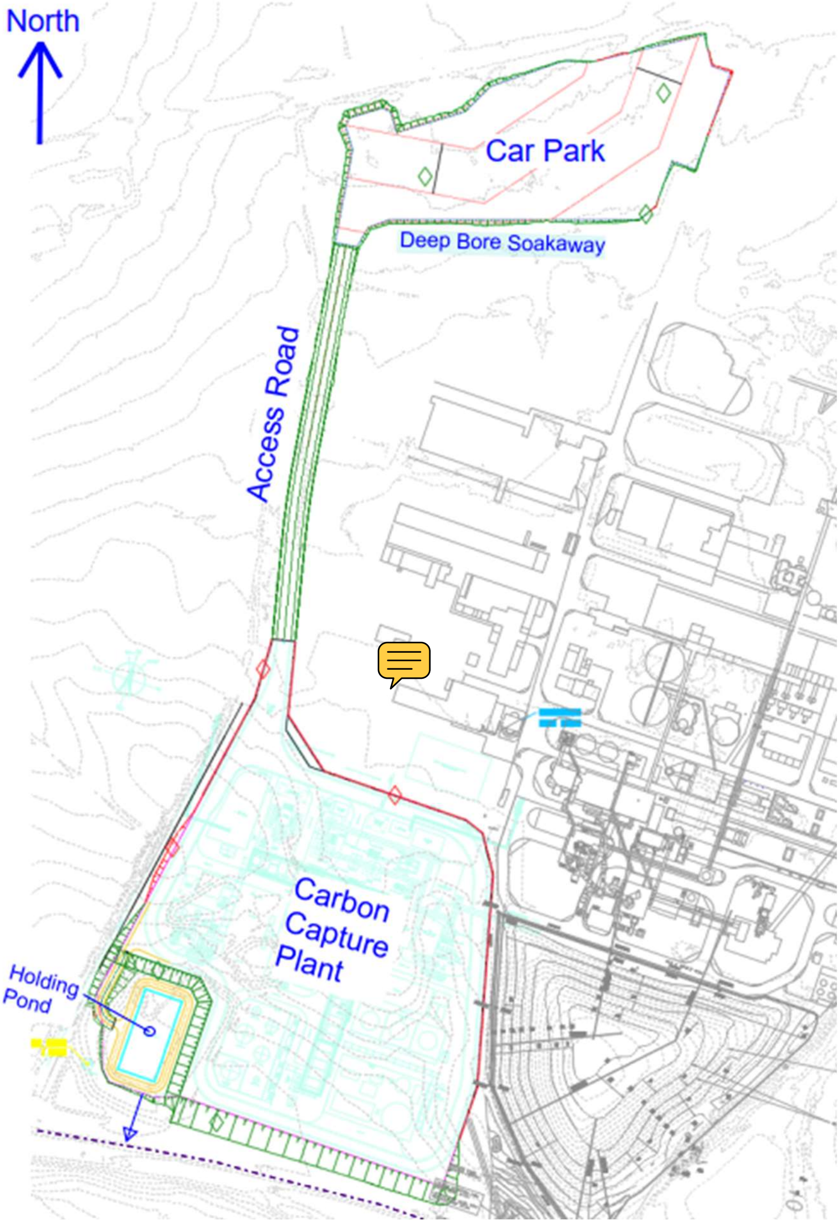


Figure 2-1: The proposed Heidelberg Materials Padeswood Carbon Capture Plant site, including the proposed car park located towards the North of the plant.

3. Abbreviations, Definitions & References

3.1 Abbreviations

Acronym	Definition
aMSL	Above Mean Sea Level
BGS	British Geological Survey
BS	British Standard
BSI	British Standards Institution
CSA	Civil, Structural & Architectural
CBR	California Bearing Ratio
DMRB	Design Manual for Roads and Bridges
EN	Euro Norm (i.e. European Standard)
FFL	Finished Floor Level
GL	Grade Level
HDPE	High Density Polyethylene
HPP	High Point Finish Paving
ISO	International Organization for Standards
LPP	Low Point Finish Paving
LLFA	Local Lead Flood Authority
MCHW	Manual of Contract Documents for Highway Works
P&ID	Piping and Instrumentation Diagram
PD	Published Documents (BSI)
SuDS	Sustainable Drainage Systems
TOC	Top of Concrete level
UK	United Kingdom

Table 1 - List of Abbreviations

3.2 Definitions

Term	Definition
COMPANY	Heidelberg Materials
CONTRACTOR	Consortium of Worley Europe Limited and Mitsubishi Heavy Industries Limited (MHI)
LICENSOR	MHI entering a Licensing Agreement with the CLIENT
PROJECT	Padeswood Carbon Capture Plant
SUPPLIER/VENDOR	Company / organisation suppling equipment, materials or services.
SUB-SUPPLIER	The organisation selected by the SUPPLIER/VENDOR to supply the part of equipment and services.
WORK	Shall mean all and any of the WORKs and / or services and / or materials required to be provided under the Contract with CLIENT.
shall and must	Indicates mandatory requirements
Should	Indicates that a provision is not mandatory but recommended as good practice.
May	Used to indicate that optional action is available

Table 2 - List of Definitions

3.3 Order of Precedence

The requirements of the standards and publications referenced in this document shall be applied in the following order of precedence:

1. Government Acts, Regulations, and Statutory Requirements
2. Project Drawings
3. This Document
4. Referenced Specifications and Publications
5. Referenced Codes & Standards

Any conflict between the minimum requirements of the above documents shall be brought to the CONTRACTOR's attention for resolution.

An alternate specification or design may only be used when it satisfies the government and statutory requirements and offers a benefit to the project. All such alternatives shall require approval from CONTRACTOR.

3.4 References

3.4.1 Codes and Standards

Document Number	Title
BS EN 752:2017	Drain and sewer systems outside buildings - Sewer system management - CORR: October 31, 2019; CORR: February 28, 2022

Table 3 - List of referenced Codes and Standards.

3.4.2 Project Documents

Document Number	Title
215000-00190-000-CI-CRT-00001	CSA Design Criteria
215000-00190-000-CI-DDR-00001	Road and Drainage Layout – Sheet 1 of 3
215000-00190-000-CI-DDR-00002	Road and Drainage Layout – Sheet 2 of 3
215000-00190-000-CI-DDR-00003	Road and Drainage Layout – Sheet 3 of 3
215000-00190-000-CI-DDR-00004	Underground Services Access Road and Car Park Road and Drainage – Sheet 1 of 3
215000-00190-000-CI-DDR-00005	Underground Services Access Road and Car Park Road and Drainage – Sheet 2 of 3
215000-00190-000-CI-DDR-00006	Underground Services Access Road and Car Park Road and Drainage – Sheet 2 of 6
215000-00190-000-PI-PLN-00002	Block Plan
215000-00190-000-PR-PHL-00004	Drainage Philosophy
215000-00190-740-PR-PID-00050	Piping And Instrumentation Diagram Interceptor and Balancing Pond

Table 4 - List of referenced Project Documents.

4. Drainage Philosophy

Refer 215000-00190-000-PR-PHL-00004 for the project drainage philosophy.

4.1 Not Potentially Contaminated Areas

The storm water drainage system shall collect surface water run-off from the following not normally contaminated areas:-

- Carbon Capture Plant perimeter roads – via gullies along the outer kerb and linear drains or filter drains along the inner edge.
- Carbon Capture Plant inner roads – via linear drains or filter drains along both edges.
- Carbon Capture Plant paved areas – paving laid with falls to the outer edges and linear drains installed along these edges.
- Proposed car park (North of Carbon Capture Plant) – surface laid with falls into the grid of gullies and linear drains connected to deep bore soakaways.
- Proposed access road (from proposed car park to Carbon Capture Plant) – via gullies along both outer kerbs with direct discharge into the ditch running along the western edge of the road.

4.2 Potentially Contaminated Areas

Potentially contaminated areas are categorized as follows:-

- Potentially solvent contaminated areas
- Potentially oil contaminated areas
- Potentially chemical contaminated areas

Refer 215000-00190-000-PR-PHL-00004 for the project drainage philosophy.

All potentially contaminated areas shall be kerbed or bunded and connected to the storm water drainage system through a valved outlet. The valve shall be normally closed. Collected water will be released to the storm water drainage system after testing and confirmation that it is not contaminated. Collected water will be removed by truck if it is contaminated.

4.2.1 Transformers

Oil filled transformers to be installed above stone filled pit and connected to a sump sized to store 110% of the largest transformer oil contents volume. Sump is connected to the storm water drainage system through a valved outlet. The valve shall be normally closed. Collected water will be released to the storm water drainage system after testing and confirmation that it is not contaminated. Collected water will be removed by truck if it is contaminated.

4.2.2 Tanker Loading Bays

Tanker loading bays shall be connected to the stormwater drain system through a local sump with a valved outlet. The valve shall be normally opened and closed during tanker loading and unloading operations to contain wash down of accidental spills within the loading bay area for removal by truck. The loading bay area shall be cleaned prior to opening the valve.

Loading bay drainage and containment philosophy to be developed further during detailed engineering.

4.3 Firewater Run-Off Collection

Firewater run-off is collected by the storm water drainage system.

5. Storm Water Drainage System

The storm water drainage system will be designed for flow rates based on the 1 in 10-year return period. Network simulation is undertaken for 1 in 30 year and 1 in 100-year events. Beyond design basis storms may result in standing water or sheet flow across surfaces. As the outfall will be at the low point of the site these flows are considered to enter the storm drainage system after peak flow.

5.1 Rainfall

In respect of Civil engineering requirements, an appropriate storm hydrograph shall be used within the design software package.

Urban creep allowance factor shall be set at 1.0 as this is considered appropriate for industrial development.

For pipe sizing a run off coefficient of 0.95 has been assumed across the site.

Climate change allowance factor is set at +20% based on BS EN 752. An additional 20% allowance is considered for FEED design, to provide some contingency for design development and accommodate specific requirements of the Local Lead Flood Authority (LLFA) during the planning process.

To estimate stormwater runoff volumes, it has been assumed that 80% of the carbon capture plant and car park will be considered impermeable.

5.2 Deep Bore Soakaway – Car Park

The surface water run-off for the proposed car park (north of Carbon Capture Plant) is collected via a storm water drainage system and discharged to deep bore soakaways.

Due to the ground conditions the soakaways used shall be deep bore soakaways. It is proposed to have 3 separate soakaways for the car park with between 5 and 16 boreholes in total. The number of boreholes will vary depending on the actual data received from site investigation. Currently the number of boreholes proposed is based on geological information and BGS borehole logs.

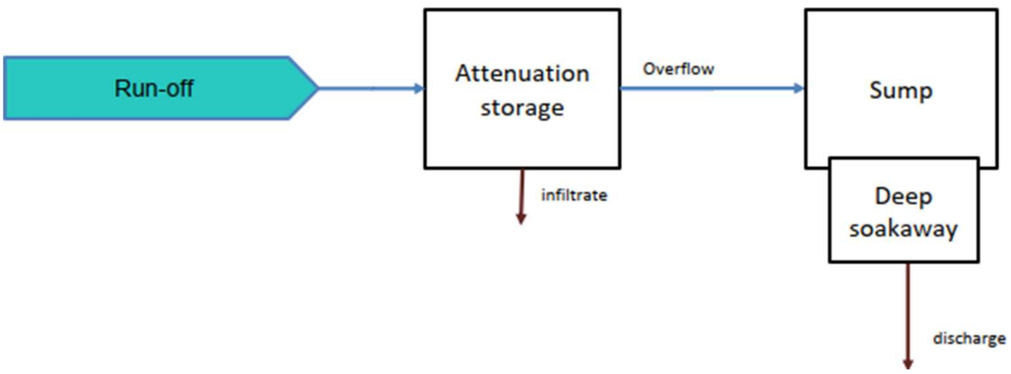


Figure 2-1: Deep bore soakaway flow diagram.

Geocell Attenuation Storage

- Geocell Type: Aquacell Core-R (or equivalent approved)
- Length: 160m
- Width: 4m
- Depth: 1m

Deep Bore Soakaway

- No. of required: between 5no. to 16no.
- Diameter: 300mm
- Depth: 18m
- Spacing: 15m

5.2.1 Interceptors – Car Park

A Class-1 full retention single chamber interceptor (separator) is installed upstream of the inlet to each deep bore soakaway (i.e 3no. in total). The following interceptor model (or equivalent approved) will meet the storm water drainage system for the car park, based on drainage layout, 215000-00190-000-CI-DDR-00004:-

SPEL Puraceptor Class-1 Full Retention Single Chamber Separator Model: P125 1C/SC

- No. of required: 1no.
- Series: 400
- Overall length: 8.850m
- Overall diameter: 2.700m
- In / Out pipe diameter: 450mm
- Equipped with Automatic Closure Device (ACD)

SPEL Puraceptor Class-1 Full Retention Single Chamber Separator Model: P200 1C/SC

- No. of required: 2no.
- Series: 400
- Overall length: 13.710
- Overall diameter: 2.700m
- In / Out pipe diameter: 600mm
- Equipped with Automatic Closure Device (ACD)

5.3 Holding Pond – Carbon Capture Plant

The storm water drainage system within the Carbon Capture Plant is routed towards the holding pond for attenuation and final inspection, prior to discharge the pre-development run-off rate, to the local watercourse located to the South of the site. The holding pond outlet is equipped with a penstock shut-off valve, which is normally closed. Refer Appendix-B1 for Carbon Capture Plant storm water drainage system MicroDrainage calculations.

The discharge outflow from the holding pond shall be limited to the greenfield runoff rate calculated in accordance with the procedures described at www.uksuds.com, and using the greenfield runoff tool. The outflow is limited to Q_{BAR} and this is 32 l/s for the proposed Carbon Capture Plant, based on plot plan 215000-00190-00-PI-PLN-00002-Rev D.

The required retention volume has been calculated as approximately 3520 m^3 for a 100-year event. The holding pond has a capacity of 3700 m^3 to allow for slight increases in impermeable areas during the design process. Refer Appendix-A for summary of the surface water storage calculations.

5.3.1 Interceptor – Carbon Capture Plant

A Class-1 full retention two chamber interceptor (separator) is installed upstream of the inlet to the holding pond. The following interceptor model (or equivalent approved) will meet the storm water drainage system for the Carbon Capture Plant, based on plot plan 215000-00190-00-PI-PLN-00002-Rev D:-

SPEL Puraceptor Class-1 Full Retention Two Chamber Separator Model: P700 2C/SC

- No. of required: 1no.
- Series: 600
- Overall length: 22.270m
- Overall diameter: 4.150m
- In / Out pipe diameter: 900mm
- Equipped with Automatic Closure Device (ACD)

5.3.2 Discharge Flow Control – Carbon Capture Plant

The holding pond outlet is equipped with a vortex flow control device (i.e Hydro-Brake by Hydro International, or equivalent). A flow measurement station shall be installed downstream of the holding pond outlet, refer P&ID 215000-00190-740-PR-PID-00050.

Appendix A. Surface Water Storage Calculations

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Alexander Dunn
Site name:	Padeswood CCS
Site location:	HMI Padeswood

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	53.15026° N
Longitude:	3.06552° W
Reference:	2274586457
Date:	May 24 2024 09:32

Site characteristics

Total site area (ha):	5.6
Significant public open space (ha):	0
Area positively drained (ha):	5.6
Impermeable area (ha):	4.5
Percentage of drained area that is impermeable (%):	80
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	5.6
Net impermable area for storage volume design (ha):	4.66
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
SPR:	0.47	0.47

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	61
Rainfall 100 yrs 12 hrs:	--	73.73
FEH / FSR conversion factor:	1.01	1.01
SAAR (mm):	802	802
M5-60 Rainfall Depth (mm):	17	17
'r' Ratio M5-60/M5-2 day:	0.3	0.3
Hydological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 10 year:	1.42	1.42
Growth curve factor 30 year:	1.78	1.78

Design criteria

Climate change allowance factor:	1.4	Growth curve factor 100 years:	2.18	2.18
Urban creep allowance factor:	1.0	Q_{BAR} for total site area (l/s):	31.7	31.7
Volume control approach	Flow control to max of 2 l/s/ha or Qbar	Q_{BAR} for net site area (l/s):	31.7	31.7
Interception rainfall depth (mm):	5			
Minimum flow rate (l/s):	2			

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	27.9	27.9
1 in 30 years (l/s):	31.7	31.7
1 in 100 year (l/s):	31.7	31.7

Estimated storage volumes

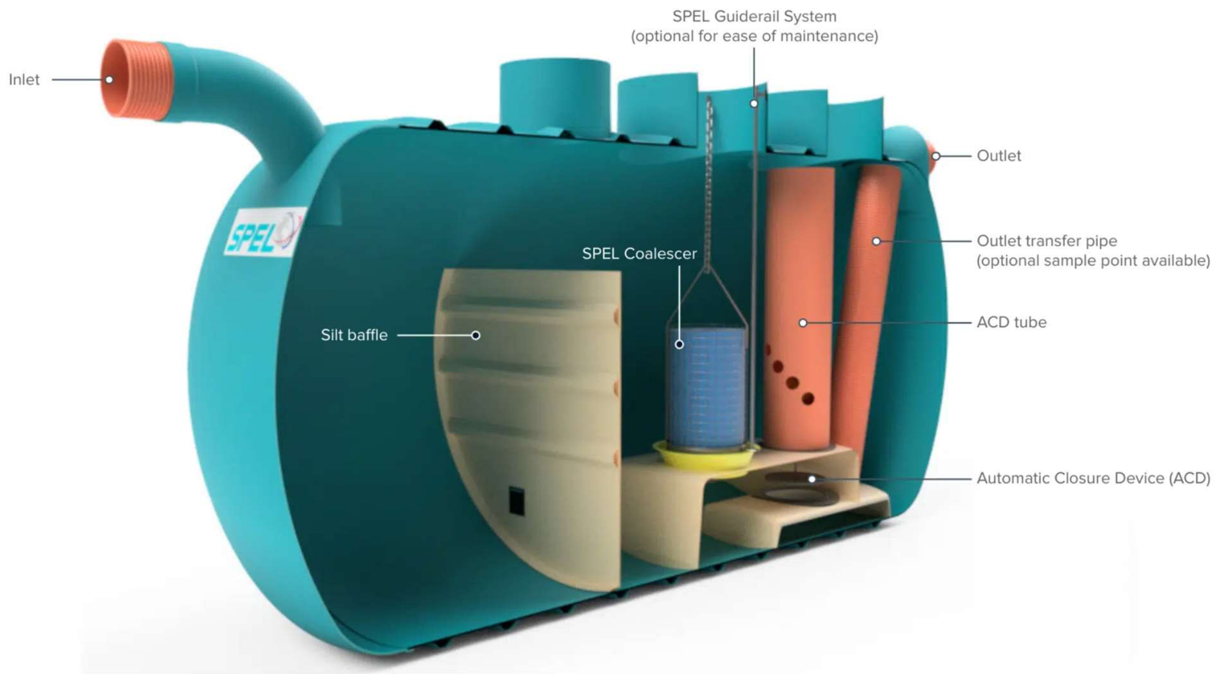
	Default	Edited
Attenuation storage 1/100 years (m³):	3520	3520
Long term storage 1/100 years (m³):	0	0
Total storage 1/100 years (m³):	3520	3520

This report was produced using the storage estimation tool developed by HRWallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at http://uksuds.com/terms-and-conditions.htm. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

Appendix B. Interceptor Sizing Charts

B.1 SPEL Puraceptor Class 1 Full Retention Separators

Operation



Class 1 Single Chamber Separator

Operation:

Flow enters the chamber from the inlet pipe, and the separation process begins as the flow moves towards the coalescer. Oil rises to the surface, silt settles out and the cleanest water then enters the coalescer which polishes the flow to a higher level prior to discharge.

The Puraceptor benefits from the unique SPEL coalescer which is the heart of all SPEL separation systems. The foam insert is located in a stainless steel basket and delivers high quality water, long life, and ease of maintenance.

The other key component is the fail safe Automatic Closure Device (ACD) which will shut the system down in the event of a catastrophic oil spill.

Class 1 Two Chamber Separator

Operation:

The SPEL Two Chamber Separator is the result of long development with National Grid and has resulted in a system that can substantially reduce maintenance costs.

The Two Chamber unit has all the benefits of the Class 1 Puraceptor but the addition of a strategically located full height baffle wall protects the unique coalescer from the bulk of the silt load.

The coalescer is mounted in the second chamber (clean zone) where it is more effective as well as being protected. The result is that it will not clog as quickly and this can equate to longer periods between maintenance.

B.2 Single Chamber Sizing Chart

This is the SPEL Puraceptor single chamber model sizing chart. For the difference between single and two chamber models see the explanation below under operation.

Model	Series	Nominal Size (NS)	Catchment Area (m^2)	Oil Storage (L)	Silt Capacity (L)	Overall Length* (mm)	Overall Diameter (mm)	Inlet Invert (mm)	Base to Inlet (mm)	Base to Outlet (mm)	Optimum In/Out Pipe Diameter** (mm)	Number of Access Shafts(dia. mm)				
		Flow (l/s)				L		A	B	C		450	600	750	900	1200
P004 1C/SC	200	4	222	40	400	1,720	1,225	630	1,110	1,050	160	–	–	1	–	–
P006 1C/SC	200	6	333	60	600	2,310	1,225	630	1,110	1,050	160	–	–	1	–	–
P010 1C/SC	200	10	556	100	1,000	3,410	1,225	630	1,110	1,050	160	–	–	1	–	–
P015 1C/SC	300	15	833	150	1,500	3,200	1,875	350	1,800	1,740	225	1	–	1	–	–
P020 1C/SC	300	20	1,111	200	2,000	3,540	1,875	350	1,800	1,740	225	–	1	1	–	–
FP 1C/SC	300	20	1,111	200	2,000	4,290	1,875	350	1,800	1,740	225	–		1	–	–
P030 1C/SC	300	30	1,667	300	3,000	4,420	1,875	390	1,760	1,700	300	–	1	–	1	–
P040 1C/SC	300	40	2,222	400	4,000	5,760	1,875	390	1,760	1,700	300	–	1	–	1	–
P050 1C/SC	300	50	2,778	500	5,000	7,060	1,875	390	1,760	1,700	300	–	1	–	1	–
P065 1C/SC	400	65	3,611	650	6,500	4,860	2,700	425	2,625	2,525	300	–	1	–	2	–
P080 1C/SC	400	80	4,444	800	8,000	5,700	2,700	425	2,625	2,525	300	–	1	–	2	–
P100 1C/SC	400	100	5,555	1,000	10,000	7,400	2,700	475	2,575	2,475	450	–	1	–	2	–

Model	Series	Nominal Size (NS)	Catchment Area (m^2)	Oil Storage (L)	Silt Capacity (L)	Overall Length* (mm)	Overall Diameter (mm)	Inlet Invert (mm)	Base to Inlet (mm)	Base to Outlet (mm)	Optimum In/Out Pipe Diameter** (mm)	Number of Access Shafts(dia. mm)				
P125 1C/SC	400	125	6,944	1,250	12,500	8,580	2,700	475	2,575	2,475	450	–	–	1	2	–
P150 1C/SC	400	150	8,333	1,500	15,000	10,180	2,700	475	2,575	2,475	450	–	–	1	2	–
P165 1C/SC	400	165	9,166	1,650	16,500	11,200	2,700	500	2,550	2,450	450	–	2	1	1	–
P200 1C/SC	400	200	11,110	2,000	20,000	13,710	2,700	660	2,390	2,290	600	–	2	1	1	–
P250 1C/SC	400	250	13,888	2,500	25,000	16,750	2,700	660	2,390	2,290	600	–	2	1	2	–
P280 1C/SC	400	280	15,555	2,800	28,000	18,800	2,700	660	2,390	2,290	600	–	1	2	2	–
P300 1C/SC	500	300	16,665	3,000	30,000	12,410	3,650	805	3,070	2,970	750	–	1	2	2	–
P400 1C/SC	500	400	22,220	4,000	40,000	15,760	3,650	805	3,070	2,970	750	–	2	2	2	–
P500 1C/SC	500	500	27,775	5,000	50,000	20,530	3,650	955	2,920	2,820	900	–	2	2	1	1
P500 1C/SC	600	500	27,775	5,000	50,000	16,040	4,150	925	3,250	3,150	900	–	2	2	1	1
P600 1C/SC	600	600	33,330	6,000	60,000	19,080	4,150	925	3,250	3,150	900	–	2	2	–	2
P700 1C/SC	600	700	38,888	7,000	70,000	21,460	4,150	925	3,250	3,150	900	–	3	2	3	–
P800 1C/SC	600	800	44,440	8,000	80,000	23,020	4,150	925	3,250	3,150	900	–	3	2	2	1

**Overall length subject to inlet/outlet and orientation.*

***SPEL Separators are designed for a maximum flow (NS/NSB) but can be fitted with larger than the recommended maximum connection size IN/OUT or with the addition of adapters providing the maximum flow (NS/NSB) cannot be exceeded or any increase in the operating level in the SPEL Separator to cause the captured pollutants to escape into the vent connections or through access shaft connections. Any overriding of the above criteria could jeopardise performance to the European Standard BS EN 858-1.*

***Note: Model FP1C/SC is a special Forecourt separator with 7600 litre spillage holding capacity**. Click here for more information on Forecourt Separators.*

B.3 Two Chamber Sizing Chart

Model	Series	Nominal Size (NS)	Catchment Area (m^2)	Oil Storage (L)	Silt Capacity (L)	Overall Length* (mm)	Overall Diameter (mm)	Inlet Invert (mm)	Base to Inlet (mm)	Base to Outlet (mm)	Optimum In/Out Pipe Diameter** (mm)	Number of Access Shafts(dia. mm)				
		Flow (l/s)				L		A	B	C		450	600	750	900	1200
P006 2C/SC	200	6	333	60	600	3,050	1,225	340	1,200	1,140	160	–	1	1	–	–
P010 2C/SC	200	10	556	100	1,000	3,820	1,225	340	1,200	1,140	160	–	1	1	–	–
P015 2C/SC	300	15	833	150	1,500	4,020	1,875	350	1,800	1,740	225	–	–	2	–	–
P020 2C/SC	300	20	1,111	200	2,000	4,020	1,875	350	1,800	1,740	225	–	–	2	–	–
FP 2C/SC***	300	20	1,111	200	2,000	5,500	1,875	350	1,800	1,740	225	–	–	2	–	–
P025 2C/SC	300	25	1,389	250	2,500	4,290	1,875	350	1,800	1,740	225	–	–	2	–	–
P030 2C/SC	300	30	1,667	300	3,000	4,420	1,875	390	1,760	1,700	300	–	1	2	–	–
P035 2C/SC	300	35	1,944	350	3,500	5,070	1,875	390	1,760	1,700	300	–	1	2	–	–
P040 2C/SC	300	40	2,222	400	4,000	5,760	1,875	390	1,760	1,700	300	–	1	2	–	–
P050 2C/SC	300	50	2,778	500	5,000	7,060	1,875	390	1,760	1,700	300	–	1	2	–	–
P065 2C/SC	300	65	3,611	650	6,500	9,180	1,875	390	1,760	1,700	300	1	–	2	–	–
P080 2C/SC	400	80	4,444	800	8,000	5,700	2,700	425	2,625	2,525	300	–	–	1	1	–
P100 2C/SC	400	100	555	1,000	10,000	7,400	2,700	475	2,575	2,475	450	–	–	1	1	–

Model	Series	Nominal Size (NS)	Catchment Area (m^2)	Oil Storage (L)	Silt Capacity (L)	Overall Length* (mm)	Overall Diameter (mm)	Inlet Invert (mm)	Base to Inlet (mm)	Base to Outlet (mm)	Optimum In/Out Pipe Diameter** (mm)	Number of Access Shafts(dia. mm)				
P125 2C/SC	400	125	6,944	1,250	12,500	8,580	2,700	475	2,575	2,475	450	–	–	2	1	–
P150 2C/SC	400	150	8,333	1,500	15,000	10,180	2,700	500	2,550	2,450	450	–	–	2	1	–
P200 2C/SC	400	200	11,110	2,000	20,000	13,710	2,700	660	2,390	2,290	600	–	1	2	1	–
P250 2C/SC	400	250	13,888	2,500	25,000	16,752	2,700	660	2,390	2,290	600	–	2	1	2	–
P300 2C/SC	500	300	16,665	3,000	30,000	12,530	3,650	675	3,200	3,100	600	–	1	2	–	1
P400 2C/SC	500	400	22,220	4,000	40,000	15,980	3,650	675	3,200	3,100	600	–	2	2	2	–
P500 2C/SC	500	500	27,775	5,000	50,000	20,530	3,650	955	2,920	2,820	900	–	2	2	1	1
P500 2C/SC	600	500	27,775	5,000	50,000	16,260	4,150	925	3,250	3,150	900	–	2	1	1	1
P600 2C/SC	600	600	33,330	6,000	60,000	19,080	4,150	925	3,250	3,150	900	–	2	2	3	–
P700 2C/SC	600	700	38,888	7,000	70,000	22,270	4,150	925	3,250	3,150	900	–	3	2	3	–
P800 2C/SC	600	800	44,440	8,000	80,000	23,020	4,150	925	3,250	3,150	900	–	3	2	2	1
P900 2C/SC	600	900	50,000	9,000	90,000	24,658	4,150	925	3,250	3,150	900	–	3	2	1	2

**Overall length subject to inlet/outlet and orientation.*

***SPEL Separators are designed for a maximum flow (NS/NSB) but can be fitted with larger than the recommended maximum connection size IN/OUT or with the addition of adapters providing the maximum flow (NS/NSB) cannot be exceeded or any increase in the operating level in the SPEL Separator to cause the captured pollutants to escape into the vent connections or through access shaft connections. Any overriding of the above criteria could jeopardise performance to the European Standard BS EN 858-1.*

***Note: Model FP2C/SC is a special Forecourt separator with 7600 litre spillage holding capacity**. Click here for more information on Forecourt Separators.*

Appendix C. Car Park Deep Bore Soakaway Technical Note and Calculations

C.1 Soakaway Potential

The potential for a soakaway to take car park run off at Heidelberg Materials has been evaluated.

C.2 Geology & Hydrogeology

The geotechnical site investigation included a mixture of shallow (Window Sample) and deeper (Rotary Cored) boreholes. Only window sample boreholes were undertaken in the vicinity of the car park and proposed soakaways.

The geological information from these indicates superficial deposits of Glacial Till, a varied composition of clays, silts and sand and gravels. Clay and silt predominates in approximately the top 3 m with sand lenses present intermittently at 1.5 to 2 m below ground. A consistent sand and gravel layer appears at around 3 to 3.5 m below ground level in the vicinity of the car park, deeper towards the south of the site.

Borehole records indicate that the Superficial deposits are approximately 18 m thick and underlain by Coal Measures comprising sandstone, siltstone and mudstone. The composition of the Superficial Deposits at depth is variable sands, gravels and sandy clays. Substantial thicknesses of sand and gravel (approximately 5 m) are present.

No piezometers were installed with only water strike information available. No infiltration test data is available for the site.

Water strikes have been recorded in the vicinity of the car park at 2 to 2.5 m below ground level but variable across the investigation at up to 7 m. The deeper ones are associated with the Rotary Cored boreholes which use water flush and therefore are less reliable. A correlation appears to associate water strikes with the intermittent sand lenses. A review of historic boreholes in the surrounding area further support this with water levels recorded at similar elevations or shallower (1.5 m below ground level). This is likely to be perched water and seasonally present.

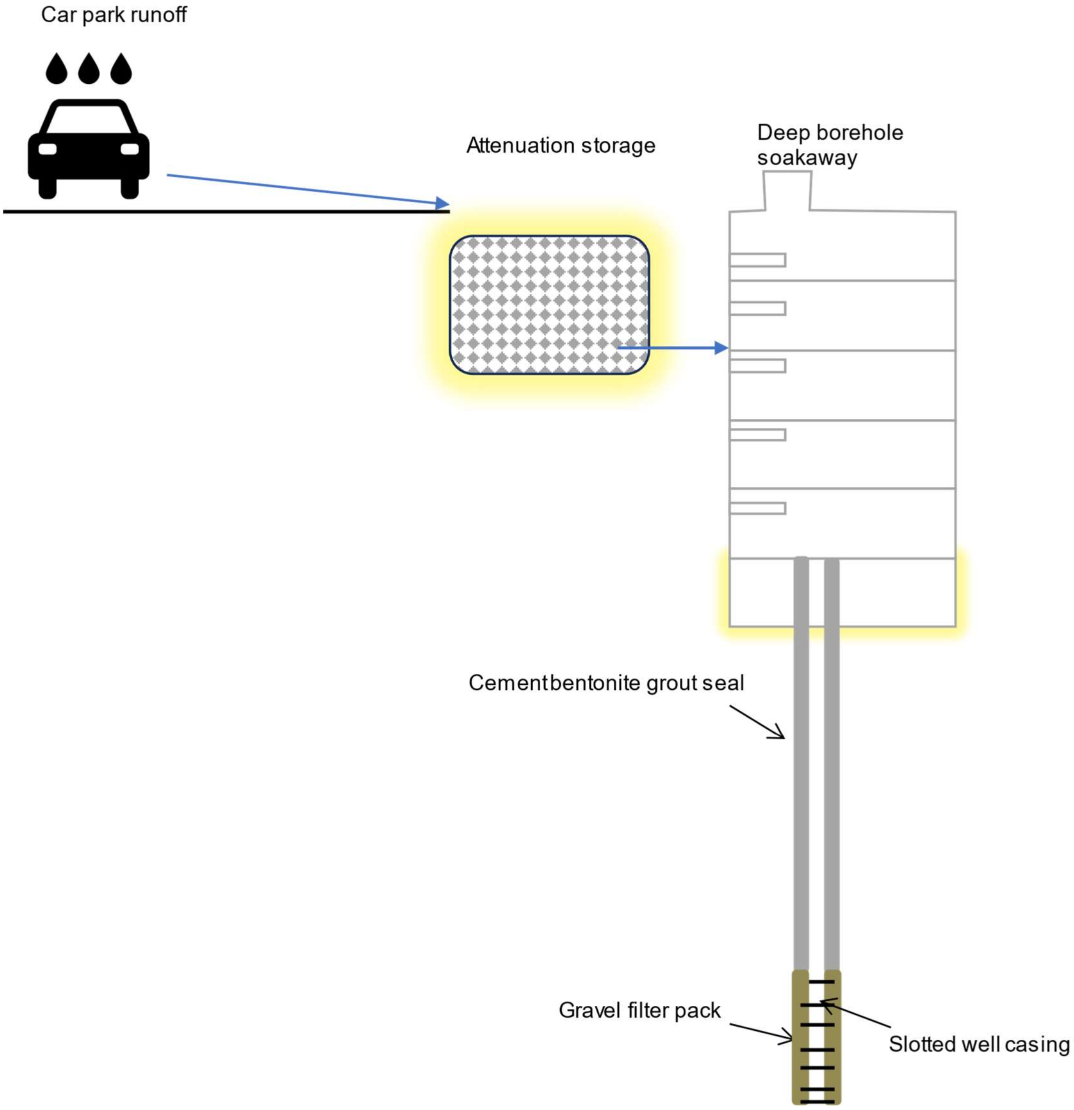
Boreholes of deeper extent (BGS reference SE26SE15/1115/1158) have been reviewed and indicate that the Superficial Deposits are generally dry (with the exception of the shallow sand lenses) with no groundwater encountered or have groundwater at depths of greater than 15 m. On site boreholes appear to support this (water strikes of 18 m below ground level). The infiltration potential should be confirmed through testing.

Glacial Till has an overall low permeability in the order of 10^{-7} m/s; however the site investigation logs show defined sand and gravel layers present under the site which are likely to have a higher permeability in the order of 10^{-3} to 10^{-5} m/s. This would indicate good infiltration potential. This would require confirmation through infiltration tests.

C.3 Soakaway Design Principles

The CIRIA SuDS manual sets out the basic design principles for infiltration devices, one of which is a minimum 1 m to the groundwater table. Based on the observed information and variable ground, a linear infiltration trench of 1 m deep (restricted by the perched water in sand lenses) with overflow to deeper borehole soakaways could offer a Sustainable drainage design. However, volumes of run-off may not be conducive to this approach and therefore a attenuation through geocell storage is proposed with overflow to deep soakaway (refer sketch).

To conform with guidance and standards confirmation of infiltration potential should be undertaken through testing.



Prepared by: J. Assem
Date: 17-May-24
Issue: Issue for Information
Rev-A

Heidelberg Materials

Padeswood Carbon Capture Plant

FEED

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Deep Soakaway Calculations

Key

Item	Description
	Assumptions
	Input

Version History

		Digitally signed by James Assem DN: cn=James Assem, ou=Users, email=JAMES.ASSEM@advisian.com Reason: I am the author of this document Date: 2024.05.24 16:17:21 +01'00'		Digitally signed by Stanley Siong DN: cn=Stanley Siong, ou=Users, email=Stanley.Siong@worley.com Date: 2024.05.24 16:19:19 +01'00'	
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worley	**Introduction** GENERAL	Doc. No. 215000-00190-000-CI-TEN-00001: Appendix C	
		Revision ↓	
Project	Padeswood Carbon Capture Plant		B
Document	Deep Soakaway Calculations		

1	**INTRODUCTION**	
2	A large car park area requires control of rainfall run off to meet UK planning Sustainable urban Drainage Design. Soakaway is the prefered option.	
3	**PURPOSE**	
4	The purpose of this calculation is to estimate the number of deep soakway boreholes required and their provisional design details (depth and diameter).	
5	**BASIS / METHOD**	
6	The basis of the study is literature, geotechnical information and engineering judgement. No infiltration data is available. Anticipated flow rates are 389 l/s (5 year event) and 752 l/s (100 year event). Methods applied are CIRIA C753 SuDs manual for infiltration, coupled with Method 1 - The Soakaway Design Guide and Method 2 - hydrogeological principles	B
7	**CONDITIONS / ASSUMPTIONS / LIMITS OF APPLICABILITY**	
8	Key assumptions are: Permeability of the Glacial Till ranges from 10-3 to 10-5 m/s Soakage rate of the Glacial Till = 200 l/m2/min	
9	**REFERENCE DATA**	
10	As listed per individual calculation sheet.	

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Run-off

Below is a summary of the estimated rainfall runoff from the car park split into three "catchment" areas.

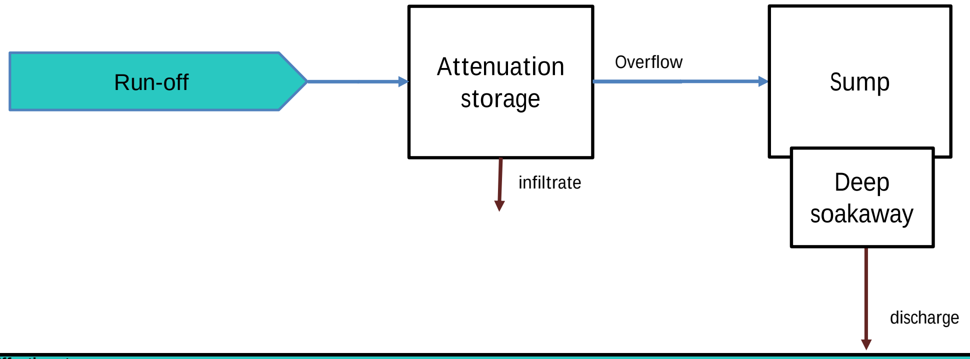
Description	Area m2	5 yr (l/s)	100 yr (l/s)
Area 1	9985	155	273
Area 2	5547	86	216
Area 3	9467	147	263
Total	25,000	389	752

Infiltration trench

Below is the infiltration trench sizing and infiltration estimate. (CIRIA C753, SuDS manual)

Parameters	Units	Area 1		Area 2		Area 3	
		5yr	100 yr	5yr	100 yr	5yr	100 yr
Depth	m	1		1		1	
Width	m	4		3		4	
Length	m	55		50		55	
Porosity	-	0.98		0.98		0.98	
Storage	m3	215.6		147		215.6	
Freeboard	m	0.15		0.15		0.15	
Manning's n	-	0.009		0.009		0.009	
Bed Slope (S)	-	0.0001		0.0001		0.0001	
Side Slope (x)	m						
Area	m2	4		3		4	
Wetted perimeter	m	8.0	8.0	6.0	6.0	8.0	8.0
Discharge rate	m3/s	2.8	2.8	2.1	2.1	2.8	2.8
Velocity	m/s	0.7	0.7	0.7	0.7	0.7	0.7
Permeability bedding	m/s	0.0005		0.0005		0.0005	
Factor of Safety		2	2	2	2	2	2
Filtration rate	m3/s	0.055	0.055	0.0375	0.0375	0.055	0.055
% infiltrated	%	35%	20%	43%	17%	37%	21%

Flow Diagram



Effective storage

Sump	unit	Value
Depth	m	3
Diameter	m	1.8
Pipe inlet height	m	1
Effective storage	m3	5.1
Infiltration storage	m3	215.6
Total effective storage	m3	220.7

Required Discharge

		Area 1		Area 2		Area 3		
Parameters	**Units**	**5YR**	**100YR**	**5YR**	**100YR**	**5YR**	**100YR**	**Remarks / Reference**
% infiltrated	%	35%	20%	43%	17%	37%	21%	Calculated in Basis
Reduction factor		5	5	5	5	5	5	Figure 16 from deep soakaway design guide
Required discharge	l/s	20	44	10	36	18	42	

Deep borehole Design

Parameters	**Units**	Value	**Remarks / Reference**
Drilled diameter	mm	300	
Depth to base of liner	m	18	Depth to top of coal meaures
Screen length	m	5	Thickness of sand and gravels
Soakage area	m2	4.7	
Max Head	m	14.5	Midpoint of screen to pipe invert
Soakage rate	l/m2/min	200	Assumed value (200 l/m2/min)
Available discharge	l/min	471.2	FoS 2
Available discharge	l/sec	7.85	

	Area 1		Area 2		Area 3	
	5YR	**100YR**	**5YR**	**100YR**	**5YR**	**100YR**
No. of boreholes	3	6	1	5	2	5

1 **Conventional hydrogeology theory**

Jacob Equation

To estimate potential increase in water level from discharge within a single well and define number of wells

$$s = \frac{2.3Q}{4\pi KD}\log\left(\frac{2.25\ KDt}{r^2 S}\right)$$

Parameters	Units	Value 5YR	Value 100YR	Remarks / Reference
Flow, Q	m3/day	21686	51868	Total flow minus infiltration
Permeability, k	m/s	0.001	0.001	
Permeability, k	m/day	86.4	86.4	
Thickness, D	m	5	5	
Storativity, S		0.1	0.1	range: 0.01 and 0.1 (EA, BGS, 2005)
well radius, r	m	0.15	0.15	Drilled radius
time, t	days	0.25	0.25	6 hour storm
Water level, change, s	m	46	111	Available head 14.5 m
Number of boreholes		5	12	FoS 1.5

Logan Equation

To define available discharge within a single well and define number of wells

$$T \approx \frac{1.22\ Q}{s_w}$$

Parameters	Units	Value 5YR	Value 100YR
Max Head, s	m	14.5	14.5
Transmissivity, T	m2/d	432	432
Available discharge, Q	m3/day	5134	5134
Factor of Safety		1.5	1.5
Number of boreholes		6	15

Javandel and Tsang Equation

Define spacing between boreholes

$L = Q/2\pi KDi$

Parameters	Units	Value 5YR	Value 100YR	Remarks / Reference
Flow, Q	m3/day	810	339	Total flow minus infiltration
Permeability, k	m/day	86.4	86.4	
Thickness, D	m	5	5	
gradient, i	-	0.01	0.01	typical unconfined
Influence, L	m	30	12	

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1	**Summary**	
2	Two approaches have been assessed to determine the number of boreholes : 1. using the soakaway design guide 2. using hydrogeological principles	
3	Geological information from the geotechincal study and BGS borehole logs have been used to design the boreholes of 18 m in length (to base of the Glacial Till and above groundwater table) with a 5 m screened length (covering the sand and gravel layer).	
4	Based on flow rates of 389 l/s (5 year event) and 752 l/s (100 year event), between 5 and 16 boreholes are required to take overflow from the geocelluar storage, including safety factor. These would need to be spaced approximately 15 m apart.	
5	**Recommendations**	
6	There are key assumptions on the premability and infiltration rate of the ground, based on literature. Site specific information shold be gathered from boreholes through falling head tests. This should be conducted at a minimum of three locations.	

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Appendix D. Carbon Capture Plant Storm Water Drainage System – MicroDrainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes Pades CC Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	1000

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
S1.000	60.355	0.201	300.3	0.050	5.00	0.0	0.600	o	300	Pipe/Conduit	
S2.000	48.661	0.122	398.9	0.178	5.00	0.0	0.600	o	400	Pipe/Conduit	
S2.001	23.391	0.052	450.0	0.202	0.00	0.0	0.600	o	450	Pipe/Conduit	
S2.002	40.562	0.090	450.0	0.149	0.00	0.0	0.600	o	450	Pipe/Conduit	
S2.003	38.682	0.111	350.0	0.243	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.001	71.218	0.142	500.0	0.463	0.00	0.0	0.600	o	500	Pipe/Conduit	
S3.000	35.024	0.117	299.4	0.295	5.00	0.0	0.600	o	300	Pipe/Conduit	
S3.001	34.737	0.116	300.0	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)
S1.000	50.00	6.12	98.400	0.050	0.0	0.0	0.0	0.90	63.8	6.8
S2.000	50.00	5.86	98.150	0.178	0.0	0.0	0.0	0.94	118.0	24.1
S2.001	50.00	6.27	97.978	0.380	0.0	0.0	0.0	0.95	151.4	51.5
S2.002	50.00	6.98	97.926	0.530	0.0	0.0	0.0	0.95	151.4	71.7
S2.003	50.00	7.58	97.836	0.773	0.0	0.0	0.0	1.08	171.9	104.7
S1.001	50.00	8.81	97.675	1.286	0.0	0.0	0.0	0.96	189.4	174.2
S3.000	50.00	5.65	98.300	0.295	0.0	0.0	0.0	0.90	63.9	40.0
S3.001	50.00	6.29	98.183	0.295	0.0	0.0	0.0	0.90	63.8	40.0

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
S3.002	45.896	0.153	300.0	0.142	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	39.685	0.066	600.0	0.160	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.003	19.356	0.032	600.0	0.125	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.004	22.029	0.037	600.0	0.080	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.005	21.473	0.029	750.0	0.093	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.006	12.912	0.017	750.0	0.086	0.00	0.0	0.600	o	750	Pipe/Conduit	
S4.000	24.109	0.121	199.2	0.358	5.00	0.0	0.600	o	450	Pipe/Conduit	
S4.001	28.977	0.116	250.0	0.134	0.00	0.0	0.600	o	450	Pipe/Conduit	
S5.000	16.259	0.081	200.0	0.109	5.00	0.0	0.600	o	200	Pipe/Conduit	
S4.002	15.446	0.044	350.0	0.119	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.007	11.369	0.244	46.5	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S6.000	56.579	0.226	250.3	0.238	5.00	0.0	0.600	o	450	Pipe/Conduit	
S7.000	16.221	0.065	249.6	0.230	5.00	0.0	0.600	o	450	Pipe/Conduit	
S6.001	64.475	0.215	300.0	0.000	0.00	0.0	0.600	o	450	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)
S3.002	50.00	7.14	98.067	0.437	0.0	0.0	0.0	0.90	63.8	59.2
S1.002	50.00	9.48	97.433	1.884	0.0	0.0	0.0	0.99	279.0	255.1
S1.003	50.00	9.81	97.367	2.009	0.0	0.0	0.0	0.99	279.0	272.0
S1.004	50.00	10.13	97.185	2.089	0.0	0.0	0.0	1.14	501.5	282.8
S1.005	50.00	10.48	97.148	2.182	0.0	0.0	0.0	1.01	448.0	295.4
S1.006	50.00	10.70	97.119	2.268	0.0	0.0	0.0	1.01	448.0	307.1
S4.000	50.00	5.28	98.300	0.358	0.0	0.0	0.0	1.44	228.5	48.5
S4.001	50.00	5.66	98.179	0.492	0.0	0.0	0.0	1.28	203.8	66.6
S5.000	50.00	5.32	98.650	0.109	0.0	0.0	0.0	0.85	26.8	14.8
S4.002	50.00	5.89	98.063	0.721	0.0	0.0	0.0	1.08	171.9	97.6
S1.007	50.00	10.74	97.102	2.989	0.0	0.0	0.0	4.11	1815.8	404.7
S6.000	50.00	5.74	98.150	0.238	0.0	0.0	0.0	1.28	203.6	32.3
S7.000	50.00	5.21	98.150	0.230	0.0	0.0	0.0	1.28	204.0	31.2
S6.001	50.00	6.66	97.924	0.468	0.0	0.0	0.0	1.17	185.8	63.4

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
S6.002	41.443	0.104	400.0	0.528	0.00	0.0	0.600	o	450	Pipe/Conduit	
S6.003	18.017	0.036	500.0	0.139	0.00	0.0	0.600	o	500	Pipe/Conduit	
S6.004	26.106	0.052	500.0	0.000	0.00	0.0	0.600	o	500	Pipe/Conduit	
S6.005	59.504	0.119	500.0	0.218	0.00	0.0	0.600	o	500	Pipe/Conduit	
S6.006	58.151	0.097	600.0	0.244	0.00	0.0	0.600	o	550	Pipe/Conduit	
S6.007	18.894	0.031	600.0	0.092	0.00	0.0	0.600	o	600	Pipe/Conduit	
S6.008	15.165	0.025	600.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S6.009	40.859	0.068	600.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.008	46.590	0.052	896.0	0.097	0.00	0.0	0.600	o	900	Pipe/Conduit	
S1.009	61.402	0.068	900.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
S1.010	19.156	0.021	900.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
S1.011	7.155	0.008	900.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
S1.012	22.761	0.228	99.8	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)
S6.002	50.00	7.34	97.709	0.997	0.0	0.0	0.0	1.01	160.7	134.9
S6.003	50.00	7.65	97.555	1.136	0.0	0.0	0.0	0.96	189.4	153.8
S6.004	50.00	8.10	97.519	1.136	0.0	0.0	0.0	0.96	189.4	153.8
S6.005	50.00	9.13	97.467	1.354	0.0	0.0	0.0	0.96	189.4	183.3
S6.006	50.00	10.17	97.298	1.598	0.0	0.0	0.0	0.93	221.9	216.4
S6.007	50.00	10.49	97.151	1.691	0.0	0.0	0.0	0.99	279.0	229.0
S6.008	50.00	10.74	97.120	1.691	0.0	0.0	0.0	0.99	279.0	229.0
S6.009	50.00	11.43	97.095	1.691	0.0	0.0	0.0	0.99	279.0	229.0
S1.008	49.95	12.18	95.200	4.777	0.0	0.0	0.0	1.04	660.7	646.1
S1.009	47.85	13.17	95.148	4.777	0.0	0.0	0.0	1.04	659.2	646.1
S1.010	47.24	13.48	95.080	4.777	0.0	0.0	0.0	1.04	659.2	646.1
S1.011	47.02	13.59	95.058	4.777	0.0	0.0	0.0	1.04	659.2	646.1
S1.012	46.56	13.83	94.000	4.777	0.0	0.0	0.0	1.57	111.2«	646.1

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)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	100.000	1.600	Open Manhole	1200	S1.000	98.400	300				
S2	100.000	1.850	Open Manhole	1350	S2.000	98.150	400				
S3	100.000	2.022	Open Manhole	1350	S2.001	97.978	450	S2.000	98.028	400	
S4	100.000	2.074	Open Manhole	1350	S2.002	97.926	450	S2.001	97.926	450	
S5	100.000	2.164	Open Manhole	1350	S2.003	97.836	450	S2.002	97.836	450	
S2	100.000	2.325	Open Manhole	1500	S1.001	97.675	500	S1.000	98.199	300	324
								S2.003	97.725	450	
S3	100.000	1.700	Open Manhole	1200	S3.000	98.300	300				
S4	100.000	1.817	Open Manhole	1200	S3.001	98.183	300	S3.000	98.183	300	
S5	100.000	1.933	Open Manhole	1200	S3.002	98.067	300	S3.001	98.067	300	
S3	100.000	2.567	Open Manhole	1500	S1.002	97.433	600	S1.001	97.533	500	
								S3.002	97.914	300	181
S4	100.000	2.633	Open Manhole	1500	S1.003	97.367	600	S1.002	97.367	600	
S5	100.000	2.815	Open Manhole	1800	S1.004	97.185	750	S1.003	97.335	600	
S6	100.000	2.852	Open Manhole	1800	S1.005	97.148	750	S1.004	97.148	750	
S7	100.000	2.881	Open Manhole	1800	S1.006	97.119	750	S1.005	97.119	750	
S15	100.000	1.700	Open Manhole	1350	S4.000	98.300	450				
S16	100.000	1.821	Open Manhole	1350	S4.001	98.179	450	S4.000	98.179	450	
S17	100.000	1.350	Open Manhole	1200	S5.000	98.650	200				
S17	100.000	1.937	Open Manhole	1350	S4.002	98.063	450	S4.001	98.063	450	
								S5.000	98.569	200	256
S8	100.000	2.898	Open Manhole	1800	S1.007	97.102	750	S1.006	97.102	750	
								S4.002	98.019	450	617
S16	100.000	1.850	Open Manhole	1350	S6.000	98.150	450				
S21	100.000	1.850	Open Manhole	1350	S7.000	98.150	450				
S17	100.000	2.076	Open Manhole	1350	S6.001	97.924	450	S6.000	97.924	450	
								S7.000	98.085	450	161
S18	100.000	2.291	Open Manhole	1350	S6.002	97.709	450	S6.001	97.709	450	
S19	100.000	2.445	Open Manhole	1500	S6.003	97.555	500	S6.002	97.605	450	
S20	100.000	2.481	Open Manhole	1500	S6.004	97.519	500	S6.003	97.519	500	
S21	100.000	2.533	Open Manhole	1500	S6.005	97.467	500	S6.004	97.467	500	
S22	100.000	2.702	Open Manhole	1500	S6.006	97.298	550	S6.005	97.348	500	
S23	100.000	2.849	Open Manhole	1500	S6.007	97.151	600	S6.006	97.201	550	
S24	100.000	2.880	Open Manhole	1500	S6.008	97.120	600	S6.007	97.120	600	
S25	100.000	2.905	Open Manhole	1500	S6.009	97.095	600	S6.008	97.095	600	
S9	100.000	4.800	Open Manhole	2100	S1.008	95.200	900	S1.007	96.857	750	1507
								S6.009	97.026	600	1526
S10	97.000	1.852	Open Manhole	2100	S1.009	95.148	900	S1.008	95.148	900	

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)
S11	97.000	1.920	Open Manhole	2100	S1.010	95.080	900	S1.009	95.080	900	
S12	97.000	1.942	Open Manhole	2100	S1.011	95.058	900	S1.010	95.058	900	
S13	97.000	3.000	Open Manhole	2100	S1.012	94.000	300	S1.011	95.051	900	1651
S	95.000	1.228	Open Manhole	0		OUTFALL		S1.012	93.772	300	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	134.465	381.556	134.465	381.556	Required	
S2	275.970	322.000	275.970	322.000	Required	
S3	227.310	322.000	227.310	322.000	Required	
S4	203.919	322.000	203.919	322.000	Required	
S5	163.357	322.000	163.357	322.000	Required	
S2	124.675	322.000	124.675	322.000	Required	
S3	228.779	251.725	228.779	251.725	Required	
S4	193.755	251.725	193.755	251.725	Required	
S5	159.018	251.725	159.018	251.725	Required	
S3	113.122	251.725	113.122	251.725	Required	
S4	106.685	212.565	106.685	212.565	Required	
S5	111.119	193.724	111.119	193.724	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S6	129.968	182.321	129.968	182.321	Required	
S7	151.441	182.321	151.441	182.321	Required	
S15	230.906	182.143	230.906	182.143	Required	
S16	206.797	182.143	206.797	182.143	Required	
S17	182.848	197.605	182.848	197.605	Required	
S17	177.820	182.143	177.820	182.143	Required	
S8	163.233	177.063	163.233	177.063	Required	
S16	310.673	284.500	310.673	284.500	Required	
S21	308.858	229.785	308.858	229.785	Required	
S17	325.079	229.785	325.079	229.785	Required	
S18	341.176	167.353	341.176	167.353	Required	
S19	341.176	125.909	341.176	125.909	Required	
S20	334.336	109.241	334.336	109.241	Required	
S21	308.626	104.707	308.626	104.707	Required	
S22	249.122	104.707	249.122	104.707	Required	

<u>Manhole Schedules for Storm</u>

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S23	190.971	104.707	190.971	104.707	Required	
S24	173.445	111.765	173.445	111.765	Required	
S25	168.332	126.043	168.332	126.043	Required	
S9	168.332	166.901	168.332	166.901	Required	
S10	121.742	166.901	121.742	166.901	Required	
S11	121.870	105.500	121.870	105.500	Required	
S12	141.026	105.585	141.026	105.585	Required	
S13	142.910	98.683	142.910	98.683	Required	
S	142.877	75.922			No Entry	

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)
S1.000	o	300	S1	100.000	98.400	1.300	Open Manhole	1200
S2.000	o	400	S2	100.000	98.150	1.450	Open Manhole	1350
S2.001	o	450	S3	100.000	97.978	1.572	Open Manhole	1350
S2.002	o	450	S4	100.000	97.926	1.624	Open Manhole	1350
S2.003	o	450	S5	100.000	97.836	1.714	Open Manhole	1350
S1.001	o	500	S2	100.000	97.675	1.825	Open Manhole	1500
S3.000	o	300	S3	100.000	98.300	1.400	Open Manhole	1200
S3.001	o	300	S4	100.000	98.183	1.517	Open Manhole	1200
S3.002	o	300	S5	100.000	98.067	1.633	Open Manhole	1200
S1.002	o	600	S3	100.000	97.433	1.967	Open Manhole	1500
S1.003	o	600	S4	100.000	97.367	2.033	Open Manhole	1500
S1.004	o	750	S5	100.000	97.185	2.065	Open Manhole	1800
S1.005	o	750	S6	100.000	97.148	2.102	Open Manhole	1800
S1.006	o	750	S7	100.000	97.119	2.131	Open Manhole	1800
S4.000	o	450	S15	100.000	98.300	1.250	Open Manhole	1350
S4.001	o	450	S16	100.000	98.179	1.371	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)
S1.000	60.355	300.3	S2	100.000	98.199	1.501	Open Manhole	1500
S2.000	48.661	398.9	S3	100.000	98.028	1.572	Open Manhole	1350
S2.001	23.391	450.0	S4	100.000	97.926	1.624	Open Manhole	1350
S2.002	40.562	450.0	S5	100.000	97.836	1.714	Open Manhole	1350
S2.003	38.682	350.0	S2	100.000	97.725	1.825	Open Manhole	1500
S1.001	71.218	500.0	S3	100.000	97.533	1.967	Open Manhole	1500
S3.000	35.024	299.4	S4	100.000	98.183	1.517	Open Manhole	1200
S3.001	34.737	300.0	S5	100.000	98.067	1.633	Open Manhole	1200
S3.002	45.896	300.0	S3	100.000	97.914	1.786	Open Manhole	1500
S1.002	39.685	600.0	S4	100.000	97.367	2.033	Open Manhole	1500
S1.003	19.356	600.0	S5	100.000	97.335	2.065	Open Manhole	1800
S1.004	22.029	600.0	S6	100.000	97.148	2.102	Open Manhole	1800
S1.005	21.473	750.0	S7	100.000	97.119	2.131	Open Manhole	1800
S1.006	12.912	750.0	S8	100.000	97.102	2.148	Open Manhole	1800
S4.000	24.109	199.2	S16	100.000	98.179	1.371	Open Manhole	1350
S4.001	28.977	250.0	S17	100.000	98.063	1.487	Open Manhole	1350

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)
S5.000	o	200	S17	100.000	98.650	1.150	Open Manhole	1200
S4.002	o	450	S17	100.000	98.063	1.487	Open Manhole	1350
S1.007	o	750	S8	100.000	97.102	2.148	Open Manhole	1800
S6.000	o	450	S16	100.000	98.150	1.400	Open Manhole	1350
S7.000	o	450	S21	100.000	98.150	1.400	Open Manhole	1350
S6.001	o	450	S17	100.000	97.924	1.626	Open Manhole	1350
S6.002	o	450	S18	100.000	97.709	1.841	Open Manhole	1350
S6.003	o	500	S19	100.000	97.555	1.945	Open Manhole	1500
S6.004	o	500	S20	100.000	97.519	1.981	Open Manhole	1500
S6.005	o	500	S21	100.000	97.467	2.033	Open Manhole	1500
S6.006	o	550	S22	100.000	97.298	2.152	Open Manhole	1500
S6.007	o	600	S23	100.000	97.151	2.249	Open Manhole	1500
S6.008	o	600	S24	100.000	97.120	2.280	Open Manhole	1500
S6.009	o	600	S25	100.000	97.095	2.305	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)
S5.000	16.259	200.0	S17	100.000	98.569	1.231	Open Manhole	1350
S4.002	15.446	350.0	S8	100.000	98.019	1.531	Open Manhole	1800
S1.007	11.369	46.5	S9	100.000	96.857	2.393	Open Manhole	2100
S6.000	56.579	250.3	S17	100.000	97.924	1.626	Open Manhole	1350
S7.000	16.221	249.6	S17	100.000	98.085	1.465	Open Manhole	1350
S6.001	64.475	300.0	S18	100.000	97.709	1.841	Open Manhole	1350
S6.002	41.443	400.0	S19	100.000	97.605	1.945	Open Manhole	1500
S6.003	18.017	500.0	S20	100.000	97.519	1.981	Open Manhole	1500
S6.004	26.106	500.0	S21	100.000	97.467	2.033	Open Manhole	1500
S6.005	59.504	500.0	S22	100.000	97.348	2.152	Open Manhole	1500
S6.006	58.151	600.0	S23	100.000	97.201	2.249	Open Manhole	1500
S6.007	18.894	600.0	S24	100.000	97.120	2.280	Open Manhole	1500
S6.008	15.165	600.0	S25	100.000	97.095	2.305	Open Manhole	1500
S6.009	40.859	600.0	S9	100.000	97.026	2.374	Open Manhole	2100

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)
S1.008	o	900	S9	100.000	95.200	3.900	Open Manhole	2100
S1.009	o	900	S10	97.000	95.148	0.952	Open Manhole	2100
S1.010	o	900	S11	97.000	95.080	1.020	Open Manhole	2100
S1.011	o	900	S12	97.000	95.058	1.042	Open Manhole	2100
S1.012	o	300	S13	97.000	94.000	2.700	Open Manhole	2100

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)
S1.008	46.590	896.0	S10	97.000	95.148	0.952	Open Manhole	2100
S1.009	61.402	900.0	S11	97.000	95.080	1.020	Open Manhole	2100
S1.010	19.156	900.0	S12	97.000	95.058	1.042	Open Manhole	2100
S1.011	7.155	900.0	S13	97.000	95.051	1.049	Open Manhole	2100
S1.012	22.761	99.8	S	95.000	93.772	0.928	Open Manhole	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.350		

Storage Structures for Storm

Tank or Pond Manhole: S11, DS/PN: S1.010

Invert Level (m) 95.080

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1375.0	1.000	1375.0	2.000	1375.0	3.000	1375.0

Summary Wizard of 15 minute 30 year Summer I+40% for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.336
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 60, 720, 2880
Return Period(s) (years) 1, 30, 100
Climate Change (%) 40, 40, 40

PN	US/MH Name	Storm Rank	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S1.000	S1	6	99.029	0.329	0.000	0.25		15.2	SURCHARGED
S2.000	S2	6	99.394	0.844	0.000	0.50		54.0	SURCHARGED
S2.001	S3	6	99.359	0.931	0.000	0.83		104.6	SURCHARGED
S2.002	S4	6	99.318	0.942	0.000	1.05		142.0	SURCHARGED
S2.003	S5	6	99.218	0.932	0.000	1.34		204.0	SURCHARGED
S1.001	S2	6	99.010	0.834	0.000	1.82		318.8	SURCHARGED
S3.000	S3	5	99.573	0.973	0.000	1.53		89.7	SURCHARGED
S3.001	S4	5	99.313	0.830	0.000	1.51		88.4	SURCHARGED
S3.002	S5	6	99.050	0.683	0.000	1.95		116.7	SURCHARGED
S1.002	S3	6	98.481	0.448	0.000	1.91		454.4	SURCHARGED
S1.003	S4	6	98.224	0.257	0.000	2.80		470.3	SURCHARGED
S1.004	S5	6	97.999	0.065	0.000	1.52		474.2	SURCHARGED
S1.005	S6	6	97.935	0.037	0.000	1.98		484.0	SURCHARGED
S1.006	S7	8	97.869	0.000	0.000	2.38		490.5	OK
S4.000	S15	4	98.861	0.111	0.000	0.70		133.1	SURCHARGED
S4.001	S16	4	98.802	0.173	0.000	1.03		180.5	SURCHARGED
S5.000	S17	4	99.003	0.153	0.000	1.71		41.4	SURCHARGED
S4.002	S17	4	98.671	0.158	0.000	2.12		264.2	SURCHARGED
S1.007	S8	6	97.644	-0.208	0.000	0.87		674.1	OK
S6.000	S16	6	99.114	0.514	0.000	0.40		74.8	SURCHARGED
S7.000	S21	6	99.100	0.500	0.000	0.50		79.0	SURCHARGED
S6.001	S17	6	99.077	0.703	0.000	0.70		120.5	SURCHARGED

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes Pades CC Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	1000

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
S1.000	60.355	0.201	300.3	0.050	5.00	0.0	0.600	o	300	Pipe/Conduit	
S2.000	48.661	0.122	398.9	0.178	5.00	0.0	0.600	o	400	Pipe/Conduit	
S2.001	23.391	0.052	450.0	0.202	0.00	0.0	0.600	o	450	Pipe/Conduit	
S2.002	40.562	0.090	450.0	0.149	0.00	0.0	0.600	o	450	Pipe/Conduit	
S2.003	38.682	0.111	350.0	0.243	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.001	71.218	0.142	500.0	0.463	0.00	0.0	0.600	o	500	Pipe/Conduit	
S3.000	35.024	0.117	299.4	0.295	5.00	0.0	0.600	o	300	Pipe/Conduit	
S3.001	34.737	0.116	300.0	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)
S1.000	50.00	6.12	98.400	0.050	0.0	0.0	0.0	0.90	63.8	6.8
S2.000	50.00	5.86	98.150	0.178	0.0	0.0	0.0	0.94	118.0	24.1
S2.001	50.00	6.27	97.978	0.380	0.0	0.0	0.0	0.95	151.4	51.5
S2.002	50.00	6.98	97.926	0.530	0.0	0.0	0.0	0.95	151.4	71.7
S2.003	50.00	7.58	97.836	0.773	0.0	0.0	0.0	1.08	171.9	104.7
S1.001	50.00	8.81	97.675	1.286	0.0	0.0	0.0	0.96	189.4	174.2
S3.000	50.00	5.65	98.300	0.295	0.0	0.0	0.0	0.90	63.9	40.0
S3.001	50.00	6.29	98.183	0.295	0.0	0.0	0.0	0.90	63.8	40.0

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
S3.002	45.896	0.153	300.0	0.142	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	39.685	0.066	600.0	0.160	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.003	19.356	0.032	600.0	0.125	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.004	22.029	0.037	600.0	0.080	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.005	21.473	0.029	750.0	0.093	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.006	12.912	0.017	750.0	0.086	0.00	0.0	0.600	o	750	Pipe/Conduit	
S4.000	24.109	0.121	199.2	0.358	5.00	0.0	0.600	o	450	Pipe/Conduit	
S4.001	28.977	0.116	250.0	0.134	0.00	0.0	0.600	o	450	Pipe/Conduit	
S5.000	16.259	0.081	200.0	0.109	5.00	0.0	0.600	o	200	Pipe/Conduit	
S4.002	15.446	0.044	350.0	0.119	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.007	11.369	0.244	46.5	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S6.000	56.579	0.226	250.3	0.238	5.00	0.0	0.600	o	450	Pipe/Conduit	
S7.000	16.221	0.065	249.6	0.230	5.00	0.0	0.600	o	450	Pipe/Conduit	
S6.001	64.475	0.215	300.0	0.000	0.00	0.0	0.600	o	450	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)
S3.002	50.00	7.14	98.067	0.437	0.0	0.0	0.0	0.90	63.8	59.2
S1.002	50.00	9.48	97.433	1.884	0.0	0.0	0.0	0.99	279.0	255.1
S1.003	50.00	9.81	97.367	2.009	0.0	0.0	0.0	0.99	279.0	272.0
S1.004	50.00	10.13	97.185	2.089	0.0	0.0	0.0	1.14	501.5	282.8
S1.005	50.00	10.48	97.148	2.182	0.0	0.0	0.0	1.01	448.0	295.4
S1.006	50.00	10.70	97.119	2.268	0.0	0.0	0.0	1.01	448.0	307.1
S4.000	50.00	5.28	98.300	0.358	0.0	0.0	0.0	1.44	228.5	48.5
S4.001	50.00	5.66	98.179	0.492	0.0	0.0	0.0	1.28	203.8	66.6
S5.000	50.00	5.32	98.650	0.109	0.0	0.0	0.0	0.85	26.8	14.8
S4.002	50.00	5.89	98.063	0.721	0.0	0.0	0.0	1.08	171.9	97.6
S1.007	50.00	10.74	97.102	2.989	0.0	0.0	0.0	4.11	1815.8	404.7
S6.000	50.00	5.74	98.150	0.238	0.0	0.0	0.0	1.28	203.6	32.3
S7.000	50.00	5.21	98.150	0.230	0.0	0.0	0.0	1.28	204.0	31.2
S6.001	50.00	6.66	97.924	0.468	0.0	0.0	0.0	1.17	185.8	63.4

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
S6.002	41.443	0.104	400.0	0.528	0.00	0.0	0.600	o	450	Pipe/Conduit	
S6.003	18.017	0.036	500.0	0.139	0.00	0.0	0.600	o	500	Pipe/Conduit	
S6.004	26.106	0.052	500.0	0.000	0.00	0.0	0.600	o	500	Pipe/Conduit	
S6.005	59.504	0.119	500.0	0.218	0.00	0.0	0.600	o	500	Pipe/Conduit	
S6.006	58.151	0.097	600.0	0.244	0.00	0.0	0.600	o	550	Pipe/Conduit	
S6.007	18.894	0.031	600.0	0.092	0.00	0.0	0.600	o	600	Pipe/Conduit	
S6.008	15.165	0.025	600.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S6.009	40.859	0.068	600.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.008	46.590	0.052	896.0	0.097	0.00	0.0	0.600	o	900	Pipe/Conduit	
S1.009	61.402	0.068	900.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
S1.010	19.156	0.021	900.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
S1.011	7.155	0.008	900.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
S1.012	22.761	0.228	99.8	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)
S6.002	50.00	7.34	97.709	0.997	0.0	0.0	0.0	1.01	160.7	134.9
S6.003	50.00	7.65	97.555	1.136	0.0	0.0	0.0	0.96	189.4	153.8
S6.004	50.00	8.10	97.519	1.136	0.0	0.0	0.0	0.96	189.4	153.8
S6.005	50.00	9.13	97.467	1.354	0.0	0.0	0.0	0.96	189.4	183.3
S6.006	50.00	10.17	97.298	1.598	0.0	0.0	0.0	0.93	221.9	216.4
S6.007	50.00	10.49	97.151	1.691	0.0	0.0	0.0	0.99	279.0	229.0
S6.008	50.00	10.74	97.120	1.691	0.0	0.0	0.0	0.99	279.0	229.0
S6.009	50.00	11.43	97.095	1.691	0.0	0.0	0.0	0.99	279.0	229.0
S1.008	49.95	12.18	95.200	4.777	0.0	0.0	0.0	1.04	660.7	646.1
S1.009	47.85	13.17	95.148	4.777	0.0	0.0	0.0	1.04	659.2	646.1
S1.010	47.24	13.48	95.080	4.777	0.0	0.0	0.0	1.04	659.2	646.1
S1.011	47.02	13.59	95.058	4.777	0.0	0.0	0.0	1.04	659.2	646.1
S1.012	46.56	13.83	94.000	4.777	0.0	0.0	0.0	1.57	111.2«	646.1

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)
S1	100.000	1.600	Open Manhole	1200	S1.000	98.400	300				
S2	100.000	1.850	Open Manhole	1350	S2.000	98.150	400				
S3	100.000	2.022	Open Manhole	1350	S2.001	97.978	450	S2.000	98.028	400	
S4	100.000	2.074	Open Manhole	1350	S2.002	97.926	450	S2.001	97.926	450	
S5	100.000	2.164	Open Manhole	1350	S2.003	97.836	450	S2.002	97.836	450	
S2	100.000	2.325	Open Manhole	1500	S1.001	97.675	500	S1.000	98.199	300	324
								S2.003	97.725	450	
S3	100.000	1.700	Open Manhole	1200	S3.000	98.300	300				
S4	100.000	1.817	Open Manhole	1200	S3.001	98.183	300	S3.000	98.183	300	
S5	100.000	1.933	Open Manhole	1200	S3.002	98.067	300	S3.001	98.067	300	
S3	100.000	2.567	Open Manhole	1500	S1.002	97.433	600	S1.001	97.533	500	
								S3.002	97.914	300	181
S4	100.000	2.633	Open Manhole	1500	S1.003	97.367	600	S1.002	97.367	600	
S5	100.000	2.815	Open Manhole	1800	S1.004	97.185	750	S1.003	97.335	600	
S6	100.000	2.852	Open Manhole	1800	S1.005	97.148	750	S1.004	97.148	750	
S7	100.000	2.881	Open Manhole	1800	S1.006	97.119	750	S1.005	97.119	750	
S15	100.000	1.700	Open Manhole	1350	S4.000	98.300	450				
S16	100.000	1.821	Open Manhole	1350	S4.001	98.179	450	S4.000	98.179	450	
S17	100.000	1.350	Open Manhole	1200	S5.000	98.650	200				
S17	100.000	1.937	Open Manhole	1350	S4.002	98.063	450	S4.001	98.063	450	
								S5.000	98.569	200	256
S8	100.000	2.898	Open Manhole	1800	S1.007	97.102	750	S1.006	97.102	750	
								S4.002	98.019	450	617
S16	100.000	1.850	Open Manhole	1350	S6.000	98.150	450				
S21	100.000	1.850	Open Manhole	1350	S7.000	98.150	450				
S17	100.000	2.076	Open Manhole	1350	S6.001	97.924	450	S6.000	97.924	450	
								S7.000	98.085	450	161
S18	100.000	2.291	Open Manhole	1350	S6.002	97.709	450	S6.001	97.709	450	
S19	100.000	2.445	Open Manhole	1500	S6.003	97.555	500	S6.002	97.605	450	
S20	100.000	2.481	Open Manhole	1500	S6.004	97.519	500	S6.003	97.519	500	
S21	100.000	2.533	Open Manhole	1500	S6.005	97.467	500	S6.004	97.467	500	
S22	100.000	2.702	Open Manhole	1500	S6.006	97.298	550	S6.005	97.348	500	
S23	100.000	2.849	Open Manhole	1500	S6.007	97.151	600	S6.006	97.201	550	
S24	100.000	2.880	Open Manhole	1500	S6.008	97.120	600	S6.007	97.120	600	
S25	100.000	2.905	Open Manhole	1500	S6.009	97.095	600	S6.008	97.095	600	
S9	100.000	4.800	Open Manhole	2100	S1.008	95.200	900	S1.007	96.857	750	1507
								S6.009	97.026	600	1526
S10	97.000	1.852	Open Manhole	2100	S1.009	95.148	900	S1.008	95.148	900	

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)
S11	97.000	1.920	Open Manhole	2100	S1.010	95.080	900	S1.009	95.080	900	
S12	97.000	1.942	Open Manhole	2100	S1.011	95.058	900	S1.010	95.058	900	
S13	97.000	3.000	Open Manhole	2100	S1.012	94.000	300	S1.011	95.051	900	1651
S	95.000	1.228	Open Manhole	0		OUTFALL		S1.012	93.772	300	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	134.465	381.556	134.465	381.556	Required	
S2	275.970	322.000	275.970	322.000	Required	
S3	227.310	322.000	227.310	322.000	Required	
S4	203.919	322.000	203.919	322.000	Required	
S5	163.357	322.000	163.357	322.000	Required	
S2	124.675	322.000	124.675	322.000	Required	
S3	228.779	251.725	228.779	251.725	Required	
S4	193.755	251.725	193.755	251.725	Required	
S5	159.018	251.725	159.018	251.725	Required	
S3	113.122	251.725	113.122	251.725	Required	
S4	106.685	212.565	106.685	212.565	Required	
S5	111.119	193.724	111.119	193.724	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S6	129.968	182.321	129.968	182.321	Required	
S7	151.441	182.321	151.441	182.321	Required	
S15	230.906	182.143	230.906	182.143	Required	
S16	206.797	182.143	206.797	182.143	Required	
S17	182.848	197.605	182.848	197.605	Required	
S17	177.820	182.143	177.820	182.143	Required	
S8	163.233	177.063	163.233	177.063	Required	
S16	310.673	284.500	310.673	284.500	Required	
S21	308.858	229.785	308.858	229.785	Required	
S17	325.079	229.785	325.079	229.785	Required	
S18	341.176	167.353	341.176	167.353	Required	
S19	341.176	125.909	341.176	125.909	Required	
S20	334.336	109.241	334.336	109.241	Required	
S21	308.626	104.707	308.626	104.707	Required	
S22	249.122	104.707	249.122	104.707	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S23	190.971	104.707	190.971	104.707	Required	
S24	173.445	111.765	173.445	111.765	Required	
S25	168.332	126.043	168.332	126.043	Required	
S9	168.332	166.901	168.332	166.901	Required	
S10	121.742	166.901	121.742	166.901	Required	
S11	121.870	105.500	121.870	105.500	Required	
S12	141.026	105.585	141.026	105.585	Required	
S13	142.910	98.683	142.910	98.683	Required	
S	142.877	75.922			No Entry	

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)
S1.000	o	300	S1	100.000	98.400	1.300	Open Manhole	1200
S2.000	o	400	S2	100.000	98.150	1.450	Open Manhole	1350
S2.001	o	450	S3	100.000	97.978	1.572	Open Manhole	1350
S2.002	o	450	S4	100.000	97.926	1.624	Open Manhole	1350
S2.003	o	450	S5	100.000	97.836	1.714	Open Manhole	1350
S1.001	o	500	S2	100.000	97.675	1.825	Open Manhole	1500
S3.000	o	300	S3	100.000	98.300	1.400	Open Manhole	1200
S3.001	o	300	S4	100.000	98.183	1.517	Open Manhole	1200
S3.002	o	300	S5	100.000	98.067	1.633	Open Manhole	1200
S1.002	o	600	S3	100.000	97.433	1.967	Open Manhole	1500
S1.003	o	600	S4	100.000	97.367	2.033	Open Manhole	1500
S1.004	o	750	S5	100.000	97.185	2.065	Open Manhole	1800
S1.005	o	750	S6	100.000	97.148	2.102	Open Manhole	1800
S1.006	o	750	S7	100.000	97.119	2.131	Open Manhole	1800
S4.000	o	450	S15	100.000	98.300	1.250	Open Manhole	1350
S4.001	o	450	S16	100.000	98.179	1.371	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)
S1.000	60.355	300.3	S2	100.000	98.199	1.501	Open Manhole	1500
S2.000	48.661	398.9	S3	100.000	98.028	1.572	Open Manhole	1350
S2.001	23.391	450.0	S4	100.000	97.926	1.624	Open Manhole	1350
S2.002	40.562	450.0	S5	100.000	97.836	1.714	Open Manhole	1350
S2.003	38.682	350.0	S2	100.000	97.725	1.825	Open Manhole	1500
S1.001	71.218	500.0	S3	100.000	97.533	1.967	Open Manhole	1500
S3.000	35.024	299.4	S4	100.000	98.183	1.517	Open Manhole	1200
S3.001	34.737	300.0	S5	100.000	98.067	1.633	Open Manhole	1200
S3.002	45.896	300.0	S3	100.000	97.914	1.786	Open Manhole	1500
S1.002	39.685	600.0	S4	100.000	97.367	2.033	Open Manhole	1500
S1.003	19.356	600.0	S5	100.000	97.335	2.065	Open Manhole	1800
S1.004	22.029	600.0	S6	100.000	97.148	2.102	Open Manhole	1800
S1.005	21.473	750.0	S7	100.000	97.119	2.131	Open Manhole	1800
S1.006	12.912	750.0	S8	100.000	97.102	2.148	Open Manhole	1800
S4.000	24.109	199.2	S16	100.000	98.179	1.371	Open Manhole	1350
S4.001	28.977	250.0	S17	100.000	98.063	1.487	Open Manhole	1350

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)
S5.000	o	200	S17	100.000	98.650	1.150	Open Manhole	1200
S4.002	o	450	S17	100.000	98.063	1.487	Open Manhole	1350
S1.007	o	750	S8	100.000	97.102	2.148	Open Manhole	1800
S6.000	o	450	S16	100.000	98.150	1.400	Open Manhole	1350
S7.000	o	450	S21	100.000	98.150	1.400	Open Manhole	1350
S6.001	o	450	S17	100.000	97.924	1.626	Open Manhole	1350
S6.002	o	450	S18	100.000	97.709	1.841	Open Manhole	1350
S6.003	o	500	S19	100.000	97.555	1.945	Open Manhole	1500
S6.004	o	500	S20	100.000	97.519	1.981	Open Manhole	1500
S6.005	o	500	S21	100.000	97.467	2.033	Open Manhole	1500
S6.006	o	550	S22	100.000	97.298	2.152	Open Manhole	1500
S6.007	o	600	S23	100.000	97.151	2.249	Open Manhole	1500
S6.008	o	600	S24	100.000	97.120	2.280	Open Manhole	1500
S6.009	o	600	S25	100.000	97.095	2.305	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)
S5.000	16.259	200.0	S17	100.000	98.569	1.231	Open Manhole	1350
S4.002	15.446	350.0	S8	100.000	98.019	1.531	Open Manhole	1800
S1.007	11.369	46.5	S9	100.000	96.857	2.393	Open Manhole	2100
S6.000	56.579	250.3	S17	100.000	97.924	1.626	Open Manhole	1350
S7.000	16.221	249.6	S17	100.000	98.085	1.465	Open Manhole	1350
S6.001	64.475	300.0	S18	100.000	97.709	1.841	Open Manhole	1350
S6.002	41.443	400.0	S19	100.000	97.605	1.945	Open Manhole	1500
S6.003	18.017	500.0	S20	100.000	97.519	1.981	Open Manhole	1500
S6.004	26.106	500.0	S21	100.000	97.467	2.033	Open Manhole	1500
S6.005	59.504	500.0	S22	100.000	97.348	2.152	Open Manhole	1500
S6.006	58.151	600.0	S23	100.000	97.201	2.249	Open Manhole	1500
S6.007	18.894	600.0	S24	100.000	97.120	2.280	Open Manhole	1500
S6.008	15.165	600.0	S25	100.000	97.095	2.305	Open Manhole	1500
S6.009	40.859	600.0	S9	100.000	97.026	2.374	Open Manhole	2100

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)
S1.008	o	900	S9	100.000	95.200	3.900	Open Manhole	2100
S1.009	o	900	S10	97.000	95.148	0.952	Open Manhole	2100
S1.010	o	900	S11	97.000	95.080	1.020	Open Manhole	2100
S1.011	o	900	S12	97.000	95.058	1.042	Open Manhole	2100
S1.012	o	300	S13	97.000	94.000	2.700	Open Manhole	2100

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)
S1.008	46.590	896.0	S10	97.000	95.148	0.952	Open Manhole	2100
S1.009	61.402	900.0	S11	97.000	95.080	1.020	Open Manhole	2100
S1.010	19.156	900.0	S12	97.000	95.058	1.042	Open Manhole	2100
S1.011	7.155	900.0	S13	97.000	95.051	1.049	Open Manhole	2100
S1.012	22.761	99.8	S	95.000	93.772	0.928	Open Manhole	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.350		

Storage Structures for Storm

Tank or Pond Manhole: S11, DS/PN: S1.010

Invert Level (m) 95.080

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**	**Depth (m)**	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	1375.0	1.000	1375.0	2.000	1375.0	3.000	1375.0

Summary Wizard of 15 minute 30 year Summer I+40% for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.336
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 60, 720, 2880
Return Period(s) (years)	1, 30, 100
Climate Change (%)	40, 40, 40

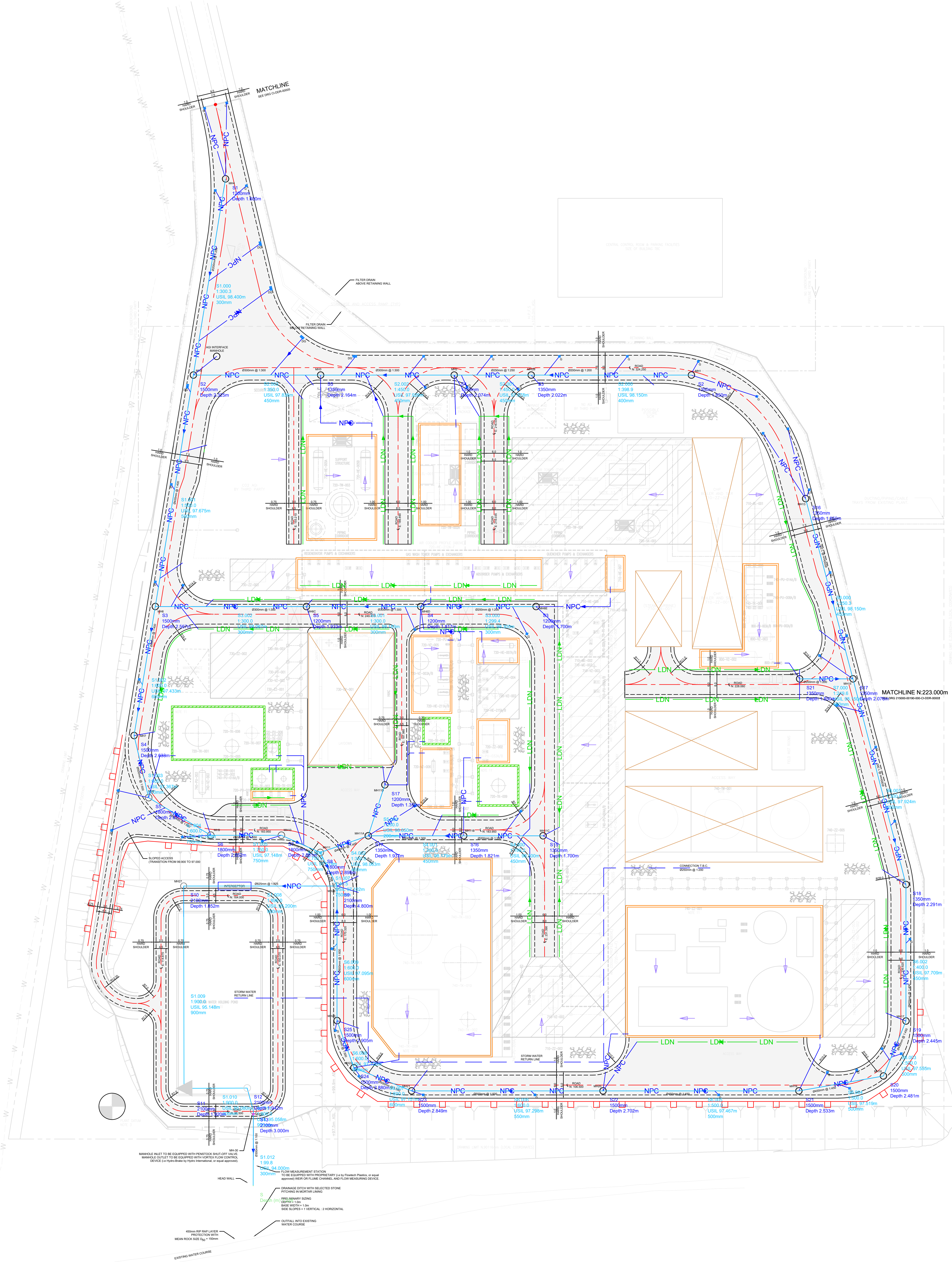
PN	US/MH Name	Storm Rank	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S1.000	S1	6	99.029	0.329	0.000	0.25		15.2	SURCHARGED
S2.000	S2	6	99.394	0.844	0.000	0.50		54.0	SURCHARGED
S2.001	S3	6	99.359	0.931	0.000	0.83		104.6	SURCHARGED
S2.002	S4	6	99.318	0.942	0.000	1.05		142.0	SURCHARGED
S2.003	S5	6	99.218	0.932	0.000	1.34		204.0	SURCHARGED
S1.001	S2	6	99.010	0.834	0.000	1.82		318.8	SURCHARGED
S3.000	S3	5	99.573	0.973	0.000	1.53		89.7	SURCHARGED
S3.001	S4	5	99.313	0.830	0.000	1.51		88.4	SURCHARGED
S3.002	S5	6	99.050	0.683	0.000	1.95		116.7	SURCHARGED
S1.002	S3	6	98.481	0.448	0.000	1.91		454.4	SURCHARGED
S1.003	S4	6	98.224	0.257	0.000	2.80		470.3	SURCHARGED
S1.004	S5	6	97.999	0.065	0.000	1.52		474.2	SURCHARGED
S1.005	S6	6	97.935	0.037	0.000	1.98		484.0	SURCHARGED
S1.006	S7	8	97.869	0.000	0.000	2.38		490.5	OK
S4.000	S15	4	98.861	0.111	0.000	0.70		133.1	SURCHARGED
S4.001	S16	4	98.802	0.173	0.000	1.03		180.5	SURCHARGED
S5.000	S17	4	99.003	0.153	0.000	1.71		41.4	SURCHARGED
S4.002	S17	4	98.671	0.158	0.000	2.12		264.2	SURCHARGED
S1.007	S8	6	97.644	-0.208	0.000	0.87		674.1	OK
S6.000	S16	6	99.114	0.514	0.000	0.40		74.8	SURCHARGED
S7.000	S21	6	99.100	0.500	0.000	0.50		79.0	SURCHARGED
S6.001	S17	6	99.077	0.703	0.000	0.70		120.5	SURCHARGED

Summary Wizard of 15 minute 30 year Summer I+40% for Storm

PN	US/MH Name	Storm Rank	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S6.002	S18	6	98.959	0.800	0.000	1.69		242.3	SURCHARGED
S6.003	S19	6	98.660	0.604	0.000	2.09		259.7	SURCHARGED
S6.004	S20	6	98.521	0.502	0.000	1.65		257.8	SURCHARGED
S6.005	S21	6	98.379	0.412	0.000	1.61		278.8	SURCHARGED
S6.006	S22	7	98.059	0.211	0.000	1.50		300.5	SURCHARGED
S6.007	S23	7	97.839	0.088	0.000	1.86		307.3	SURCHARGED
S6.008	S24	7	97.770	0.051	0.000	2.19		307.1	SURCHARGED
S6.009	S25	7	97.709	0.015	0.000	1.29		307.1	SURCHARGED
S1.008	S9	14	96.285	0.185	0.000	1.74		926.8	SURCHARGED
S1.009	S10	15	96.124	0.076	0.000	1.63		908.0	SURCHARGED
S1.010	S11	17	95.601	-0.379	0.000	0.17		48.3	OK
S1.011	S12	18	95.615	-0.343	0.000	0.07		33.3	OK
S1.012	S13	18	95.615	1.315	0.000	0.29		28.6	SURCHARGED

Summary Wizard of 15 minute 30 year Summer I+40% for Storm

PN	US/MH Name	Storm Rank	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S6.002	S18	6	98.959	0.800	0.000	1.69		242.3	SURCHARGED
S6.003	S19	6	98.660	0.604	0.000	2.09		259.7	SURCHARGED
S6.004	S20	6	98.521	0.502	0.000	1.65		257.8	SURCHARGED
S6.005	S21	6	98.379	0.412	0.000	1.61		278.8	SURCHARGED
S6.006	S22	7	98.059	0.211	0.000	1.50		300.5	SURCHARGED
S6.007	S23	7	97.839	0.088	0.000	1.86		307.3	SURCHARGED
S6.008	S24	7	97.770	0.051	0.000	2.19		307.1	SURCHARGED
S6.009	S25	7	97.709	0.015	0.000	1.29		307.1	SURCHARGED
S1.008	S9	14	96.285	0.185	0.000	1.74		926.8	SURCHARGED
S1.009	S10	15	96.124	0.076	0.000	1.63		908.0	SURCHARGED
S1.010	S11	17	95.601	-0.379	0.000	0.17		48.3	OK
S1.011	S12	18	95.615	-0.343	0.000	0.07		33.3	OK
S1.012	S13	18	95.615	1.315	0.000	0.29		28.6	SURCHARGED


MATCHLINE
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STORM WATER RETURN LINE
CONNECTION T.B.C.
SHOULDER

Appendix E. Car Park Storm Water Drainage System – MicroDrainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes Pades CC Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.322	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

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
S1.000	54.388	0.272	200.0	0.000	5.00	0.0	0.600	o	200	Pipe/Conduit	🔒
S1.001	26.209	0.131	200.0	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	🔓
S1.002	23.890	0.119	200.0	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	🔓
S2.000	67.217	0.336	200.1	0.000	5.00	0.0	0.600	R21	-44	Pipe/Conduit	🔒
S3.000	56.883	0.284	200.3	0.000	5.00	0.0	0.600	R21	-44	Pipe/Conduit	🔒
S1.003	39.257	0.196	200.3	0.945	0.00	0.0	0.600	o	400	Pipe/Conduit	🔓
S4.000	46.992	0.235	200.0	0.000	5.00	0.0	0.600	R21	-44	Pipe/Conduit	🔒
S5.000	14.606	0.073	200.1	0.000	5.00	0.0	0.600	R21	-44	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)
S1.000	50.00	6.06	109.600	0.000	0.0	0.0	0.0	0.85	26.8	0.0
S1.001	50.00	6.57	109.328	0.000	0.0	0.0	0.0	0.85	26.8	0.0
S1.002	50.00	7.04	109.197	0.000	0.0	0.0	0.0	0.85	26.8	0.0
S2.000	50.00	6.04	110.600	0.000	0.0	0.0	0.0	1.08	47.4	0.0
S3.000	50.00	5.88	110.600	0.000	0.0	0.0	0.0	1.08	47.4	0.0
S1.003	50.00	7.53	108.878	0.945	0.0	0.0	0.0	1.33	167.1	128.0
S4.000	50.00	5.73	110.600	0.000	0.0	0.0	0.0	1.08	47.5	0.0
S5.000	50.00	5.23	110.600	0.000	0.0	0.0	0.0	1.08	47.4	0.0

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
S4.001	79.001	0.395	200.0	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	
S6.000	52.593	0.263	200.0	0.000	5.00	0.0	0.600	R21	-44	Pipe/Conduit	
S7.000	40.890	0.204	200.4	0.000	5.00	0.0	0.600	R21	-44	Pipe/Conduit	
S1.004	26.061	0.065	400.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S8.000	24.585	0.123	199.9	0.000	5.00	0.0	0.600	o	200	Pipe/Conduit	
S9.000	20.814	0.104	200.1	0.000	5.00	0.0	0.600	o	200	Pipe/Conduit	
S1.005	8.900	0.020	450.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S10.000	22.014	0.110	200.1	0.000	5.00	0.0	0.600	o	200	Pipe/Conduit	
S10.001	23.393	0.117	200.0	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	
S10.002	50.816	0.254	200.0	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	
S10.003	43.053	0.108	400.0	1.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S11.000	8.816	0.044	200.4	0.000	5.00	0.0	0.600	o	200	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)
S4.001	50.00	7.27	109.600	0.000	0.0	0.0	0.0	0.85	26.8	0.0
S6.000	50.00	5.81	110.600	0.000	0.0	0.0	0.0	1.08	47.5	0.0
S7.000	50.00	5.63	110.600	0.000	0.0	0.0	0.0	1.08	47.4	0.0
S1.004	50.00	7.96	108.632	0.945	0.0	0.0	0.0	1.01	160.5	128.0
S8.000	50.00	5.48	109.600	0.000	0.0	0.0	0.0	0.85	26.8	0.0
S9.000	50.00	5.41	109.600	0.000	0.0	0.0	0.0	0.85	26.8	0.0
S1.005	50.00	8.12	108.567	0.945	0.0	0.0	0.0	0.95	151.4	128.0
S10.000	50.00	5.43	109.600	0.000	0.0	0.0	0.0	0.85	26.8	0.0
S10.001	50.00	5.89	109.490	0.000	0.0	0.0	0.0	0.85	26.8	0.0
S10.002	50.00	6.88	109.373	0.000	0.0	0.0	0.0	0.85	26.8	0.0
S10.003	50.00	7.59	108.869	1.000	0.0	0.0	0.0	1.01	160.7	135.4
S11.000	50.00	5.17	109.600	0.000	0.0	0.0	0.0	0.85	26.8	0.0

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
S12.000	26.152	0.131	199.6	0.000	5.00	0.0	0.600	R21	-44	Pipe/Conduit	
S12.001	17.303	0.087	198.9	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	
S11.001	11.459	0.057	200.0	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	
S11.002	24.109	0.121	200.0	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	
S11.003	30.340	0.152	200.0	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	
S13.000	28.028	0.140	200.2	0.000	5.00	0.0	0.600	R21	-44	Pipe/Conduit	
S14.000	33.254	0.166	200.3	0.000	5.00	0.0	0.600	R21	-44	Pipe/Conduit	
S15.000	40.032	0.200	200.2	0.000	5.00	0.0	0.600	R21	-44	Pipe/Conduit	
S10.004	8.396	0.019	441.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S16.000	62.238	0.311	200.1	0.000	5.00	0.0	0.600	R21	-44	Pipe/Conduit	
S17.000	60.949	0.305	199.8	0.000	5.00	0.0	0.600	R21	-44	Pipe/Conduit	
S16.001	40.771	0.204	199.9	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	
S18.000	57.564	0.288	199.9	0.000	5.00	0.0	0.600	R21	-44	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)
S12.000	50.00	5.40	110.600	0.000	0.0	0.0	0.0	1.08	47.5	0.0
S12.001	50.00	5.74	109.600	0.000	0.0	0.0	0.0	0.86	26.9	0.0
S11.001	50.00	5.96	109.513	0.000	0.0	0.0	0.0	0.85	26.8	0.0
S11.002	50.00	6.44	109.456	0.000	0.0	0.0	0.0	0.85	26.8	0.0
S11.003	50.00	7.03	109.335	0.000	0.0	0.0	0.0	0.85	26.8	0.0
S13.000	50.00	5.43	110.600	0.000	0.0	0.0	0.0	1.08	47.4	0.0
S14.000	50.00	5.51	110.600	0.000	0.0	0.0	0.0	1.08	47.4	0.0
S15.000	50.00	5.62	110.600	0.000	0.0	0.0	0.0	1.08	47.4	0.0
S10.004	50.00	7.74	108.761	1.000	0.0	0.0	0.0	0.96	152.8	135.4
S16.000	50.00	5.96	110.600	0.000	0.0	0.0	0.0	1.08	47.4	0.0
S17.000	50.00	5.94	110.600	0.000	0.0	0.0	0.0	1.08	47.5	0.0
S16.001	50.00	6.76	109.600	0.000	0.0	0.0	0.0	0.85	26.8	0.0
S18.000	50.00	5.89	110.600	0.000	0.0	0.0	0.0	1.08	47.5	0.0

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
S16.002	18.900	0.054	350.0	0.557	0.00	0.0	0.600	o	350	Pipe/Conduit	
S19.000	37.798	0.189	200.0	0.000	5.00	0.0	0.600	R21	-44	Pipe/Conduit	
S16.003	7.724	0.022	351.1	0.000	0.00	0.0	0.600	o	350	Pipe/Conduit	
S16.004	30.069	0.086	349.6	0.000	0.00	0.0	0.600	o	350	Pipe/Conduit	
S16.005	9.559	0.027	354.0	0.000	0.00	0.0	0.600	o	350	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)
S16.002	50.00	7.10	109.246	0.557	0.0	0.0	0.0	0.92	88.6	75.4
S19.000	50.00	5.58	110.600	0.000	0.0	0.0	0.0	1.08	47.5	0.0
S16.003	50.00	7.24	109.192	0.557	0.0	0.0	0.0	0.92	88.5	75.4
S16.004	50.00	7.78	109.170	0.557	0.0	0.0	0.0	0.92	88.7	75.4
S16.005	50.00	7.96	109.084	0.557	0.0	0.0	0.0	0.92	88.1	75.4

Conduit Sections for Storm

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m^2)
-44	R21	200	250			0.288	0.044

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)
S1	111.000	1.400	Open Manhole	1200	S1.000	109.600	200			
S2	111.000	1.672	Open Manhole	1200	S1.001	109.328	200	S1.000	109.328	200
S3	111.000	1.803	Open Manhole	1200	S1.002	109.197	200	S1.001	109.197	200
S4	111.000	0.400	Junction		S2.000	110.600	-44			
S5	111.000	0.400	Junction		S3.000	110.600	-44			
S4	111.000	2.122	Open Manhole	1200	S1.003	108.878	400	S1.002	109.078	200
								S2.000	110.264	-44
								S3.000	110.316	-44
S5	111.000	0.400	Junction		S4.000	110.600	-44			
S6	111.000	0.400	Junction		S5.000	110.600	-44			
S5	111.000	1.400	Open Manhole	1200	S4.001	109.600	200	S4.000	110.365	-44
								S5.000	110.527	-44
S10	111.000	0.400	Junction		S6.000	110.600	-44			
S11	111.000	0.400	Junction		S7.000	110.600	-44			
S5	111.000	2.368	Open Manhole	1200	S1.004	108.632	450	S1.003	108.682	400
								S4.001	109.205	200
								S6.000	110.337	-44
								S7.000	110.396	-44
S7	111.000	1.400	Open Manhole	1200	S8.000	109.600	200			
S8	111.000	1.400	Open Manhole	1200	S9.000	109.600	200			
S6	111.000	2.433	Open Manhole	1350	S1.005	108.567	450	S1.004	108.567	450
								S8.000	109.477	200
								S9.000	109.496	200
SSoakaway 1	110.000	1.453	Open Manhole	450		OUTFALL		S1.005	108.547	450
S10	111.000	1.400	Open Manhole	1200	S10.000	109.600	200			
S11	111.000	1.510	Open Manhole	1200	S10.001	109.490	200	S10.000	109.490	200
S12	111.000	1.627	Open Manhole	1200	S10.002	109.373	200	S10.001	109.373	200
S13	111.000	2.131	Open Manhole	1350	S10.003	108.869	450	S10.002	109.119	200
S14	111.000	1.400	Open Manhole	1200	S11.000	109.600	200			
S21	111.000	0.400	Junction		S12.000	110.600	-44			
S22	111.000	1.400	Open Manhole	1200	S12.001	109.600	200	S12.000	110.469	-44
S15	111.000	1.487	Open Manhole	1200	S11.001	109.513	200	S11.000	109.556	200
								S12.001	109.513	200
S16	111.000	1.544	Open Manhole	1200	S11.002	109.456	200	S11.001	109.456	200
S17	111.000	1.665	Open Manhole	1200	S11.003	109.335	200	S11.002	109.335	200
S26	111.000	0.400	Junction		S13.000	110.600	-44			
S27	111.000	0.400	Junction		S14.000	110.600	-44			
S28	111.000	0.400	Junction		S15.000	110.600	-44			

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)
S14	111.000	2.239	Open Manhole	1500	S10.004	108.761	450	S10.003	108.761	450
								S11.003	109.183	200
								S13.000	110.460	-44
								S14.000	110.434	-44
								S15.000	110.400	-44
SSoakaway 2	110.000	1.258	Open Manhole	450		OUTFALL		S10.004	108.742	450
S25	111.000	0.400	Junction		S16.000	110.600	-44			
S26	111.000	0.400	Junction		S17.000	110.600	-44			
S19	111.000	1.400	Open Manhole	1200	S16.001	109.600	200	S16.000	110.289	-44
								S17.000	110.295	-44
S28	111.000	0.400	Junction		S18.000	110.600	-44			
S20	111.000	1.754	Open Manhole	1200	S16.002	109.246	350	S16.001	109.396	200
								S18.000	110.312	-44
S30	111.000	0.400	Junction		S19.000	110.600	-44			
S21	111.000	1.808	Open Manhole	1200	S16.003	109.192	350	S16.002	109.192	350
								S19.000	110.411	-44
S22	111.000	1.830	Open Manhole	1200	S16.004	109.170	350	S16.003	109.170	350
S23	111.000	1.916	Open Manhole	1500	S16.005	109.084	350	S16.004	109.084	350
SSoakaway 3	110.000	0.943	Open Manhole	350		OUTFALL		S16.005	109.057	350

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	329108.061	362625.958	329108.061	362625.958	Required	
S2	329055.221	362613.073	329055.221	362613.073	Required	
S3	329029.380	362608.697	329029.380	362608.697	Required	
S4	329094.250	362607.938			No Entry	
S5	329087.845	362589.051			No Entry	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S4	329031.115	362584.871	329031.115	362584.871	Required	
S5	329126.523	362609.263			No Entry	
S6	329105.712	362551.287			No Entry	
S5	329110.562	362565.064	329110.562	362565.064	Required	
S10	329080.618	362570.000			No Entry	
S11	329074.542	362550.785			No Entry	
S5	329033.967	362545.717	329033.967	362545.717	Required	
S7	329060.444	362519.556	329060.444	362519.556	Required	
S8	329015.045	362519.725	329015.045	362519.725	Required	
S6	329035.860	362519.725	329035.860	362519.725	Required	
SSoakaway 1	329035.825	362510.825			No Entry	
S10	328998.182	362601.818	328998.182	362601.818	Required	
S11	328977.494	362594.293	328977.494	362594.293	Required	
S12	328960.923	362577.782	328960.923	362577.782	Required	
S13	328912.360	362562.815	328912.360	362562.815	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S14	328898.332	362559.310	328898.332	362559.310	Required	
S21	328906.126	362575.144			No Entry	
S22	328881.057	362567.695	328881.057	362567.695	Required	
S15	328891.420	362553.838	328891.420	362553.838	Required	
S16	328886.448	362543.513	328886.448	362543.513	Required	
S17	328882.105	362519.799	328882.105	362519.799	Required	
S26	328886.733	362530.919			No Entry	
S27	328943.729	362531.038			No Entry	
S28	328906.219	362559.307			No Entry	
S14	328912.445	362519.762	328912.445	362519.762	Required	
SSoakaway 2	328912.396	362511.366			No Entry	
S25	329026.257	362592.008			No Entry	
S26	329027.735	362574.763			No Entry	
S19	328966.796	362573.622	328966.796	362573.622	Required	
S28	329028.392	362557.190			No Entry	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S20	328975.772	362533.852	328975.772	362533.852	Required	
S30	329029.049	362540.438			No Entry	
S21	328993.554	362527.447	328993.554	362527.447	Required	
S22	328993.412	362519.725	328993.412	362519.725	Required	
S23	328963.343	362519.722	328963.343	362519.722	Required	
SSoakaway 3	328963.343	362510.163			No Entry	

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)
S1.000	o	200	S1	111.000	109.600	1.200	Open Manhole	1200
S1.001	o	200	S2	111.000	109.328	1.472	Open Manhole	1200
S1.002	o	200	S3	111.000	109.197	1.603	Open Manhole	1200
S2.000	R21	-44	S4	111.000	110.600	0.150	Junction	
S3.000	R21	-44	S5	111.000	110.600	0.150	Junction	
S1.003	o	400	S4	111.000	108.878	1.722	Open Manhole	1200
S4.000	R21	-44	S5	111.000	110.600	0.150	Junction	
S5.000	R21	-44	S6	111.000	110.600	0.150	Junction	
S4.001	o	200	S5	111.000	109.600	1.200	Open Manhole	1200
S6.000	R21	-44	S10	111.000	110.600	0.150	Junction	
S7.000	R21	-44	S11	111.000	110.600	0.150	Junction	
S1.004	o	450	S5	111.000	108.632	1.918	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)
S1.000	54.388	200.0	S2	111.000	109.328	1.472	Open Manhole	1200
S1.001	26.209	200.0	S3	111.000	109.197	1.603	Open Manhole	1200
S1.002	23.890	200.0	S4	111.000	109.078	1.722	Open Manhole	1200
S2.000	67.217	200.1	S4	111.000	110.264	0.486	Open Manhole	1200
S3.000	56.883	200.3	S4	111.000	110.316	0.434	Open Manhole	1200
S1.003	39.257	200.3	S5	111.000	108.682	1.918	Open Manhole	1200
S4.000	46.992	200.0	S5	111.000	110.365	0.385	Open Manhole	1200
S5.000	14.606	200.1	S5	111.000	110.527	0.223	Open Manhole	1200
S4.001	79.001	200.0	S5	111.000	109.205	1.595	Open Manhole	1200
S6.000	52.593	200.0	S5	111.000	110.337	0.413	Open Manhole	1200
S7.000	40.890	200.4	S5	111.000	110.396	0.354	Open Manhole	1200
S1.004	26.061	400.9	S6	111.000	108.567	1.983	Open Manhole	1350

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)
S8.000	o	200	S7	111.000	109.600	1.200	Open Manhole	1200
S9.000	o	200	S8	111.000	109.600	1.200	Open Manhole	1200
S1.005	o	450	S6	111.000	108.567	1.983	Open Manhole	1350
S10.000	o	200	S10	111.000	109.600	1.200	Open Manhole	1200
S10.001	o	200	S11	111.000	109.490	1.310	Open Manhole	1200
S10.002	o	200	S12	111.000	109.373	1.427	Open Manhole	1200
S10.003	o	450	S13	111.000	108.869	1.681	Open Manhole	1350
S11.000	o	200	S14	111.000	109.600	1.200	Open Manhole	1200
S12.000	R21	-44	S21	111.000	110.600	0.150	Junction	
S12.001	o	200	S22	111.000	109.600	1.200	Open Manhole	1200
S11.001	o	200	S15	111.000	109.513	1.287	Open Manhole	1200
S11.002	o	200	S16	111.000	109.456	1.344	Open Manhole	1200
S11.003	o	200	S17	111.000	109.335	1.465	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)
S8.000	24.585	199.9	S6	111.000	109.477	1.323	Open Manhole	1350
S9.000	20.814	200.1	S6	111.000	109.496	1.304	Open Manhole	1350
S1.005	8.900	450.0	SSoakaway 1	110.000	108.547	1.003	Open Manhole	450
S10.000	22.014	200.1	S11	111.000	109.490	1.310	Open Manhole	1200
S10.001	23.393	200.0	S12	111.000	109.373	1.427	Open Manhole	1200
S10.002	50.816	200.0	S13	111.000	109.119	1.681	Open Manhole	1350
S10.003	43.053	400.0	S14	111.000	108.761	1.789	Open Manhole	1500
S11.000	8.816	200.4	S15	111.000	109.556	1.244	Open Manhole	1200
S12.000	26.152	199.6	S22	111.000	110.469	0.281	Open Manhole	1200
S12.001	17.303	198.9	S15	111.000	109.513	1.287	Open Manhole	1200
S11.001	11.459	200.0	S16	111.000	109.456	1.344	Open Manhole	1200
S11.002	24.109	200.0	S17	111.000	109.335	1.465	Open Manhole	1200
S11.003	30.340	200.0	S14	111.000	109.183	1.617	Open Manhole	1500

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)
S13.000	R21	-44	S26	111.000	110.600	0.150	Junction	
S14.000	R21	-44	S27	111.000	110.600	0.150	Junction	
S15.000	R21	-44	S28	111.000	110.600	0.150	Junction	
S10.004	o	450	S14	111.000	108.761	1.789	Open Manhole	1500
S16.000	R21	-44	S25	111.000	110.600	0.150	Junction	
S17.000	R21	-44	S26	111.000	110.600	0.150	Junction	
S16.001	o	200	S19	111.000	109.600	1.200	Open Manhole	1200
S18.000	R21	-44	S28	111.000	110.600	0.150	Junction	
S16.002	o	350	S20	111.000	109.246	1.404	Open Manhole	1200
S19.000	R21	-44	S30	111.000	110.600	0.150	Junction	
S16.003	o	350	S21	111.000	109.192	1.458	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)
S13.000	28.028	200.2	S14	111.000	110.460	0.290	Open Manhole	1500
S14.000	33.254	200.3	S14	111.000	110.434	0.316	Open Manhole	1500
S15.000	40.032	200.2	S14	111.000	110.400	0.350	Open Manhole	1500
S10.004	8.396	441.9	SSoakaway 2	110.000	108.742	0.808	Open Manhole	450
S16.000	62.238	200.1	S19	111.000	110.289	0.461	Open Manhole	1200
S17.000	60.949	199.8	S19	111.000	110.295	0.455	Open Manhole	1200
S16.001	40.771	199.9	S20	111.000	109.396	1.404	Open Manhole	1200
S18.000	57.564	199.9	S20	111.000	110.312	0.438	Open Manhole	1200
S16.002	18.900	350.0	S21	111.000	109.192	1.458	Open Manhole	1200
S19.000	37.798	200.0	S21	111.000	110.411	0.339	Open Manhole	1200
S16.003	7.724	351.1	S22	111.000	109.170	1.480	Open Manhole	1200

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)
S16.004	o	350	S22	111.000	109.170	1.480	Open Manhole	1200
S16.005	o	350	S23	111.000	109.084	1.566	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)
S16.004	30.069	349.6	S23	111.000	109.084	1.566	Open Manhole	1500
S16.005	9.559	354.0	SSoakaway 3	110.000	109.057	0.593	Open Manhole	350

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.000	0.000	0.000
1.003	User	-	100	0.945	0.945	0.945
4.000	-	-	100	0.000	0.000	0.000
5.000	-	-	100	0.000	0.000	0.000
4.001	-	-	100	0.000	0.000	0.000
6.000	-	-	100	0.000	0.000	0.000
7.000	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
8.000	-	-	100	0.000	0.000	0.000
9.000	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
10.000	-	-	100	0.000	0.000	0.000
10.001	-	-	100	0.000	0.000	0.000
10.002	-	-	100	0.000	0.000	0.000
10.003	User	-	100	1.000	1.000	1.000
11.000	-	-	100	0.000	0.000	0.000
12.000	-	-	100	0.000	0.000	0.000
12.001	-	-	100	0.000	0.000	0.000
11.001	-	-	100	0.000	0.000	0.000
11.002	-	-	100	0.000	0.000	0.000
11.003	-	-	100	0.000	0.000	0.000
13.000	-	-	100	0.000	0.000	0.000
14.000	-	-	100	0.000	0.000	0.000
15.000	-	-	100	0.000	0.000	0.000
10.004	-	-	100	0.000	0.000	0.000
16.000	-	-	100	0.000	0.000	0.000
17.000	-	-	100	0.000	0.000	0.000
16.001	-	-	100	0.000	0.000	0.000
18.000	-	-	100	0.000	0.000	0.000
16.002	User	-	100	0.557	0.557	0.557
19.000	-	-	100	0.000	0.000	0.000
16.003	-	-	100	0.000	0.000	0.000
16.004	-	-	100	0.000	0.000	0.000
16.005	-	-	100	0.000	0.000	0.000
				Total 2.501	Total 2.501	Total 2.501

Surcharged Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.005	SSoakaway 1	110.000	108.547	0.000	450	0

Surcharged Outfall Details for Storm

Datum (m) 0.000 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
5	1.000	15	1.000	25	1.000	35	1.000	45	1.000	55	1.000
10	1.000	20	1.000	30	1.000	40	1.000	50	1.000	60	1.000

Surcharged Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S10.004	SSoakaway 2	110.000	108.742	0.000	450	0

Datum (m) 0.000 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
5	1.000	15	1.000	25	1.000	35	1.000	45	1.000	55	1.000
10	1.000	20	1.000	30	1.000	40	1.000	50	1.000	60	1.000

Surcharged Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S16.005	SSoakaway 3	110.000	109.057	0.000	350	0

Datum (m) 0.000 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
5	1.000	15	1.000	25	1.000	35	1.000	45	1.000	55	1.000
10	1.000	20	1.000	30	1.000	40	1.000	50	1.000	60	1.000

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.322		

Summary Wizard of 15 minute 30 year Summer I+40% for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.313
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 60, 720, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	40, 40, 40

PN	US/MH Name	Storm Rank	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S1.000	S1	6	109.867	0.067	0.000	0.05		1.3	SURCHARGED
S1.001	S2	6	109.867	0.339	0.000	0.53		13.3	SURCHARGED
S1.002	S3	6	109.889	0.492	0.000	0.87		21.6	SURCHARGED
S2.000	S4	14	110.600	-0.250	0.000	0.00		0.0	OK
S3.000	S5	14	110.600	-0.250	0.000	0.00		0.0	OK
S1.003	S4	6	109.954	0.677	0.000	1.66		250.5	SURCHARGED
S4.000	S5	14	110.600	-0.250	0.000	0.00		0.0	OK
S5.000	S6	14	110.600	-0.250	0.000	0.00		0.0	OK
S4.001	S5	15	109.600	-0.200	0.000	0.00		0.0	OK
S6.000	S10	14	110.600	-0.250	0.000	0.00		0.0	OK
S7.000	S11	14	110.600	-0.250	0.000	0.00		0.0	OK
S1.004	S5	6	109.388	0.306	0.000	1.84		248.5	SURCHARGED
S8.000	S7	14	109.600	-0.200	0.000	0.00		0.0	OK
S9.000	S8	14	109.600	-0.200	0.000	0.00		0.0	OK
S1.005	S6	6	109.170	0.154	0.000	2.93		247.5	SURCHARGED
S10.000	S10	6	109.760	-0.040	0.000	0.04		1.1	OK
S10.001	S11	6	109.768	0.078	0.000	0.25		6.1	SURCHARGED
S10.002	S12	5	109.795	0.222	0.000	0.40		10.4	SURCHARGED
S10.003	S13	5	109.853	0.534	0.000	1.94		280.0	SURCHARGED
S11.000	S14	14	109.600	-0.200	0.000	0.00		0.0	OK
S12.000	S21	14	110.600	-0.250	0.000	0.00		0.0	OK
S12.001	S22	14	109.600	-0.200	0.000	0.00		0.0	OK

Summary Wizard of 15 minute 30 year Summer I+40% for Storm

PN	US/MH Name	Storm Rank	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S11.001	S15	15	109.513	-0.200	0.000	0.00		0.0	OK
S11.002	S16	15	109.456	-0.200	0.000	0.00		0.0	OK
S11.003	S17	5	109.408	-0.127	0.000	0.04		0.9	OK
S13.000	S26	14	110.600	-0.250	0.000	0.00		0.0	OK
S14.000	S27	14	110.600	-0.250	0.000	0.00		0.0	OK
S15.000	S28	14	110.600	-0.250	0.000	0.00		0.0	OK
S10.004	S14	5	109.421	0.210	0.000	3.19		281.1	SURCHARGED
S16.000	S25	14	110.600	-0.250	0.000	0.00		0.0	OK
S17.000	S26	14	110.600	-0.250	0.000	0.00		0.0	OK
S16.001	S19	6	110.274	0.474	0.000	0.12		3.1	SURCHARGED
S18.000	S28	15	110.600	-0.250	0.000	0.00		0.0	OK
S16.002	S20	6	110.284	0.688	0.000	1.99		148.3	SURCHARGED
S19.000	S30	14	110.600	-0.250	0.000	0.00		0.0	OK
S16.003	S21	6	110.059	0.517	0.000	2.57		148.5	SURCHARGED
S16.004	S22	6	109.873	0.353	0.000	1.85		146.3	SURCHARGED
S16.005	S23	6	109.577	0.143	0.000	2.43		146.9	SURCHARGED

INTERNAL LAYOUT OF THE CARPARK TO
BE DETERMINED BY THE ARCHITECT.
GEOCELL ATTENUATION STORAGE
DEEP BORE
SOAKAWAY (typ.)
SPEL Class 1 Full Retention Separator
Model P125 1C/SC
Or similar approved
SPEL Class 1 Full Retention Separator
Model P200 1C/SC
Or similar approved
SPEL Class 1 Full Retention Separator
Model P200 1C/SC
Or similar approved
S1
Depth 1.400m
S1.000
1:200.0
USIL 109.600m
200mm
S1.001
1:200.0
USIL 109.328m
200mm
S2
Depth 1.672m
S3
Depth 1.803m
S4
Depth 0.400m
S5
Depth 0.400m
S10
Depth 1.400m
S10.000
1:200.1
USIL 109.600m
200mm
S11
Depth 1.510m
S1.002
1:200.0
USIL 109.197m
200mm
S25
Depth 0.400m
S2.000
1:200.1
USIL 110.600m
-44mm
S5
Depth 0.400m
S3.000
1:200.3
USIL 110.600m
-44mm
S4
Depth 2.122m
S4.000
1:200.0
USIL 110.600m
-44mm
S10.001
1:200.0
USIL 109.490m
200mm
S16.000
1:200.1
USIL 110.600m
-44mm
S12
Depth 1.627m
S19
Depth 1.400m
S17.000
1:199.8
USIL 110.600m
-44mm
S26
Depth 0.400m
S21
Depth 0.400m
S12.000
1:199.6
USIL 110.600m
-44mm
S22
Depth 1.400m
S10.002
1:200.0
USIL 109.373m
200mm
S10
Depth 0.400m
S5
Depth 1.400m
S1.003
1:200.3
USIL 108.878m
400mm
S13
Depth 2.131m
S12.001
1:198.9
USIL 109.600m
200mm
S14
Depth 1.400m
S28
Depth 0.400m
S15
Depth 1.487m
S11.000
1:200.4
USIL 109.600m
200mm
S16.001
1:199.9
USIL 109.600m
200mm
S28
Depth 0.400m
S6.000
1:200.0
USIL 110.600m
-44mm
S4.001
1:200.0
USIL 109.600m
200mm
S11
Depth 0.400m
S5.000
1:200.1
USIL 110.600m
-44mm
S6
Depth 0.400m
S11.001
1:200.0
USIL 109.513m
200mm
S16
Depth 1.544m
S10.003
1:200.0
USIL 108.869m
S15.000
S18.000
1:199.9
USIL 110.600m
-44mm
S5
Depth 2.368m
S7.000
1:200.4
USIL 110.600m
-44mm
S30
Depth 0.400m
ABR
ABR
ABR
S27
Depth 0.400m
S20
Depth 1.754m
S19.000
1:200.0
USIL 110.600m
-44mm
S1.004
1:400.9
USIL 108.632m
450mm
S11.002
S26
Depth 0.400m
USIL 109.456m
S13.000
1:200.2
USIL 110.600m
-44mm
S14.000
1:200.3
USIL 110.600m
-44mm
S16.002
1:350.0
USIL 109.246m
350mm
S21
Depth 1.808m
S16.003
1:351.1
USIL 109.192m
S17
Depth 1.665m
S14
Depth 2.239m
S23
Depth 1.916m
S16.004
S22
Depth 1.830m
S8
Depth 1.400m
S9.000
1:200.1
USIL 109.600m
200mm
S6
Depth 2.433m
S8.000
1:199.9
USIL 109.600m
200mm
S7
Depth 1.400m
S10.004
1:441.9
USIL 108.761m
350mm
S16.005
1:354.0
USIL 109.084m
350mm
S1.005
1:450.0
USIL 108.567m
450mm
Soakaway 1
Depth (m) 1.453
Soakaway 3
Depth (m) 0.943
-3.0%
-3.2%
GATE-2
MHAR1