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IFA2

IFA 2 Converter Station

CIVIL & STRUCTURAL REPORT
SITE DRAINAGE STRATEGY

BakerHicks Ref: **30000764-IRV-0001**

ABB Ref: **TBC**

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Project Title: **IFA 2 Converter Station** Project Number: **30000764**

Document Title: **Civil & Structural Report – Site Drainage Scheme Strategy**

Document Ref: **30000661-IRV-0001**

Rev	Date	Description	Prepared by	Checked by	Approved by
P01	28/06/2017	First Issue	Ryan Barraclough	Neal Shaw	Steve Perkins
P02	12/07/2017	Issued for Planning	Ryan Barraclough	James Spaul	Steve Perkins

Revision History:

Revision:	*Date:*	*Amendments:*
P01:	28th June 2017	First Issue to support planning application
P02:	12th July 2017	General amendments to suit amended site layout and client comments.

TABLE OF CONTENTS

1.0 Introduction

This document presents information relating to the below ground drainage scheme design for IFA 2 converter station project. It should be read alongside the drainage general arrangement drawing 30000764-IDV-4200 Rev P2 (included in Appendix C of this document).

2.0 Assumptions & Caveats

The drainage strategy adopted is based on the following assumptions which will need to be confirmed at detailed design stage.

2.1 General

a) It is assumed the site layout is as indicated on the general arrangement drawing 30000764-IDV-4420_P2.
b) It is assumed the finished site level is 9.000m.

2.2 Surface water drainage

c) Only catchment areas within the proposed fence line are accounted for with the exception of the MVS (Medium Voltage Switchgear) building (see sketch in Appendix A). It is assumed areas outside of the fence line will drain via infiltration.
d) It is assumed the groundwater table is approximately 2.5m below site level i.e at 6.500m based on Table K of the Ground Investigation Report (referenced in section 5.4).
e) Flood Studies Report rainfall data has been used for simulation of design storms. The site co-ordinates are set to X=456818m, Y=102409m.
f) Where infiltration to the ground is not feasible, discharge to watercourse/sewer will be limited to 8.0 l/s in line with the 1 year return period green-field runoff rate taken from section 5.0 of the Flood Risk Assessment (referenced in section 5.4).
g) It is assumed any necessary discharge consents will be successfully obtained.
h) It is assumed access roads adjacent to the transformer area and shunt reactor area are at higher risk of oil contamination. Runoff from these areas will be conveyed by the surface water drainage network and pass through a suitable Oil Separator in line with Environment Agency guidance.
i) It is assumed that surface water runoff from all other impermeable access road/car park areas is at low risk of oil contamination and will runoff to chippings and/or infiltrate into the soil.
j) It is assumed that roof rainwater pipe positions are as indicated in Appendix A - generally one per corner. This will be confirmed with the architects at detailed design and any changes will have a minor impact on the scheme.
k) It is assumed under normal conditions runoff from the valve cooling tower slab drains continuously to the surface water drainage network i.e. automatic valve in line with section 2.2 of ABB document 1JNL417030.
l) Runoff from the Transformer bunds and Shunt Reactor bund is to be pumped using bund water control units. However for simulation purposes the catchment areas are included in the model as if the areas are continuously draining.
m) It is assumed type 2 oil containment design is required for the Transformer bunds in line with the IFA2 specification. The storage volume for the remote underground tank is sized to ensure the oil and fire fighting water can be contained with an additional allowance. The volume of oil in a single transformer is taken from email correspondence and will be confirmed at detailed design.

2.3 Foul water drainage

n) It is assumed an existing foul sewer south of the site has sufficient spare capacity to convey the foul water flow rate from the site.
o) It is assumed any necessary discharge consents will be obtained.

3.0 Surface water drainage strategy

3.1 Catchment areas

The table below presents a list of catchment areas accounted for in the design and should be read alongside the sketch presented in Appendix A. As mentioned in section 2.0, only areas within the fence line are considered with the exception of the MVS Building. Generally the values shown are rounded up to the nearest $10m^2$ for simplicity.

Description	Plan Area (m²)	Comments
Valve/DC hall	3480	Roof runoff to RWP
Reactor hall	1160	Roof runoff to RWP
AC hall	1460	Roof runoff to RWP
Service building	690	Roof runoff to RWP
Office/control building	960	Roof runoff to RWP
Valve coolers	350	Roof runoff to RWP
Climate room DC hall	110	Roof runoff to RWP
Climate room Reactor hall	110	Roof runoff to RWP
Valve hall climate system	2x150	Roof runoff to RWP
MVS building	70	Roof runoff to RWP
Storage building	780	Roof runoff to RWP
Road around valve coolers	690	Falls into channel
Road adjacent to service building	220	Falls into channel
Road adjacent to transformers	1000	Falls into channel and discharge via oil separator
Road adjacent to shunt reactors	360	Falls into channel and discharge via oil separator
Shunt reactor	60	BWCU pump and discharge via oil separator
Transformer area	680	BWCU pump and discharge via oil separator
Road at entrance	240	Falls into channel and discharge via oil separator
Main Car park	600	Porous surface and infiltration to soil
Small Car park	280	Porous surface and infiltration to soil
All other access road	3900	Falls into chippings and infiltration to soil
Water tanks	300	Falls into chippings and infiltration to soil
Pump house	40	Falls into chippings and infiltration to soil
Chippings	5480	Infiltration to soil

Total Area:	**23,320**	**m²**
Area direct to BGD network:	**10,380**	**m²**
Area via oil interceptor:	**2,340**	**m²**
Area to infiltration:	**10,600**	**m²**

3.2 Discharge of surface water

In line with requirements of BS EN 752 and the guidance in the Flood Risk Assessment, the design intent is to discharge surface water as per the following hierarchy. Each option is described in the sections that follow.

- Preferred option is infiltration to soil
- If infiltration is not feasible, next option is discharge to a watercourse
- Final option is discharge to the existing sewer network

The proposed drainage strategy for the site is as per the general arrangement drawing – a large proportion of surface water runoff will be discharged to a watercourse at the green-field runoff rate with some infiltration where feasible.

3.2.1 Discharge to the ground

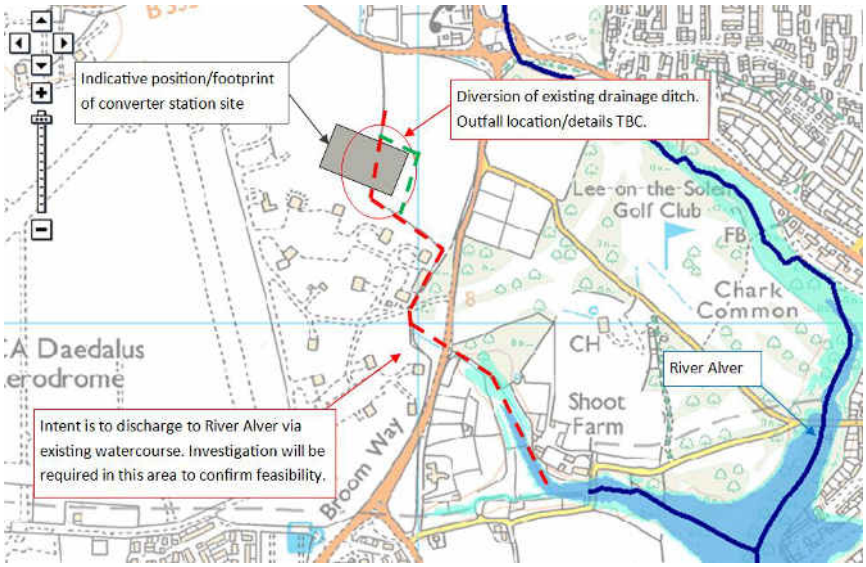
From inspection of the Ground Investigation Report the water table at the site is relatively high with an average of approximately 2.5m BGL. The SuDS design manual suggests there should be at least 1m between the formation level of any infiltration component and the water table. With this in mind any infiltration systems adopted will need to be shallow. Where possible it is envisaged that porous paving and/or shallow swales will provide effective drainage solutions. However drainage of roof runoff to the soil via underground infiltration tanks generally appears to be difficult whilst also complying with the requirement above. It should also be noted that retention ponds have not been considered due to the proximity of the adjacent airfield.

From the typical description of stratum in the Ground Investigation Report it is difficult to make a confident assessment of permeability rates for the site. Soak away testing in accordance with BRE Digest 365 will be completed on site to ensure infiltration is a viable solution and to inform detailed design.

3.2.2 Discharge to a watercourse

Discharge from the site surface water drainage network will be limited to 8.0l/s in line with the 1 year return period green-field runoff rate stated in the Flood Risk Assessment. This ensures the impact of the new development on the surrounding environment is minimised.

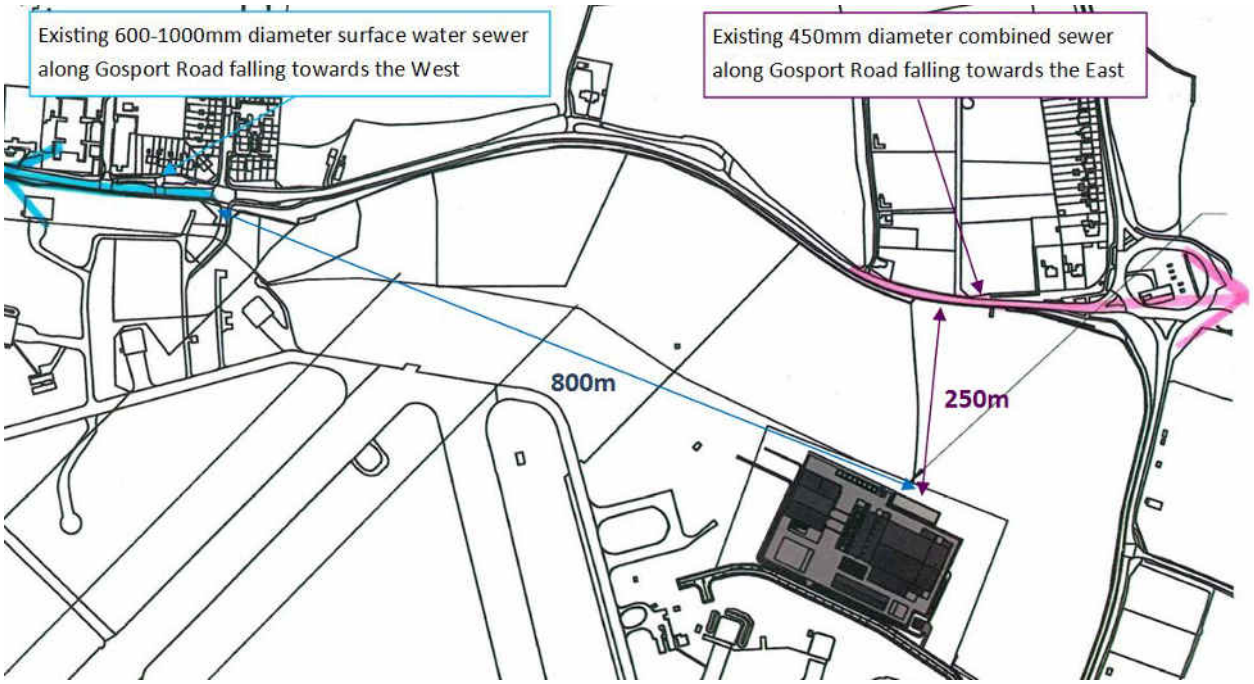
There is an existing drainage ditch which runs through the proposed site location and it is believed this ultimately discharges to the River Alver to the east. This drainage ditch will need to be diverted as part of the works. The intention is to provide an outfall for the surface water drainage at a suitable location along this drainage ditch - further survey investigation is required to confirm feasibility and consider outfall details. It is assumed that any necessary discharge consent from the relevant authorities will be obtained. The map below taken from the Environment Agency website provides an overview of the area to be investigated.



It should be noted that on another project in the Daedalus Enterprise Zone the surface water drainage layout suggests a very similar approach was adopted with attenuation, flow control and discharge to this watercourse.

3.2.3 Discharge to a sewer

From inspection of the Southern Water sewer map included in the Flood Risk Assessment there appears to be 2no. options if connection into a sewer is required. It is assumed that the sewers have sufficient capacity to convey the additional flow.



The closest connection is a 450mm diameter combined sewer approximately 250m north of the site to which there appears to be several existing manholes along Gosport Road where connection could be made. This sewer flows towards the east and across the roundabout however it is not clear where this sewer ultimately discharges.

There is also an existing surface water sewer approximately 800m north west of the site which appears to be 600mm diameter at the junction with Marks Road. This sewer flows towards the west however it is not clear where this sewer ultimately discharges.

3.3 Drainage design parameters

3.3.1 Design Storm

In line with the recommendations of the Flood Risk Assessment the site drainage network has been designed for 100 year return period storms with a 10% increase in rainfall intensity to account for climate change. This requirement is deemed more onerous compared with the requirements of BS EN 752 and NGTS2.20. Storm durations simulated range from 15 minutes to 1 week

Flood Studies Report rainfall data has been used based on the site co-ordinates X=456818m & Y=102409m which give the following parameters.

M5:60 = 19.2mm
R = 0.350

3.3.2 Hydraulic Parameters

Key hydraulic parameters relevant to the design are listed below with references.

Impermeable runoff co-efficient:	1.0	n/a
Time of entry:	5 minutes	Clause NA.4.2.3.3, BS EN 752
Pipe roughness:	0.6 mm	Table NA.1, BS EN 752
Energy loss coefficient for manholes:	As required	Table NA.2, BS EN 752
Minimum full bore pipe velocity:	1.0 m/s	Clause NA.11.3.3, BS EN 752

3.4 Technical Details

3.4.1 Pipes

The below ground pipes associated with the surface water scheme will range from 150 to 450mm diameter. Plastic pipes are preferred to concrete as they are lighter and can be made from recycled materials whilst also providing sufficient strength, chemical resistance and flexibility. Perforated options are also available for use with the geo cellular attenuation tank(s). Special protection of the pipes will be required where pipes have less than 0.6m cover beneath chippings or 0.9m cover beneath access roads.

3.4.2 Manholes

The manhole chambers will be precast concrete with pre formed pipe openings and channels to reduce and simplify the work on site. The manhole chambers will range from 1.2m up to the maximum diameter required. At the upstream end of pipe runs rodding eyes will be used instead of manholes where feasible.

3.4.3 Channels

Runoff from access road areas will be conveyed to the below ground drainage network via linear drainage channels. The channels will be sized to convey the 100 year return period

3.4.4 Flow Control

Discharge from the site will be restricted to the 1 year return period green field runoff rate set out in the Flood Risk Assessment. This will be achieved using a Hydro Brake Optimum surface water flow control unit installed in manhole SW1.10. The design flow will be 8.0 l/s and the head will be 1.15m which is approximately the depth from the invert level of SW1.10 to the top of the geo cellular attenuation tank.

3.4.5 Geo-cellular Attenuation

Surface water attenuation is required in order to restrict the discharge from the site as per section 3.4.1 whilst also ensuring no flooding of the site network for the design storm. Geo cellular tanks wrapped in an impermeable membrane will be adopted and based on the assumptions stated in this document it is estimated the total volume of attenuation required is approximately 500m^3 after a unit porosity of 95% is accounted for i.e. net attenuation volume of 475m^3.

A perforated pipe will run through the tank in a trench backfilled with granular material in accordance with guidance set out in the SuDS Manual. The pipe will comfortably convey the flow for ‘day to day’ storms with the attenuation capacity reserved for more severe storms.

3.4.6 Car Park(s)

Porous asphalt/concrete laid on permeable subgrade will be used to convey runoff from the car park to the soil beneath. A shallow 150mm deep geo-cellular attenuation system will be used to provide temporary storage whilst also forming part of the subgrade to provide structural support. The permeability rate for the soil will need to be confirmed through infiltration testing in accordance with BRE Digest 635.

3.4.7 Rainwater Harvesting

It is anticipated that the demand for non-potable water at the site will be relatively low and with this in mind it is assumed that any rainwater harvesting solution adopted will provide no benefit to the drainage network from an attenuation perspective. However rainwater harvesting provides environmental benefits in terms of water conservation and so a solution will be considered at detailed design stage.

3.4.8 Oil Separator

It is assumed that runoff from access road areas adjacent to the transformer/shunt reactor will need to pass through a full retention oil separator. This is due to a potential risk of 'large spills' in line with Environment Agency pollution prevention guidelines. The separator will need to be Class 1 as the discharge is to the surface water drainage network. As described in section 3.1 the total catchment area is approximately 2200m^2. With this in mind an Oil Interceptor with a nominal size of NS40 will be specified in line with BS EN 858-2 such as the SPEL Puraceptor Class 1 full retention separator P040/2CSC model. As some of the flow through the interceptor is pumped, this size will need to be reviewed at detailed design to ensure the design flow rate through the separator is not exceeded. The two chamber model will be specified due to maintenance benefits. Penstock/sampling chambers will be located immediately upstream and downstream of the oil separator as well as immediately downstream of the attenuation tank.

3.4.9 Type 2 Oil Containment Underground Storage Tank

The underground tank has been sized in line with the IFA2 specification. Based on previous email correspondence it is assumed the volume of oil in one transformer is 112m^3. Allowing for fire fighting water and spare capacity it is estimated the volume required could be in the region of 200m^3 - a GRP tank will be used such as the SPEL Tankstor 200,000l capacity tank from the 600 Series range. Runoff from the transformer bunds will pass through the tank and be discharged to the site drainage network via a bund water control unit.

3.5 Results

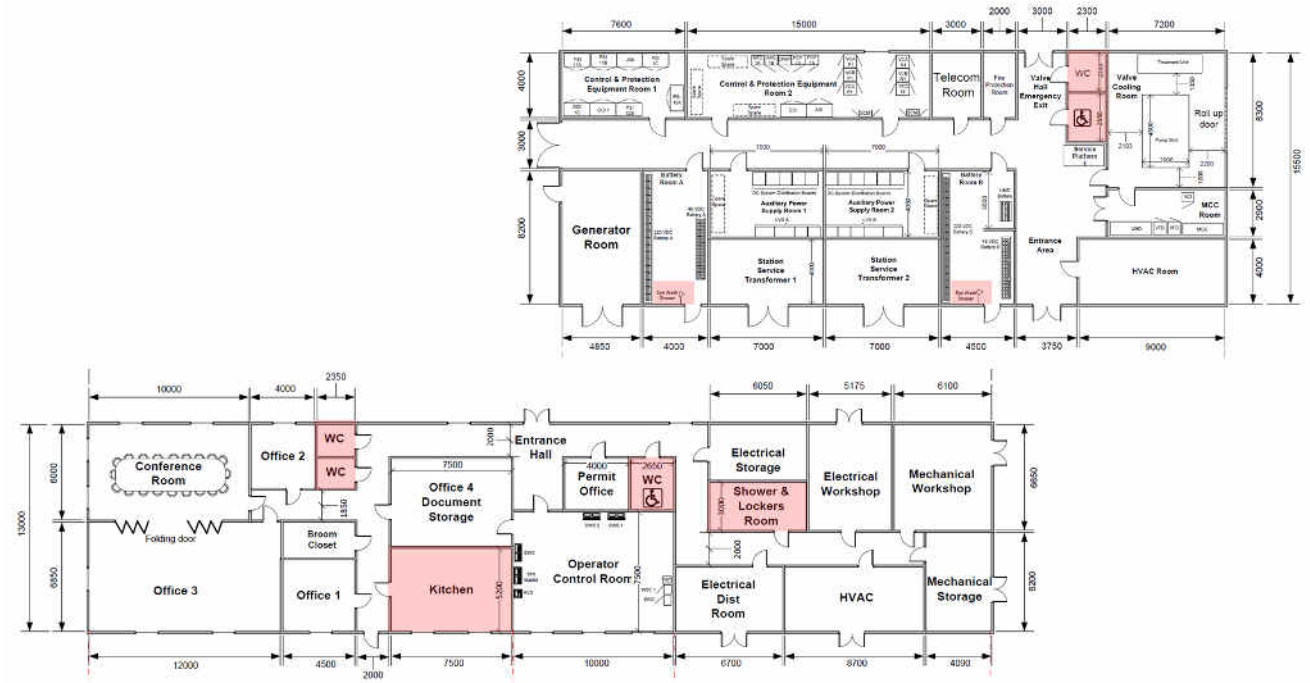
Key output from the Micro Drainage model of the surface water drainage network is included in Appendix D of this document including simulation results for the design storm.

In summary, there is no flooding for the 100 year return period (+10%) design storm and the green-field runoff rates stated in the Flood Risk Assessment are not exceeded.

4.0 Foul water drainage strategy

4.1 Sources of foul water

There will be foul water discharge from the Service building and Office/Control building. Approximate pop up locations have been determined based on room layouts provided. The sketch below shows the room layouts relative to each other with sources of foul discharge highlighted. In the service building the WCs and battery room eye wash stations are accounted for. In the office/control building the WCs, showers and kitchen are accounted for.



4.2 Foul water flow rate

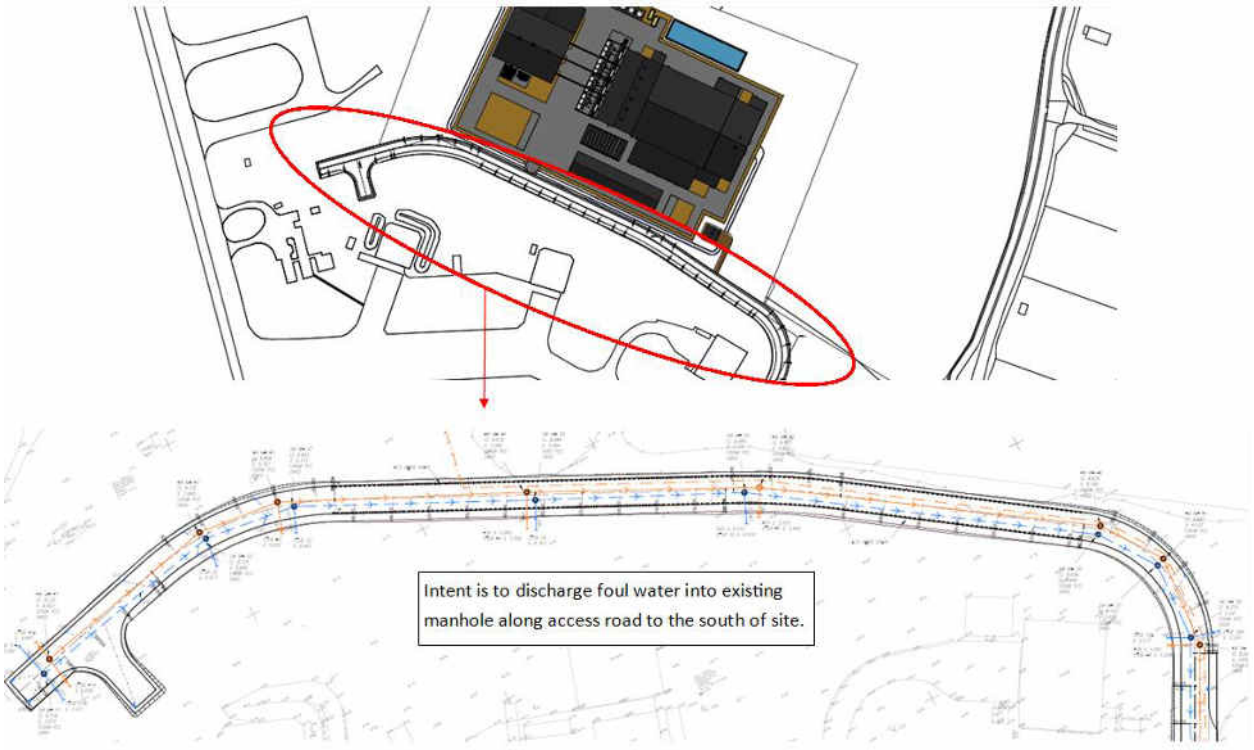
At this stage a detailed calculation of a foul water peak discharge rate has not been completed. However by inspection of the above layouts and with consideration to section 6 of BS EN 12056-2 it is anticipated that the design wastewater flow rate will be relatively low. A value is estimated below based on conservative assumptions using table 2 of BS EN 12056-2.

Source:		Discharge Units:
5no. WC		12.5 (5 x 2.5)
Shower		1.3
Kitchen Sink		1.3
	ΣDU	**15.1**
Frequency factor,	**K**	**0.5**
Foul water flow rate,	**Q = KvΣDU**	**1.94 l/s**

With this in mind a 100mm diameter pipe laid at minimum fall of 1:80 in line with BS EN 752 Table NA.19 will be sufficient. This provides a discharge capacity of 6.3 l/s as indicated in Table 6 of Building Regulations Part H.

4.3 Discharge of foul water

In line with the IFA2 specification and building regulations the preferred option is to discharge to an existing foul sewer network. From inspection of drawing EC/RJ504381/552 supplied by Fareham Council there is a 150mm diameter foul sewer along the access road just south of the site.



The as built drainage layout suggests there will be no problem tying in with the existing invert levels for this foul sewer. It follows the road east and then south before connecting into a pumping station. From email correspondence it is understood the pumping station is yet to be connected to the mains and foul water is currently tankered away from the site. It is assumed the foul sewer has sufficient spare capacity and that consent to discharge to this foul sewer/pumping station will be obtained.

5.0 References

5.1 Eurocodes & British Standards

Standard:	Description:
BS EN 752	British Standard - Drainage and sewer systems outside buildings
BS EN 858-2	British Standard - Separator systems for light liquids - Part 2: Selection of nominal size, installation, operation and maintenance
BS EN 12056-2	British Standard - Gravity drainage systems inside buildings - Part 2: Sanitary pipework, layout and calculation
BS EN 124-1	British Standard - Gully tops and manhole tops for vehicular and pedestrian areas
BS EN 1433	British Standard – Drainage channels for vehicular and pedestrian areas

5.2 Design Guides / Regulations

Design Guide:	Description:
E2.2-b	IFA2 Converter Specification
Building Regulations Part H	The Building Regulations 2010 – Approved document H – Drainage and waste disposal
CIRIA C753	The SuDS Manual 2015
PPG3	Environment Agency Pollution Prevention Guidelines – Use and design of oil separators in surface water drainage systems
BRE DG 365	BRE Digest 365 – Soakaway Design

5.3 Internal Drawings/Documents

Description:	BakerHicks no.	ABB no.
Drainage General Arrangement	30000764-IDV-4200	TBC

5.4 External Drawings/Documents

Document No.	Description:
1JNL100399-527	Daedalus – Converter station 320kV DC, 1000MW
1JNL417030	ABB Instructions for Civil Design of HVDC Converter Buildings Light G4
IF2-ENV-ASM-003	IFA2 UK Onshore Development Flood Risk Assessment
305002-00006-51829-04	Advisian Factual Geo-Environmental Ground Investigation Report
208108_MCA Daedalus Aero 1	Southern Water Sewer Maps dated 15/01/2016
EC/RJ504381/552	Daedalus Solent Enterprise Zone – Drainage Layout (3no. sheets)

6.0 Appendices

Refer to the table below for a list of appendices included in this document.

Appendix A: Surface Water Catchment Areas Sketch

APPENDIX A : SURFACE WATER CATCHMENT AREAS

BLUE = AREAS TO DRAINAGE NETWORK.
GREEN = AREAS TO CHIPPINGS / INFILTRATION.

TANK SCREENING TO MATCH BUILDINGS

WATER TANKS

TANK PUMP HOUSE

CLIMATE BUILDING

390m²

CLIMATE BUILDING

STORAGE BUILDING

390m²

370m²

370m²

AC HALL

VEHICLE ACCESS DOORS

370m²

370m²

43000

15000

34000

SHUNT REACTOR

9000

EQUIPMENT ASSOCIATED WITH SHUNT REACTOR

360m²

6500

CAR PARKING SPACES

1000m²

SERVICE CROSSOVER

240m²

VEHICLE ENTRANCE

COMPOUND FENCING AND EQUIPMENT

12000

9000

CLIMATE BUILDING

110m²

TRANSFORMER PENS

170m²

TRANSFORMER PENS

170m²

TRANSFORMER PENS

170m²

170m²

TRANSFORMER PENS

290m²

290m²

290m²

290m²

24000

REACTOR HALL

49250

870m²

870m²

52000

VALVE HALL

VALVE HALL

VALVE COOLERS

1040m²

17000

9000

CLIMATE BUILDING

150m²

12000

9000

CLIMATE BUILDING

110m²

870m²

DC HALL

DC HALL

870m²

SERVICE BUILDING

16000

350m²

350m²

43000

8000

CLIMATE BUILDING

150m²

9000

17000

240m²

240m²

240m²

240m²

240m²

CONTROL BUILDING

CHILLERS

60000

16000

CAR PARKING SPACES

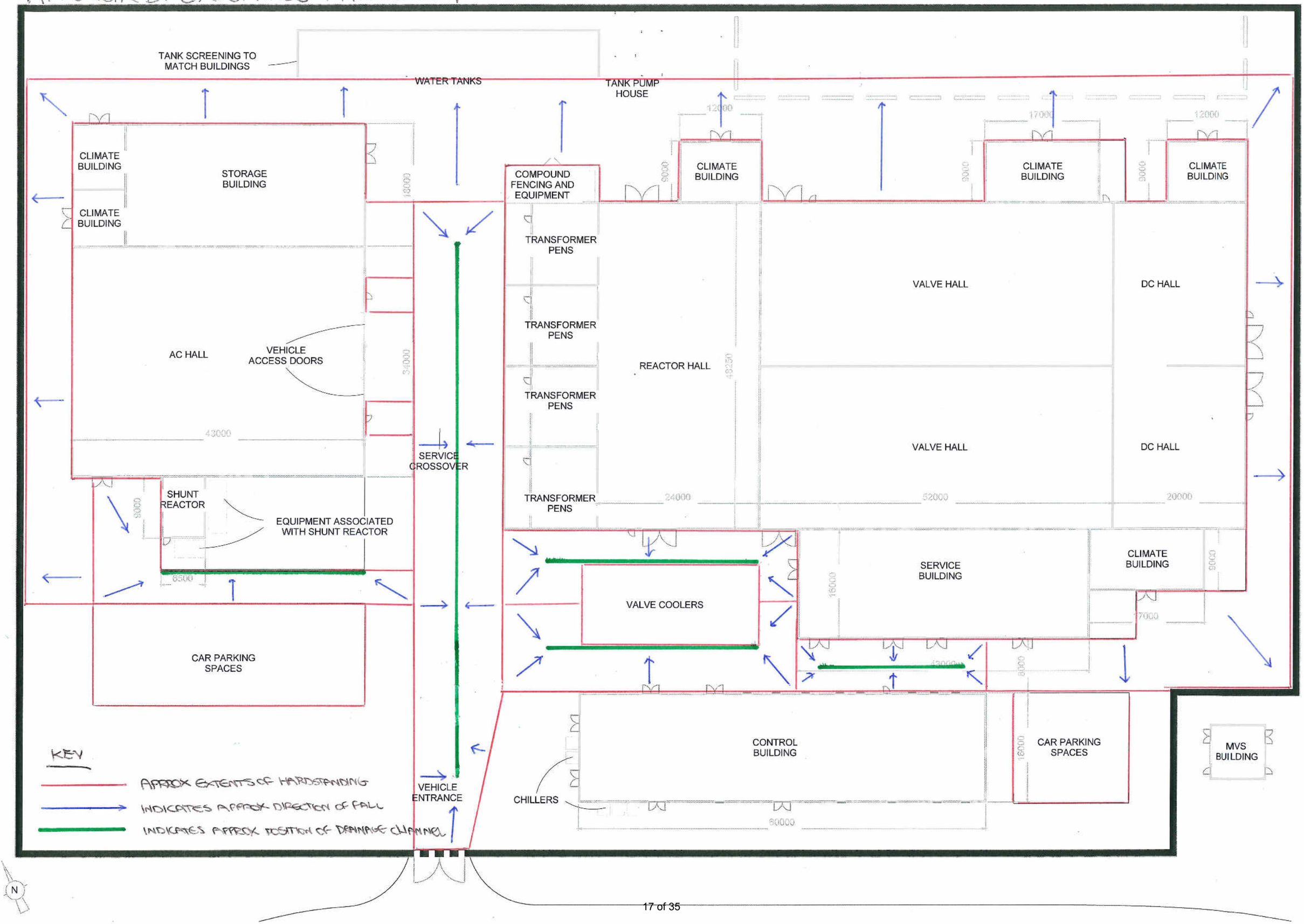
MVS BUILDING

70m²

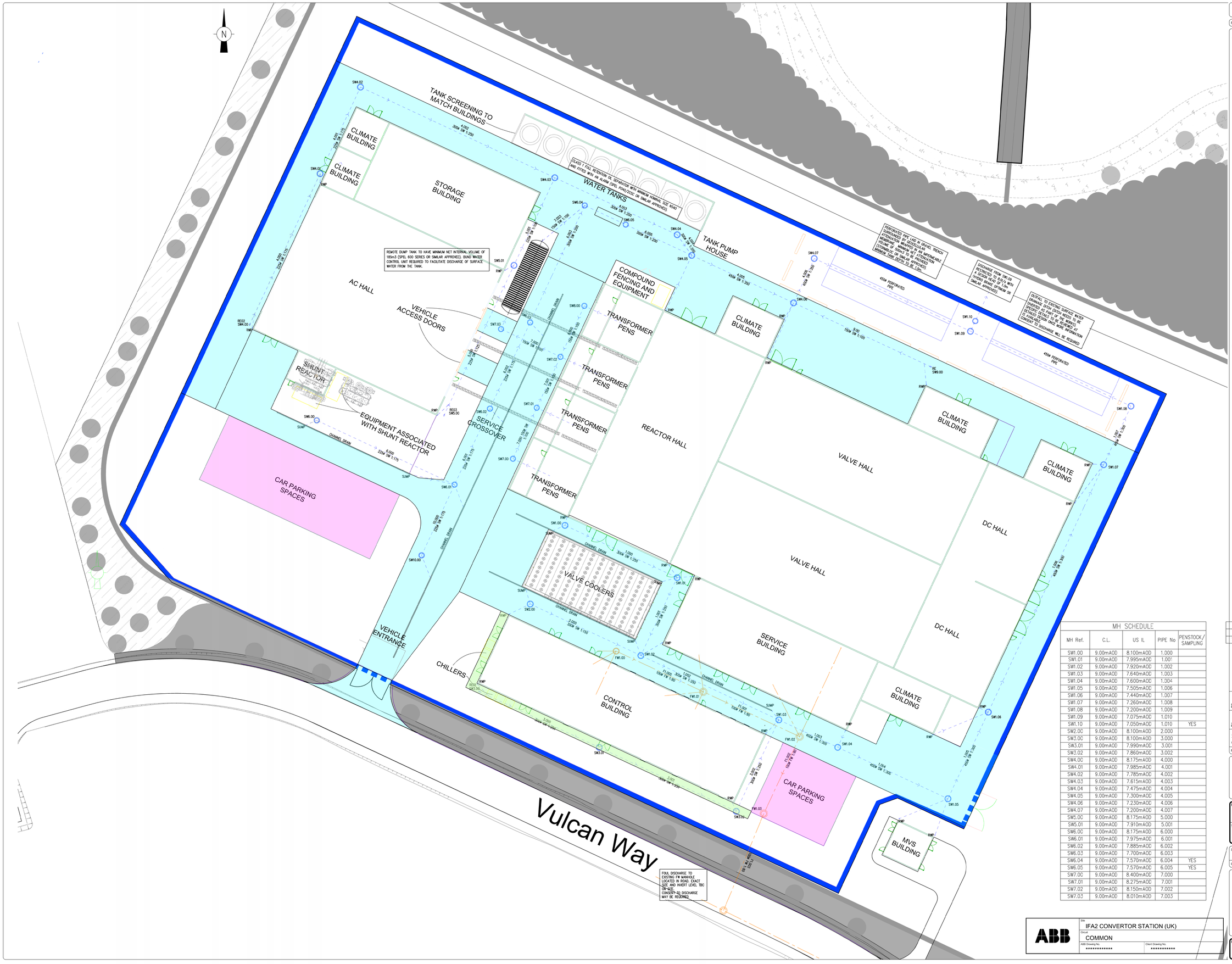
N

Appendix B: Externals Philosophy Sketch

APPENDIX B: EXTERNALS PHILOSOPHY.



Appendix C: Drainage General Arrangement Drawing



0 100
This drawing may have been reduced original scale : 100mm

Reference Drawings | Legend | Notes

GENERAL NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
3. ALL LEVELS ARE IN METRES AND ARE RELATIVE TO ORDNANCE DATUM (A.O.D).
4. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTURAL AND ENGINEERING DETAILS, DRAWINGS AND SPECIFICATIONS.
5. ALL PIPES SHALL BE LAID WITH SOFFITS LEVEL UNLESS NOTED OTHERWISE. ALL MANHOLE INVERT LEVELS RELATE TO THE OUTLET PIPE. PIPE RUNS SHALL BE LAID TO THE INVERT LEVELS INDICATED – PIPE GRADIENTS SHOWN ARE APPROXIMATE.
6. THE COVER LEVELS SHOWN ARE APPROXIMATE AND SHALL SUIT THE EXACT FINISHED LEVEL AS REQUIRED ON SITE.
7. ALL WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH BS EN 752 & CURRENT BUILDING REGULATIONS.
8. DETAILS AND POSITIONS OF ALL EXISTING SERVCES TO BE CONFIRMED PRIOR TO THE COMMENCEMENT OF WORKS ON SITE.
9. POSITIONS OF ABOVE GROUND RAINWATER PIPES SHOWN ARE INDICATIVE. SETTING OUT TO BE CONFIRMED BY THE ARCHITECT.
10. PIPES TO BE 100% RECYCLED HDPE WITH MINIMUM NOMINAL STIFFNESS OF SN4.
11. CLASS Z BEDDING (CONCRETE BED AND SURROUND) TO BE PROVIDED FOR ALL PIPES WITH LESS THAN 900MM COVER BENEATH ROADS OR 600MM COVER ELSEWHERE. OTHERWISE CLASS S BEDDING TO BE PROVIDED.
12. ALL MANHOLE ACCESS COVERS TO BE RATED TO LOAD CLASS D400 IN ACCORDANCE WITH BS EN 124.
13. ALL DRAINAGE CHANNELS TO MEET MINIMUM DIMENSIONS 150mm WIDE X 185mm INVERT DEPTH. ALL CHANNEL GRATINGS TO BE RATED TO LOAD CLASS D400 IN ACCORDANCE WITH BS EN 1433.

CAVEATS AND ASSUMPTIONS:

1. SURFACE WATER DISCHARGE FROM THE SITE IS RESTRICTED TO 8.0 L/S IN ACCORDANCE WITH THE 1 YEAR RETURN PERIOD GREENFIELD RUNOFF RATE STATED IN THE FLOOD RISK ASSESSMENT.
2. INFILTRATION OF SURFACE WATER INTO THE SOL IS SUBJECT TO CONFIRMATION OF ACCEPTABLE PERMEABILITY RATES UPON COMPLETION OF SOAKAWAY TESTING IN ACCORDANCE WITH BRE DIGEST 365.
3. CONSENT TO DISCHARGE TO AN EXISITNG WATERCOURSE/SEWER WILL BE REQUIRED.

KEY:

- ROAD (CONCRETE)
- CAR PARK
- SUMP — CHANNEL DRAIN SUMP UNIT
- RWP — RAIN WATER PIPE
- RE — RODDING EYE
- SW1.05 — SURFACE WATER PIPE AND MANHOLE
- FW1.03 — FOUL WATER PIPE AND MANHOLE

MH SCHEDULE

MH Ref.	C.L.	US IL	PIPE No	PENSTOCK/ SAMPLING
SW1.00	9.00mAOD	8.100mAOD	1.000	
SW1.01	9.00mAOD	7.995mAOD	1.001	
SW1.02	9.00mAOD	7.920mAOD	1.002	
SW1.03	9.00mAOD	7.640mAOD	1.003	
SW1.04	9.00mAOD	7.600mAOD	1.004	
SW1.05	9.00mAOD	7.505mAOD	1.006	
SW1.06	9.00mAOD	7.440mAOD	1.007	
SW1.07	9.00mAOD	7.260mAOD	1.008	
SW1.08	9.00mAOD	7.200mAOD	1.009	
SW1.09	9.00mAOD	7.075mAOD	1.010	
SW1.10	9.00mAOD	7.050mAOD	1.010	YES
SW2.00	9.00mAOD	8.100mAOD	2.000	
SW3.00	9.00mAOD	8.100mAOD	3.000	
SW3.01	9.00mAOD	7.990mAOD	3.001	
SW3.02	9.00mAOD	7.860mAOD	3.002	
SW4.00	9.00mAOD	8.175mAOD	4.000	
SW4.01	9.00mAOD	7.985mAOD	4.001	
SW4.02	9.00mAOD	7.785mAOD	4.002	
SW4.03	9.00mAOD	7.615mAOD	4.003	
SW4.04	9.00mAOD	7.475mAOD	4.004	
SW4.05	9.00mAOD	7.300mAOD	4.005	
SW4.06	9.00mAOD	7.230mAOD	4.006	
SW4.07	9.00mAOD	7.200mAOD	4.007	
SW5.00	9.00mAOD	8.175mAOD	5.000	
SW5.01	9.00mAOD	7.910mAOD	5.001	
SW6.00	9.00mAOD	8.175mAOD	6.000	
SW6.01	9.00mAOD	7.975mAOD	6.001	
SW6.02	9.00mAOD	7.885mAOD	6.002	
SW6.03	9.00mAOD	7.700mAOD	6.003	
SW6.04	9.00mAOD	7.570mAOD	6.004	YES
SW6.05	9.00mAOD	7.570mAOD	6.005	YES
SW7.00	9.00mAOD	8.400mAOD	7.000	
SW7.01	9.00mAOD	8.275mAOD	7.001	
SW7.02	9.00mAOD	8.150mAOD	7.002	
SW7.03	9.00mAOD	8.010mAOD	7.003	
SW8.00	9.00mAOD	8.275mAOD	8.000	
SW9.00	9.00mAOD	7.950mAOD	9.000	
SW10.00	9.00mAOD	8.100mAOD	10.000	

Revision		Description	Drawn	Date	Checked	Approved
P2		ISSUED FOR PLANNING	JR	12/07/2017	NS	SP
P1		ISSUED FOR COMMENT	JR	29/06/2017	NS	SP

Revisions

nationalgrid

Project: IFA2 CONVERTOR STATION (UK)

Title: SITE PLAN SHOWING DRAINAGE GENERAL ARRANGEMENT

Scale	Drawn	Checked	Approved
1:250 (when plotted @ A3)	JR Date 30/06/2017	NS Date 30/06/2017	SP Date 30/06/2017

CAD Ref

ABB

Site: IFA2 CONVERTOR STATION (UK)
Group: COMMON
ABB Drawing No.: **********
Client Drawing No.: **********

BakerHicks

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Project number	Drawing number	Revision
30000764	IDV-4200	P2

Appendix D: Surface Water Drainage - Micro Drainage Output

- Network Details
- Pipeline Schedule
- Catchment Areas Summary
- Online Controls
- Storage Structures
- 1 year return period (+10%) simulation results - critical storm by level
- 100 year return period simulation results - critical storm by level

Existing Network Details for Storm

- Indicates pipe length does not match coordinates

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	26.193	0.105	249.5	0.081	5.00	0.0	0.600	o	300
1.001	18.185	0.075	242.5	0.116	0.00	0.0	0.600	o	300
2.000	25.824	0.180	143.5	0.076	5.00	0.0	0.600	o	300
1.002	32.223	0.130	247.9	0.035	0.00	0.0	0.600	o	300
3.000	27.982	0.110	254.4	0.024	5.00	0.0	0.600	o	300
3.001	32.223	0.130	247.9	0.000	0.00	0.0	0.600	o	300
3.002	18.000	0.070	257.1	0.024	0.00	0.0	0.600	o	300
1.003	11.522	0.040	288.1	0.046	0.00	0.0	0.600	o	450
1.004	27.960	0.095	294.3	0.034	0.00	0.0	0.600	o	450
1.005	20.231	0.065	311.2	0.007	0.00	0.0	0.600	o	450
1.006	53.770	0.180	298.7	0.102	0.00	0.0	0.600	o	450
1.007	17.679	0.060	294.7	0.098	0.00	0.0	0.600	o	450
1.008	37.475	0.125	299.8	0.000	0.00	0.0	0.600	o	450
4.000	35.263	0.190	185.6	0.037	5.00	0.0	0.600	o	225
4.001	20.215	0.125	161.7	0.075	0.00	0.0	0.600	o	225

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
1.000	8.100	0.081	0.0	0.99	70.0
1.001	7.995	0.197	0.0	1.01	71.1
2.000	8.100	0.076	0.0	1.31	92.6
1.002	7.920	0.308	0.0	0.99	70.3
3.000	8.100	0.024	0.0	0.98	69.4
3.001	7.990	0.024	0.0	0.99	70.3
3.002	7.860	0.048	0.0	0.98	69.0
1.003	7.640	0.402	0.0	1.19	189.7
1.004	7.600	0.436	0.0	1.18	187.7
1.005	7.505	0.443	0.0	1.15	182.4
1.006	7.440	0.545	0.0	1.17	186.2
1.007	7.260	0.643	0.0	1.18	187.5
1.008	7.200	0.643	0.0	1.17	185.9
4.000	8.175	0.037	0.0	0.96	38.0
4.001	7.985	0.112	0.0	1.03	40.8

Existing Network Details 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)
4.002	42.331	0.170	249.0	0.000	0.00	0.0	0.600	o	300
5.000	35.012	0.265	132.1	0.037	5.00	0.0	0.600	o	225
5.001	20.465	0.220	93.0	0.075	0.00	0.0	0.600	o	225
4.003	28.579	0.140	204.1	0.000	0.00	0.0	0.600	o	300
4.004	5.347	0.025	213.9	0.000	0.00	0.0	0.600	o	300
6.000	32.182	0.200	160.9	0.024	5.00	0.0	0.600	o	225
6.001	15.952	0.090	177.2	0.075	0.00	0.0	0.600	o	225
6.002	20.129	0.110	183.0	0.033	0.00	0.0	0.600	o	225
6.003	27.314	0.130	210.1	0.034	0.00	0.0	0.600	o	300
7.000	11.913	0.125	95.3	0.017	5.00	0.0	0.600	o	150
7.001	11.893	0.125	95.1	0.017	0.00	0.0	0.600	o	150
8.000	11.906	0.125	95.2	0.017	5.00	0.0	0.600	o	150
7.002	13.899	0.140	99.3	0.017	0.00	0.0	0.600	o	150
7.003	31.589	0.290	108.9	0.000	0.00	0.0	0.600	o	150
6.004	25.009	0.120	208.4	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
4.002	7.785	0.112	0.0	0.99	70.1
5.000	8.175	0.037	0.0	1.14	45.2
5.001	7.910	0.112	0.0	1.36	53.9
4.003	7.615	0.224	0.0	1.10	77.5
4.004	7.475	0.224	0.0	1.07	75.7
6.000	8.175	0.024	0.0	1.03	40.9
6.001	7.975	0.099	0.0	0.98	38.9
6.002	7.885	0.132	0.0	0.96	38.3
6.003	7.700	0.166	0.0	1.08	76.4
7.000	8.400	0.017	0.0	1.03	18.2
7.001	8.275	0.034	0.0	1.03	18.2
8.000	8.275	0.017	0.0	1.03	18.2
7.002	8.150	0.068	0.0	1.01	17.8
7.003	8.010	0.068	0.0	0.96	17.0
6.004	7.570	0.234	0.0	1.09	76.7

Existing Network Details 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)
4.005	23.199	0.070	331.4	0.029	0.00	0.0	0.600	o	450
9.000	32.682	0.330	99.0	0.015	5.00	0.0	0.600	o	150
4.006	10.363	0.030	345.4	0.127	0.00	0.0	0.600	o	450
4.007	37.171	0.125	297.4	0.000	0.00	0.0	0.600	o	450
1.009	20.000#	0.100	200.0	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
4.005	7.300	0.487	0.0	1.11	176.7
9.000	7.950	0.015	0.0	1.01	17.8
4.006	7.230	0.629	0.0	1.09	173.1
4.007	7.200	0.629	0.0	1.17	186.7
1.009	7.075	1.272	0.0	1.11	78.3

PIPELINE SCHEDULES for Storm

Upstream Manhole

- Indicates pipe length does not match coordinates

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	300	SW1.00	9.000	8.100	0.600	Open Manhole	1200
1.001	o	300	SW1.01	9.000	7.995	0.705	Open Manhole	1200
2.000	o	300	SW2.00	9.000	8.100	0.600	Open Manhole	1200
1.002	o	300	SW1.02	9.000	7.920	0.780	Open Manhole	1200
3.000	o	300	SW3.00	9.000	8.100	0.600	Open Manhole	300
3.001	o	300	SW3.01	9.000	7.990	0.710	Open Manhole	1200
3.002	o	300	SW3.02	9.000	7.860	0.840	Open Manhole	1200
1.003	o	450	SW1.03	9.000	7.640	0.910	Open Manhole	1350
1.004	o	450	SW1.04	9.000	7.600	0.950	Open Manhole	1350
1.005	o	450	SW1.05	9.000	7.505	1.045	Open Manhole	1350
1.006	o	450	SW1.06	9.000	7.440	1.110	Open Manhole	1350
1.007	o	450	SW1.07	9.000	7.260	1.290	Open Manhole	1350
1.008	o	450	SW1.08	9.000	7.200	1.350	Open Manhole	1350
4.000	o	225	SW4.00	9.000	8.175	0.600	Open Manhole	300

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	26.193	249.5	SW1.01	9.000	7.995	0.705	Open Manhole	1200
1.001	18.185	242.5	SW1.02	9.000	7.920	0.780	Open Manhole	1200
2.000	25.824	143.5	SW1.02	9.000	7.920	0.780	Open Manhole	1200
1.002	32.223	247.9	SW1.03	9.000	7.790	0.910	Open Manhole	1350
3.000	27.982	254.4	SW3.01	9.000	7.990	0.710	Open Manhole	1200
3.001	32.223	247.9	SW3.02	9.000	7.860	0.840	Open Manhole	1200
3.002	18.000	257.1	SW1.03	9.000	7.790	0.910	Open Manhole	1350
1.003	11.522	288.1	SW1.04	9.000	7.600	0.950	Open Manhole	1350
1.004	27.960	294.3	SW1.05	9.000	7.505	1.045	Open Manhole	1350
1.005	20.231	311.2	SW1.06	9.000	7.440	1.110	Open Manhole	1350
1.006	53.770	298.7	SW1.07	9.000	7.260	1.290	Open Manhole	1350
1.007	17.679	294.7	SW1.08	9.000	7.200	1.350	Open Manhole	1350
1.008	37.475	299.8	SW1.09	9.000	7.075	1.475	Open Manhole	1350
4.000	35.263	185.6	SW4.01	9.000	7.985	0.790	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)
4.001	o	225	SW4.01	9.000	7.985	0.790	Open Manhole	1200
4.002	o	300	SW4.02	9.000	7.785	0.915	Open Manhole	1200
5.000	o	225	SW5.00	9.000	8.175	0.600	Open Manhole	300
5.001	o	225	SW5.01	9.000	7.910	0.865	Open Manhole	1200
4.003	o	300	SW4.03	9.000	7.615	1.085	Open Manhole	1200
4.004	o	300	SW4.04	9.000	7.475	1.225	Open Manhole	1200
6.000	o	225	SW6.00	9.000	8.175	0.600	Open Manhole	1200
6.001	o	225	SW6.01	9.000	7.975	0.800	Open Manhole	1200
6.002	o	225	SW6.02	9.000	7.885	0.890	Open Manhole	1200
6.003	o	300	SW6.03	9.000	7.700	1.000	Open Manhole	1200
7.000	o	150	SW7.00	9.000	8.400	0.450	Open Manhole	1200
7.001	o	150	SW7.01	9.000	8.275	0.575	Open Manhole	1200
8.000	o	150	SW8.00	9.000	8.275	0.575	Open Manhole	1200
7.002	o	150	SW7.02	9.000	8.150	0.700	Open Manhole	1200
7.003	o	150	SW7.03	9.000	8.010	0.840	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)
4.001	20.215	161.7	SW4.02	9.000	7.860	0.915	Open Manhole	1200
4.002	42.331	249.0	SW4.03	9.000	7.615	1.085	Open Manhole	1200
5.000	35.012	132.1	SW5.01	9.000	7.910	0.865	Open Manhole	1200
5.001	20.465	93.0	SW4.03	9.000	7.690	1.085	Open Manhole	1200
4.003	28.579	204.1	SW4.04	9.000	7.475	1.225	Open Manhole	1200
4.004	5.347	213.9	SW4.05	9.000	7.450	1.250	Open Manhole	1350
6.000	32.182	160.9	SW6.01	9.000	7.975	0.800	Open Manhole	1200
6.001	15.952	177.2	SW6.02	9.000	7.885	0.890	Open Manhole	1200
6.002	20.129	183.0	SW6.03	9.000	7.775	1.000	Open Manhole	1200
6.003	27.314	210.1	SW6.04	9.000	7.570	1.130	Open Manhole	1200
7.000	11.913	95.3	SW7.01	9.000	8.275	0.575	Open Manhole	1200
7.001	11.893	95.1	SW7.02	9.000	8.150	0.700	Open Manhole	1200
8.000	11.906	95.2	SW7.02	9.000	8.150	0.700	Open Manhole	1200
7.002	13.899	99.3	SW7.03	9.000	8.010	0.840	Open Manhole	1200
7.003	31.589	108.9	SW6.04	9.000	7.720	1.130	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)
6.004	o	300	SW6.04	9.000	7.570	1.130	Open Manhole	1200
4.005	o	450	SW4.05	9.000	7.300	1.250	Open Manhole	1350
9.000	o	150	SW8.00	9.000	7.950	0.900	Open Manhole	1200
4.006	o	450	SW4.06	9.000	7.230	1.320	Open Manhole	1350
4.007	o	450	SW4.07	9.000	7.200	1.350	Open Manhole	1350
1.009	o	300	SW1.09	9.000	7.075	1.625	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)
6.004	25.009	208.4	SW4.05	9.000	7.450	1.250	Open Manhole	1350
4.005	23.199	331.4	SW4.06	9.000	7.230	1.320	Open Manhole	1350
9.000	32.682	99.0	SW4.06	9.000	7.620	1.230	Open Manhole	1350
4.006	10.363	345.4	SW4.07	9.000	7.200	1.350	Open Manhole	1350
4.007	37.171	297.4	SW1.09	9.000	7.075	1.475	Open Manhole	1350
1.009	20.000#	200.0		9.000	6.975	1.725	Open Manhole	150

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.081	0.081	0.081
1.001	-	-	100	0.116	0.116	0.116
2.000	-	-	100	0.076	0.076	0.076
1.002	-	-	100	0.035	0.035	0.035
3.000	-	-	100	0.024	0.024	0.024
3.001	-	-	100	0.000	0.000	0.000
3.002	-	-	100	0.024	0.024	0.024
1.003	-	-	100	0.046	0.046	0.046
1.004	-	-	100	0.034	0.034	0.034
1.005	-	-	100	0.007	0.007	0.007
1.006	-	-	100	0.102	0.102	0.102
1.007	-	-	100	0.098	0.098	0.098
1.008	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.037	0.037	0.037
4.001	-	-	100	0.075	0.075	0.075
4.002	-	-	100	0.000	0.000	0.000
5.000	-	-	100	0.037	0.037	0.037
5.001	-	-	100	0.075	0.075	0.075
4.003	-	-	100	0.000	0.000	0.000
4.004	-	-	100	0.000	0.000	0.000
6.000	-	-	100	0.024	0.024	0.024
6.001	-	-	100	0.075	0.075	0.075
6.002	-	-	100	0.033	0.033	0.033
6.003	-	-	100	0.034	0.034	0.034
7.000	-	-	100	0.017	0.017	0.017
7.001	-	-	100	0.017	0.017	0.017
8.000	-	-	100	0.017	0.017	0.017
7.002	-	-	100	0.017	0.017	0.017
7.003	-	-	100	0.000	0.000	0.000
6.004	-	-	100	0.000	0.000	0.000
4.005	-	-	100	0.029	0.029	0.029
9.000	-	-	100	0.015	0.015	0.015
4.006	-	-	100	0.127	0.127	0.127
4.007	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.272	1.272	1.272

Online Controls for Storm

Hydro-Brake Optimum® Manhole: SW1.09, DS/PN: 1.009, Volume (m³): 14.2

Unit Reference	MD-SHE-0129-8000-1150-8000
Design Head (m)	1.150
Design Flow (l/s)	8.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	129
Invert Level (m)	7.075
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.150	8.0
Flush-Flo™	0.341	8.0
Kick-Flo®	0.741	6.5
Mean Flow over Head Range	-	6.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.6	1.200	8.2	3.000	12.6	7.000	18.8
0.200	7.6	1.400	8.8	3.500	13.5	7.500	19.5
0.300	8.0	1.600	9.3	4.000	14.4	8.000	20.1
0.400	8.0	1.800	9.9	4.500	15.2	8.500	20.7
0.500	7.8	2.000	10.4	5.000	16.0	9.000	21.3
0.600	7.5	2.200	10.8	5.500	16.8	9.500	21.8
0.800	6.7	2.400	11.3	6.000	17.5		
1.000	7.5	2.600	11.7	6.500	18.2		

Storage Structures for Storm

Cellular Storage Manhole: SW1.09, DS/PN: 1.009

Invert Level (m) 7.075 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	500.0	0.0	1.001	0.0	0.0
1.000	500.0	0.0			

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) 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	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.100	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 100
Climate Change (%)	10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	SW1.00	15 Winter	1	+10%	100/15 Summer				8.188
1.001	SW1.01	15 Winter	1	+10%	100/15 Summer				8.134
2.000	SW2.00	15 Winter	1	+10%	100/15 Summer				8.171
1.002	SW1.02	15 Winter	1	+10%	100/15 Summer				8.086
3.000	SW3.00	15 Winter	1	+10%	100/240 Winter				8.145
3.001	SW3.01	15 Winter	1	+10%	100/240 Winter				8.033
3.002	SW3.02	15 Winter	1	+10%	100/180 Winter				7.924
1.003	SW1.03	15 Winter	1	+10%	100/180 Winter				7.825
1.004	SW1.04	15 Winter	1	+10%	100/180 Winter				7.778
1.005	SW1.05	15 Winter	1	+10%	100/15 Winter				7.689
1.006	SW1.06	15 Winter	1	+10%	100/15 Winter				7.625
1.007	SW1.07	15 Winter	1	+10%	100/15 Summer				7.471
1.008	SW1.08	15 Winter	1	+10%	100/15 Winter				7.398
4.000	SW4.00	15 Winter	1	+10%	100/240 Winter				8.232
4.001	SW4.01	15 Winter	1	+10%	100/15 Summer				8.081
4.002	SW4.02	15 Winter	1	+10%	100/15 Summer				7.878
5.000	SW5.00	15 Winter	1	+10%	100/240 Winter				8.227
5.001	SW5.01	15 Winter	1	+10%	100/15 Summer				7.992

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW1.00	-0.212	0.000	0.17		11.0	OK	
1.001	SW1.01	-0.161	0.000	0.39		23.8	OK	
2.000	SW2.00	-0.229	0.000	0.13		10.4	OK	
1.002	SW1.02	-0.134	0.000	0.58		37.5	OK	
3.000	SW3.00	-0.255	0.000	0.05		3.3	OK	
3.001	SW3.01	-0.257	0.000	0.05		3.2	OK	
3.002	SW3.02	-0.236	0.000	0.10		5.9	OK	
1.003	SW1.03	-0.265	0.000	0.35		48.4	OK	
1.004	SW1.04	-0.272	0.000	0.32		51.0	OK	
1.005	SW1.05	-0.266	0.000	0.35		51.2	OK	
1.006	SW1.06	-0.265	0.000	0.35		59.3	OK	
1.007	SW1.07	-0.239	0.000	0.45		66.1	OK	
1.008	SW1.08	-0.252	0.000	0.40		65.4	OK	
4.000	SW4.00	-0.168	0.000	0.14		5.1	OK	
4.001	SW4.01	-0.129	0.000	0.38		13.9	OK	
4.002	SW4.02	-0.207	0.000	0.21		13.5	OK	
5.000	SW5.00	-0.173	0.000	0.12		5.1	OK	
5.001	SW5.01	-0.143	0.000	0.28		13.9	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
4.003	SW4.03	15 Winter	1	+10%	100/15 Summer				7.744
4.004	SW4.04	15 Winter	1	+10%	100/15 Summer				7.629
6.000	SW6.00	15 Winter	1	+10%	100/15 Winter				8.220
6.001	SW6.01	15 Winter	1	+10%	100/15 Summer				8.067
6.002	SW6.02	15 Winter	1	+10%	100/15 Summer				7.992
6.003	SW6.03	15 Winter	1	+10%	100/15 Summer				7.809
7.000	SW7.00	15 Winter	1	+10%	100/15 Summer				8.438
7.001	SW7.01	15 Winter	1	+10%	100/15 Summer				8.328
8.000	SW8.00	15 Winter	1	+10%	100/15 Summer				8.313
7.002	SW7.02	15 Winter	1	+10%	100/15 Summer				8.229
7.003	SW7.03	15 Winter	1	+10%	100/15 Summer				8.088
6.004	SW6.04	15 Winter	1	+10%	100/15 Summer				7.703
4.005	SW4.05	15 Winter	1	+10%	100/15 Summer				7.529
9.000	SW8.00	15 Winter	1	+10%	100/180 Winter				7.985
4.006	SW4.06	15 Winter	1	+10%	100/15 Summer				7.486
4.007	SW4.07	15 Winter	1	+10%	100/15 Summer				7.404
1.009	SW1.09	360 Winter	1	+10%	1/180 Winter				7.396

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
4.003	SW4.03	-0.171	0.000	0.38		26.7	OK	
4.004	SW4.04	-0.146	0.000	0.52		26.6	OK	
6.000	SW6.00	-0.180	0.000	0.09		3.3	OK	
6.001	SW6.01	-0.133	0.000	0.35		12.1	OK	
6.002	SW6.02	-0.118	0.000	0.45		15.7	OK	
6.003	SW6.03	-0.191	0.000	0.28		19.5	OK	
7.000	SW7.00	-0.112	0.000	0.14		2.4	OK	
7.001	SW7.01	-0.097	0.000	0.26		4.4	OK	
8.000	SW8.00	-0.112	0.000	0.14		2.4	OK	
7.002	SW7.02	-0.071	0.000	0.54		8.8	OK	
7.003	SW7.03	-0.072	0.000	0.53		8.7	OK	
6.004	SW6.04	-0.167	0.000	0.41		27.8	OK	
4.005	SW4.05	-0.221	0.000	0.39		56.6	OK	
9.000	SW8.00	-0.115	0.000	0.12		2.1	OK	
4.006	SW4.06	-0.194	0.000	0.61		69.3	OK	
4.007	SW4.07	-0.246	0.000	0.42		69.2	OK	
1.009	SW1.09	0.021	0.000	0.12		8.0	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) 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	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.100	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 100
Climate Change (%)	10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	SW1.00	480 Winter	100	+10%	100/15 Summer				8.830
1.001	SW1.01	480 Winter	100	+10%	100/15 Summer				8.829
2.000	SW2.00	480 Winter	100	+10%	100/15 Summer				8.828
1.002	SW1.02	480 Winter	100	+10%	100/15 Summer				8.828
3.000	SW3.00	480 Winter	100	+10%	100/240 Winter				8.825
3.001	SW3.01	480 Winter	100	+10%	100/240 Winter				8.825
3.002	SW3.02	480 Winter	100	+10%	100/180 Winter				8.825
1.003	SW1.03	480 Winter	100	+10%	100/180 Winter				8.824
1.004	SW1.04	480 Winter	100	+10%	100/180 Winter				8.824
1.005	SW1.05	480 Winter	100	+10%	100/15 Winter				8.822
1.006	SW1.06	480 Winter	100	+10%	100/15 Winter				8.821
1.007	SW1.07	480 Winter	100	+10%	100/15 Summer				8.818
1.008	SW1.08	480 Winter	100	+10%	100/15 Winter				8.817
4.000	SW4.00	480 Winter	100	+10%	100/240 Winter				8.826
4.001	SW4.01	480 Winter	100	+10%	100/15 Summer				8.825
4.002	SW4.02	480 Winter	100	+10%	100/15 Summer				8.823
5.000	SW5.00	480 Winter	100	+10%	100/240 Winter				8.825
5.001	SW5.01	480 Winter	100	+10%	100/15 Summer				8.824

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW1.00	0.430	0.000	0.07		4.5	FLOOD RISK	
1.001	SW1.01	0.534	0.000	0.18		10.8	FLOOD RISK	
2.000	SW2.00	0.428	0.000	0.05		4.2	FLOOD RISK	
1.002	SW1.02	0.608	0.000	0.26		17.0	FLOOD RISK	
3.000	SW3.00	0.425	0.000	0.02		1.3	FLOOD RISK	
3.001	SW3.01	0.535	0.000	0.02		1.3	FLOOD RISK	
3.002	SW3.02	0.665	0.000	0.04		2.6	FLOOD RISK	
1.003	SW1.03	0.734	0.000	0.16		22.0	FLOOD RISK	
1.004	SW1.04	0.774	0.000	0.15		23.6	FLOOD RISK	
1.005	SW1.05	0.867	0.000	0.16		23.4	FLOOD RISK	
1.006	SW1.06	0.931	0.000	0.16		28.0	FLOOD RISK	
1.007	SW1.07	1.108	0.000	0.21		31.7	FLOOD RISK	
1.008	SW1.08	1.167	0.000	0.19		31.1	FLOOD RISK	
4.000	SW4.00	0.426	0.000	0.06		2.0	FLOOD RISK	
4.001	SW4.01	0.615	0.000	0.17		6.2	FLOOD RISK	
4.002	SW4.02	0.738	0.000	0.09		6.2	FLOOD RISK	
5.000	SW5.00	0.425	0.000	0.05		2.0	FLOOD RISK	
5.001	SW5.01	0.689	0.000	0.13		6.2	FLOOD RISK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
4.003	SW4.03	480 Winter	100	+10%	100/15 Summer				8.822
4.004	SW4.04	480 Winter	100	+10%	100/15 Summer				8.820
6.000	SW6.00	480 Winter	100	+10%	100/15 Winter				8.827
6.001	SW6.01	480 Winter	100	+10%	100/15 Summer				8.827
6.002	SW6.02	480 Winter	100	+10%	100/15 Summer				8.825
6.003	SW6.03	480 Winter	100	+10%	100/15 Summer				8.823
7.000	SW7.00	480 Winter	100	+10%	100/15 Summer				8.828
7.001	SW7.01	480 Winter	100	+10%	100/15 Summer				8.827
8.000	SW8.00	480 Winter	100	+10%	100/15 Summer				8.827
7.002	SW7.02	480 Winter	100	+10%	100/15 Summer				8.826
7.003	SW7.03	480 Winter	100	+10%	100/15 Summer				8.824
6.004	SW6.04	480 Winter	100	+10%	100/15 Summer				8.821
4.005	SW4.05	480 Winter	100	+10%	100/15 Summer				8.819
9.000	SW8.00	480 Winter	100	+10%	100/180 Winter				8.819
4.006	SW4.06	480 Winter	100	+10%	100/15 Summer				8.818
4.007	SW4.07	480 Winter	100	+10%	100/15 Summer				8.816
1.009	SW1.09	480 Winter	100	+10%	1/180 Winter				8.814

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
4.003	SW4.03	0.907	0.000	0.17		12.1	FLOOD RISK	
4.004	SW4.04	1.045	0.000	0.23		11.9	FLOOD RISK	
6.000	SW6.00	0.427	0.000	0.03		1.3	FLOOD RISK	
6.001	SW6.01	0.627	0.000	0.16		5.4	FLOOD RISK	
6.002	SW6.02	0.715	0.000	0.21		7.3	FLOOD RISK	
6.003	SW6.03	0.823	0.000	0.13		9.1	FLOOD RISK	
7.000	SW7.00	0.278	0.000	0.06		0.9	FLOOD RISK	
7.001	SW7.01	0.402	0.000	0.11		1.9	FLOOD RISK	
8.000	SW8.00	0.402	0.000	0.06		0.9	FLOOD RISK	
7.002	SW7.02	0.526	0.000	0.23		3.7	FLOOD RISK	
7.003	SW7.03	0.664	0.000	0.23		3.7	FLOOD RISK	
6.004	SW6.04	0.951	0.000	0.18		12.5	FLOOD RISK	
4.005	SW4.05	1.069	0.000	0.17		25.2	FLOOD RISK	
9.000	SW8.00	0.719	0.000	0.05		0.9	FLOOD RISK	
4.006	SW4.06	1.138	0.000	0.29		32.5	FLOOD RISK	
4.007	SW4.07	1.166	0.000	0.19		32.0	FLOOD RISK	
1.009	SW1.09	1.439	0.000	0.14		9.7	FLOOD RISK	