SURFACE WATER DRAINAGE STRATEGY

for

WILLIAM PYE LIMITED

ERECTION OF COMMERCIAL UNITS

at

CHAPEL HILL TRADING ESTATE

CHAPEL HILL, LONGRIDGE

APRIL 2022

REFORD

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CONTENTS

1. INTRODUCTION

1.1 This surface water and foul water drainage strategy has been produced on behalf of William Pye Limited in support of a planning application for the erection of commercial units at Chapel Hill Industrial Estate, Chapel Hill, Longridge. A location plan is included within Appendix A.

1.2 This drainage strategy describes the existing site conditions and proposed development. It assesses the potential impact of proposals on existing drainage and includes a proposed strategy for the provision of new drainage to serve the proposed development.

2. BASE INFORMATION

Existing site

2.1 The site is located off Chapel Hill, Longridge to the rear of the existing William Pye established site.

2.2 The site comprises rough ground. The neighbouring school's fields border the proposal and there are some residential dwellings under construction on Chapel Hill.

2.3 Access is gained through the established estate from the existing access off Chapel Hill.

2.4 The site size is approx. 0.52ha.

Site geology

2.5 The online Soilscapes Viewer has identified the site lying in a region characterised by slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soil, which are not conducive to infiltration of surface water runoff from the site.

Understanding of existing drainage local to and within the site

2.6 There are no existing watercourses within the vicinity of the site.

2.7 A small pond lies midway along the development site's western boundary. The pond is not within the applicants site ownership and appears to have no inlets or outlets.

2.8 Sewer records have been obtained from United Utilities. The sewer records show a 225mm diameter public sewer running westwards along Chapel Hill. The sewer records are included within Appendix B.

2.9 The established site is currently drained by a private surface water drainage system within the estate that collects surface water runoff from the building roofs, hardstanding areas and roads. There is also private foul drainage within the estate that collects foul water from the existing buildings. Drainage survey work has previously been carried out within the established site and it has been determined

that the both the existing foul and surface water drainage within the existing site drain to the public sewer that lies within Chapel Hill.

Proposed development

2.10 The proposal is for the erection of four commercial units and associated access and car parking.

2.11 The proposal is shown on drawing 4021-3 submitted with the planning application.

3. PROPOSED DRAINAGE STRATEGY

Surface water drainage

3.1 In accordance with the National Standards for Sustainable Drainage, the surface water drainage strategy should incorporate the use of Sustainable Drainage (SUDS) where possible. The approach promotes the use infiltration features in the first instance. If drainage cannot be achieved solely through infiltration due to site conditions or contamination risks, the preferred options are (in order of preference):

(i) a controlled discharge to a local waterbody or watercourse, or

(ii) a controlled discharge into the public sewer network (depending on availability and capacity).

3.2 The online Soilscapes Viewer has identified the site lying in a region characterised by slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soil, which are not conducive to infiltration of surface water runoff from the site. Trial holes have previously been excavated within the adjacent site and the soils found comprised clays, which are not conducive to infiltration techniques.

3.3 There are no existing watercourses within the vicinity of the site.

3.4 A small pond lies midway along the development site's western boundary. The pond is not within the applicants site ownership and appears to have no inlets or outlets. It will therefore not be possible for surface water from the developed site to discharge into the pond and for it to be used for attenuation storage.

3.5 United Utilities sewer records show a 225mm diameter public sewer running westwards along Chapel Hill.

3.6 The established site is currently drained by a private surface water drainage system within the estate that collects surface water runoff from the building roofs, hardstanding areas and roads. There is also private foul drainage within the estate that collects foul water from the existing buildings. Drainage survey work has previously been carried out within the established site and it has been determined

that the both the existing foul and surface water drainage within the existing site drain to the public sewer that lies within Chapel Hill.

3.7 It is therefore intended that surface water runoff from the developed site will discharge into the existing drainage system within the established site.

3.8 Due to the size of the site, surface water runoff generated by all rainfall events up to the 100 year critical rain storm pus 40% added for climate change will be restricted to 5 l/s and attenuation provided prior to a discharge being made. The additional 40% is to allow for climate change and has been included in the surface water volume.

3.9 A surface water drainage design has been carried out for the proposed development for all rainfall events up to the 100 year critical rain storm plus 40% included for climate change on stored volumes. Attenuation will be provided within the development site using underground storage within the hardstanding areas.

3.10 Any exceedance flows will run off the site to the south and onto the established site's access road and Chapel Hill.

3.11 The surface water drainage design is included within Appendix C.

Foul water drainage

3.12 It is intended that foul water discharges from the site will be into the existing drainage system within the established site that connects to the public foul sewer system in Chapel Hill.

4. SUMMARY AND CONCLUSIONS

4.1 This surface water and foul water drainage strategy has been produced on behalf of William Pye Limited in support of a planning application for the erection of commercial units at Chapel Hill Industrial Estate, Chapel Hill, Longridge.

4.2 Surface water runoff from the developed site will be restricted to 5 l/s and attenuation storage provided prior to a discharge being made into the existing drainage system within the established site and the public sewer that lies within Chapel Hill.

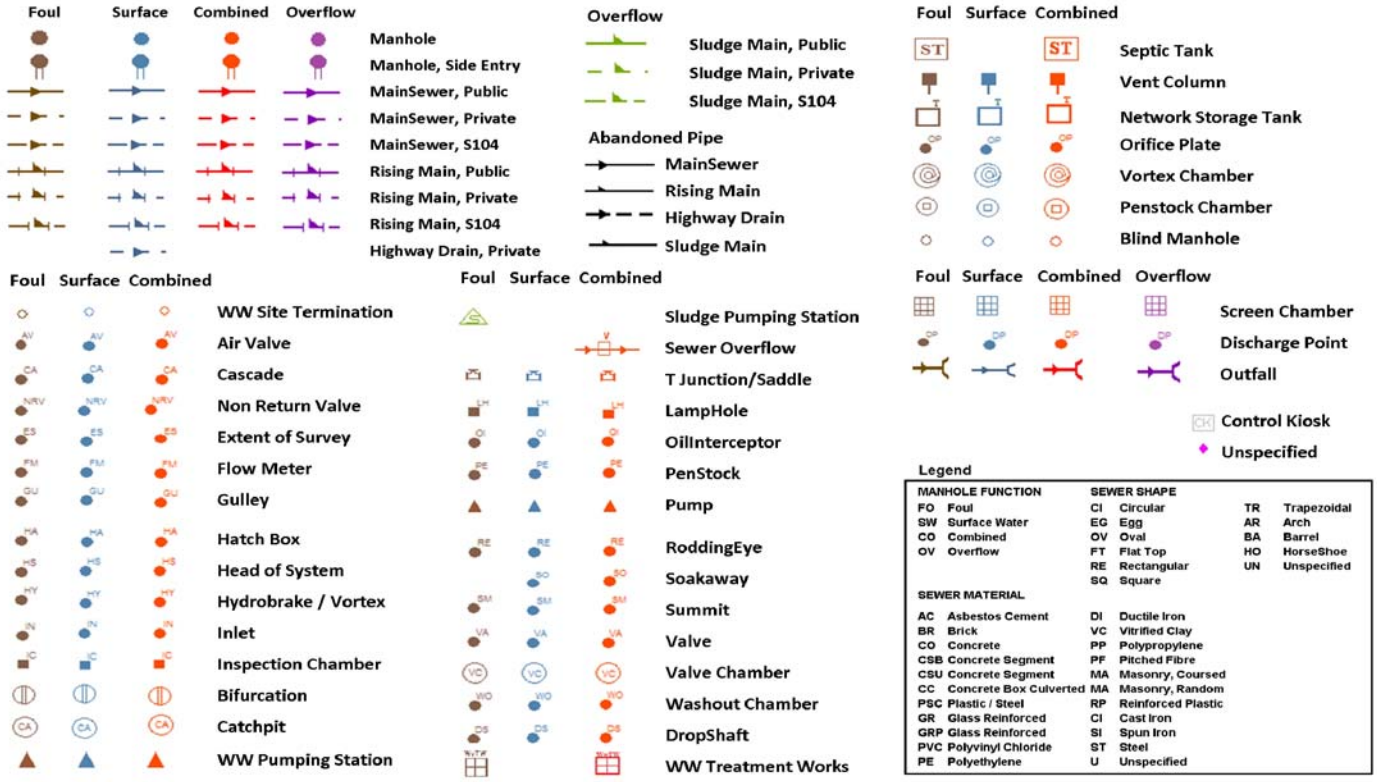
4.3 Foul water discharges from the site will be into the existing drainage system within the established site that connects to the public foul sewer system in Chapel Hill.

APPENDIX A

LOCATION PLAN

APPENDIX B

WASTE WATER SYMBOLOGY



Legend

MANHOLE FUNCTION		SEWER SHAPE			
FO	Foul	CI	Circular	TR	Trapezoidal
SW	Surface Water	EG	Egg	AR	Arch
CO	Combined	OV	Oval	BA	Barrel
OV	Overflow	FT	Flat Top	HO	HorseShoe
		RE	Rectangular	UN	Unspecified
		SQ	Square		

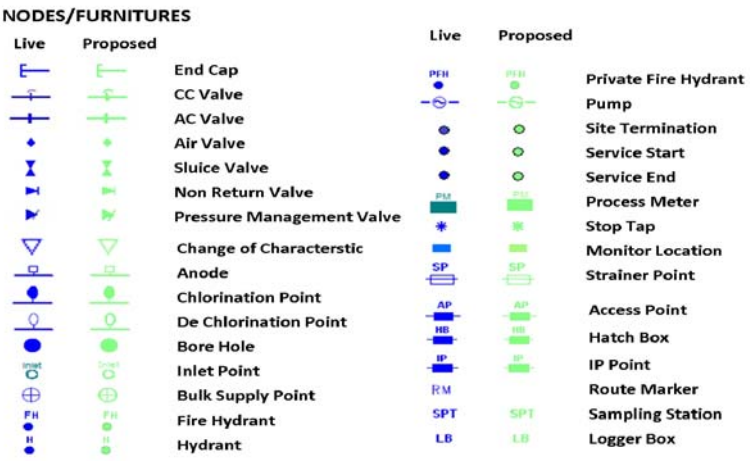
SEWER MATERIAL			
AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	VC	Vitrified Clay
CO	Concrete	PP	Polypropylene
CSB	Concrete Segment	PF	Pitched Fibre
CSU	Concrete Segment	MA	Masonry, Coursed
CC	Concrete Box Culverted	MA	Masonry, Random
PSC	Plastic / Steel	RP	Reinforced Plastic
GR	Glass Reinforced	CI	Cast Iron
GRP	Glass Reinforced	SI	Spun Iron
PVC	Polyvinyl Chloride	ST	Steel
PE	Polyethylene	U	Unspecified

CLEAN WATER SYMBOLOGY

PIPE WORK

ABANDONED PIPE

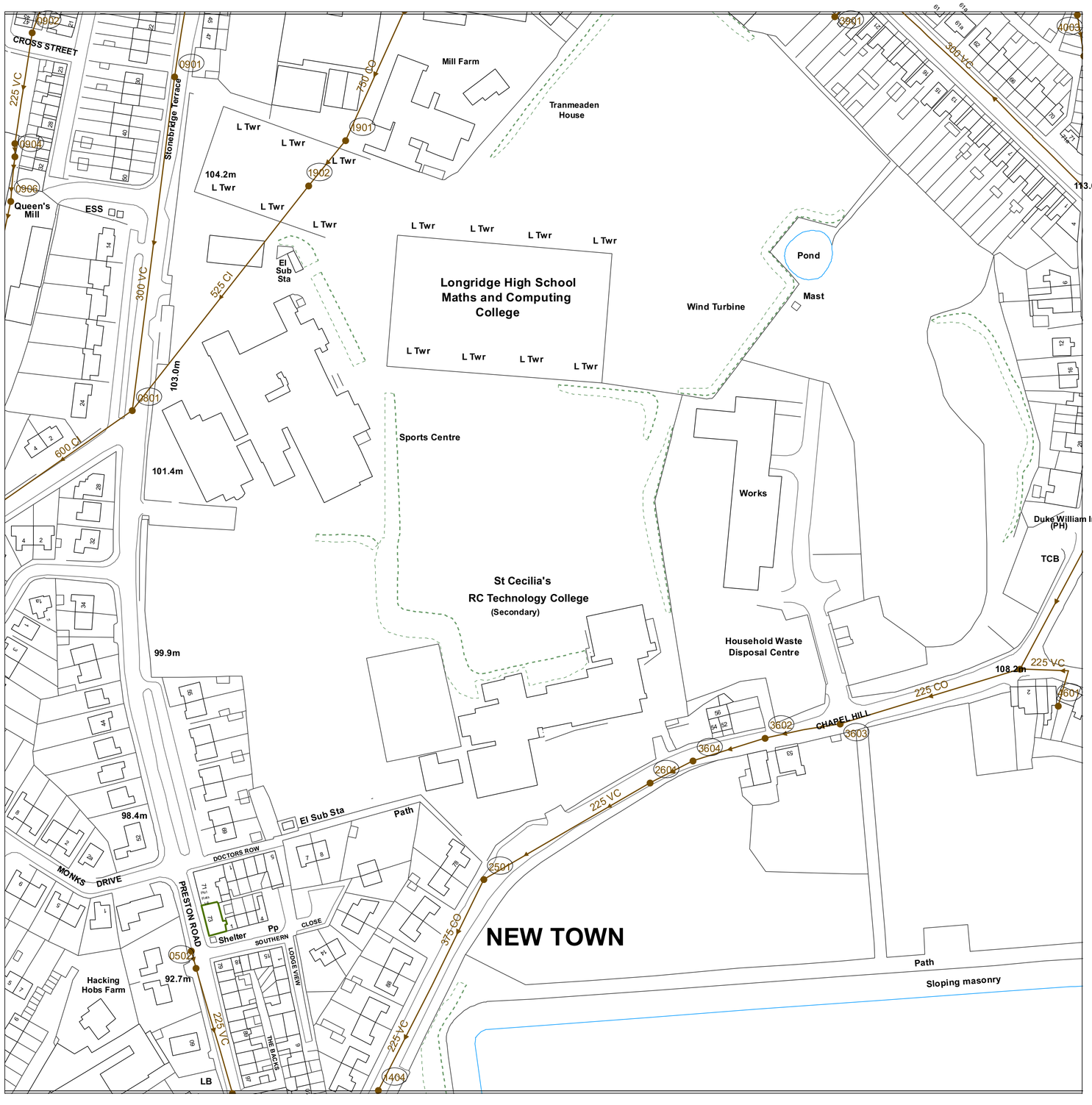
NODES/FURNITURES



PROPERTY TYPES

Legend

MATERIAL TYPES		LINING TYPES	
AC	ASBESTOS CEMENT	CL	CEMENT LINING
CI	CAST IRON	TB	TAR OR BITUMEN
CU	COPPER	ERL	EPOXY RESIN
CO	CONCRETE		
DI	DUCTILE IRON	INSERTION TYPES	
GI	GALVANISED IRON		
GR	GREY IRON	DD	DIE DRAWN
OT	OTHERS	DR	DIRECTIONAL DRILLING
PB	LEAD	MO	MOLING
PV	uPVC	PI	PIPELINE
SI	SPUN IRON	SL	SLIP LINED
ST	STEEL		
UN	UNKONWN		
PE	POLYETHYLENE		



Refno	Cover	Func	Invert	Size.x	Size.y	Shape	Matl	Length	Grad
0501	97.57	FO	96.26	225		CI	VC	8.25	8
0502	97.47	FO							
0801	102.42	FO	99.73	600		CI	CI	80.18	0
0901	105.87	FO							
0902	104.03	FO							
0903	100.91	FO							
0904	101.19	FO							
0906	100.95	FO							
1404	94.74	FO							
1901	109.04	FO							
1902		FO							
2501	99.55	FO							
2601	102.68	FO	99.31	225		CI	VC	44.14	0
3602	106.64	FO							
3603	107.73	FO	104.13	225		CI	CO	17.42	0
3604	104.8	FO							
3901	112.41	FO	111.9	150		CI	VC	22.06	0
4601	129.54	FO							
4602	108.22	FO	104.8	225		CI	CO	87.49	0
4003	117.87	FO							
0905		FO	99.67	150		CI	VC	10.82	0
1501		FO	95.36	225		CI	VC	54.72	0
2602		FO	98.28	375		CI	CO	45.1	0
3601		FO	104.82	225		CI	VC	18.08	0

Refno	Cover	Func	Invert	Size.x	Size.y	Shape	Matl	Length	Grad

WASTE WATER SYMBOLOGY

Foul Surface Combined Overflow

Manhole
Manhole, Side Entry
MainSewer, Public
MainSewer, Private
MainSewer, S104
Rising Main, Public
Rising Main, Private
Rising Main, S104
Highway Drain, Private

Foul Surface Combined

WW Site Termination
Air Valve
Cascade
Non Return Valve
Extent of Survey
Flow Meter
Gulley
Hatch Box
Head of System
Hydrobrake / Vortex
Inlet
Inspection Chamber
Bifurcation
Catchpit
Contaminated Surface Water
WW Pumping Station
Sludge Pumping Station
Sewer Overflow
T Junction/Saddle
LampHole
OilInterceptor
PenStock
Pump
RoddingEye
Soakaway
Summit
Valve
Valve Chamber
Washout Chamber
DropShaft
WW Treatment Works
Septic Tank
Vent Column
Network Storage Tank
Orifice Plate
Vortex Chamber
Penstock Chamber
Blind Manhole
Screen Chamber
Discharge Point
Outfall

Sludge Main, Public
Sludge Main, Private
Sludge Main, S104

ABANDONED PIPE
MainSewer
Rising Main
Highway Drain
Sludge Main

Control Kiosk
Unspecified

LEGEND

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
PE	Polyethylene	CI	Cast Iron
RP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vitrified Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

OS Sheet No: SD6036NW
Scale: 1: 1250 Date: 10/01/2014
24 Nodes
Sheet 1 of 1

United Utilities

SEWER RECORDS

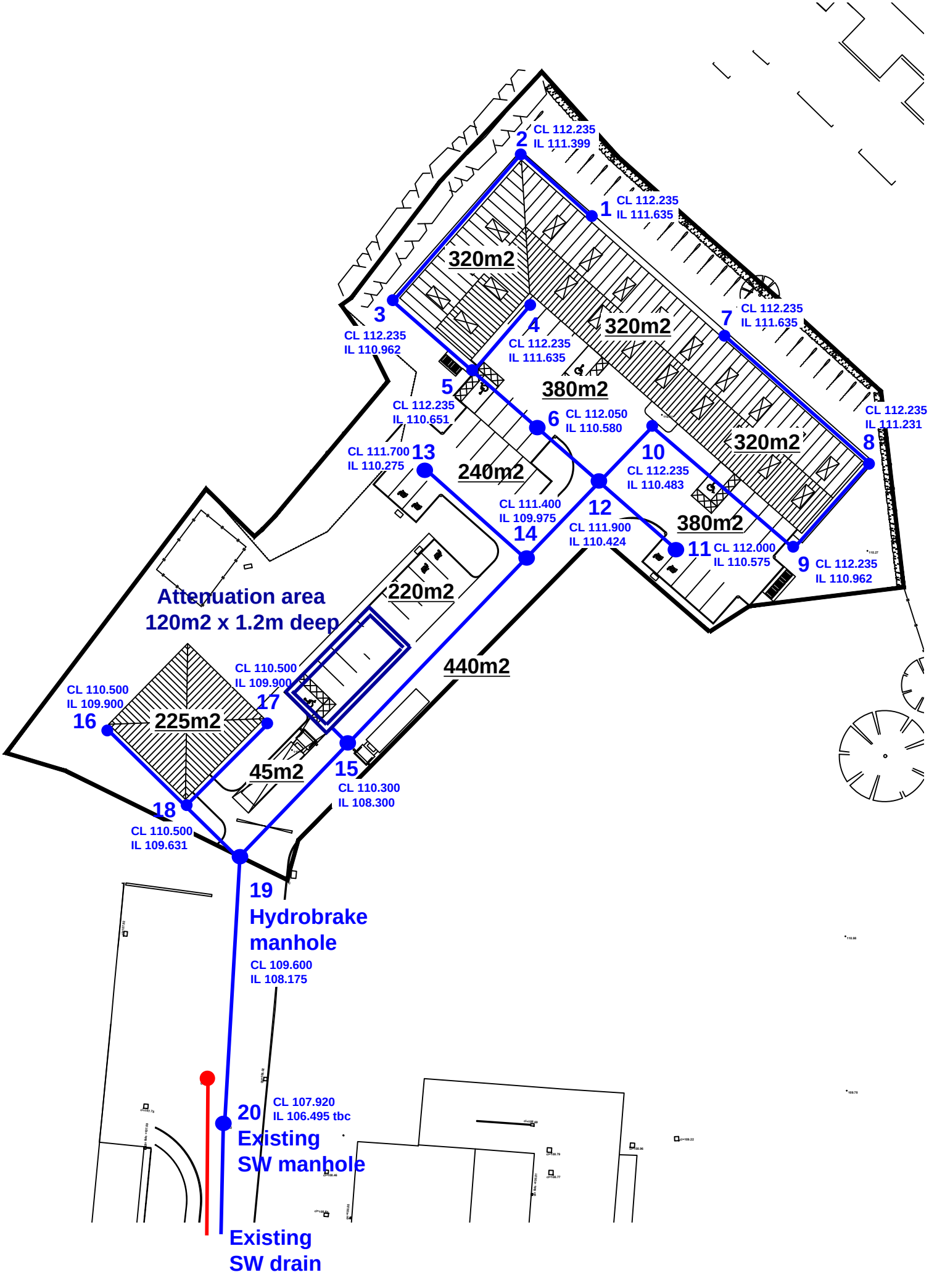
OS Sheet No: SD6036NW

Scale: 1: 1250 Date: 10/01/2014

Printed By: Angela Gall

APPENDIX C

PROPOSED SURFACE WATER DRAINAGE LAYOUT



Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	75.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	18.700	Minimum Backdrop Height (m)	2.000
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
1	0.008	5.00	112.235	600	0.600
2	0.008	5.00	112.235	600	0.836
3	0.008	5.00	112.235	600	1.273
4	0.016	5.00	112.235	600	0.600
5	0.008	5.00	112.235	600	1.584
6	0.038	5.00	112.050	1200	1.470
7	0.016	5.00	112.235	600	0.600
8	0.008	5.00	112.235	600	1.004
9	0.008	5.00	112.235	600	1.273
10	0.016	5.00	112.235	600	1.752
11	0.038	5.00	112.000	1200	1.425
12	0.010	5.00	111.900	1200	1.476
13	0.024	5.00	111.700	1200	1.425
14	0.022	5.00	111.400	1200	1.425
15	0.039	5.00	110.300	1200	2.000
16	0.012	5.00	110.500	600	0.600
17	0.012	5.00	110.500	600	0.600
18			110.500	600	0.869
19			109.600	1200	1.425
20			107.920	1200	1.425

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	14.000	0.600	111.635	111.399	0.236	59.3	150	5.18	55.9
1.001	2	3	26.000	0.600	111.399	110.962	0.437	59.5	150	5.51	54.5
1.002	3	5	14.000	0.600	110.962	110.726	0.236	59.3	150	5.69	53.9
2.000	4	5	12.000	0.600	111.635	110.726	0.909	13.2	150	5.07	56.3
1.003	5	6	12.000	0.600	110.651	110.580	0.071	169.0	225	5.89	53.1
1.004	6	12	12.000	0.600	110.580	110.424	0.156	76.9	225	6.02	52.6
3.000	7	8	24.000	0.600	111.635	111.231	0.404	59.4	150	5.31	55.4
3.001	8	9	16.000	0.600	111.231	110.962	0.269	59.5	150	5.51	54.5
3.002	9	10	24.000	0.600	110.962	110.558	0.404	59.4	150	5.82	53.4
3.003	10	12	10.000	0.600	110.483	110.424	0.059	169.5	225	5.98	52.8
4.000	11	12	14.000	0.600	110.575	110.424	0.151	92.7	225	5.17	55.9
1.005	12	14	15.000	0.600	110.424	109.975	0.449	33.4	225	6.13	52.2
5.000	13	14	18.000	0.600	110.275	109.975	0.300	60.0	225	5.18	55.9
1.006	14	15	35.000	0.600	109.975	108.300	1.675	20.9	225	6.34	51.5

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	1.308	23.1	1.2	0.450	0.686	0.008	0.0
1.001	1.306	23.1	2.4	0.686	1.123	0.016	0.0
1.002	1.308	23.1	3.5	1.123	1.359	0.024	0.0
2.000	2.787	49.3	2.4	0.450	1.359	0.016	0.0
1.003	1.003	39.9	6.9	1.359	1.245	0.048	0.0
1.004	1.492	59.3	12.3	1.245	1.251	0.086	0.0
3.000	1.307	23.1	2.4	0.450	0.854	0.016	0.0
3.001	1.306	23.1	3.5	0.854	1.123	0.024	0.0
3.002	1.307	23.1	4.6	1.123	1.527	0.032	0.0
3.003	1.001	39.8	6.9	1.527	1.251	0.048	0.0
4.000	1.358	54.0	5.8	1.200	1.251	0.038	0.0
1.005	2.271	90.3	25.8	1.251	1.200	0.182	0.0
5.000	1.691	67.2	3.6	1.200	1.200	0.024	0.0
1.006	2.875	114.3	31.8	1.200	1.775	0.228	0.0

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.007	15	19	20.000	0.600	108.300	108.175	0.125	160.0	225	6.66	50.4
6.000	16	18	16.000	0.600	109.900	109.631	0.269	59.5	150	5.20	55.8
7.000	17	18	16.000	0.600	109.900	109.631	0.269	59.5	150	5.20	55.8
6.001	18	19	10.000	0.600	109.631	108.250	1.381	7.2	150	5.25	55.6
1.008	19	20	36.000	0.600	108.175	106.495	1.680	21.4	150	6.93	49.6

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.007	1.031	41.0	36.5	1.775	1.200	0.267	0.0
6.000	1.306	23.1	1.8	0.450	0.719	0.012	0.0
7.000	1.306	23.1	1.8	0.450	0.719	0.012	0.0
6.001	3.768	66.6	3.6	0.719	1.200	0.024	0.0
1.008	2.185	38.6	39.1	1.275	1.275	0.291	0.0

Simulation Settings

Rainfall Methodology	FSR	Summer CV	0.750	Drain Down Time (mins)	240
FSR Region	England and Wales	Winter CV	0.840	Additional Storage (m³/ha)	20.0
M5-60 (mm)	18.700	Analysis Speed	Normal	Check Discharge Rate(s)	x
Ratio-R	0.300	Skip Steady State	x	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0	100	0	0	0
30	0	0	0	100	40	0	0

Node 19 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	108.175	Product Number	CTL-SHE-0100-5000-1400-5000
Design Depth (m)	1.400	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node 15 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	108.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	120.0	0.0	1.200	120.0	0.0	1.201	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.50%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	111.656	0.021	1.0	0.0115	0.0000	OK
15 minute winter	2	11	111.428	0.029	2.0	0.0137	0.0000	OK
15 minute winter	3	11	110.998	0.036	2.9	0.0148	0.0000	OK
15 minute winter	4	10	111.655	0.020	1.9	0.0167	0.0000	OK
15 minute winter	5	11	110.710	0.059	5.6	0.0227	0.0000	OK
15 minute winter	6	11	110.645	0.064	9.9	0.1062	0.0000	OK
15 minute winter	7	10	111.664	0.029	1.9	0.0236	0.0000	OK
15 minute winter	8	10	111.266	0.035	2.9	0.0156	0.0000	OK
15 minute winter	9	11	111.004	0.041	3.8	0.0169	0.0000	OK
15 minute winter	10	11	110.541	0.058	5.5	0.0270	0.0000	OK
15 minute winter	11	10	110.619	0.044	4.5	0.0724	0.0000	OK
15 minute winter	12	11	110.501	0.077	21.0	0.0972	0.0000	OK
15 minute winter	13	10	110.307	0.032	2.9	0.0463	0.0000	OK
15 minute winter	14	10	110.056	0.081	26.3	0.1171	0.0000	OK
120 minute winter	15	88	108.450	0.150	12.3	17.2881	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	1.0	0.505	0.042	0.0271	
15 minute winter	2	1.001	3	1.9	0.677	0.082	0.0737	
15 minute winter	3	1.002	5	2.8	0.878	0.123	0.0453	
15 minute winter	4	2.000	5	1.9	1.329	0.038	0.0170	
15 minute winter	5	1.003	6	5.6	0.634	0.141	0.1060	
15 minute winter	6	1.004	12	10.0	0.938	0.168	0.1279	
15 minute winter	7	3.000	8	1.9	0.680	0.081	0.0662	
15 minute winter	8	3.001	9	2.8	0.798	0.121	0.0568	
15 minute winter	9	3.002	10	3.7	0.955	0.162	0.0940	
15 minute winter	10	3.003	12	5.6	0.557	0.140	0.1003	
15 minute winter	11	4.000	12	4.5	0.549	0.082	0.1205	
15 minute winter	12	1.005	14	21.0	1.716	0.233	0.1847	
15 minute winter	13	5.000	14	2.8	0.366	0.042	0.1465	
15 minute winter	14	1.006	15	26.8	2.954	0.235	0.3818	
120 minute winter	15	1.007	19	5.1	0.292	0.124	0.6781	

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.50%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	16	11	109.926	0.026	1.4	0.0179	0.0000	OK
15 minute winter	17	11	109.926	0.026	1.4	0.0179	0.0000	OK
15 minute summer	18	10	109.652	0.021	2.7	0.0060	0.0000	OK
120 minute winter	19	88	108.448	0.273	6.1	0.3092	0.0000	SURCHARGED
15 minute summer	20	1	106.495	0.000	4.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	16	6.000	18	1.4	0.790	0.061	0.0285	
15 minute winter	17	7.000	18	1.4	0.790	0.061	0.0285	
15 minute summer	18	6.001	19	2.8	1.759	0.041	0.0904	
120 minute winter	19	Hydro-Brake®	20	4.9				37.8

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.50%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	111.667	0.032	2.3	0.0175	0.0000	OK
15 minute winter	2	10	111.444	0.045	4.6	0.0213	0.0000	OK
15 minute winter	3	11	111.020	0.058	6.8	0.0236	0.0000	OK
15 minute winter	4	10	111.667	0.032	4.7	0.0262	0.0000	OK
15 minute winter	5	10	110.749	0.098	13.6	0.0374	0.0000	OK
15 minute winter	6	10	110.690	0.110	24.5	0.1813	0.0000	OK
15 minute winter	7	10	111.681	0.046	4.7	0.0372	0.0000	OK
15 minute winter	8	10	111.288	0.057	6.9	0.0250	0.0000	OK
15 minute winter	9	11	111.029	0.067	9.1	0.0275	0.0000	OK
15 minute winter	10	11	110.585	0.102	13.5	0.0472	0.0000	OK
15 minute winter	11	10	110.644	0.069	11.1	0.1140	0.0000	OK
15 minute winter	12	11	110.558	0.134	51.3	0.1692	0.0000	OK
15 minute winter	13	10	110.324	0.049	7.0	0.0713	0.0000	OK
15 minute winter	14	10	110.102	0.127	64.2	0.1832	0.0000	OK
120 minute winter	15	116	108.808	0.507	28.7	58.6259	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	2.3	0.642	0.099	0.0500	
15 minute winter	2	1.001	3	4.5	0.851	0.195	0.1384	
15 minute winter	3	1.002	5	6.8	1.110	0.292	0.0851	
15 minute winter	4	2.000	5	4.7	1.726	0.095	0.0324	
15 minute winter	5	1.003	6	13.5	0.758	0.338	0.2146	
15 minute winter	6	1.004	12	24.2	1.111	0.408	0.2624	
15 minute winter	7	3.000	8	4.6	0.876	0.201	0.1271	
15 minute winter	8	3.001	9	6.8	1.003	0.295	0.1092	
15 minute winter	9	3.002	10	9.1	1.212	0.394	0.1802	
15 minute winter	10	3.003	12	13.6	0.647	0.341	0.2097	
15 minute winter	11	4.000	12	11.0	0.659	0.204	0.2413	
15 minute winter	12	1.005	14	51.4	2.214	0.570	0.3546	
15 minute winter	13	5.000	14	6.9	0.489	0.103	0.2648	
15 minute winter	14	1.006	15	65.7	3.268	0.575	0.9910	
120 minute winter	15	1.007	19	4.9	0.295	0.120	0.7954	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.50%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	16	10	109.942	0.042	3.5	0.0283	0.0000	OK
15 minute winter	17	10	109.942	0.042	3.5	0.0283	0.0000	OK
15 minute winter	18	10	109.664	0.033	6.9	0.0092	0.0000	OK
120 minute winter	19	116	108.806	0.631	5.7	0.7133	0.0000	SURCHARGED
15 minute summer	20	1	106.495	0.000	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	16	6.000	18	3.5	1.025	0.150	0.0542	
15 minute winter	17	7.000	18	3.5	1.025	0.150	0.0542	
15 minute winter	18	6.001	19	6.9	1.953	0.103	0.1021	
120 minute winter	19	Hydro-Brake®	20	5.0				87.9

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.50%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	111.671	0.036	3.0	0.0199	0.0000	OK
15 minute winter	2	10	111.450	0.051	6.0	0.0244	0.0000	OK
15 minute winter	3	11	111.029	0.067	8.8	0.0272	0.0000	OK
15 minute winter	4	10	111.671	0.036	6.0	0.0291	0.0000	OK
15 minute winter	5	10	110.766	0.115	17.6	0.0440	0.0000	OK
15 minute winter	6	10	110.712	0.132	31.6	0.2170	0.0000	OK
15 minute winter	7	10	111.687	0.052	6.0	0.0423	0.0000	OK
15 minute winter	8	10	111.297	0.066	8.9	0.0290	0.0000	OK
15 minute winter	9	11	111.040	0.078	11.8	0.0319	0.0000	OK
15 minute winter	10	11	110.608	0.125	17.4	0.0580	0.0000	OK
15 minute winter	11	10	110.653	0.078	14.3	0.1301	0.0000	OK
15 minute winter	12	11	110.585	0.161	66.2	0.2041	0.0000	OK
15 minute winter	13	10	110.330	0.055	9.1	0.0813	0.0000	OK
15 minute winter	14	10	110.123	0.148	82.7	0.2125	0.0000	OK
180 minute winter	15	176	109.059	0.759	27.9	87.6953	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	3.0	0.691	0.128	0.0603	
15 minute winter	2	1.001	3	5.8	0.909	0.253	0.1674	
15 minute winter	3	1.002	5	8.7	1.185	0.377	0.1029	
15 minute winter	4	2.000	5	6.0	1.812	0.122	0.0415	
15 minute winter	5	1.003	6	17.4	0.785	0.437	0.2667	
15 minute winter	6	1.004	12	31.2	1.147	0.526	0.3271	
15 minute winter	7	3.000	8	5.9	0.930	0.257	0.1535	
15 minute winter	8	3.001	9	8.8	1.063	0.381	0.1325	
15 minute winter	9	3.002	10	11.7	1.290	0.506	0.2177	
15 minute winter	10	3.003	12	17.5	0.661	0.440	0.2651	
15 minute winter	11	4.000	12	14.2	0.686	0.263	0.2963	
15 minute winter	12	1.005	14	66.3	2.333	0.734	0.4316	
15 minute winter	13	5.000	14	9.0	0.520	0.134	0.3165	
15 minute winter	14	1.006	15	83.5	3.340	0.731	1.1225	
180 minute winter	15	1.007	19	4.9	0.295	0.121	0.7954	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.50%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	16	10	109.947	0.047	4.5	0.0324	0.0000	OK
15 minute winter	17	10	109.947	0.047	4.5	0.0324	0.0000	OK
15 minute winter	18	10	109.668	0.037	8.9	0.0105	0.0000	OK
180 minute winter	19	176	109.058	0.883	5.3	0.9985	0.0000	SURCHARGED
15 minute summer	20	1	106.495	0.000	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	16	6.000	18	4.5	1.099	0.193	0.0652	
15 minute winter	17	7.000	18	4.5	1.099	0.193	0.0652	
15 minute winter	18	6.001	19	8.9	1.882	0.133	0.1049	
180 minute winter	19	Hydro-Brake®	20	5.0				108.4

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.50%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	111.678	0.043	4.2	0.0237	0.0000	OK
15 minute winter	2	10	111.461	0.062	8.4	0.0294	0.0000	OK
15 minute winter	3	10	111.044	0.082	12.5	0.0336	0.0000	OK
15 minute winter	4	10	111.677	0.042	8.4	0.0342	0.0000	OK
15 minute winter	5	12	110.833	0.182	24.7	0.0699	0.0000	OK
15 minute winter	6	12	110.807	0.227	44.5	0.3735	0.0000	SURCHARGED
15 minute winter	7	10	111.697	0.062	8.4	0.0508	0.0000	OK
15 minute winter	8	10	111.312	0.081	12.5	0.0357	0.0000	OK
15 minute winter	9	10	111.058	0.096	16.5	0.0390	0.0000	OK
15 minute winter	10	11	110.745	0.262	25.1	0.1220	0.0000	SURCHARGED
15 minute winter	11	11	110.728	0.153	20.1	0.2545	0.0000	OK
15 minute winter	12	11	110.714	0.290	85.8	0.3676	0.0000	SURCHARGED
15 minute winter	13	10	110.341	0.066	12.7	0.0963	0.0000	OK
15 minute summer	14	10	110.162	0.187	107.9	0.2691	0.0000	OK
240 minute winter	15	232	109.485	1.185	32.4	136.8847	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	4.2	0.759	0.180	0.0773	
15 minute winter	2	1.001	3	8.3	0.986	0.358	0.2178	
15 minute winter	3	1.002	5	12.5	1.279	0.539	0.1545	
15 minute winter	4	2.000	5	8.4	1.832	0.170	0.1013	
15 minute winter	5	1.003	6	24.4	0.805	0.613	0.4452	
15 minute winter	6	1.004	12	41.8	1.182	0.705	0.4772	
15 minute winter	7	3.000	8	8.3	1.007	0.361	0.1988	
15 minute winter	8	3.001	9	12.3	1.163	0.535	0.1722	
15 minute winter	9	3.002	10	16.7	1.332	0.723	0.3490	
15 minute winter	10	3.003	12	23.3	0.653	0.585	0.3977	
15 minute winter	11	4.000	12	18.6	0.722	0.344	0.4796	
15 minute winter	12	1.005	14	85.3	2.267	0.945	0.5550	
15 minute winter	13	5.000	14	12.6	0.566	0.187	0.3945	
15 minute summer	14	1.006	15	108.0	3.401	0.945	1.2646	
240 minute winter	15	1.007	19	4.7	0.284	0.116	0.7954	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.50%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	16	10	109.957	0.057	6.3	0.0388	0.0000	OK
15 minute winter	17	10	109.957	0.057	6.3	0.0388	0.0000	OK
15 minute winter	18	10	109.675	0.044	12.5	0.0124	0.0000	OK
240 minute winter	19	232	109.483	1.308	5.3	1.4794	0.0000	FLOOD RISK
15 minute summer	20	1	106.495	0.000	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	16	6.000	18	6.2	1.204	0.271	0.0832	
15 minute winter	17	7.000	18	6.2	1.204	0.271	0.0832	
15 minute winter	18	6.001	19	12.4	1.985	0.187	0.1095	
240 minute winter	19	Hydro-Brake®	20	5.0				123.1

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.400	5.000
Flush-Flo™	0.416	4.991
Kick-Flo®	0.855	3.980
Mean Flow		4.382

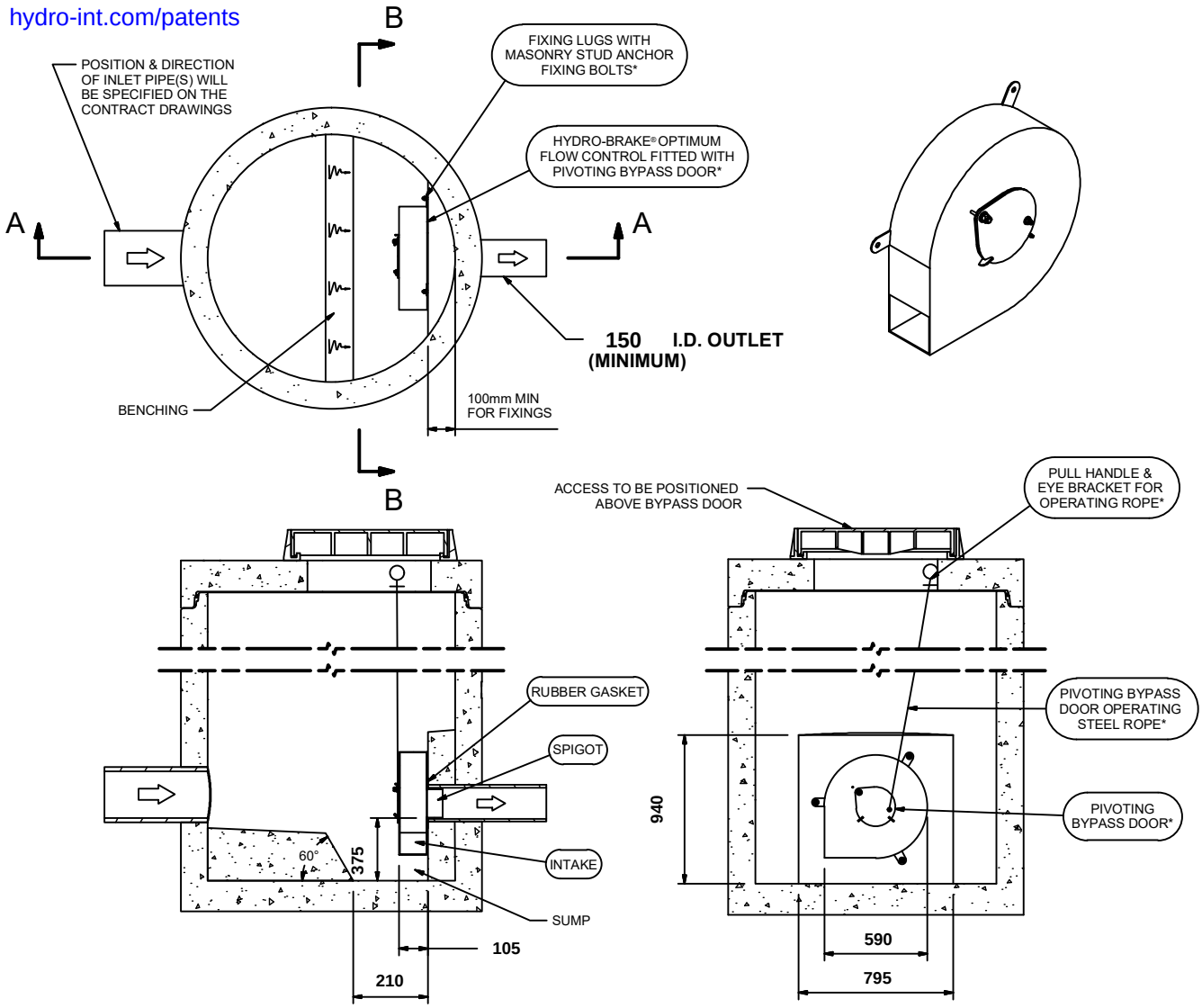
Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 164 kg

BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE 08/4596

WRC Approved PT/329/0412

hydro-int.com/patents



SECTION A-A

SECTION B-B

IMPORTANT: ⬭ LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE

The head/flow characteristics of this SHE-0100-5000-1400-5000 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International®

DATE	4/12/2022 4:31 PM
SITE	Chapel Hill
DESIGNER	Robert Ford
REF	21.1101

SHE-0100-5000-1400-5000
Hydro-Brake® Optimum

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