DETAILED SURFACE WATER SUSTAINABLE DRAINAGE STRATEGY

for

WILLIAM PYE LIMITED

ERECTION OF COMMERCIAL UNITS

at

CHAPEL HILL TRADING ESTATE

CHAPEL HILL, LONGRIDGE

APRIL 2024

REFORD

Consulting Engineers Limited

Hindley Fallows, Midgery Lane, Fulwood, Preston, PR2 9SX

[redacted] [redacted]

Company number: 09620365 VAT Reg. 215 5638 12

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1. INTRODUCTION

1.1 This detailed surface water sustainable drainage strategy has been produced on behalf of William Pye Limited to discharge Conditions 14 and 16 of the planning approval from Ribble Valley Borough Council (Reference 3/2021/1262) for the erection of four commercial units on land at the north of the Chapel Hill site, Longridge. A location plan is included within Appendix A.

1.2 Condition 14 states the following:

No development shall commence in any phase until a detailed, final surface water sustainable drainage strategy for the site has been submitted to, and approved in writing by, the Local Planning Authority.

The detailed surface water sustainable drainage strategy shall be based upon the indicative surface water sustainable drainage strategy submitted and sustainable drainage principles and requirements set out in the National Planning Policy Framework, Planning Practice Guidance and Defra Technical Standards for Sustainable Drainage Systems. No surface water shall be allowed to discharge to the public foul sewer(s), directly or indirectly.

The details of the drainage strategy to be submitted for approval shall Include, as a minimum;

a) Sustainable drainage calculations for peak flow control and volume control for the:
   i. 100% (1 in 1-year) annual exceedance probability event;
   ii. 3.3% (1 in 30-year) annual exceedance probability event + 40% climate change allowance, with an allowance for urban creep;
   iii. 1% (1 in 100-year) annual exceedance probability event + 40% climate change allowance.

Calculations must be provided for the whole site, including all existing and proposed surface water drainage systems.

b) *Final sustainable drainage plans appropriately labelled to include, as a minimum:*
    i. *Site plan showing all permeable and impermeable areas that contribute to the drainage network either directly or indirectly, including surface water flows from outside the curtilage as necessary;*
    ii. *Sustainable drainage system layout showing all pipe and structure references, dimensions and design levels; to include all existing and proposed surface water drainage systems up to and including the final outfall;*
    iii. *Details of all sustainable drainage components, including landscape drawings showing topography and slope gradient as appropriate;*
    iv. *Drainage plan showing flood water exceedance routes in accordance with Defra Technical Standards for Sustainable Drainage Systems;*
    v. *Finished Floor Levels (FFL) in AOD with adjacent ground levels for all sides of each building and connecting cover levels to confirm minimum 150mm+ difference for FFL;*
    vi. *Details of proposals to collect and mitigate surface water runoff from the development boundary;*
    vii. *Measures taken to manage the quality of the surface water runoff to prevent pollution, protect groundwater and surface waters, and delivers suitably clean water to sustainable drainage components;*
c) *Evidence of an assessment of the site conditions to include site investigation and test results to confirm infiltrations rates and groundwater levels in accordance with BRE365.*
d) *Evidence of an assessment of the existing on-site surface water sewer to be used, to confirm that these systems are in sufficient condition and have sufficient capacity to accept surface water runoff generated from the development.*
e) *Evidence that a free-flowing outfall can be achieved. If this is not possible, evidence of a surcharged outfall applied to the sustainable drainage calculations will be required.*

The sustainable drainage strategy shall be implemented in accordance with the approved details.

1.3 Condition 16 states the following:

No development shall be commenced until a site-specific Operation and Maintenance Manual for the lifetime of the development, pertaining to the surface water drainage system and prepared by a suitably competent person, has been submitted to and approved in writing by the Local Planning Authority.

The details of the manual to be submitted for approval shall include, as a minimum:

a) A timetable for its implementation;
b) Details of SuDS components and connecting drainage structures, including watercourses and their ownership, and maintenance, operational and access requirement for each component;
c) Pro-forma to allow the recording of each inspection and maintenance activity, as well as allowing any faults to be recorded and actions taken to rectify issues;
d) The arrangements for adoption by any public body or statutory undertaker, or any other arrangements to secure the operation of the sustainable drainage scheme in perpetuity;
e) Details of financial management including arrangements for the replacement of major components at the end of the manufacturer's recommended design life;
f) Details of whom to contact if pollution is seen in the system or if it is not working correctly; and
g) Means of access for maintenance and easements.

Thereafter the drainage system shall be retained, managed, and maintained in accordance with the approved details.

1.4 This surface water drainage scheme is to discharge Conditions 14 and 16 of the planning approval. It describes the existing site conditions and proposed development. It assesses the potential impact of proposals on existing drainage and includes a proposed scheme 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 that have recently been constructed 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. 0.51ha.

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. The existing site drainage layout is included within Appendix C.

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 the approved drawing 4021/3 Revision: G.

3. PROPOSED 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. The BGS boreholes website provides information on two boreholes that have been undertaken within the development site. The boreholes identify the soil underlying the site to comprise clay. The boreholes are included within Appendix D. As such the ground is 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 Surface water runoff from the developed site will be controlled to 2.0 l/s or the existing pre-development Greenfield runoff rate, Qbar, whichever is the greater, allowing surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 40% on stored volumes to discharge into the private surface water drainage system within the estate that connects to the public sewer that lies within Chapel Hill. The additional 40% is to allow for climate change and has been included in the surface water volume.

3.9 To determine the restricted surface water discharge rate from the developed site, the pre-development Greenfield runoff rates have been calculated using the 'Causeway Flow' programme. The calculations are based upon the area of the application site that has been measured as 0.51ha. The existing pre-development Greenfield runoff rate Qbar has been calculated as 5.6 l/s. The calculation is below.

Pre-development discharge

Site Makeup	Brownfield
Brownfield Method	Greenfield
Greenfield Method	IH124
Positively Drained Area (ha)	0.510
SAAR (mm)	1132
Soil Index	5
SPR	0.53
Region	10
Betterment (%)	0
	Calc
QBar (l/s)	5.6

Return Period (years)	Growth Factor	Q (l/s)
1	0.87	4.9
30	1.70	9.5
100	2.08	11.7

3.10 A surface water drainage design has been carried out for the 100 year critical rain storm plus 40% on stored volumes. The proposed surface water drainage takes surface water runoff from the proposed roofs, access and hardstanding areas and is attenuated to 5.6 l/s, prior to a controlled discharge being made into the private surface water drainage system within the estate that connects to the public sewer that lies within Chapel Hill.

3.11 Attenuation storage of approx. 132m^3 is provided within the proposed drainage network and will be provided within the development site using underground storage within the hardstanding areas. The surface water drainage design is included within Appendix E.

3.12 A bypass interceptor is to be placed on the surface water drainage outfall from the site downstream of the hydrobrake control chamber.

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

Sustainable Drainage Management and Maintenance Plan

3.14 The Sustainable Drainage Management and Maintenance Plan for the surface water drainage within the proposed development site is included within Appendix F.

4. SUMMARY AND CONCLUSIONS

4.1 This detailed surface water sustainable drainage strategy has been produced on behalf of William Pye Limited to discharge Conditions 14 and 16 of the planning approval from Ribble Valley Borough Council (Reference 3/2021/1262) for the erection of four commercial units on land at the north of the Chapel Hill site, Longridge.

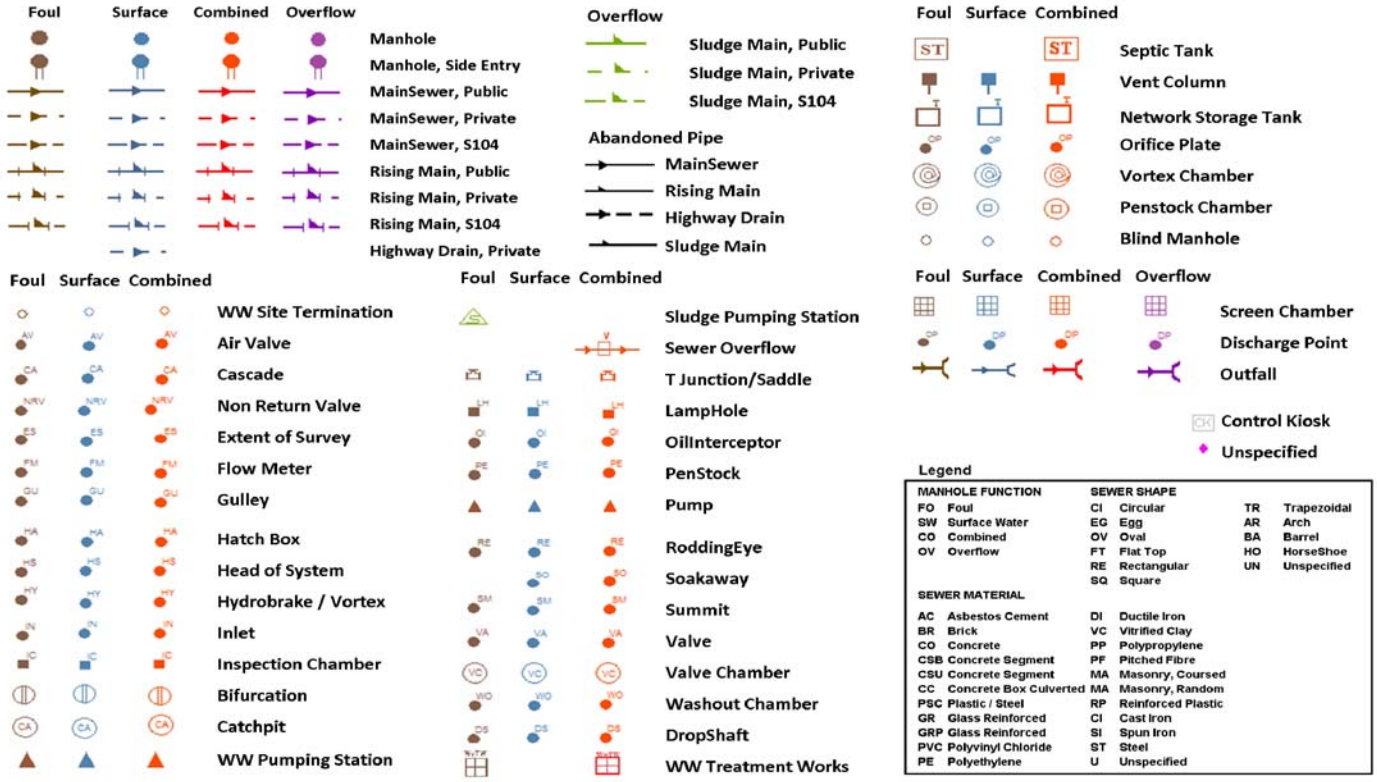
4.2 Surface water runoff from the developed site will be restricted to 5.6 l/s and attenuation storage provided, prior to a controlled discharge being made into the private surface water drainage system within the estate that connects to the public sewer that lies within Chapel Hill.

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		

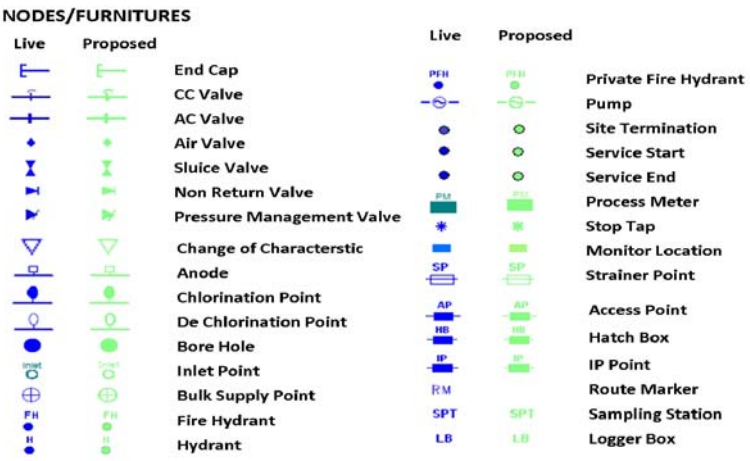
SEWER MATERIAL			
AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	VC	Vitrified Clay
CO	Concrete	PP	Polypropylene
CSB	Concrete Segment	PF	Pitched Fibre
CSU	Concrete Segment	MA	Masonry, Coursed
CC	Concrete Box Culverted	MA	Masonry, Random
PSC	Plastic / Steel	RP	Reinforced Plastic
GR	Glass Reinforced	CI	Cast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

CLEAN WATER SYMBOLOGY

PIPE WORK

ABANDONED PIPE

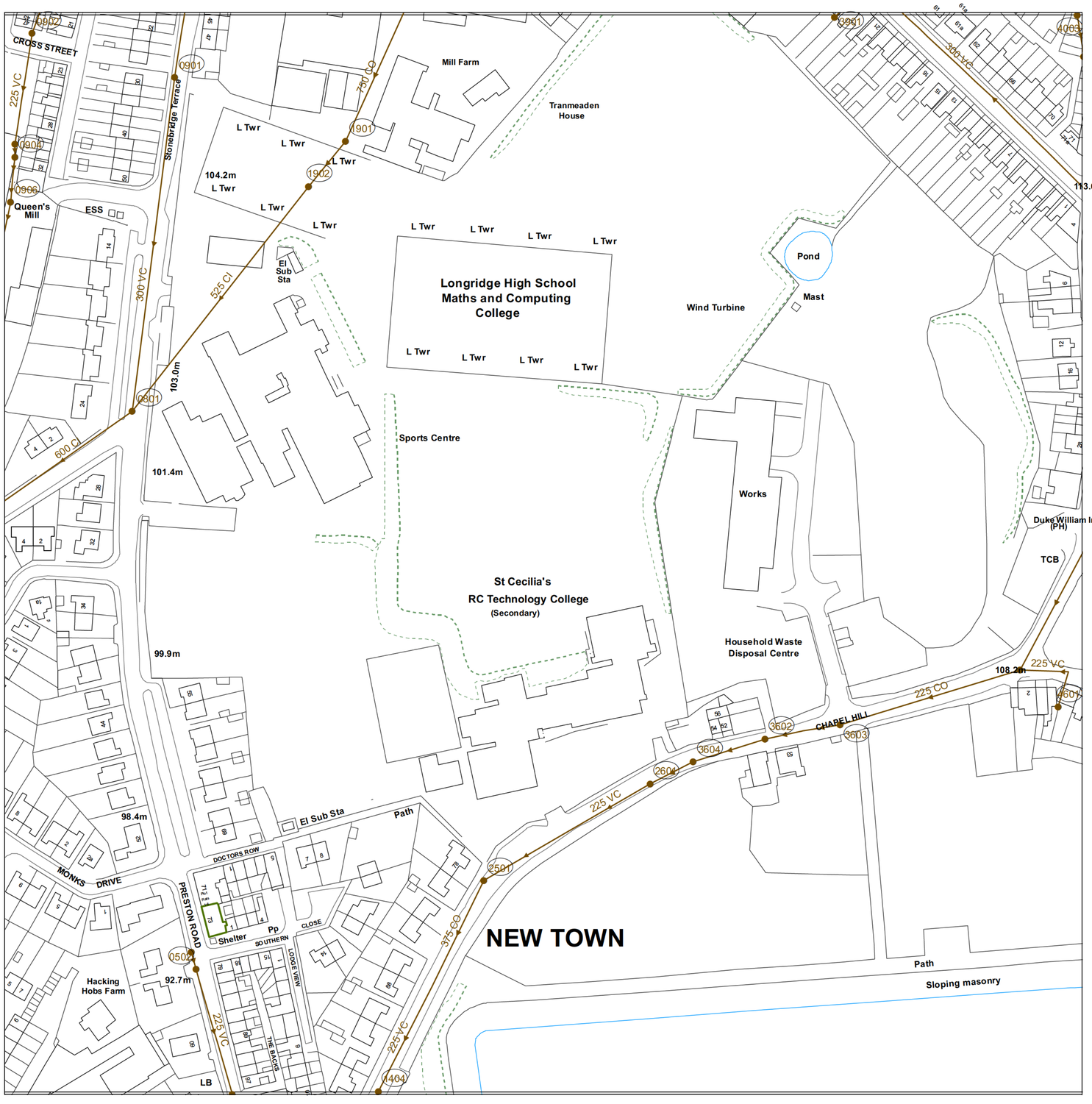
NODES/FURNITURES



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
2602	106.64	FO							
2603	107.73	FO	104.13	225		CI	CO	17.42	0
2604	104.9	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

Printed By: Angela Gall

OS Sheet No: SD6036NW

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

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
Foul Surface Combined Overflow
Screen Chamber
Discharge Point
Outfall
Control Kiosk
Unspecified

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

ABANDONED PIPE

MainSewer
Rising Main
Highway Drain
Sludge Main

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

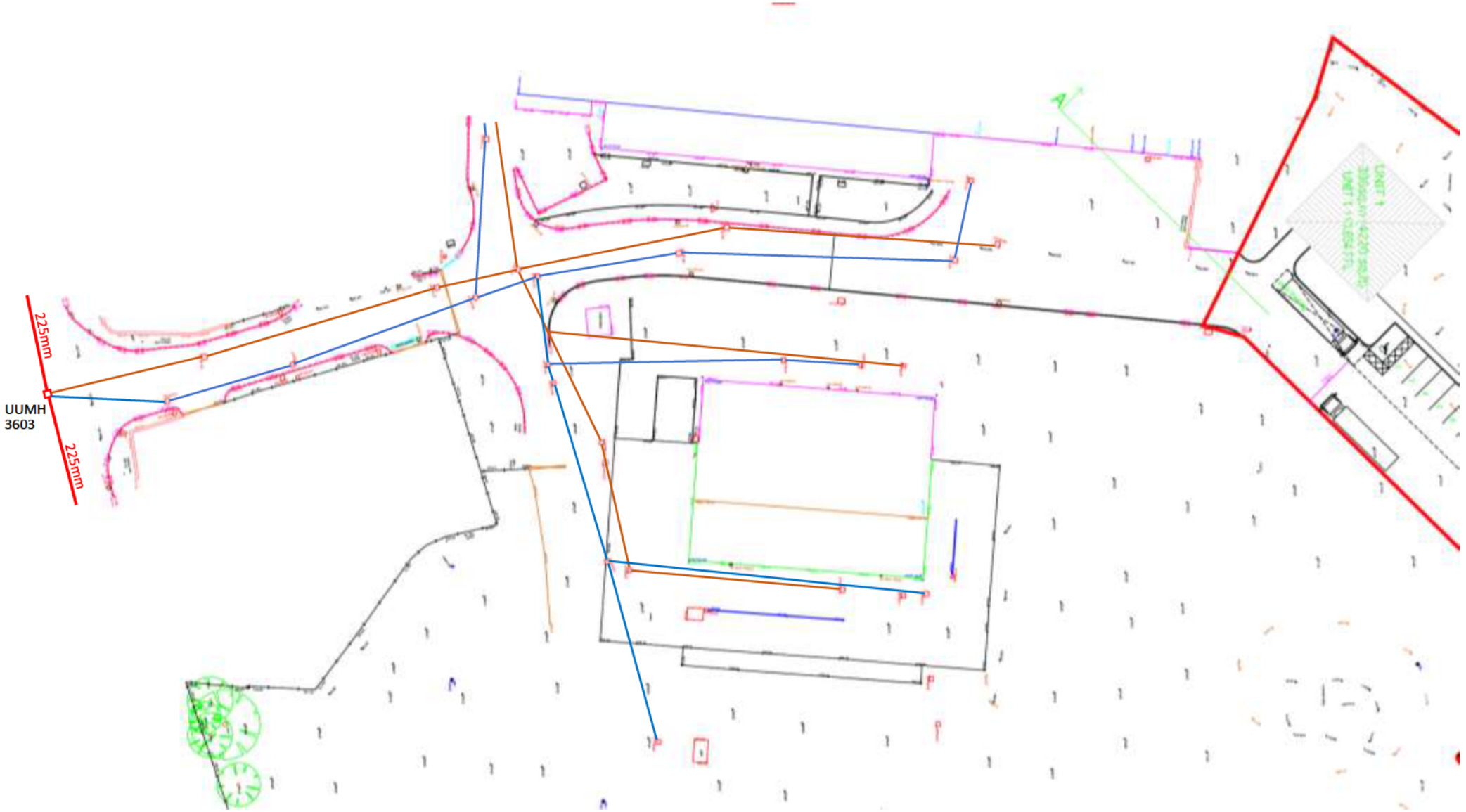
AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
PE	Polyethylene	CI	Cast Iron
RP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vitrified Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel 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

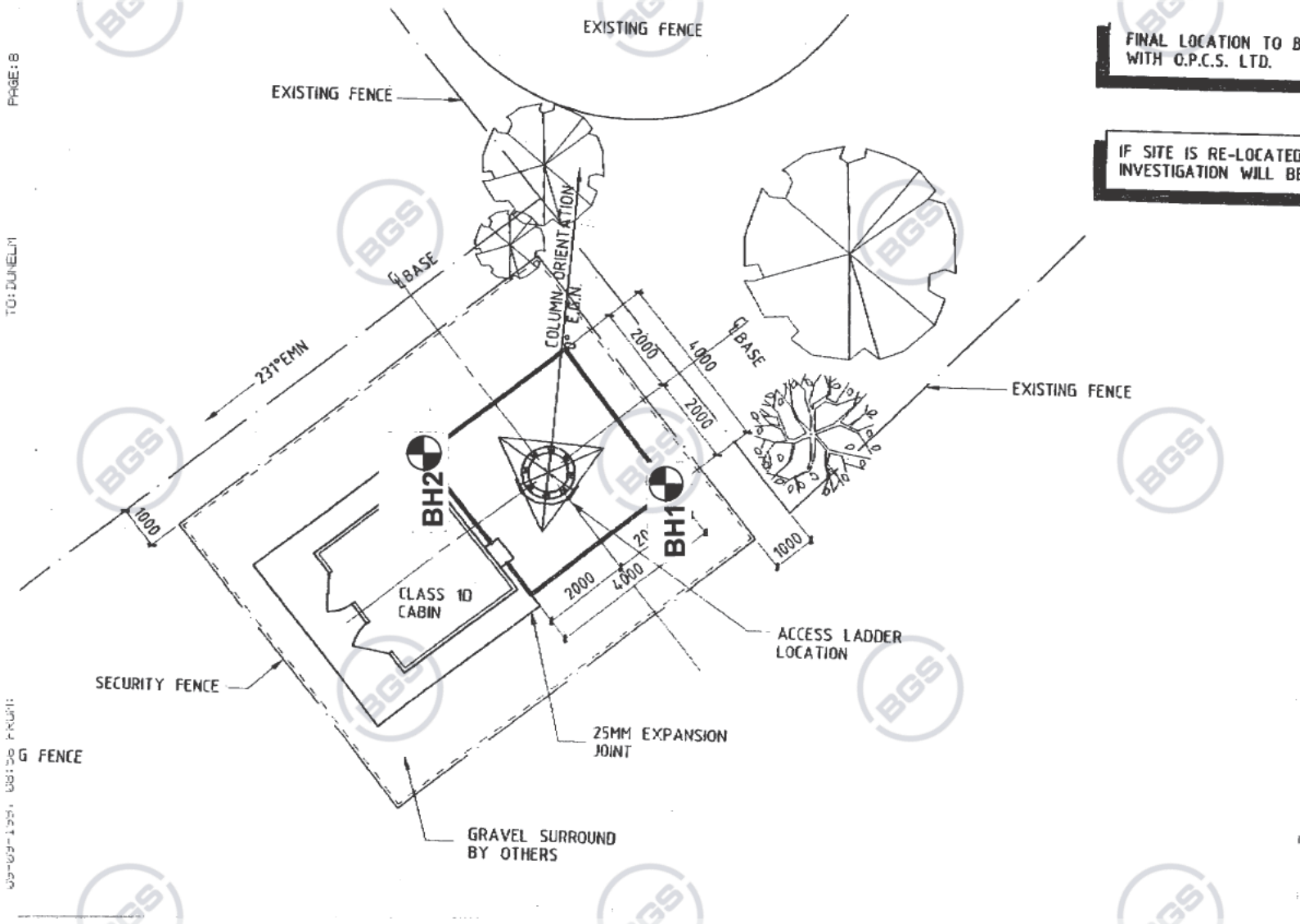
SEWER RECORDS

APPENDIX C



EXISTING DRAINAGE WITHIN THE ESTABLISHED SITE

APPENDIX D


EXISTING FENCE
EXISTING FENCE
FINAL LOCATION TO B
WITH O.P.C.S. LTD.
IF SITE IS RE-LOCATED
INVESTIGATION WILL BE
PAGE:8
TO:DUNELM
℄BASE
231°EMN
COLUMN ORIENTATION
E.M.N.
2000
4000
2000
℄BASE
EXISTING FENCE
BH2
BH1
1000
1000
CLASS 10
CABIN
2000
4000
ACCESS LADDER
LOCATION
SECURITY FENCE
25MM EXPANSION
JOINT
G FENCE
GRAVEL SURROUND
BY OTHERS

CLIENT	JOB NO	LOCATION	BOREHOLE NO
JOHN ALLEN ASOCIATES	C9222	LAN 0127, LONGRIDGE	BH1
DATE: SEPTEMBER 1997 — SCALE: 1 to 50	BORING METHOD: CABLE PERCUSSIVE		Sheet: 1

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
26TH							0.0
				TOPSOL			0.20
	U 1	0.60	70.89	Firm to stiff brown sandy silty CLAY.			
	D 2	1.20					
	U 3	1.50	72.66				
							2.20
	U 4	2.50	166.80	Firm to stiff brown fine stoned silty CLAY (Glacial Till).			
26TH							
	D 5	3.20					
	U 6	3.50	86.99				
	D 7	4.40					
	S 8	4.60	11				
26TH							6.00

DUNELM DRILLING CO
0191 626 2684 FAX 0191 617 0086

BOREHOLE LOGSHEET

Water Observations, Remarks, Etc
Water struck • 2.40m
Standing • 2.30m

CLIENT	JOB NO	LOCATION	BOREHOLE NO
JOHN ALLEN ASOCIATES	C9222	LAN 0127, LONGRIDGE	BH2
DATE: SEPTEMBER 1997 — SCALE: 1 to 50	BORING METHOD: CABLE PERCUSSIVE		Sheet: 1

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
26TH							0.0
				TOPSOIL			0.30
	D 1	0.50		Firm to stiff brown sandy silty CLAY.			
	U 2	0.70	80.62				
	D 3	1.20					
	U 4	1.50	143.17				
	D 5	2.10					2.00
	U 6	2.50	81.86	Firm to stiff brown fine stoned silty CLAY (Glacial Till).			
26TH							
	U 7	3.50	89.19				
	D 8 / S 8	4.50 / 4.60	11				
26TH							5.00

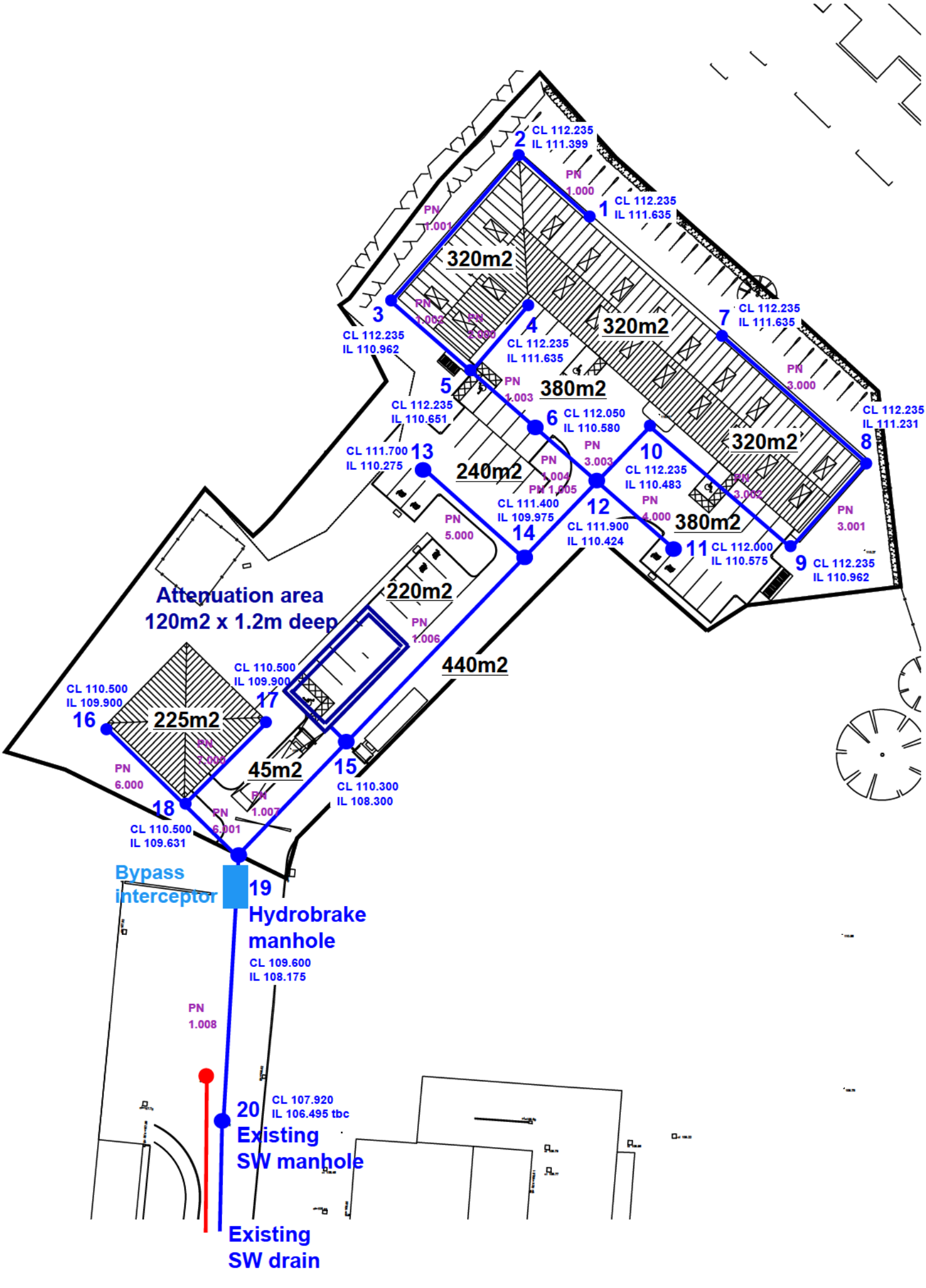
DUNELM DRILLING CO
0191 626 2834 FAX 0191 617 0086

BOREHOLE LOGSHEET

Water Observations, Remarks, Etc
Water struck ▼ 2.30m
Standing ▼ 2.20m

APPENDIX E

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)	0.450
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	40	0	0
30	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-0106-5600-1400-5600
Design Depth (m)	1.400	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.6	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)	240

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: 99.63%

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	86	108.440	0.140	12.3	16.1223	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	1.715	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	0.3785	
120 minute winter	15	1.007	19	5.6	0.310	0.138	0.6563	

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.63%

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	86	108.438	0.263	6.6	0.2975	0.0000	SURCHARGED
15 minute summer	20	1	106.495	0.000	5.2	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	2.7	1.816	0.041	0.0903	
120 minute winter	19	Hydro-Brake®	20	5.4				37.8

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.63%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	111.673	0.038	3.3	0.0209	0.0000	OK
15 minute winter	2	10	111.453	0.054	6.6	0.0257	0.0000	OK
15 minute winter	3	11	111.033	0.071	9.7	0.0289	0.0000	OK
15 minute winter	4	10	111.672	0.037	6.5	0.0301	0.0000	OK
15 minute winter	5	10	110.773	0.122	19.2	0.0469	0.0000	OK
15 minute winter	6	10	110.721	0.141	34.5	0.2324	0.0000	OK
15 minute winter	7	10	111.689	0.054	6.5	0.0442	0.0000	OK
15 minute winter	8	10	111.300	0.069	9.7	0.0305	0.0000	OK
15 minute winter	9	11	111.045	0.083	12.9	0.0337	0.0000	OK
15 minute winter	10	11	110.619	0.136	19.0	0.0632	0.0000	OK
15 minute winter	11	10	110.657	0.082	15.6	0.1362	0.0000	OK
15 minute winter	12	11	110.598	0.174	72.3	0.2199	0.0000	OK
15 minute winter	13	10	110.333	0.058	9.8	0.0844	0.0000	OK
15 minute winter	14	10	110.131	0.156	90.1	0.2247	0.0000	OK
180 minute winter	15	176	109.099	0.799	30.1	92.3268	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	3.3	0.711	0.141	0.0647	
15 minute winter	2	1.001	3	6.4	0.931	0.279	0.1803	
15 minute winter	3	1.002	5	9.6	1.214	0.416	0.1108	
15 minute winter	4	2.000	5	6.5	1.799	0.131	0.0484	
15 minute winter	5	1.003	6	19.1	0.798	0.479	0.2890	
15 minute winter	6	1.004	12	34.0	1.159	0.574	0.3530	
15 minute winter	7	3.000	8	6.4	0.946	0.279	0.1636	
15 minute winter	8	3.001	9	9.6	1.082	0.416	0.1421	
15 minute winter	9	3.002	10	12.8	1.317	0.554	0.2333	
15 minute winter	10	3.003	12	19.1	0.665	0.481	0.2897	
15 minute winter	11	4.000	12	15.5	0.691	0.286	0.3183	
15 minute winter	12	1.005	14	72.3	2.363	0.801	0.4630	
15 minute winter	13	5.000	14	9.7	0.523	0.144	0.3364	
15 minute winter	14	1.006	15	91.2	3.351	0.797	1.1853	
180 minute winter	15	1.007	19	5.5	0.314	0.135	0.7954	

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.63%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	16	10	109.950	0.050	4.9	0.0339	0.0000	OK
15 minute winter	17	10	109.950	0.050	4.9	0.0339	0.0000	OK
15 minute winter	18	10	109.670	0.039	9.7	0.0109	0.0000	OK
180 minute winter	19	176	109.098	0.923	5.9	1.0434	0.0000	SURCHARGED
15 minute summer	20	1	106.495	0.000	5.6	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	4.8	1.124	0.210	0.0692	
15 minute winter	17	7.000	18	4.8	1.124	0.210	0.0692	
15 minute winter	18	6.001	19	9.6	1.939	0.144	0.1059	
180 minute winter	19	Hydro-Brake®	20	5.6				120.8

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.63%

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	0.226	44.5	0.3732	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	0.0391	0.0000	OK
15 minute winter	10	11	110.745	0.262	25.1	0.1218	0.0000	SURCHARGED
15 minute winter	11	11	110.728	0.153	20.1	0.2544	0.0000	OK
15 minute winter	12	11	110.714	0.290	85.8	0.3674	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	0.2694	0.0000	OK
180 minute winter	15	176	109.439	1.139	39.7	131.5552	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	0.1543	
15 minute winter	4	2.000	5	8.4	1.831	0.170	0.1011	
15 minute winter	5	1.003	6	24.4	0.806	0.613	0.4449	
15 minute winter	6	1.004	12	41.8	1.182	0.705	0.4771	
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	0.652	0.585	0.3977	
15 minute winter	11	4.000	12	18.6	0.722	0.344	0.4795	
15 minute winter	12	1.005	14	85.3	2.266	0.944	0.5553	
15 minute winter	13	5.000	14	12.6	0.565	0.187	0.3949	
15 minute summer	14	1.006	15	108.0	3.406	0.945	1.2648	
180 minute winter	15	1.007	19	5.3	0.310	0.129	0.7954	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.63%

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
180 minute winter	19	176	109.437	1.262	6.0	1.4268	0.0000	FLOOD RISK
15 minute summer	20	1	106.495	0.000	5.6	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	0.0833	
15 minute winter	17	7.000	18	6.2	1.204	0.271	0.0833	
15 minute winter	18	6.001	19	12.4	2.054	0.187	0.1095	
180 minute winter	19	Hydro-Brake®	20	5.6				119.9

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.400	5.600
Flush-Flo™	0.413	5.588
Kick-Flo®	0.856	4.458
Mean Flow		4.900

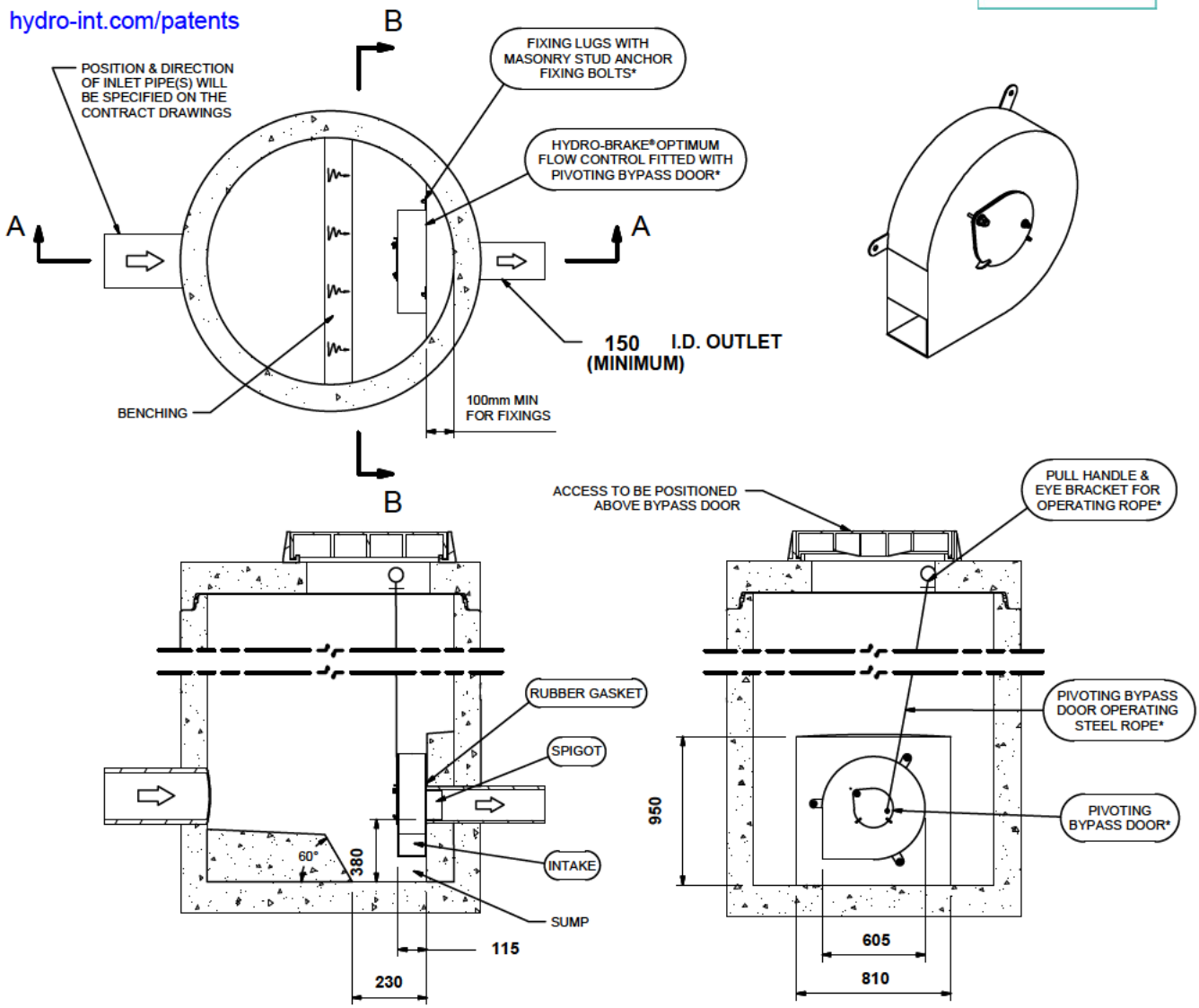
Hydro-Brake® Optimum Flow Control including:

- 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: 20 kg

BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE 08/4596

wrc approved PT/503/0422

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-0105-5600-1400-5600 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
A CRH COMPANY

DATE	09/04/2024 19:04
SITE	Chapel Hill
DESIGNER	Robert Ford
REF	23.1445

SHE-0105-5600-1400-5600
Hydro-Brake® Optimum

Hydro International Ltd • Unit 2, Rivermead Court • Kenn Business Park • Windmill Road • Kenn • Clevedon • BS21 6FT • Tel: 01275 878371 • www.hydro-int.com • Email: Enquiries@hydro-int.com

r.e.ford@virginmedia.com

APPENDIX F

REFORD

Consulting Engineers Limited

Hindley Fallows, Midgery Lane, Fulwood, Preston, PR2 9SX
Mobile: 07970 265334 Email: refordcel@hotmail.com
Company number: 09620365 VAT Reg. 215 5638 12

LAND AT CHAPEL HILL TRADING ESTATE, CHAPEL HILL, LONGRIDGE - Sustainable Drainage Management and Maintenance Plan
Condition 16 – Planning approval reference 3/2021/1262

The drainage within the developed site will remain private with the owner of the developed site being responsible for the maintenance of the various drainage features of the scheme. If pollution is seen in the system or if it is not working correctly the owner of the building shall be contacted.

The table below lists the various drainage features utilised within the proposed surface water drainage design, along with the maintenance regime that should be followed.

BUILDING DRAINAGE	
Regular maintenance	**Frequency**
Visually inspect gutters to ensure they are kept clear of leaves, debris etc. Lift covers of drainage to inspect chambers for debris and build-up of silts. Manhole covers are securely in place.	Annually. No triggers other than maintenance to be taken on regular schedule.
Occasional tasks	**Frequency**
Remove leaves and debris from gutters. Remove debris from inspection chambers to ensure outlets are kept clear of debris to ensure adequate drainage.	As required. Indicator of problem / trigger for maintenance when surcharging or flooding of drains occurs or gutters and chambers full of debris and leaves etc.
Remedial work	**Frequency**
Should drains be heavily blocked or damaged contact drainage maintenance company for unblocking / repair works.	As required. Indicator of problem / trigger for maintenance when drainage not functioning and unblocking pipes and chambers etc. not effective.

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

INSPECTION AND MAINTENANCE ACTIVITY PROFORMA FOR SITE AND BUILDING DRAINAGE (to be printed and completed for each inspection)

Date of inspection …….

Inspection by ……

BUILDING DRAINAGE			
Maintenance item	**Faults recorded / comments**	**Corrective action**	**Date corrective action completed**
Regular maintenance Visually inspect gutters to ensure they are kept clear of leaves, debris etc. Lift covers of drainage to inspect chambers for debris and build-up of silts. Manhole covers are securely in place.			
Occasional tasks Remove leaves and debris from gutters. Remove debris from inspection chambers to ensure outlets are kept clear of debris to ensure adequate drainage.			

ATTENUATION STORAGE TANKS			
Maintenance item	**Faults recorded / comments**	**Corrective action**	**Date corrective action completed**
Regular maintenance Inspect and identify any areas that are not operating correctly. If required, take remedial action. Remove debris from the catchment surface (where it may cause risks to performance). For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary. Remove sediment from pre-treatment structures and / or internal forebays.			
Occasional tasks Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed. Survey inside of tank for sediment build-up and remove if necessary.			