H17215

SURFACE WATER STRATEGY REPORT

BP BULLIONFIELD SF CONNECT
A90, INVERGOWRIE
DUNDEE
DD2 6EG

MARKS HEELEY

MARKS HEELEY LTD

OCTOBER 2023

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CONTENTS

1.0 INTRODUCTION

1.1 Marks Heeley UK have been instructed by MBH Ltd to prepare a drainage strategy in respect of surface water drainage for the proposed electrical charging bays at the petrol filling station known as BP Bullionfield SF Connect, A90, Invergowrie, Dundee, DD2 6EG.

1.2 This report incorporates the following:

- Details of the strategy for the disposal of surface water on the site.
- An appropriate run-off rate and storage provision has been chosen.
- Demonstrate how surface water generated during events up to the 1 in 100 year event plus an allowance for climate change are managed.
- Details of the maintenance of SuDS features to demonstrate that all components will remain fully operational throughout the lifetime of the development.
- Construction details of SuDS features.

2.0 EXISTING SITE

2.1 The existing site is located adjacent the A90. The site is currently a petrol filling station, comprising of forecourt and shop, and HGV re-fueling. The proposed works are isolated to the East of the site, this is currently a redundant LPG area and grass verge.

2.2 The existing ground is generally flat across the site. There is a slight fall towards the boundary adjacent the LPG enclosure of up to 1200mm.

3.0 SITE GEOLOGY

3.1 From drift maps superficial deposits consist of gravel, sand and silt over Dundee formation, consisting of sandstone, siltstone and mudstone, as Figure. 1.

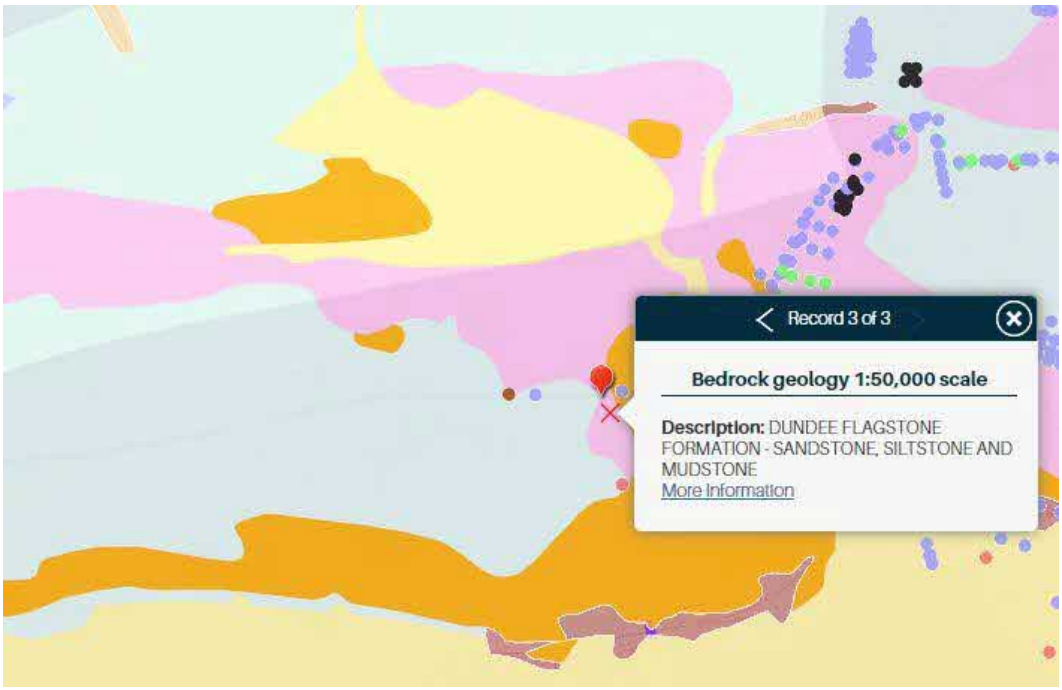

Figure. 1 - Geology

3.2 Local boreholes within the area identify sandy clay, containing occasional gravel over compact purple-grey clayey silt.

3.3 Infiltration testing has not been completed on site, however boreholes carried out within the vicinity of the site confirm the BGS mapping, suggesting that infiltration on site would not be possible, considering this and that the existing site is currently served by public mains sewers we are proposing to follow this principle associated with the forecourt extension. See Figure. 2.

SITE: DUNDEE Kingsway Stage III			CO-ORDINATES: oh 2510	BOREHOLE No. TP 3
MACHINE: International 360	BOREHOLE DIAMETER:		DATE (S): 16 Feb 1983	GROUND LEVEL: 19.73m OD

Samples/Tests Depth (m)	Sample Type	Ground Water	Legend	Depth (m)	O.D. Level (m)	Description of Strata
				0.45	19.28	Topsoil
0.85	B1			0.85	18.88	Loose brown silty fine and medium sand
2.00	B2			2.50	17.23	Firm becoming firm to stiff fissured reddish brown changing to dark brown (with greyish discolouring) sandy clay containing occasional gravel initially
2.80	B3	DRY		3.00	16.73	Compact purple-grey clayey silt

Figure. 2 - Boreholes

3.4 See Figure. 3 for an extract of Scottish Water's asset map.

Figure. 3 – Extract asset map

4.0 PROPOSED DEVELOPMENT

4.1 The proposal is to construct 4no. EV charging bays and ancillary plant, including a HV substation and LV transformer.

4.2 The Extent of existing hardstanding to the overall site is 3526m^2 (0.35 Ha). Refer to Appendix 'A'.

4.3 The existing GPS drainage survey and existing drainage strategy can be found within Appendix 'B'.

4.4 The proposals increase this impermeable area to a total of 3940m^2 (0.39 Ha), an increase of 378m^2. Refer to Appendix 'C'.

4.5 Due to levels, the new treated and attenuated drainage catchment area will include 453m^2 (0.045 Ha). Refer to Appendix 'D'.

4.6 New surface water drainage will be required to service this (453m^2) increased impermeable area created on site. The purpose of this document is to discuss these proposals.

5.0 PROPOSED SURFACE WATER DRAINAGE STRATEGY

5.1 Surface water run-off created by the proposals will need to be disposed of in the most appropriate way. This is to ensure the proposed development does not create additional run-off that could affect surrounding sites or put additional load on the existing sewer system which could cause surcharging in peak storm events.

5.2 Following the SuDS hierarchy, we have determined the most suitable method of providing surface water drainage to the proposed development.

5.3 Due to the bedrock geology, it is not feasible to infiltrate on site and as such this should be avoided. As there are no existing water courses in the vicinity, the surface water should be discharged to the surface water network

5.4 The PFS Design-Life is based on 50 years. As such climate change allowance is based on "Total Potential Change Anticipated for the 2050's" (2040 to 2069) from table 2 within the government guidance of flood risk assessments and SEPA guidance. This proposed scheme provides a 35% climate change.

5.5 As such, the drainage proposals have been based on provision of attenuation designed for a 1 in 100 year return period plus 35% additional allowance for climate change in accordance with SEPA guidelines. These will discharge to the existing surface water connection.

5.6 It is proposed that the storm water from the EV canopy and hard-standings will discharge through either gullies or drainage channel, on to an attenuation tank, hydro-brake at 1L/S and SDS Aqua-Swirl, before connecting back onto the existing on site SW network site where it will pass through the existing petrol interceptor and onto the public SW drain. We await a response from Scottish Water regarding the additional surface area being served.

5.7 Incorporating the attenuation and restricted outflow to 1l/s across the 453m^2 area, the wider site benefits from a 12.5% reduction in discharge rate. This is demonstrated on the catchment Appendix 'D'.

5.8 Micro-drainage calculations for the attenuation are included within Appendix 'E'.

5.9 Proposed drainage drawings are included within Appendix 'F'.

6.0 STORM WATER DRAINAGE COMPONENTS

6.1 Micro-drainage calculations included in Appendix 'E' show the required attenuation size, based on a 1:100 year event +35% climate change.

6.2 It is proposed to install Hydro Stormblocs (or SDS Geolight), wrapped in an impermeable membrane and surrounded in a single sized stone.

6.3 Construction details of the SuDS features are included in Appendix 'F'.

6.4 Discharge to the existing surface water network will be provided using a hydro-brake at 1L/S.

7.0 MAINTENANCE REQUIREMENTS

7.1 The petrol station and all of its drainage is privately owned and maintained by BP. It is the store managers responsibly to ensure that the drainage system is regularly inspected and maintained, in accordance with this plan. Appendix 'F' shows the layout of the drainage system including the location of each of the items requiring maintenance, listed in this plan and a summary of the maintenance requirements.

7.2 The majority of tasks can be completed by BP's staff trained for each specific task. Training should include manual handling, for lifting manhole covers. Manholes & chambers can be dangerous due to trapped harmful gases and should not be entered unless staff are confined space trained and issued with appropriate equipment. Entering confined spaces should not normally be required and should be controlled by a permit to enter system administered by the store manager. It may be appropriate to rely on non-store based, specialist staff, on the rare occasions when confined space entry is required.

7.3 Maintenance of SuDS fits within an overall asset management process:

- Mapping of SuDS assets
- Inspection / monitoring
- Routine light (regular) maintenance
- Routine heavy (infrequent) maintenance
- Remedial maintenance

There should also be regular reviews of maintenance regimes to ensure that they are being effective and the performance of the systems are being maintained. Such regular reviews may also allow maintenance to be reduced.

7.4 Most Manufactures provide guidance on the maintenance requirements for Engineered solutions. These include the following for this site; Premier Tech Aqua Forecourt separators, Hydro Stormbloc, Hydro-Brake, SDS Aqua-Swirl. Refer to Appendix 'G' for the specific maintenance guides.

Catchpit Manholes and Gullies

7.5 Catchpit manholes and gullies need to be inspected on a monthly basis except during the autumn leaf fall when they may require inspections to be increased to fortnightly.

7.6 Equipment required for inspection includes, moveable barriers and cones to guard openings, manhole keys, gloves and a torch. A minimum of two people are required.

7.7 Catchpit manholes and gullies need to be emptied once the sump becomes half full. Emptying should be performed using a gulley emptying vacuum truck or similar device which does not require man entry.

Foul Water Manholes and Inspection Chambers

7.8 Foul water manholes and inspection chambers need to be inspected on a monthly basis or immediately if foul odours are present or there is a suspected blockage.

7.9 Equipment required for inspection includes moveable barriers and cones to guard openings, manhole keys, gloves and a torch. A minimum of two people are required.

7.10 If manholes show any signs of blockage, specialist contractors should be called for clearance work, without delay.

Drainage Channel Outlets

7.11 Drainage channel outlets need to be inspected on a monthly basis except during the autumn when leaf fall, may require inspections to be increased to fortnightly.

7.12 Equipment required for inspection includes moveable barriers and cones to guard openings, lifting tools, gloves and a torch. A minimum of two people are required.

7.13 Silt, leaves and debris should be cleared from the channel outlets during each inspection.

Surface Water Treatment

7.14 The Aqua-Swirl maintenance regime will be carried out in accordance with Appendix 'G'.

7.15 Inspection and maintenance of the attenuation crates is to be carried out in accordance with the manufacturer's recommendations, see Appendix 'G'.

Drainage Inspection and Maintenance Records

7.16 Appendix 'H' includes the annual drainage record log sheet. Copies should be taken of the log sheet for use for each year's records. Each inspection should be recorded on the log sheet for that year by the store manager. The log sheet shall be kept with this maintenance plan in the store manager's office for inspection.

8.0 MAINTENANCE RESPONSIBILITY

8.1 The responsibility for the enacting of this SuDS Maintenance Plan is entrusted to the owner of the property. The developer will provide this SuDS Maintenance Plan in addition to an Operation and Maintenance Manual to the onsite PFS management.

8.2 The Operation and Maintenance Manual shall be passed on to subsequent future owners of the PFS. This will include engineering drawings that detail the design and installation of the SuDS components so that persons undertaking any maintenance works will have a point of reference for the required specification of each of these. Where applicable, the engineering drawings shall make reference to this SuDS Maintenance Plan

8.3 Following construction but prior to practical completion, the responsibility for maintenance shall lie with the developer.

9.0 TIMESCALE FOR IMPLEMENTATION

9.1 The duties of maintenance will come into effect prior to occupation of the PFS, following practical completion and handover

9.2 Installation to be inspected immediately following the first storm event, whenever this should occur post installation.

9.3 Maintenance to be no less frequent than at monthly intervals for the first three months and thereafter:

A.	Inspection / Monitoring	Monthly
B.	Regular Maintenance	2 Monthly Intervals
C.	Infrequent Maintenance	6 Monthly Intervals

10.0 CONCLUSION

10.1 The drainage scheme has been based upon disposal of surface water runoff via the existing surface water connections on site, ensuring that no increase of flood risk will result from the proposed redevelopment.

10.2 The proposed attenuation storage is to accommodate run-off from a 1:100-year rainfall event plus a 35% additional allowance for climate change, in accordance with SEPA guidelines.

10.3 The proposed drainage network incorporates storm water pollution prevention measures such as, SDS Aqua-Swirl, and a Class 1 petrol interceptor.

10.4 Therefore, we consider the proposals acceptable from a surface water flooding and SuDS point of view.

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APPENDIX A

EXISTING HARD STANDING

Setting out dimensions, walls and levels to architects' drawings

SURFACE AREA SERVED
BY EXISTING DRAINAGE
3526m²

EXISTING HARD STANDING
1:200

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12. High risk of saturation and freezing (masonry most vulnerable is situated 150mm above and 150mm below finished ground level) durability classification to be a MX3.2, F2, S2 or S1*

PRELIMINARY

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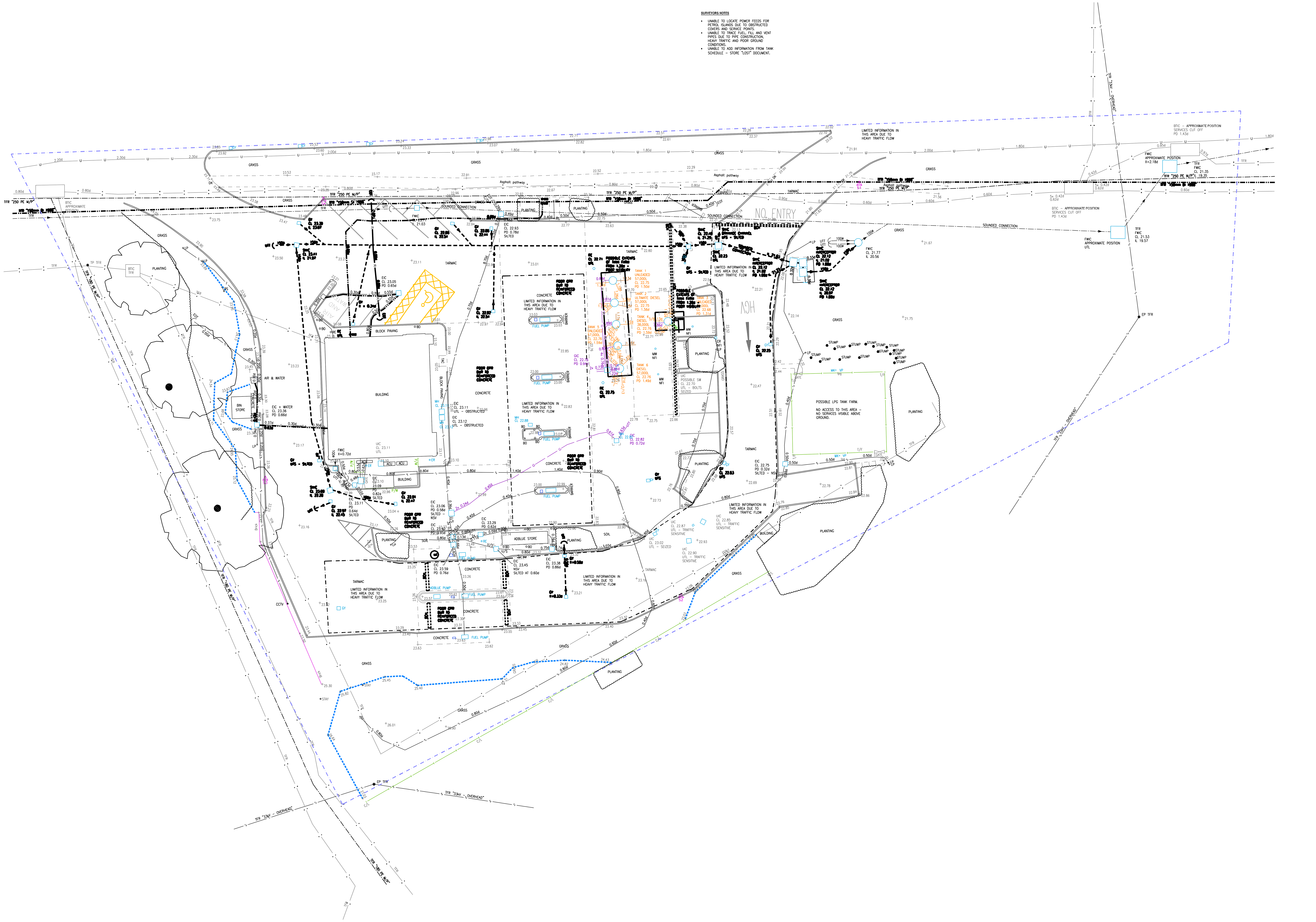
Title
EXISTING HARD STANDING

Sheet Size	Original Scale	Designed/Drawn	Checked	Authorised
A1	1:200	AR Date 20.10.23	MN Date 20.10.23	MN Date 20.10.23

Status	Drawing Number	Rev
P	H17215 -D01	-

APPENDIX B

EXISTING GPS DRAINAGE SURVEY & EXISTING DRAINAGE PHILOSOPHY



SURVEYORS NOTES

- UNABLE TO LOCATE POWER FEEDS FOR PETROL ISLANDS DUE TO OBSTRUCTED COVERS AND SERVICE POINTS.
- UNABLE TO TRACE FUEL, FILL AND VENT PIPES DUE TO PIPE CONSTRUCTION, HEAVY TRAFFIC AND POOR GROUND CONDITIONS.
- UNABLE TO ADD INFORMATION FROM TANK SCHEDULE - STORE "LOST" DOCUMENT.

Electromagnetic and/or Ground Penetrating Radar techniques have been used to locate/map underground utilities and features on this drawing. Intersect Surveys Ltd has made every endeavour to make sure that the information contained within this drawing is accurate and of the highest quality. Intersect Surveys Ltd has used any record drawings provided by the client or by the Statutory Utility Providers, at the client's request, at the time of the survey. Any information taken from these drawings (e.g. pipe sizes and position) is not guaranteed. Historic record information is often incomplete and inaccurate and cannot be relied upon. Intersect Surveys Ltd is not liable for any topographical survey that has not been undertaken by us. Any inaccuracies relating to topographical plans/development plans/Ordnance Survey data that we have no control over is the liability of the customer. Where quoted, depth information of underground services/features is stated. Depths are generally within +/10% accurate, but cannot be guaranteed. Any depths shown on drains are usually to invert (base of drainage channel) unless otherwise stated. At Intersect Surveys Ltd we use skilled staff and modern, calibrated equipment to perform our surveys. However, the completeness of any underground survey cannot be 100% guaranteed and the results from these types of surveys are not infallible. If the location or depth of services/features is of particular importance to a project then it is strongly recommended that discussions are held with Intersect Surveys Ltd regarding any possible limitations or anomalies. It is also strongly advised that trial excavations should be undertaken to confirm survey results. We cannot be held responsible for any inaccuracies beyond those that could be reasonably expected by a competent company.

ABBREVIATIONS (Land & Utilities)

AR	ASSUMED ROUTE	KO	KERB OUTLET	SiL	SIGNAL LOST
AV	AIR VALVE	Lby	LIFEBOUY	SP	SIGN POST
BB	BELISHA BEACON	Lck	LOCK GATE	SPil	SHEET PILING
BD	BACKDROP	Ldr	LADDER	Spr	SPRING
Bdl	BED LEVEL	LH	LAMP HOLE	SPt	SAMPLING POINT
BH	BOREHOLE	LP	LAMP POST	ST	STOP TAP
BHch	BASEMENT HATCH COVER	LV	LOW VOLTAGE	Sti	STILE
Bin	LITTER / GRIT SALT BIN	MgP	MOORING POST	Stl	STRUCTURE TOP LEVEL
BL	BASEMENT LIGHT	mH	METERS HIGH	Stp	STUMP (TREE)
Bol	BOLLARD	Mhcy	MACHINERY	StP	STAND PIPE
BP	BOUNDARY POST	MH	MANHOLE	StPo	STAY POST
BS	BUS STOP	Mkr	MARKER POST	StW	STAY WIRE
BTIC	BRITISH TELECOM CHAMBER	MkrE	MARKER POST (ELECTRIC)	SV	STOP VALVE
CatL	CATENARY LEVEL	MkrG	MARKER POST (GAS)	SVP	SOIL VENT PIPE
CATV	CABLE TV COVER	MkrR	MARKER POST (RAILWAY)	TBM	TEMPORARY BENCH MARK
CB	CONTROL BOX	MkrT	MARKER POST (TELECOM)	TCB	TELEPHONE CALL BOX
CBlt	CONVEYOR BELT	MkrW	MARKER POST (WATER)	TEL	TELECOM CHAMBER COVER
CC	COAL CHUTE	MP	MILE POST	TFR	TAKEN FROM RECORDS
CGrd	CATTLE GRID	MS	MILE STONE	Thl	THRESHOLD LEVEL
ChL	CHANNEL LEVEL	NL	NOT LOCATED	TL	TRAFFIC LIGHT
Chy	CHIMNEY	NP	NAME PLATE	TP	TELEGRAPH POLE
CI	CAST IRON	OSA	OUTSIDE SURVEY AREA	Tpt	TRIAL PIT
CL	COVER LEVEL	OSBM	O.S BENCH MARK	Tr	TROUGH
CO	CONCRETE	OGP	OVERGROUND PIPE	UTF	UNABLE TO FIND
CP	CABLE PIT	OHCu	O/H CABLE (UNIDENTIFIED)	UTGA	UNABLE TO GAIN ACCESS
CpL	COPING LEVEL	OHE	OVERHEAD CABLE (ELECTRIC)	UTL	UNABLE TO LIFT
Cpsn	CAPSTAN	OHG	OVERHEAD GANTRY	UTR	UNABLE TO ROD
Cpst	CAMERA POST	OHP	OVERHEAD PIPE	UTS	UNABLE TO SURVEY
CR	CABLE RISER	OHT	OVERHEAD CABLE (TELECOM)	UTT	UNABLE TO TRACE
CrL	CROWN LEVEL	OP	OUTLET PIPE	VC	VITREOUS CLAY
CulP	CULVERT PIPE	P	POST	VP	VENT PIPE
CWM	CABLE WINDING MACHINERY	Pb	PARK BENCH	VR	VAPOUR RECOVERY
d	DEPTH	PB	POST BOX	VS	VENTILATION SHAFT
Dia.	DIAMETER	PCsg	PEDESTRIAN CROSSING	VW	VALVE / SLUICE WHEEL
DS	DIRECTION SIGN	PE	POLYETHALINE	WB	WEIGHBRIDGE
EIC	ELECTRIC INSPECTION COVER	PF	PITCH FIBER	WL	WATER LEVEL
EoC	EDGE OF CANOPY	Pl	PILE	WM	WATER METER
EOR	END OF RECORDS	Pir	MOVEMENT DETECTOR	WO	WASH OUT VALVE
EOT	END OF TRACE	Pmd	PLANT MOTOR DRIVE	Wr	WEIR
EP	ELECTRICITY POLE	PP	PETROL / DIESEL PUMP	WrL	WEIR LEVEL
ER	EARTH ROD	PR	PIPE RISER	WrPl	WEIR PLATE (TOP)
EShwr	EMERGENCY SHOWER	Psk	PENSTOCK	WWP	WASTE WATER PIPE
ESP	ELECTRICITY SUPPLY POINT	PU	PUMP		
Esw	ELECTRICAL SWITCH	PV	PIPE (VERTICAL)	FENCE TYPES:	
FB	FOOTBRIDGE	PVC	POLYVINYL CHLORIDE	AMF	ARMCO
FH	FIRE HYDRANT	Pyl	PYLON	BWF	BARBED WIRE
FL	FLOOR LEVEL	Pz	PIEZOMETER	CBF	CLOSE BOARDED
FS	FLAG STAFF / POLE	RE	RODDING EYE	CIF	CORRUGATED IRON
G	GULLY	RG	RAIN GAUGE	CLF	CHAIN LINK
G=	GIRTH	RMP	RESERVOIR MONITORING PNT	CPF	CHESTNUT PALING
GIP	GAS INLET PIPE	RP	REFLECTOR POST	IRF	IRON RAILING
GP	GUIDE POST	RS	ROAD SIGN	IWF	INTERWOVEN
GPR	TRACED BY G.P.R	RSP	RAILWAY SIGNAL POST	PCF	POST & CHAIN
Grl	GRILLE	RWP	RAIN WATER PIPE	PIF	POST & IRON RAIL
GV	GAS VALVE	S	SPREAD	PRF	POST & RAIL
Hgt	HEIGHT	SA	SURVEY ABANDONED	PWF	POST & WIRE
Hrl	HANDRAIL	SB	SIGN BOARD	SPF	STEEL PALLISADE
HV	HIGH VOLTAGE	Shlt	SHELTER (BUS / TRAM)	WMF	WIRE MESH
IC	INSPECTION CHAMBER	SI	SPUN IRON		
IL	INVERT LEVEL	SL	SOFFIT LEVEL		
IP	INLET PIPE	SltL	SILT LEVEL (TOP)		
JN	JUNCTION	SMP	SETTLEMENT MONITORING PNT		

KEY

Symbol	Description
TV	CCTV / CABLE TELEVISION
450	COMBINED DRAINAGE
COM	COMMUNICATIONS CABLE
A	COMPRESSED AIR
	DUCTING
E	EARTH CABLE
	ELECTRIC CABLE
EOT	END OF TRACE
150	FOUL DRAINAGE
F	FUEL PIPE
	GAS PIPE
G	GAUGE LINE
H	HEATING
O	OFFSET FILL PIPE
	PUMPING MAIN
R	RADAR AREA ANOMALY
R	RADAR UTILITY TRACE
300	SURFACE DRAINAGE
	SURVEY BOUNDARY
	TELECOM CABLE
TL	TRAFFIC LIGHTS
U	UNIDENTIFIED
VR	VAPOUR RECOVERY
V	VENT PIPE
	WATER PIPE
	O.S BENCH MARK
	SURVEY CONTROL STATION

Revision	Description	Date

Drawing Status:

INFORMATION

INTER/SECT SURVEYS

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Client: MBH

Project: BULLIONFIELD

Title: UNDERGROUND UTILITY SERVICES LAYOUT

Drawn	Surveyed:	Date
A.J.O.	A.S.	MAY'23
Cad File: 001		Scale 1:250@A1
Drawing Number 1007048-001		Revision

APPENDIX C

HARD STANDING

Setting out dimensions, walls and levels to architects' drawings

SURFACE AREA SERVED BY
PROPOSED DRAINAGE
3940m²

PROPOSED HARD STANDING
1:200

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Status	Drawing Number	Rev
P	H17215 -D02	-

APPENDIX D

PROPOSED CATCHMENT AREA

Setting out dimensions, walls and levels to architects' drawings

AREA SERVED BY
ADDITIONAL HARD STANDING
453m2

3526X0.07 =246.82M2
/1000x360 = 88L/S

3073x0.07=215m2
/1000x360 =77L/S

+1 L/S= 78L/S

12.5% REDUCTION.

PROPOSED CATCHEMENT
SERVED BY NEW DRAINAGE
1:200

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CATCHMENT AREA

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P	H17215 -D03	-

APPENDIX E

MICRO-DRAINAGE CALCULATIONS

Summary of Results for 100 year Return Period (+35%)

Half Drain Time : 126 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	98.683	0.183	0.0	1.0	6.3	O K
30 min Summer	98.750	0.250	0.0	1.0	8.6	O K
60 min Summer	98.810	0.310	0.0	1.0	10.7	O K
120 min Summer	98.851	0.351	0.0	1.0	12.1	O K
180 min Summer	98.862	0.362	0.0	1.0	12.5	O K
240 min Summer	98.864	0.364	0.0	1.0	12.6	O K
360 min Summer	98.858	0.358	0.0	1.0	12.4	O K
480 min Summer	98.844	0.344	0.0	1.0	11.9	O K
600 min Summer	98.825	0.325	0.0	1.0	11.2	O K
720 min Summer	98.804	0.304	0.0	1.0	10.5	O K
960 min Summer	98.764	0.264	0.0	1.0	9.1	O K
1440 min Summer	98.694	0.194	0.0	1.0	6.7	O K
2160 min Summer	98.624	0.124	0.0	1.0	4.3	O K
2880 min Summer	98.587	0.087	0.0	1.0	3.0	O K
4320 min Summer	98.562	0.062	0.0	0.8	2.2	O K
5760 min Summer	98.551	0.051	0.0	0.7	1.8	O K
7200 min Summer	98.545	0.045	0.0	0.6	1.6	O K
8640 min Summer	98.541	0.041	0.0	0.5	1.4	O K
10080 min Summer	98.538	0.038	0.0	0.4	1.3	O K
15 min Winter	98.707	0.207	0.0	1.0	7.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	83.064	0.0	7.0	18
30 min Summer	58.720	0.0	9.9	32
60 min Summer	39.275	0.0	13.2	62
120 min Summer	25.274	0.0	17.0	112
180 min Summer	19.364	0.0	19.6	144
240 min Summer	15.984	0.0	21.6	176
360 min Summer	12.162	0.0	24.6	246
480 min Summer	10.004	0.0	27.0	316
600 min Summer	8.591	0.0	29.0	386
720 min Summer	7.584	0.0	30.7	450
960 min Summer	6.226	0.0	33.6	578
1440 min Summer	4.713	0.0	38.1	822
2160 min Summer	3.566	0.0	43.3	1164
2880 min Summer	2.923	0.0	47.3	1500
4320 min Summer	2.205	0.0	53.5	2204
5760 min Summer	1.803	0.0	58.4	2936
7200 min Summer	1.543	0.0	62.5	3648
8640 min Summer	1.358	0.0	66.0	4376
10080 min Summer	1.219	0.0	69.1	5048
15 min Winter	83.064	0.0	7.8	18

Summary of Results for 100 year Return Period (+35%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	98.783	0.283	0.0	1.0	9.8	O K
60 min Winter	98.857	0.357	0.0	1.0	12.3	O K
120 min Winter	98.905	0.405	0.0	1.0	14.0	O K
180 min Winter	98.915	0.415	0.0	1.0	14.3	O K
240 min Winter	98.916	0.416	0.0	1.0	14.4	O K
360 min Winter	98.902	0.402	0.0	1.0	13.9	O K
480 min Winter	98.879	0.379	0.0	1.0	13.1	O K
600 min Winter	98.849	0.349	0.0	1.0	12.1	O K
720 min Winter	98.812	0.312	0.0	1.0	10.8	O K
960 min Winter	98.743	0.243	0.0	1.0	8.4	O K
1440 min Winter	98.642	0.142	0.0	1.0	4.9	O K
2160 min Winter	98.575	0.075	0.0	0.9	2.6	O K
2880 min Winter	98.560	0.060	0.0	0.8	2.1	O K
4320 min Winter	98.546	0.046	0.0	0.6	1.6	O K
5760 min Winter	98.540	0.040	0.0	0.5	1.4	O K
7200 min Winter	98.536	0.036	0.0	0.4	1.2	O K
8640 min Winter	98.533	0.033	0.0	0.4	1.1	O K
10080 min Winter	98.531	0.031	0.0	0.3	1.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	58.720	0.0	11.1	32
60 min Winter	39.275	0.0	14.8	60
120 min Winter	25.274	0.0	19.1	116
180 min Winter	19.364	0.0	21.9	150
240 min Winter	15.984	0.0	24.2	186
360 min Winter	12.162	0.0	27.6	266
480 min Winter	10.004	0.0	30.2	344
600 min Winter	8.591	0.0	32.5	420
720 min Winter	7.584	0.0	34.4	488
960 min Winter	6.226	0.0	37.6	614
1440 min Winter	4.713	0.0	42.7	838
2160 min Winter	3.566	0.0	48.5	1124
2880 min Winter	2.923	0.0	53.0	1472
4320 min Winter	2.205	0.0	60.0	2204
5760 min Winter	1.803	0.0	65.4	2936
7200 min Winter	1.543	0.0	70.0	3640
8640 min Winter	1.358	0.0	73.9	4448
10080 min Winter	1.219	0.0	77.4	4992

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	14.700	Shortest Storm (mins)	15
Ratio R	0.250	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+35

Time Area Diagram

Total Area (ha) 0.045

Time (mins) From:	To:	Area (ha)
0	4	0.045

Model Details

Storage is Online Cover Level (m) 100.000

Cellular Storage Structure

Invert Level (m) 98.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.96
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf.Area (m²)	Depth (m)	Area (m²)	Inf.Area (m²)
0.000	36.0	36.0	0.600	0.0	49.0
0.500	36.0	49.0			

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0054-1000-0500-1000
Design Head (m)	0.500
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	54
Invert Level (m)	98.500
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	1.0
Flush-Flo™	0.151	1.0
Kick-Flo®	0.332	0.8
Mean Flow over Head Range	-	0.9

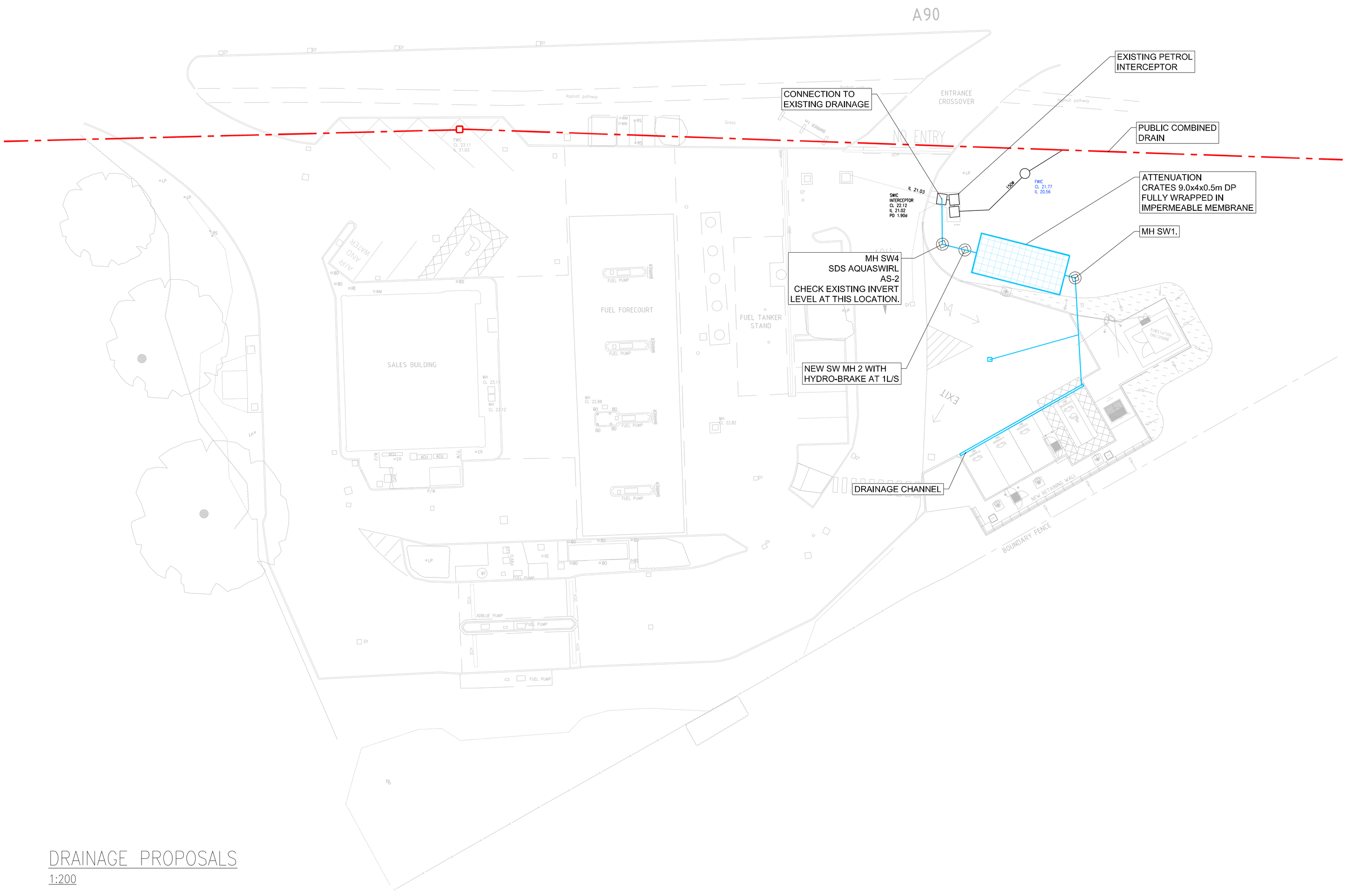
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.0	1.200	1.5	3.000	2.2	7.000	3.4
0.200	1.0	1.400	1.6	3.500	2.4	7.500	3.5
0.300	0.9	1.600	1.7	4.000	2.6	8.000	3.6
0.400	0.9	1.800	1.8	4.500	2.7	8.500	3.7
0.500	1.0	2.000	1.9	5.000	2.8	9.000	3.8
0.600	1.1	2.200	1.9	5.500	3.0	9.500	3.9
0.800	1.2	2.400	2.0	6.000	3.1		
1.000	1.4	2.600	2.1	6.500	3.2		

APPENDIX F

PROPOSED DRAINAGE PLAN

Setting out dimensions, walls and levels to architects' drawings



DRAINAGE PROPOSALS
1:200

GENERAL NOTES:

1. This drawing is copyright (C).
2. This drawing is to be read in conjunction with all relevant drawings and specifications.
3. This drawing shall not be scaled; use only figured dimensions. All dimensions are shown in millimetres and levels in metres above OS Datum.
4. Dimensions and conditions shall be verified on site. Any discrepancies between this drawing and site conditions shall be brought to the attention of the Engineer for resolution prior to placing orders or construction.
5. All work shall comply with the Building Regulations and the requirements of the Local Authority, current Codes of practice and British Standards.
6. Dimensions indicated thus:- * are to be confirmed on site.
7. For remainder of notes see drg no.H****/**.
8. Our design is based upon the assumptions: Existing blockwork is assumed to be 100mm 3.5N in 1:6 mortar. Existing brickwork to be 20.5N in 1:6 mortar. Existing timbers to be grade C16. Lintels assumed to exist over all existing openings. Wall ties assumed to be in good condition. Assumed minimum party wall thickness to be 225mm solid masonry wall construction.
9. Waterproofing details shown are indicative only, Architect to confirm final details
10. Splice requirements to new steel beams to be allowed for by contractor as required. Splice design assumed responsibility of fabricator, unless specifically requested of S.Eng.
11. All structural steelwork shall be to BS EN 10025 & BS EN 10210, Grade S355 unless noted otherwise. All beams to be CE marked.
12. High risk of saturation and freezing (masonry most vulnerable is situated 150mm above and 150mm below finished ground level) durability classification to be a MX3.2, F2, S2 or S1*

PRELIMINARY

Rev	Description	By	Date	Chk'd	Auth

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FACSIMILE: 01279 465999
GENERAL@MARKSHEELEY.CO.UK
CONSULTING STRUCTURAL AND CIVIL ENGINEERS

bp pulse envevo

Project
BULLIONFIELD SF CONNECT
A90, INVERGOWRIE, DUNDEE
DD2 5EG

Title
PROPOSED DRAINAGE SCHEME

Sheet Size	Original Scale	Designed/Drawn	Checked	Authorised
A1	1:200	AR Date 20.10.23	MN Date 20.10.23	MN Date 20.10.23

Status	Drawing Number	Rev
P	H17215 -D04	-

APPENDIX G

SuDs FEATURES MAINTENANCE DETAILS

STORMWATER TREATMENT

SDS Aqua-Swirl™

Hydrodynamic Vortex Separator

SDS Water Infrastructure Systems

SDS Aqua-Swirl™ is a custom engineered, flow through water quality device that utilises hydrodynamic separation technology to maximise the removal of sediment, debris and free floating oil within surface water runoff.

SYMBiotIC™

When connected to a SDS SYMBiotIC™ system, SDS Aqua-Swirl™ provides real time data on a broad range of key operating factors such as pollutant loads and silt capture level.

- *BBA HAPAS approved*
- *HDPE plastic construction*
- *No moving parts*
- *Sealed baffle*
- *Large debris storage chamber*
- *Lifting supports*
- *Compact dimensions*
- *Available in 9 different sizes*
- *Bespoke sizing available*

SDS Aqua-Swirl™ is sized according to water quality treatment flow rates which are based on the initial movement of pollutants into the storm drainage system. This flow rate typically represents approximately 90% to 95% of the total pollutants in the runoff volume.

The treatment flow rate of the SDS Aqua-Swirl™ system is engineered to meet or exceed the local water quality treatment criteria and form an intrinsic part of the SuDS solution train.

sdslimited.com

SDS Ltd, Clearwater House, Castlemills, Biddisham, Somerset, BS26 2RE

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Features	Benefits
Available with performance monitoring via SDS SYMBiotIC™.	Provides bespoke suite of operating data, such as silt levels and pollutants, viewable via a secure web portal dashboard with live notifications via email and text.
BBA HAPAS certified.	Approved for installation under roads and pavements; adoptable by the Highways Agency.
Manufactured from HDPE high strength plastic Weholite.	Offers a durable, light weight and low cost alternative to concrete. Easy and quick to install resulting in substantial cost savings.
Specialised sealed baffle.	Delivers the most effective performance of any vortex separator.
Internal bypass with pollution retention.	Able to treat localised rain and larger storm events while retaining captured pollutants.
NJDEP verified performance.	Verification accepted by UK Government environmental regulators (as cited in the CIRIA C753 SuDS Manual).
Single swirl chamber.	Simplifies inspection and maintenance facilities with no special equipment required.
Compact dimensions.	Reduces ground excavation and product installation costs.
Small footprint design.	Can be retro-fitted with minimal disruption to existing infrastructure utilities or surface features, extending the ability to meet new regulations.
Certified installation lifting supports.	Easy installation without the need for large, expensive cranes.
Suitable for use during site construction programme.	Can be put into operation prior to completion of the site build, with the inclusion of a planned maintenance schedule.
Available in 9 different standard sizes and also bespoke.	Provides greater design flexibility and assists the removal of sediments at a greater rate than comparable systems.

SPECIFICATIONS

SDS Aqua-Swirl™ Model No.	Maximum ID pipe connection (mm) BYP[1]	Chamber Internal Diameter (mm)	Water Quality Treatment Flow Rate NJDEP (l/s) Fine	Water Quality Treatment Flow Rate (l/s) OK110 Coarse	Oil/debris storage capacity litres	Sediment storage capacity m^3	Aqua-Swirl™ Weight kg
AS-2	375	750	16	30	136	0.3	300
AS-3	500	1050	31	53	416	0.6	700
AS-4	600	1200	40	77	644	0.8	1000
AS-5	750	1500	63	120	1382	1.3	1100
AS-6	900	1800	91	173	1439	1.8	1400
AS-7	1050	2100	123	235	1987	2.5	1700
AS-8	1200	2400	161	307	2612	3.3	2200
AS-9	1350	2800	220	418	3596	4.4	2600
AS-10	1500	3000	252	480	4164	5.1	3100

[1]BYP (Internal Bypass) provides full treatment of the first flush of water while the peak design storm is diverted and channelled through the main conveyance pipe.

Notes:
Details of pollution mitigation indices, head loss and CAD details, standard drawings and Installation Guides available upon request.
The sediment storage capacity has been calculated in accordance with the relevant test protocol and is not a physical maximum; any additional sediment capacity required is achieved with bespoke deeper units.
For assistance in design and specific sizing using historical rainfall data, please contact SDS.

A-S DS/0819

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Installation & Maintenance

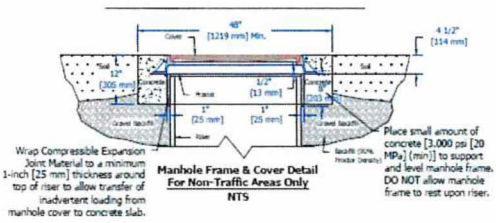
SDS Aqua Swirl ™ Hydrodynamic Separator

Aqua-Swirl™ systems are fabricated from high performance HDPE materials; they are durable lightweight and can be installed without use of heavy lifting equipment.

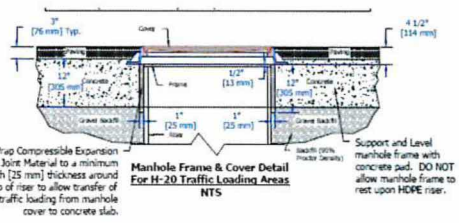
Lifting support cables are provided to allow easy off loading and installation, resulting in significantly reduced installation costs.

Installation:

1) Excavation to required size and depth allowing for 600mm around each side of the unit
2) Prepare the bed with 20-40mm clean stone to a depth of 300mm
3) Compacted in 150mm layers to ASTM D 2321 to a proctor density of 95%
4) Install the unit and backfill with 20-40mm clean stone in 150mm layers to ASTM D 2321 sufficient backfill should be placed over components prior to using heavy compaction or construction equipment to prevent damage.
5) Connect to drainage network pipework with rubber couplings like Fernco, Flex Seal or Band Seal.
6) The Aqua Swirl has an octagonal base plate extending 150mm from the outside diameter to provide mitigation against buoyancy, concrete can be poured directly onto the base plate if required to provide additional resistive force.
7) The riser pipe is supplied to the required length and can be cut to size on site to the required depth.
8) Recommended man hole cover Clark drain CD751H KMD frame and cover or equal
9) Where traffic loading is required a reinforced concrete pad must be placed over the entire Aqua swirl as per design calculated by engineer.
10) If traffic loading is not required, it's recommended that bollards are placed around access risers in non-traffic areas to prevent inadvertent loadings by maintenance vehicles.



Manhole Frame & Cover Detail
For Non-Traffic Areas Only
NTS



Manhole Frame & Cover Detail
For H-20 Traffic Loading Areas
NTS

System Operation:

The Aqua-Swirl® is most commonly installed in an "off-line" configuration. Or, depending on local regulations, an "in-line" (on-line) conveyance flow diversion (CFD) system can be used. The CFD model allows simple installation by connecting directly to the existing storm conveyance pipe thereby providing full treatment of the "first flush," while the peak design storm is diverted and channelled through the main conveyance pipe

The patented Aqua-Swirl® Stormwater Treatment System provides a highly effective means for the removal of sediment, floating debris, and free oil. Swirl technology, or vortex separation, is a proven form of treatment utilized in the Stormwater industry to accelerate gravitational separation.

The treatment operation begins when Stormwater enters the Aqua-Swirl® through a tangential inlet pipe that produces a circular (or vortex) flow pattern that causes contaminates to settle to the base of the unit. Since Stormwater flow is intermittent by nature, the Aqua-Swirl® retains water between storm events providing both dynamic and quiescent settling of solids. The dynamic settling occurs during each storm event while the quiescent settling takes place between successive storms.

A combination of gravitational and hydrodynamic drag forces encourages the solids to drop out of the flow and migrate to the center of the chamber where velocities are the lowest.

The treated flow then exits the Aqua-Swirl® behind the arched outer baffle. The top of the baffle is sealed across the treatment channel, thereby eliminating floatable pollutants from escaping the system. A vent pipe is extended up the riser to expose the backside of the baffle to atmospheric conditions, preventing a siphon from forming at the bottom of the baffle.

Maintenance:

Long term performance of the Aqua Swirl or any other device depends on inspection and maintenance program.

Recommended schedule in line with Ciria C753 guidance

On hand over – 3 months -6 months -12 months and then annually or as deemed necessary from details obtain from previous inspections.

Each sites sediment loadings will be different and at its highest just after the build phase, hence why a more frequent visit are required at the start of the programme.

The Aqua-Swirl® has been designed to minimize and simplify the inspection and maintenance process. The single chamber system can be inspected and maintained entirely from the surface thereby eliminating the need for confined space entry. Furthermore, the entire structure (specifically, the floor) is accessible for visual inspection from the surface. There are no areas of the structure that are blocked from visual inspection or periodic cleaning. Inspection of any free- floating oil and floatable debris can be directly observed and maintained through the manhole access provided directly over the swirl chamber.

Inspection:

To inspect the Aqua-Swirl®, remove the manhole cover. We also provide a permanent metal information plate affixed inside the access riser which provides our contact information, the Aqua-Swirl® model size, and serial number.

The only tools needed to inspect the Aqua-Swirl® system are a flashlight and a measuring device such as a stadia rod or pole. Given the easy and direct accessibility provided, floating oil and debris can be observed directly from the surface. Sediment depths can easily be determined by lowering a measuring device to the top of the sediment pile and to the surface of the water. When the sediment pile is within 42 to 48 inches of the water surface (or sediment pile thickness is 18 to 24 inches as measured from the base), the system should be maintained. The maximum Sediment storage capacity of the Aqua-Swirl® is reached when the sediment pile is within 30 inches of the water surface (or sediment accumulation is 36 inches thick as measured from the base).

It should be noted that in order to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile. Keep in mind that the finer sediment at the top of the pile may offer less resistance to the measuring device than the larger particles which typically occur deeper within the sediment pile.

The Aqua-Swirl® design allows for the sediment to accumulate in a semi-conical fashion as illustrated above. That is, the depth to sediment as measured below the water surface may be less in the center of the swirl chamber; and likewise, may be greater at the edges of the swirl chamber.

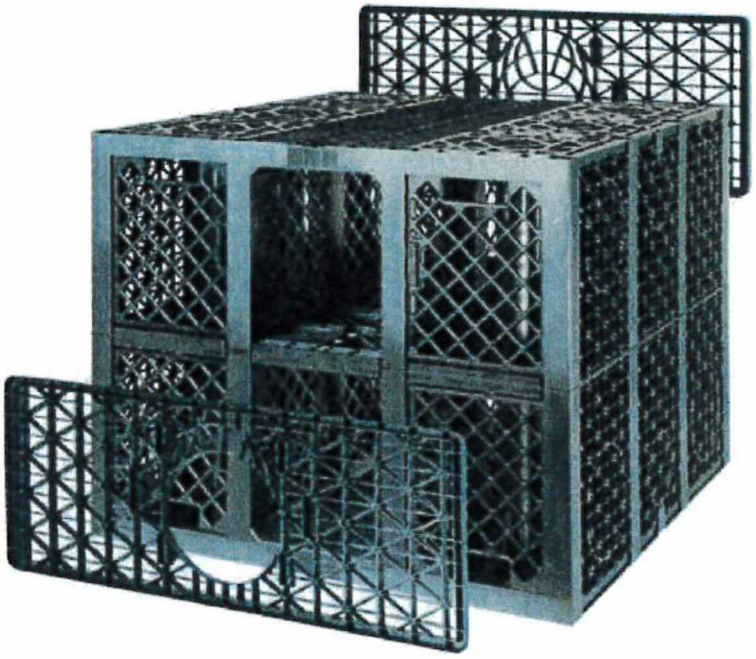
Removal:

Cleaning the Aqua-Swirl® is simple and quick. Free-floating oil and floatable debris can be observed and removed directly through the 30-inch service access riser provided. A vacuum truck is typically used to remove the accumulated sediment and debris. An advantage of the Aqua-Swirl® design is that the entire sediment storage area can be reached with a vacuum hose from the surface (reaching all the sides). Since there are no multiple or limited (hidden or "blind") chambers in the Aqua-Swirl®, there are no restrictions to impede on-site maintenance tasks.

Disposal:

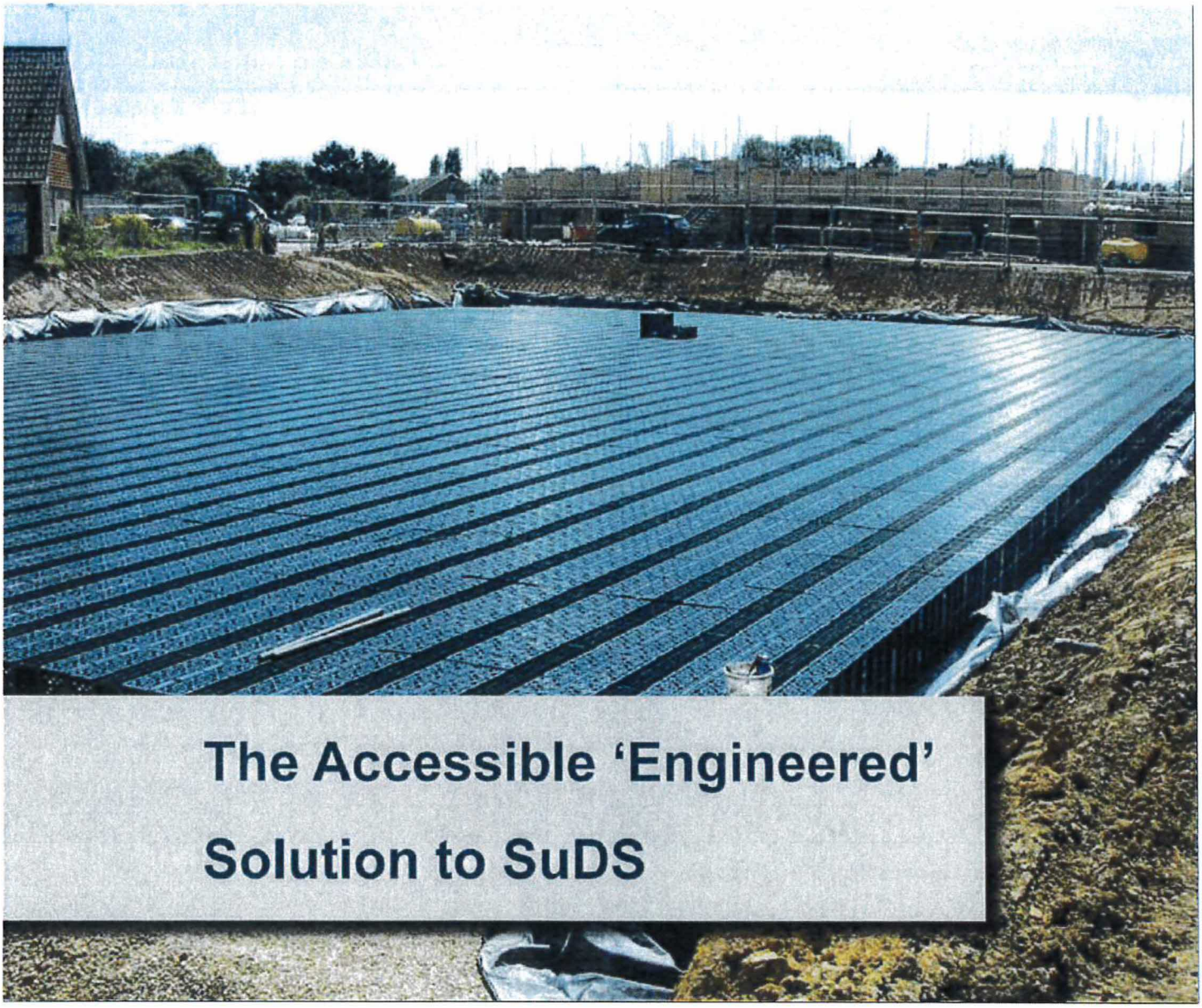
All removed products should be disposed of in line with local council requirements

Hydro International®



Stormbloc® User Manual

Turning Water Around ...®



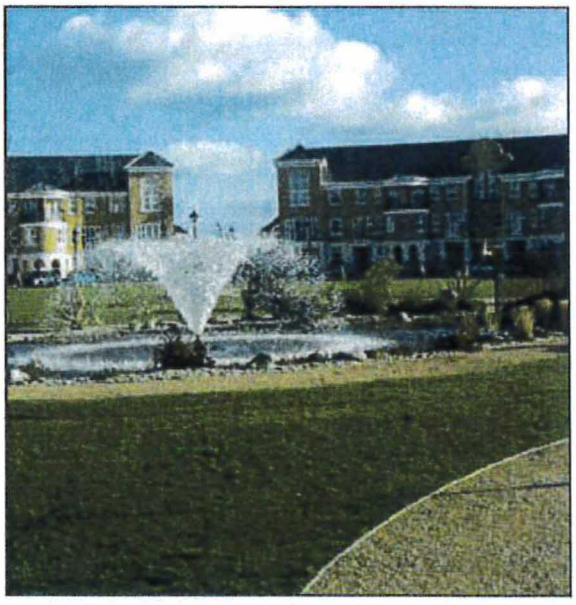
The Accessible 'Engineered' Solution to SuDS

SuDS / Source Control

Regulatory and guidance documents such as PPS 25 and Building Regulations are putting increasing demands on developers and engineers to consider sustainable drainage systems (SuDS) wherever possible and to incorporate source control approaches into surface water drainage systems.

"Sustainable drainage systems (SuDS) are increasingly being used to mitigate the flows and pollution from runoff. The philosophy of SuDS is to replicate as closely as possible the natural drainage from a site before development and to treat runoff to remove pollutants, so reducing the impact on receiving watercourses. This requires a reduction in the rate and volume of runoff from developments, combined with treatment to remove pollutants as close to the source as possible." [1]

1 *CIRIA C609 (2004) - Sustainable Drainage Systems - Hydraulic, structural and water quality advice.*



Maintenance Instructions

The patented inspection / maintenance tunnels within each Stormbloc® module allows almost the entire volume of the construct to be inspected via CCTV camera and flushed through.

A catchpit chamber immediately upstream of the system is recommended as this will reduce the amount of silt entering the installation. For larger installations it may also be advantageous to add further catchpits to the system design or an advanced vortex silt trap such as the Downstream Defender® by Hydro International. The collection sump(s) should not be allowed to overfill as this will lead to silt carry-over into the Stormbloc® modules.

As all schemes are different, the frequency at which the catchpit(s) should be emptied will need to be determined on site. For small soakaways and individual infiltration tanks it will generally only be necessary to ensure that the catchpits / silt traps are free from debris such as leaves or sediment. It is recommended that any system be inspected no less frequently than at monthly intervals for the first 3 months and thereafter at 6 monthly intervals. In addition, it is suggested that the installation is inspected immediately following the first storm event, whenever this should occur post installation.

Individual maintenance schedules should be drawn up using the information obtained from the initial inspections. It should also be noted that more regular inspections may be required should the catchpit(s) fill more frequently and/or if the initial inspections reveal that maintenance / cleaning will be required more regularly than at six month intervals.

Flushing of the system can be achieved using a jetting system with a 150 bar pump pressure (ie. approximately 80 bar at the nozzle) at a discharge flow of 300 l/min. The jet nozzle should be introduced to the system via the Stormbloc® Inspect / manhole and the integral inspection / maintenance tunnel. The silt should be flushed to the Stormbloc® Inspect or catchpit manhole and removed from there.

References

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Sewers for Adoption 5th Edition.

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9 Hydro International.
Stormcell® User Manual.

10 Hydro International.
Stormwater Package Brochure.

11 WTB Geotechnics
SC Membrane: Technical Data Sheet.

12 WTB Geotechnics
AZTEX SPR14 Geotextile Technical Data Sheet.

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BBA APPROVAL INSPECTION TESTING CERTIFICATION
TECHNICAL APPROVALS FOR CONSTRUCTION

Agrément Certificate
10/4795
Product Sheet 1

HYDRO INTERNATIONAL STORMWATER MANAGEMENT SYSTEMS

STORMBLOC STORMWATER MANAGEMENT SYSTEM

PRODUCT SCOPE AND SUMMARY OF CERTIFICATE

This relates to the Stormbloc Stormwater Management System, for use as sub-surface water storage or as a soakaway to manage run-off from impermeable surfaces.

AGRÉMENT CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.

KEY FACTORS ASSESSED

System design — information is provided in the Certificate to assist in the design of a stormwater management system (see section 5).

Strength — the system has adequate strength and stiffness to resist long- and short-term loads when used in accordance with this Certificate (see section 6).

Resistance to chemicals — the system will have adequate resistance to the types and levels of chemicals likely to be found in rainwater and soils normally encountered in civil engineering practice (see section 9).

Durability — the system will have a service life in excess of 50 years when installed in accordance with this Certificate (see section 11).

The BBA has awarded this Agrément Certificate to the company named above for the system described herein. This system has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of First issue: 24 December 2010

Brian Chamberlain
Head of Approvals — Engineering

Greg Cooper
Chief Executive

The BBA is a UKAS accredited certification body — Number 113. The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk

Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.

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Hydro International

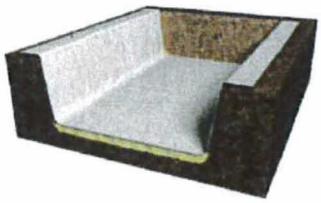
STORMBLOC® STORAGE SYSTEM – INSTALLATION GUIDELINES

Notes: Detailed design advice and installation instructions can be found in the Stormbloc® User Manual. Stormbloc® modules are delivered in stacks of 4 No 0.66m deep modules (20kg per module) or 8 No 0.35m deep modules (12kg per module). The maximum mass of any Stormbloc® Inspect component is 48kg. Modules should not be dropped or thrown and impacts should be avoided. Care should be taken when walking on the modules as these may be slippery especially when wet or frosty.

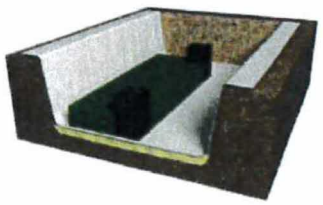
1) Excavate the area for the installation in accordance with the design. For installations greater than 3m from finished cover level to the base of the Stormbloc® tank, advice should be sought from Hydro International.

2) Form a level sand or gravel subgrade layer, min 100mm deep.

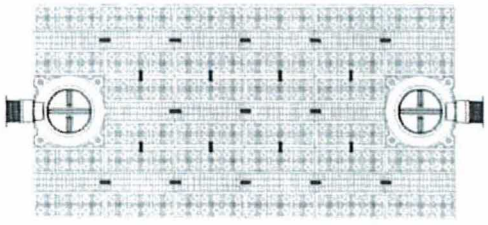
3) Line the excavation with a suitable impermeable geomembrane (min 460 g/m^2). On sites where there are concerns relating to contamination, or groundwater level / protection, a fully encapsulated system, with a heat sealed membrane installed by a specialist lining contractor will often be required. Where multiple sheets are required, these should be lapped and sealed in accordance with the manufacturer's recommendations.



4) Inspect the modules for damage prior to installation. Lay the Stormbloc® modules and Stormbloc® Inspect Chambers on the geomembrane in accordance with the design. The integral inspection tunnels within the modules should generally create a continuous line along the length of the tank.



5) The modules should be connected using the supplied connecting pieces in the centre of each edge that neighbours another module. Where a single layer of 0.35m deep modules is used, the supplied connecting pieces should link the top of the structural support pillars of neighbouring modules.



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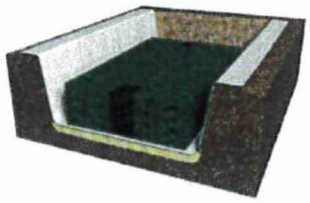
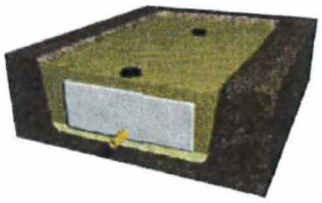
A subsidiary of Hydro International plc

Certificate No. 961366

6) For multi-layer designs, the supplied multi-layer connectors should be used between layers. Modules on the second and subsequent layers can then be located using the multi-layer connectors. Where 0.35m deep modules are used, these should form the top layer and oriented such that the text imprinted on the 0.35m deep module is at the bottom edge.	
7) All tunnel ends should be fitted with the appropriate end plate as supplied. End plates can be provided blank, with holes pre-cut to ease pipe connections, or with an adapter spigot in accordance with the design. Pipe connections into the Stormbloc® Inspect modules may require a band-seal to attach onto the spigot. Please contact Hydro International for site specific details.	
8) The sides and top of the Stormbloc® system should be completely wrapped within the geomembrane. Holes should be cut into the geomembrane to accommodate pipe connections and the extension shaft on the Stormbloc® Inspect chambers. Where multiple sheets are required, these should overlap by min 300mm. All joins, laps and pipe connections must be appropriately sealed.	
9) The sides of the excavation should be filled with a suitable granular material such as Type 1 or Type 2 sub-base or Class 6P selected granular material as defined in the Department for Transport Specification for Highway Works (SHW). This material should be compacted in 150mm layers using a laminar working device. Care should be taken to ensure that the geomembrane is not punctured or torn during installation or backfilling.	
10) Backfill over the top of the modules should also be carried out using Type 1 or Type 2 sub-base in accordance with the Department for Transport Specification for Highway Works (SHW). The initial 300mm of cover should be compacted using a laminar working device. Thereafter other types of compaction plant may be used provided the mass per metre width ≤ 2300kg.	
11) Once 500mm of well compacted cover has been achieved, heavier plant may run across the system up to a maximum mass per metre width of 5000kg. The wheel load from tipper trucks and excavators should not exceed 50 kN fully loaded. Vehicles should only traverse above the Stormbloc® in straight passes. If a change in direction is required, vehicles should drive off the system, turn and drive back on in the direction required.	

GEOLIGHT maintenance

Once received stormwater reaches the storage reservoir through one or more distribution pipes laid out on the side faces of the Geolight blocks.

These distribution pipes are covered in a trench filled with draining material requiring little compaction, like washed rolled pebbles, free from fines, and 15/25 grading.

A 10 mm mesh geogrid or GEOtextile, laid between the distribution pipe and Geolight, prevents the horizontal Geolight blocks being clogged by the draining materials.

The permeability of the supply and distribution pipe located on the periphery of the reservoir is designed to prevent any clogging of the system upstream of the stormwater drain.
This sizing is checked for each supply. It is obtained thanks to design programmes by SDS limited following testing of a size 1 reservoir in which all hydraulic configurations were studied.

These tests also made it possible to check the very good vertical and horizontal permeabilities of Geolight blocks and this general layout is usually accepted.

The choice of one of these layouts or a combination of them is according to:
- the place reserved for the reservoir
- available slopes
- hydraulic parameters (discharge)
- position of stormwater input and output systems.

The ends of feeder drains (distribution pipes) are connected to inspection chambers(manholes), acting as settling tanks and making inspection and maintenance of the whole distribution pipe possible.

For small discharges, stormwater does not penetrate Geolight blocks, but circulates either in an appropriate bypass, or in the distribution pipe drain. This is for draining the first water which will be handled downstream if required.

When the reservoir is drained, water is drained through a distribution pipe possibly the same as the one located at the input which operates in the opposite direction. Drainage discharge is controlled by the downstream system piping.

A ventilation system consisting of a drainage geocomposite is fresh air vented in the inspection pits. It is laid out in the upper part of the distribution pipes and the general space occupied by the reservoir.

We generally recommend that the stormwater tank inspection chambers are checked periodically in conjunction with general maintenance of the underground pipe network.

PREMIER TECH AQUA

CONDER® TANKS COVERED BY THIS GUIDE:

- All CNS & Forecourt Separators
- Above and Below Ground

*Environment Agency**

"Use and Design of Oil Separators in Surface Water Drainage Systems: PPG3"

CNS & Forecourt Separators Commissioning & Maintenance Guide Rev 4

CNS & Forecourt Separators Commissioning and Maintenance Guide

INTRODUCTION

The primary function of oil/water separators is to separate oil, petrol, diesel etc., from waste water and retain the separated liquids. These separated liquids must be removed regularly, using a licensed effluent disposal contractor (your contracted service provider), to ensure that the separator operates as efficiently as possible.

The natural oil/water separating process from gravity fed waste water depends on the storage, or 'dwell', time within the separator chamber. Guidelines have been established by the *Environment Agency** for minimum 'dwell' times, and hence, minimum working volumes for separators. These have been applied in tests carried out by Premier Tech Aqua Ltd which are based on the maximum flowrate into the separator (l/sec). As the working volume reduces by the accumulation of the separated oil, petrol, diesel etc., so the separating efficiency reduces.

Another major influencing factor on the efficiency of separator systems is sediment. Oil/water separators are usually designed as liquid/liquid separators unless the specification has determined a requirement to store a volume of sediment. This can be accommodated within a combined liquid/sediment separator where the storage volume is increased accordingly. However, if the design of the drainage system can allow the sediment to be separated and stored upstream of the oil/water separator, in catch-pits or sediment separators, the system would function more efficiently. Settled sediment must be removed regularly to ensure optimum effiency (ref. *Environment Agency*).

REGULAR MAINTENANCE OF SEPARATOR EQUIPMENT WILL ENSURE IT OPERATES AS INTENDED WITH MINIMUM RISK OF POLLUTION TO THE ENVIRONMENT.

MAINTENANCE INSPECTIONS

Separators are used in widely varying circumstances where some will require very frequent maintenance and others will have substantially longer intervals before any maintenance (emptying) is required. However, for every separator regular maintenance inspections should be carried out to determine whether or not there is a need to remove the accumulated oil, petrol, Diesel, etc., or sediment. The owner of the Conder® separator is responsible for its operation and ensuring that the effluent quality does not breach any Discharge Consent Standards. It is advisable to set up a 'Service Agreement' with an effluent disposal contractor who can provide 'automatic' and regular maintenance and advise you if any problems with the system occur. The owner is reminded that the existence of a 'Service Agreement' does not necessarily transfer responsibility for general maintenance which must be conducted in accordance with this guide.

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The *Environment Agency** has determined that separators shall be inspected at least every six months to establish whether or not emptying is necessary, and a log shall be maintained. Additional equipment for separators provided by Premier Tech Aqua such as an Alarm System which will give warning of the accumulation of oil, petrol, diesel, etc., but should not be used to replace regular inspections.

To keep your Conder® Separator in top condition, we recommend regular servicing by Premier Tech Aqua's service partners

MAINTENANCE PROCEDURES

1.0 Health and Safety

Section 6(a) of the United Kingdom Health and Safety at Work Act 1974 requires manufacturers to advise their customers on the safety and handling precautions to be observed when installing, operating, maintaining and servicing their products.

The maintenance procedures described here should be read and fully understood by the operator (competant person) before commencing work. Appropriate personal protective equipment should be used (gloves, goggles, waterproof clothing etc.,) particularly when handling filters which have been in contact with oil and oily sediment.

Before any work commences always identify the separator and its associated manhole covers or access covers and cone off or erect suitable barriers around the entire work area. Ensure that access and circulation areas are clearly designated and ensure that there is an adequate safety buffer between vehicles and any above ground tank and its associated pipework.

A MEWP or suitable scaffolding will be required to gain access the manway of above ground tanks; maintain adequate seperation between MEWP and the tank shell. Scaffolding should not be permitted to come in contact with the tank shell and must not be supported off of the tank shell.

DO NOT ENTER THE TANK

2.0 Commissioning the separator following installation

2.1 Sediment and other construction debris can accumulate in the separator during its installation and whilst associated works are in progess. If this has ocurred, isolate the separator from the drainage system remove the sediment as follows.

2.2 Slowly lift out the combined coalescing filter and automatic closure device asembly. This should be lifted at a rate of 20mm per second (1.2m per minute), until clear of the water, ensuring that most of the residual water is drained from the coalescing filter. This will reduce the combined overall weight of the assembly.

NOTE: This assembly could weigh up to 55kgs and should be handled by two persons unless a mechanical hoist (recommended) is being used.

2.3 Remove this assembly to a place of safe keeping.

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2.4 Fill the separator with clean water up to the outlet invert level.

2.5 Whilst ensuring that the closure is captive inside the housing tube, and the retaining cap is in place at the top of the tube, slowly lower the filter/closure assembly into the separator until it is firmly located inside the coned seating at the bottom of the tank.

NOTE: Do not lower the filter/closure assembly into the separator *before* it has been filled with water. If you do, the closure will be held in the ***closed position*** and the separator will not function.

3.0 Maintenance

3.1 If, following maintenance inspections, the separator is found to be storing the maximum volume of oil, petrol, diesel etc,. or the maximum volume of sediment, inform your licensed effluent disposal contractor who will arrange emptying. Before making arrangements, check that you are registered with the Environment Agency, as required under Hazardous Waste Regulations, where hazardous waste producers must be registeder before any waste can be removed.

The following are guidelines only for determining the maximum storage volumes of oil and sediment.

a) For CNS separators multiply the maximum flowrate for which the separator has been designed (l/sec) by 10. This will be the maximum storage volume of hydrocarbons in litres e.g. a CNS15 separator is designed for a 15 l/sec flowrate, therefore, can store 150 litres.

For forecourt separators the maximum storage volume of hydrocarbons is 7,600 litres.

b) Where no specific sediment volumes have been determined for the separator, or where no sediment has been expected to accumulate in the system, the maximum stored depth of sediment should not exceed 20% of the depth of the separator barrel e.g. a 1.8m diameter separator should not store more than 360mm depth of sediment.

3.2 Apply the Health and Safety requirements detailed in Section1 before commencing any work.

3.3 Isolate the separator from the drainage system either by closing pre-installed valves in the upstream and downstream manholes or by securely fitting proprietry pipeline stoppers.

3.4 Slowly lift out the combined coalescing filter and automatic closure device assembly. This should be lifted at a rate of 20mm per second (1.2m per minute), until clear of the water, ensuring that most of the residual water is drained from the coalescing filter. This will also reduce the combined overall weight of the assembly.

NOTE: This assembly could weigh up to 55kgs and should be handled by two persons unless a mechanical hoist (recommended) is being used.

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3.5 Remove this assembly to a place of safe keeping.

3.6 Using a licensed effluent disposal contractor (your contracted service provider) carry out the following:

Remove the oil, petrol, diesel etc., from the surface of the liquid, leaving as much of the cleaner water as possible in the separator. Remove the sediment from the bottom of the separator taking great care in and around the filter outlet housing on the base to ensure that it does not become damaged, again leaving as much of the cleaner water as possible in the separator.

3.7 Move the filter/closure assembly to a convenient position *upstream* of the separator so that any polluted water washed from the filter will be directed back to the separator.

Remove the filter from the housing tube and wash the filter using a low pressure hose. If the filter has become 'blinded' with sediment or it is too dirty to clean or has become damaged, replace it by contacting Premier Tech Aqua Tel: 0870 264 0004. Re-fit the filter to the housing tube.

3.8 Fill the separator with clean water up to the outlet invert level.

3.9 Whilst ensuring that the closure is captive inside the housing tube, and the retaining cap is in place at the top of the tube, slowly lower the filter/closure assembly into the separator until it is firmly located inside the coned seating at the bottom of the tank.

NOTE: Do not lower the filter/closure assembly into the separator *before* it has been filled with clean water. If you do, the closure will be held in the ***closed position*** and the separator will not function.

3.10 Check that the Alarm probe has not been damaged and that the alarm system is working.

3.11 Replace the manhole covers or access covers ensuring the covers are locked down where necessary and remove the cones and/or barriers from the worksite.

REMEMBER - if the alarm system activates due to the accumulation of oil, petrol, diesel etc., do not delay in contacting your licensed effluent disposal contractor.

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APPENDIX H

MAINTENANCE LOGS

MARKS HEELEY

Inspection Log – Year…….. sheet 1 of 2

Inspection Date	A - Surface Water Catchpit Manholes	B - Foul Water Manholes	E – Surface Water Treatment	G – Hydro Attenuation	Comments
January					
February					
March					
April					
May					
June					

How to complete this Log:
1.0 Write date in LH column.
2.0 Tick which items have been inspected for that date.
3.0 Add to notes and maintenance completed e.g. Catch pits or Channels emptied.

MARKS HEELEY

Inspection Log – Year…….. sheet 2 of 2

Inspection Date	A - Surface Water Catchpit Manholes	B - Foul Water Manholes	E – Surface Water Treatment	G – Hydro Attenuation	Comments
July					
August					
September					
October					
November					
December					

How to complete this Log:
1.0 Write date in LH column.
2.0 Tick which items have been inspected for that date.
3.0 Add to notes and maintenance completed e.g. Catch pits or Channels emptied.