

Drainage Statement

Angels Nursery, Yapton Road, Barnham

Client

Redrow Homes

7033/2.3F

Second Issue: 6 March 2018

Consulting Engineers

Gyoury Self
16/17 Boundary Road
Brighton & Hove
East Sussex, BN3 4EF

1.0 INTRODUCTION

This report has been prepared in relation to the proposed drainage scheme submitted for the development of the site at Angels Nursery, Yapton Road, Barnham with planning ref BN/93/19/PL.

The aim of this report is to explain the detailed site drainage design, including the SuDS components, that are shown on the proposed site drainage layout drawings submitted with this document. The Management and Maintenance Plan is covered separately in another document by Gyoury Self.

This report has been specifically designed to provide information to enable discharge of conditions 3,6 and 8 of the consent:

- (3) *Development shall not commence until full details of the proposed surface water drainage scheme have been submitted to and approved in writing by the Local Planning Authority.*

The design should follow the hierarchy of preference for different types of surface water drainage disposal systems as set out in Approved Document H of the Building Regulations, the recommendations of the SuDS Manuel produced by CIRIA.

Winter groundwater monitoring to establish highest annual ground water levels and Percolation testing to BRE 365, or similar approved, will be required to support the design of any Infiltration drainage.

- (5) *The development shall not proceed until formal consent has been approved in writing from the Lead Local Flood Authority (WSCC) or its agent (ADC) for the discharge of any flows to watercourses, or the culverting, diversion, infilling or obstruction of any watercourse on the site.*

Any discharge to a watercourse must be at a rate no greater than the pre-development run off values.

- (6) *Development shall not commence until full details of the maintenance and management of the SuDS system is set out in a site-specific maintenance manual and submitted to, and approved in writing, by the Local Planning Authority. The manual is to include (a) details of financial management of the site including arrangements made in the event that the management company (or any subsequent management company) is no longer able to fulfil its duties; and (b) arrangements for the replacement of major components at the end of the manufacturers recommended design life.*

- (8) *The development layout shall not be agreed until such time that arrangements for the future access and maintenance of any watercourse or culvert (piped watercourse) crossing or abutting the site has been submitted and approved in writing by the Local Planning Authority. No construction is permitted, which will restrict current and future land owners from undertaking their riparian maintenance responsibilities of any watercourse on or adjacent to the site.*

2.0 LIMITATIONS

This report has been prepared for Redrow Homes in relation to the proposed development at Angels Nursery, Yapton Road, Barnham. No responsibility is accepted to any third party for all or part of this study in connection with this or any other development.

3.0 EXISTING DRAINAGE

The site, whose area is approximately 3.51ha and is relatively undeveloped and unoccupied. Existing levels are relatively flat and vary from 9.2m A.O.D to 8.4m A.O.D.

Southern Water records, in Appendix A, shows an existing 225mm diameter running from east to west through the site. This sewer has recently been upgraded to a 300mm diameter sewer and the alignment has changes slightly. This has been surveyed and is shown on the proposed drainage layouts contained in this report.

There is also an existing Southern Water foul pumping main running through the southern part of the site.

There are a number of on site ditches. The central ditches appear to drain just the site itself. A southern ditch is the main receiving ditch and conveys flows towards the east and then the main watercourse turns south.

There is also a ditch on the east and west boundaries. The west drains land to the west and the eastern ditch drains a small area of land to the east. All connect to the southern ditch.

4.0 PROPOSED DRAINAGE & OVERLAND FLOW ROUTING

Condition 3,5 and 6:

The following drawings contained in Appendix B show the proposed drainage and details:

19812-GS-Z1-XX-DR-C-1061	-	Site Drainage Sheet 1 of 2
19812-GS-Z1-XX-DR-C-1062	-	Site Drainage Sheet 2 of 2
19812-GS-Z1-XX-DR-C-5101	-	Private Drainage details_sheet 1
19812-GS-Z1-XX-DR-C-5102	-	Private Drainage details_sheet 2
19812-GS-Z1-XX-DR-C-5104	-	Main Drainage details
19812-GS-Z1-XX-DR-C-5103	-	Private External Works details

The flood risk assessment prepared by WSP for the planning application identified a total proposed flow rate of 7.3 litres/second from the site into the existing southern ditch, which has been confirmed as acceptable for the detailed design by Arun DC.

Infiltration has been ruled out for the site as recommended by TEC consultation who carried out testing on site in March 2018. See summary below:

10.7 Drainage

- 10.7.1 Soakage testing has not been undertaken at the site as part of these works. However, monitoring of groundwater levels has been undertaken, with shallow resting levels recorded at depths between 0.67m and 1.08mbgl during monitoring visits for this phase of works. Previous assessments at the site also indicated this shallow groundwater body may be seasonally variable, with groundwater recorded to be locally at the surface during winter months (WSP, 2014) and at depths >2.0mbgl during summer months (Geo-Environmental, 2015).
- 10.7.2 On the basis of the shallow groundwater levels recorded at the site, it is considered unlikely that the use of soakaways will be feasible.

The total site impermeable area has been calculated as 1.238 Ha.

Peak volumes will be stored in a proposed pond and within areas of permeable paving, with flow restrictions to some of these via a control chamber with orifice plate.

The main surface water drainage in the adopted roadways are offered for adoption under a Section 104 agreement, with storage within this system provided for the 1 in 30 year event, but with links to the wider private network to store the 1 in 100 year + 40% storm.

The proposed treatment to existing ditches are as follows:

- Eastern boundary ditch – this will remain in its current location and no works to be carried out. The ditch can be maintained from the adjacent turning head and POS areas. Maintenance will be carried out on this ditch by the management company for the development.

- Western Ditch - this will remain in its current location and no works to be carried out. The ditch can be maintained from the adjacent site where it is outside the site boundary. Where it crosses into the site it can be maintained from the adjacent turning head and parking areas. Maintenance will be carried out on this ditch by the management company for the development.
- Central ditches – these will be filled as agreed at FRA stage.
- Southern ditch – this will remain but there will be a small section of culverting required for the turning head in the south west corner. This has been shown with a 600mm pipe. Maintenance will be carried out on this ditch by the management company for the development.

Microdrainage calculations are contained in Appendix C which show no flooding for the 1 in 1, 1 in 30 and up to the 1 in 100 year storm +40%.

Peak storage volumes requirements are as follows:

Storm Event	Peak Storage Volume requirement m.cu
1 in 1year	256.5
1 in 30 year	722
1 in 100 year + 10%	1559

It has been demonstrated above that conditions 3,5 and 6 has been satisfied.

Condition 8:

A drainage maintenance report has been prepared as a separate document which should satisfy this condition.

Prepared by:

Martin Roberts I.Eng ACIWEM MCIHT

On behalf of Gyoury Self

APPENDIX A – SOUTHERN WATER SEWER RECORDS



GTA Civils Ltd
Gloucester House 66A
Church Walk
Burgess Hill
West Sussex
RH15 9AS

Your ref 7033/MR/cf
Our ref 277840
Date 24 January 2018

Attention: Chloe Fagan

Dear Customer

Re: Provision of public sewer record extract

Location: Angels Nursery, Yapton Road, Barnham, PO22 0AY

Thank you for your order regarding the provision of extracts of our sewer and/or water main records. Please find enclosed the extracts from Southern Water's records for the above location.

We confirm payment of your fee in the sum of £49.92 and enclose a VAT receipt for your records.

Customers should be aware that there are areas within our region in which there are neither sewers nor water mains. Similarly, whilst the enclosed extract may indicate the approximate location of our apparatus in the area of interest, it should not be relied upon as showing that further infrastructure does not exist and may subsequently be found following site investigation. Actual positions of the disclosed (and any undisclosed) infrastructure should therefore be determined on site, because Southern Water does not accept any responsibility for inaccuracy or omission regarding the enclosed plan. Accordingly it should not be considered to be a definitive document.

Should you require any further assistance regarding this matter, please contact the LandSearch team.

Yours faithfully

LandSearch

SEWER RECORDS PAGE 1 OF 2

104426



103848

O.S. REF.

SU9604SW

Title: 277840_Angels Nursery, Yapton

Drawn by: kumaria

Scale: 1:2500

Date: 24/01/2018

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy.

The actual positions should be determined on site.

WARNING: BAD pipes are constructed of Bonded Asbestos Cement

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement

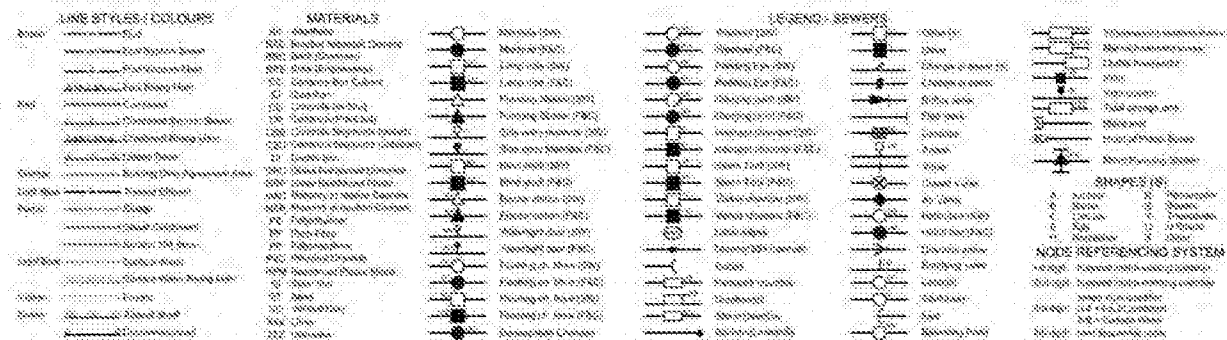
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Licence No. WU 298530.



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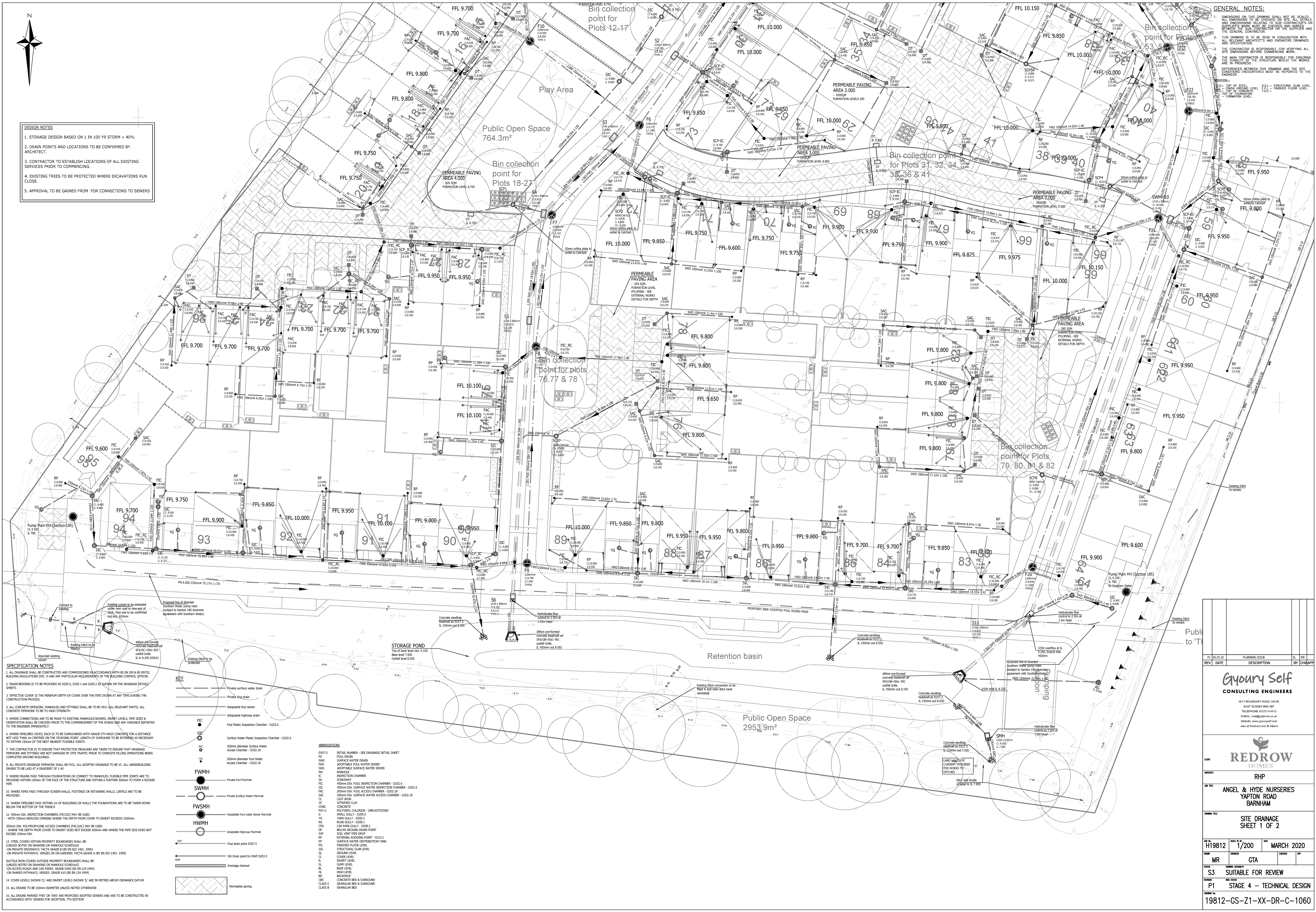
SEWER RECORDS PAGE 2 OF 2

Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape
0201X	6.9	5.29	225	VC	CIRC	8402X	5.88	3.78	175	UNK	CIRC												
0202X	7.05	5.83	175	VC	CIRC	8901X	5.8	4.14	175	VC	CIRC												
0203X	6.86	5.44	175	VC	CIRC	9001X	6.5	4.77	175	VC	CIRC												
0204X			UNK	UNK	CIRC	9002X	6.23	4.49	175	VC	CIRC												
0205X			OTHER	BRC	CIRC	9101X	6.31	5.04	175	VC	CIRC												
0301X	3.91	3.18	300	VC	CIRC	9102X			UNK	UNK	CIRC												
0302Y	3.47	2.15	450	DI	CIRC	9202X	3.15	1.7	350	PF	CIRC												
0305X	5.08		250	DI	CIRC	9203X	2.56	0.86	350	PF	CIRC												
0306X	5.69	4.29	225	VC	CIRC	9204Y	2.58	1.21	300	VC	CIRC												
0307X	5.2	1.92	375	CP	CIRC	9204X	2.58	0.97	375	CP	CIRC	*											
0308X	3.25	2.57	450	DI	CIRC	9206X	2.69	1.19	300	VC	CIRC	*											
0309X	3.25	2.06	600	CP	CIRC	9207X	2.88	2.32	150	VC	CIRC												
0310X	4.2	1.891	525	CP	CIRC	9209X			OTHER	BRC	CIRC												
0311Y	4.61	1.841	525	CP	CIRC	9209X			OTHER	BRC	CIRC												
0311X	4.61	1.841	375	CP	CIRC	920PX	3.5		450	CP	CIRC												
0312X			OTHER	BRC	CIRC	9210X			OTHER	BRC	CIRC												
0403X	3.58	2.64	150	PF	CIRC	9211X	4.53	1.816	525	CP	CIRC												
0404X	3.79	2.57	150	PF	CIRC	9212Z	3.58	1.62	450	CP	CIRC	*											
0405X	3.8	2.52	150	VC	CIRC	9212Y	3.58	3.58	375	CP	CIRC	*											
1201X	8.58	6.02	225	VC	CIRC	9212X	3.58		350	PF	CIRC	*											
1202X	6.45		225	VC	CIRC	9213X	3.66	1.07	375	CP	CIRC												
1203X	7.54	5.81	225	VC	CIRC	9214X	3		350	PF	CIRC												
1204X			UNK	UNK	UNK	9215X	3.5	1.879	450	CP	CIRC												
1205X	2.35		UNK	VC	CIRC	9216X	2.62	1.77	450	CP	CIRC												
1206X			UNK	VC	CIRC	9301X	4.1	2.85	250	DI	CIRC												
1207X			UNK	VC	CIRC	9302X	3.45	2.82	300	DI	CIRC												
1208X			UNK	VC	CIRC	9304X			UNK	UNK	UNK												
1209X			225	VC	CIRC	9305X			UNK	UNK	CIRC												
1210X			UNK	VC	CIRC	930DX			UNK	UNK	CIRC												
1301X		6.06	150	VC	CIRC																		
1302X			UNK	UNK	CIRC																		
1303X	1.4		UNK	VC	CIRC																		
130DX			UNK	VC	CIRC																		
1310X			UNK	VC	CIRC																		
1403X	7.76		150	VC	CIRC																		
2101X	8.82	6.22	225	VC	CIRC																		
2102X	6.83	6.12	225	VC	CIRC																		
210DX			225	VC	CIRC																		
220DX			UNK	UNK	CIRC																		
2301X	9.05	9.04	150	VC	CIRC																		
2302X	0.8		UNK	PVC	CIRC																		
2303X			UNK	VC	CIRC																		
2304X			UNK	VC	CIRC																		
230DX			UNK	PVC	CIRC																		
231DX			UNK	PVC	CIRC																		
232DX			UNK	PVC	CIRC																		
3001X	8.43	6.56	225	VC	CIRC																		
3101X	8.53	6.39	225	VC	CIRC																		
4001X	8.72	7.19	150	VC	CIRC																		
4002X	8.68	6.91	225	VC	CIRC																		
4003X	8.79	6.95	225	VC	CIRC																		
5001X	8.58	7.22	225	VC	CIRC																		
5002X	8.64		225	VC	CIRC																		
5901X	8.88	7.26	225	VC	CIRC																		
6901X	9.07	7.89	150	VC	CIRC																		
6902X	9.17	7.65	225	VC	CIRC																		
6903X	9.19		175	VC	CIRC																		
7001X	9.99	8.47	150	VC	CIRC																		
7902X	8.88	7.39	150	VC	CIRC																		
8001X	2.14	0.64	375	CP	CIRC																		
800DX	2.07	0.57	375	CP	CIRC																		
8101X	3.07	1.23	350	PVC	CIRC																		
8102X	2.5	0.84	375	CP	CIRC																		
8201X	2.8	0.98	375	CP	CIRC																		
8401X	6.41	4.11	175	VC	CIRC																		



APPENDIX B – SITE DRAINAGE & EXTERNAL WORKS LAYOUTS & DETAILS

19377-GS-Z1-XX-DR-C-1061	-	Site Drainage Sheet 1 of 2
19377-GS-Z1-XX-DR-C-1062	-	Site Drainage Sheet 2 of 2
19377-GS-Z1-XX-DR-C-5101	-	Private Drainage details_sheet 1
19377-GS-Z1-XX-DR-C-5102	-	Private Drainage details_sheet 2
19377-GS-Z1-XX-DR-C-1080	-	External Works Sheet 1 of 2
19377-GS-Z1-XX-DR-C-1081	-	External Works Sheet 2 of 2
19377-GS-Z1-XX-DR-C-5103	-	Private External Works details

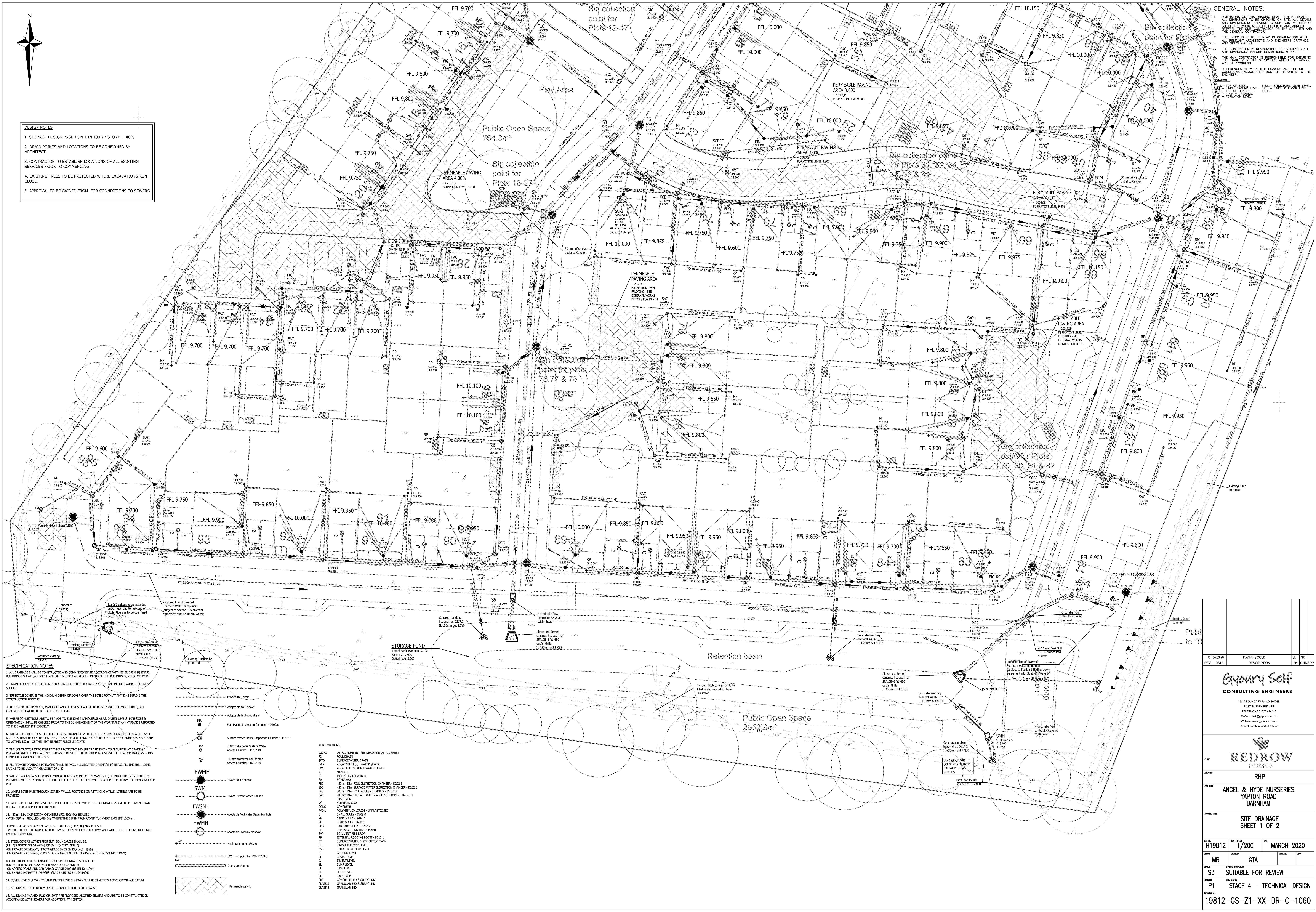


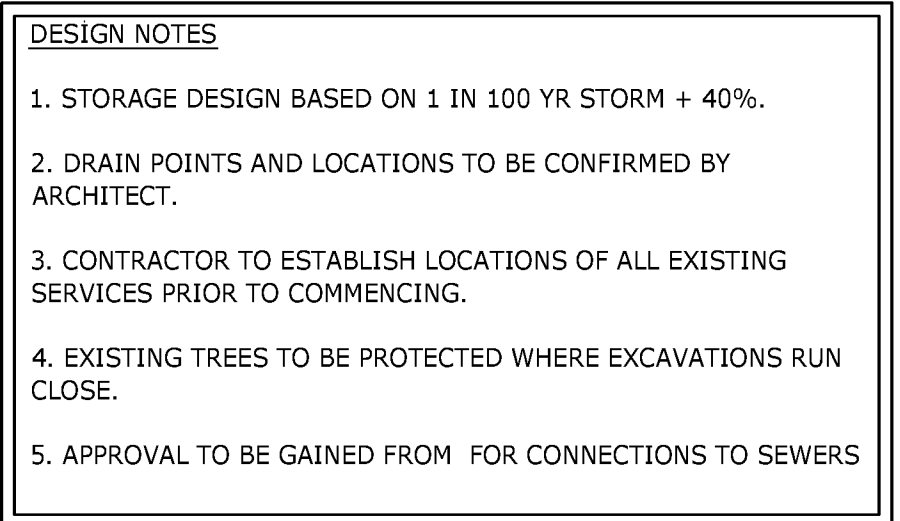
DESIGN NOTES

- STORAGE DESIGN BASED ON 1 IN 100 YR STORM + 40%.
- DRAIN POINTS AND LOCATIONS TO BE CONFIRMED BY ARCHITECT.
- CONTRACTOR TO ESTABLISH LOCATIONS OF ALL EXISTING SERVICES PRIOR TO COMMENCING.
- EXISTING TREES TO BE PROTECTED WHERE EXCAVATIONS RUN CLOSE.
- APPROVAL TO BE GAINED FROM FOR CONNECTIONS TO SEWERS

SPECIFICATION NOTES

- ALL DRAINAGE SHALL BE CONSTRUCTED AND COMMISSIONED IN ACCORDANCE WITH BS EN 205 & BS EN 206, BS EN 207 & BS EN 208, BS EN 209 & BS EN 210, BS EN 211 & BS EN 212, BS EN 213 & BS EN 214, BS EN 215 & BS EN 216, BS EN 217 & BS EN 218, BS EN 219 & BS EN 220, BS EN 221 & BS EN 222, BS EN 223 & BS EN 224, BS EN 225 & BS EN 226, BS EN 227 & BS EN 228, BS EN 229 & BS EN 230, BS EN 231 & BS EN 232, BS EN 233 & BS EN 234, BS EN 235 & BS EN 236, BS EN 237 & BS EN 238, BS EN 239 & BS EN 240, BS EN 241 & BS EN 242, BS EN 243 & BS EN 244, BS EN 245 & BS EN 246, BS EN 247 & BS EN 248, BS EN 249 & BS EN 250, BS EN 251 & BS EN 252, BS EN 253 & BS EN 254, BS EN 255 & BS EN 256, BS EN 257 & BS EN 258, BS EN 259 & BS EN 260, BS EN 261 & BS EN 262, BS EN 263 & BS EN 264, BS EN 265 & BS EN 266, BS EN 267 & BS EN 268, BS EN 269 & BS EN 270, BS EN 271 & BS EN 272, BS EN 273 & BS EN 274, BS EN 275 & BS EN 276, BS EN 277 & BS EN 278, BS EN 279 & BS EN 280, BS EN 281 & BS EN 282, BS EN 283 & BS EN 284, BS EN 285 & BS EN 286, BS EN 287 & BS EN 288, BS EN 289 & BS EN 290, BS EN 291 & BS EN 292, BS EN 293 & BS EN 294, BS EN 295 & BS EN 296, BS EN 297 & BS EN 298, BS EN 299 & BS EN 300, BS EN 301 & BS EN 302, BS EN 303 & BS EN 304, BS EN 305 & BS EN 306, BS EN 307 & BS EN 308, BS EN 309 & BS EN 310, BS EN 311 & BS EN 312, BS EN 313 & BS EN 314, BS EN 315 & BS EN 316, BS EN 317 & BS EN 318, BS EN 319 & BS EN 320, BS EN 321 & BS EN 322, BS EN 323 & BS EN 324, BS EN 325 & BS EN 326, BS EN 327 & BS EN 328, BS EN 329 & BS EN 330, BS EN 331 & BS EN 332, BS EN 333 & BS EN 334, BS EN 335 & BS EN 336, BS EN 337 & BS EN 338, BS EN 339 & BS EN 340, BS EN 341 & BS EN 342, BS EN 343 & BS EN 344, BS EN 345 & BS EN 346, BS EN 347 & BS EN 348, BS EN 349 & BS EN 350, BS EN 351 & BS EN 352, BS EN 353 & BS EN 354, BS EN 355 & BS EN 356, BS EN 357 & BS EN 358, BS EN 359 & BS EN 360, BS EN 361 & BS EN 362, BS EN 363 & BS EN 364, BS EN 365 & BS EN 366, BS EN 367 & BS EN 368, BS EN 369 & BS EN 370, BS EN 371 & BS EN 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459 & BS EN 460, BS EN 461 & BS EN 462, BS EN 463 & BS EN 464, BS EN 465 & BS EN 466, BS EN 467 & BS EN 468, BS EN 469 & BS EN 470, BS EN 471 & BS EN 472, BS EN 473 & BS EN 474, BS EN 475 & BS EN 476, BS EN 477 & BS EN 478, BS EN 479 & BS EN 480, BS EN 481 & BS EN 482, BS EN 483 & BS EN 484, BS EN 485 & BS EN 486, BS EN 487 & BS EN 488, BS EN 489 & BS EN 490, BS EN 491 & BS EN 492, BS EN 493 & BS EN 494, BS EN 495 & BS EN 496, BS EN 497 & BS EN 498, BS EN 499 & BS EN 500, BS EN 501 & BS EN 502, BS EN 503 & BS EN 504, BS EN 505 & BS EN 506, BS EN 507 & BS EN 508, BS EN 509 & BS EN 510, BS EN 511 & BS EN 512, BS EN 513 & BS EN 514, BS EN 515 & BS EN 516, BS EN 517 & BS EN 518, BS EN 519 & BS EN 520, BS EN 521 & BS EN 522, BS EN 523 & BS EN 524, BS EN 525 & BS EN 526, BS EN 527 & BS EN 528, BS EN 529 & BS EN 530, BS EN 531 & BS EN 532, BS EN 533 & BS EN 534, BS EN 535 & BS EN 536, BS EN 537 & BS EN 538, BS EN 539 & BS EN 540, BS EN 541 & BS EN 542, BS EN 543 & BS EN 544, BS EN 545 & BS EN 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[illegible]



1. ALL DRAINAGE SHALL BE CONSTRUCTED AND COMMISSIONED IN ACCORDANCE WITH BS EN 12958 B3, BS 5261, BUILDING REGULATIONS DOC. H AND ANY PARTICULAR REQUIREMENTS OF THE LOCAL AUTHORITY.

2. DRAIN DETAILING IS TO BE PROVIDED AS D200.0, D300.0 AND D200.2 AS SHOWN ON THE DRAINAGE DETAILS SHEETS.

3. EFFECTIVE COVER IS THE MINIMUM DEPTH OF COVER OVER THE PIPE CROWN AT ANY TIME DURING THE CONSTRUCTION PROCESS.

4. ALL CONCRETE PIPESWORK, MANHOLES AND FITTINGS SHALL BE TO BS 5911 (ALL RELEVANT PARTS). ALL CONCRETE PIPESWORK TO BE TO HIGH STRENGTH

5. WHERE CONNECTIONS ARE TO BE MADE TO EXISTING MANHOLES/SWERS, INVERT LEVELS, PIPE SIZES & ORIENTATION SHALL BE CHECKED PRIOR TO THE COMMENCEMENT OF THE WORKS AND ANY NECESSARY ADJUSTMENTS TO THE ENGINEER IMMEDIATELY.

6. WHERE PIPELINES CROSS, EACH IS TO BE SURROUNDED WITH GRADE 5 MASS CONCRETE FOR PROTECTION. THE PROTECTIVE CONCRETE SHALL BE 1500mm MINIMUM LENGTH & SUFFICIENT TO EXTEND AS NECESSARY TO WITHIN 150mm OF THE NEXT HIGHEST SURROUNDING JOINTS.

1. DIMENSIONS ON THIS DRAWING SHALL NOT BE SCALE. ALL DIMENSIONS TO BE CHECKED ON SITE. ALL DETAIL DIMENSIONING RELATING TO CONTRACTOR'S SUPPLY AND INSTALLATION SHALL BE CHECKED AND AGREED UPON BY THE SUB-CONTRACTOR OR THE SUPPLIER AND THE ARCHITECT.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S AND ENGINEERS DRAWINGS AND SPECIFICATION.
3. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL SITE DIMENSIONS BEFORE COMMENCING WORK.
4. THE MAIN CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT THE STRUCTURE, WHILST THE WORKS ARE IN PROGRESS.
5. DIFFERENCES BETWEEN THIS DRAWING AND THE SITE CONDITIONS ENCOUNTERED MUST BE REPORTED TO THE ENGINEER.

NOTATION:-

T.O.S - TOP OF SITE	S.S.L - STRUCTURAL SLAB LEVEL
F.O.S - FINISHED FLOOR LEVEL	F.F.L - FINISHED FLOOR LEVEL
T.O.C - TOP OF CONCRETE	T.O.F -
F.L. - FORMATION LEVEL	

	Private surface water drain
	Private foul drain
	Adoptable foul sewer
	Adoptable highway drain

FIG
● Fouled Fluid Inspection Chamber - D202.6

SIC
○ Surface Water Plastic Inspection Chamber - Q202.6

SWC
○ 300mm diameter Surface Water Access Chamber - D202.18

FWC
○ 300mm diameter Foul Water Access Chamber - D202.18

FWMH
Private Foul Manhole

SWMH
Private Surface Water Manhole

FWSMH
Adaptable Foul Water Sewer Manhole

HWMH
Adaptable Highway Manhole

DDPT 0	DETAIL NUMBER - SEE DRAINAGE DETAIL SHEET	
PO	POD DRAIN	
SWD	SURFACE WATER DRAIN	
FWH	ADAPTABLE FLOW WATER SEWER	
SWP	SURFACE WATER PUMP	
PM	MANHOLE	
CS	CONCRETE	
AS	ASPHALT	
SEC	45MM DIA. POB INSPECTOR CHAMBER - D002.6	
SEC	45MM DIA. SURFACE WATER INSPECTION CHAMBER - D002.6	
SEC	300MM DIA. POB ACCESS CHAMBER - D002.18	
SEC	300MM DIA. SURFACE WATER ACCESS CHAMBER - D002.18	
CR	CRACK TREAT	
CONC	CONCRETE	
CONC	CONCRETE, POLYMER MODIFIED	
PMVC	PRECAST POLYMER CONCRETE - UNARMED/STRENGTHENED	
G	G GRASS	
G	G GRASS	
RG	ROAD GRULLY - D002.1	
RG	CRACK GRULLY - D002.1	
DP	DEVELOPMENT DRAIN	
DP	SOIL WATER PIPE DRAIN	
RP	RECYCLED PLASTIC PIPING	
OT	OVERHEAD FLOOR FINISH	
OT	SURFACE WATER DISTRIBUTION TANK	
SL	STRUCTURAL, LEVEL	
CL	CONCRETE, LEVEL	
CL	CONCRETE, LEVEL	
CL	CONCRETE, LEVEL	
SL	SLURRY LEVEL	
RL	RAIL LEVEL	
HL	HIGH LEVEL	
BD	BACKDROP	
CS	CONCRETE BED SURROUND	
CLASS 5	GRANULAR BED SURROUND	
CLASS 5	GRANULAR BED SURROUND	

[illegible]

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EAST SUSSEX BN3 4EF
TELEPHONE 01273 416413
E-MAIL: mail@gpsurvey.co.uk
Website: www.gpsurvey.co.uk

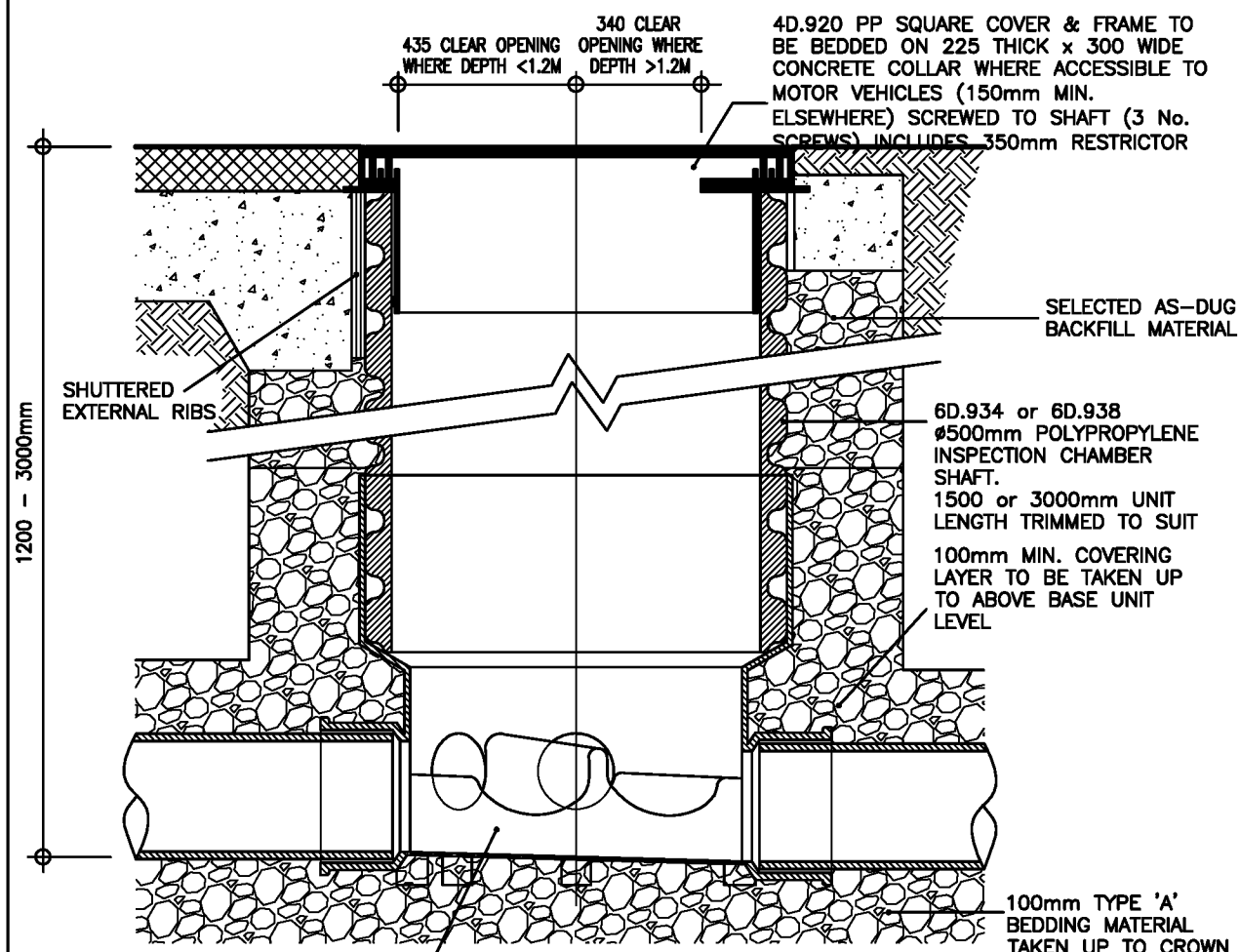
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DRAWING TITLE
SITE DRAINAGE
SHEET 2 OF 2

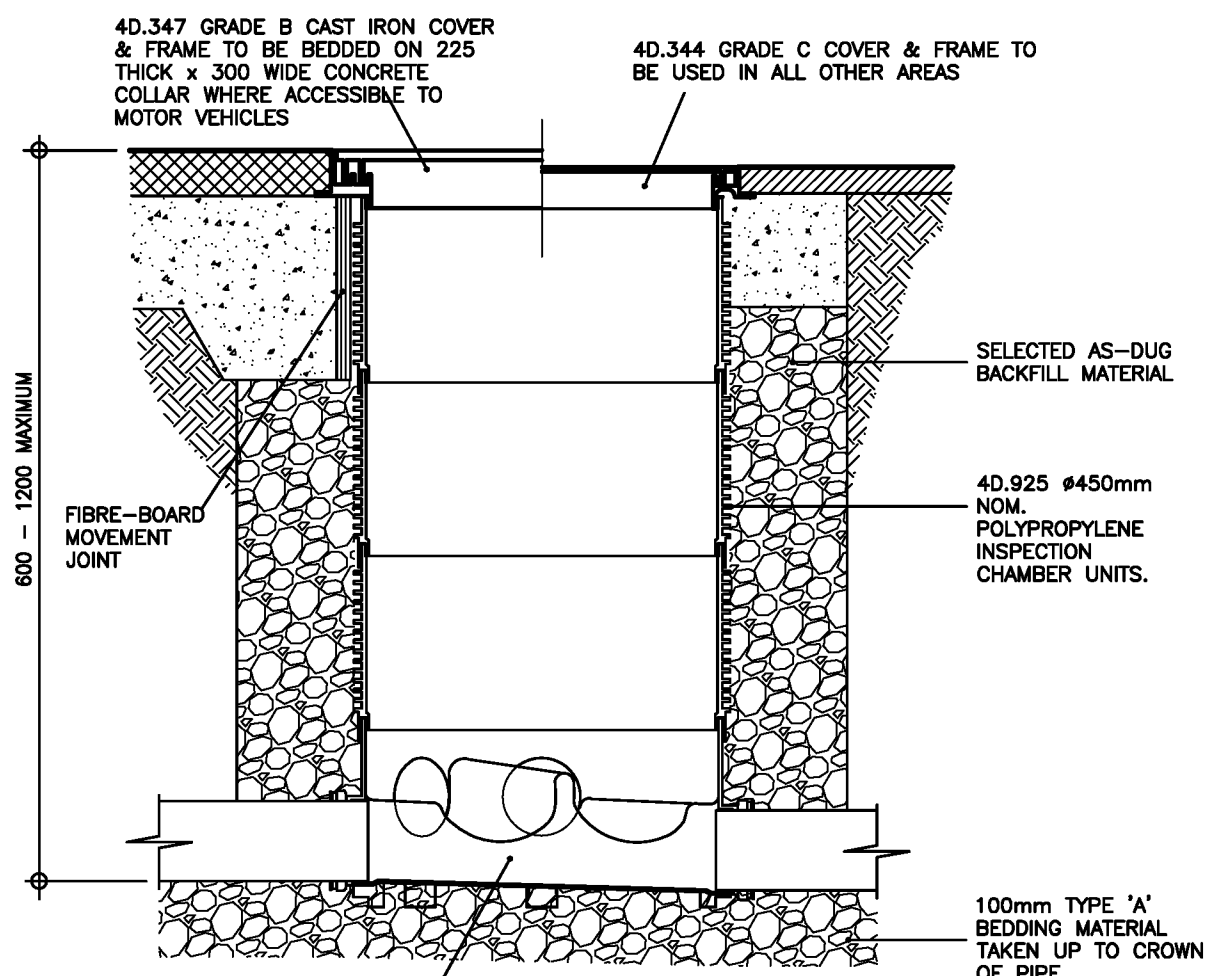
H19812	1/200	MARCH 2020
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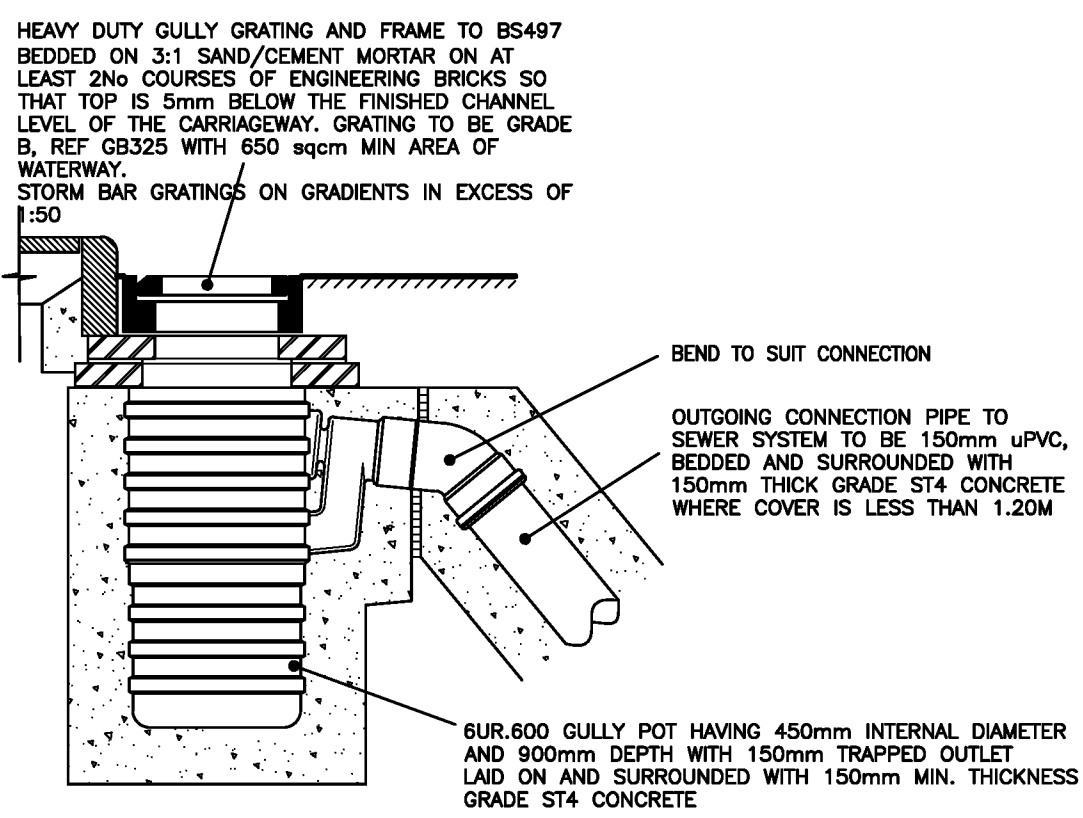
PI	STAGE 4 - TECHNICAL DESIGN
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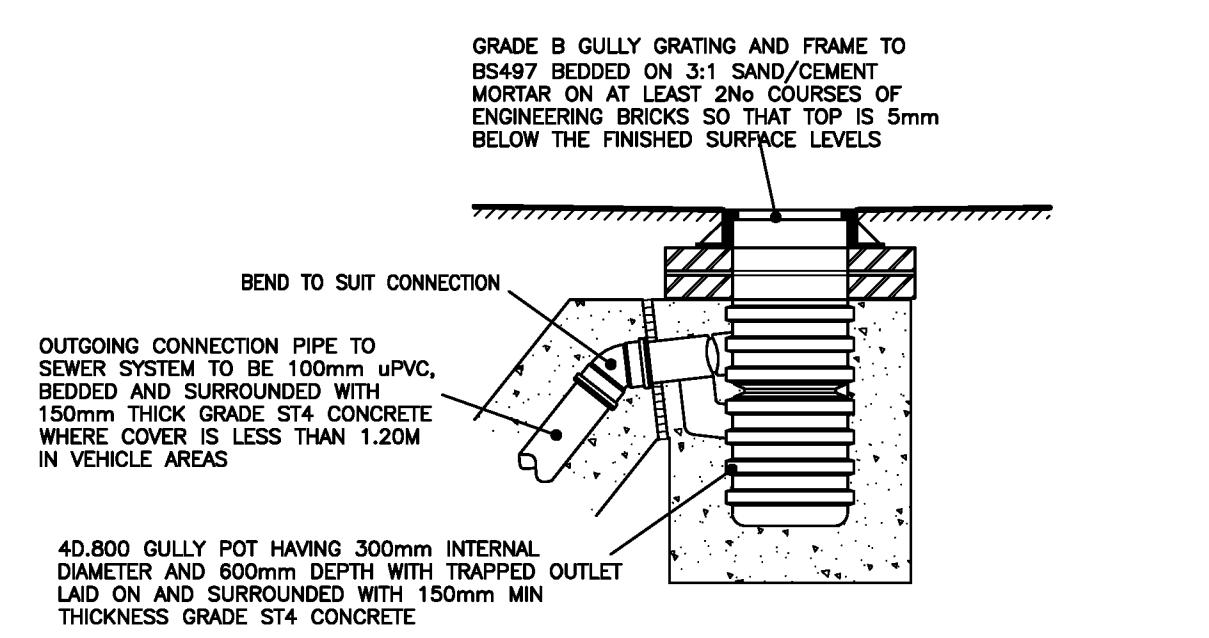
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INSPECTION CHAMBER (1:10 typical)**



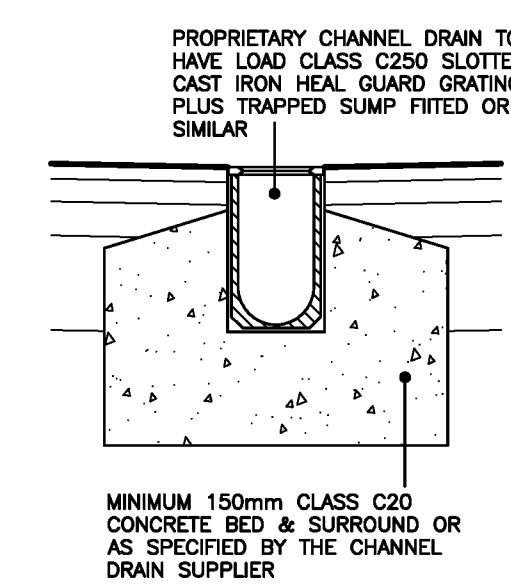
**TYPICAL 'BIN' TYPE INSPECTION
CHAMBER – TYPE 'Y' (1:10 typical)**



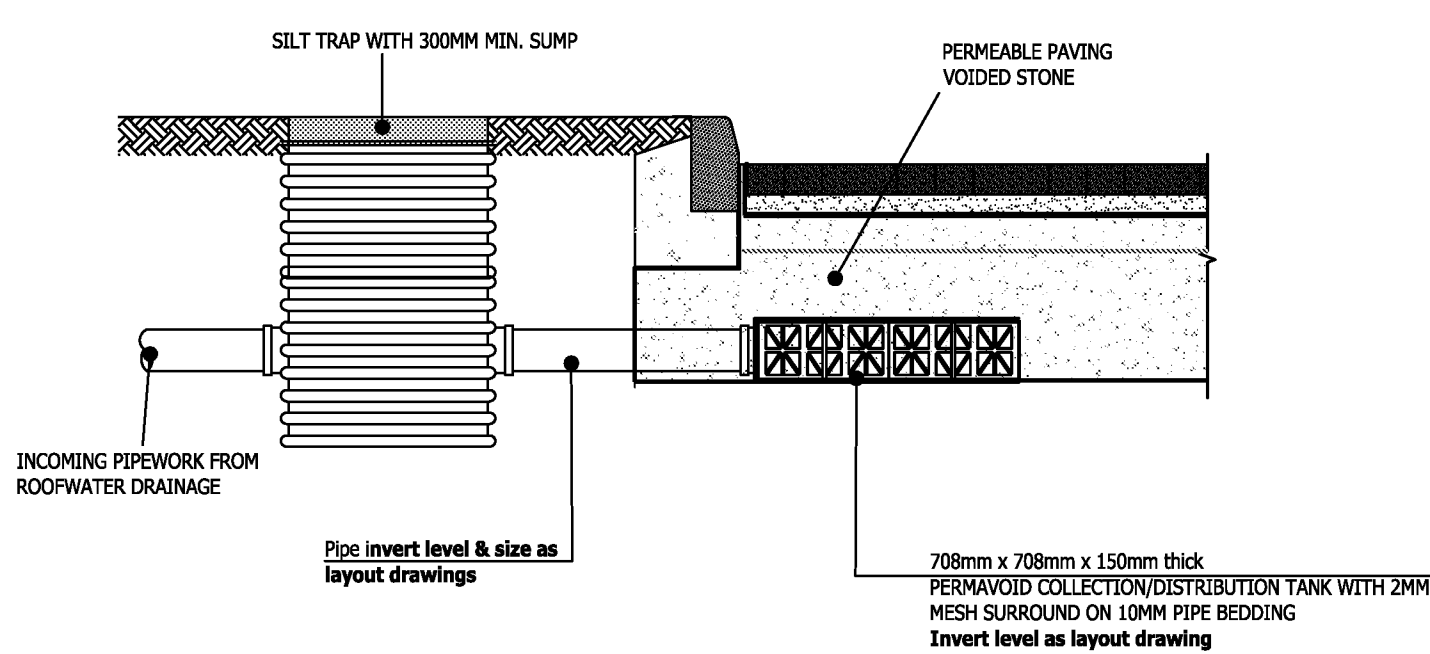
ROAD GULLY DETAIL (1:20 Typical)



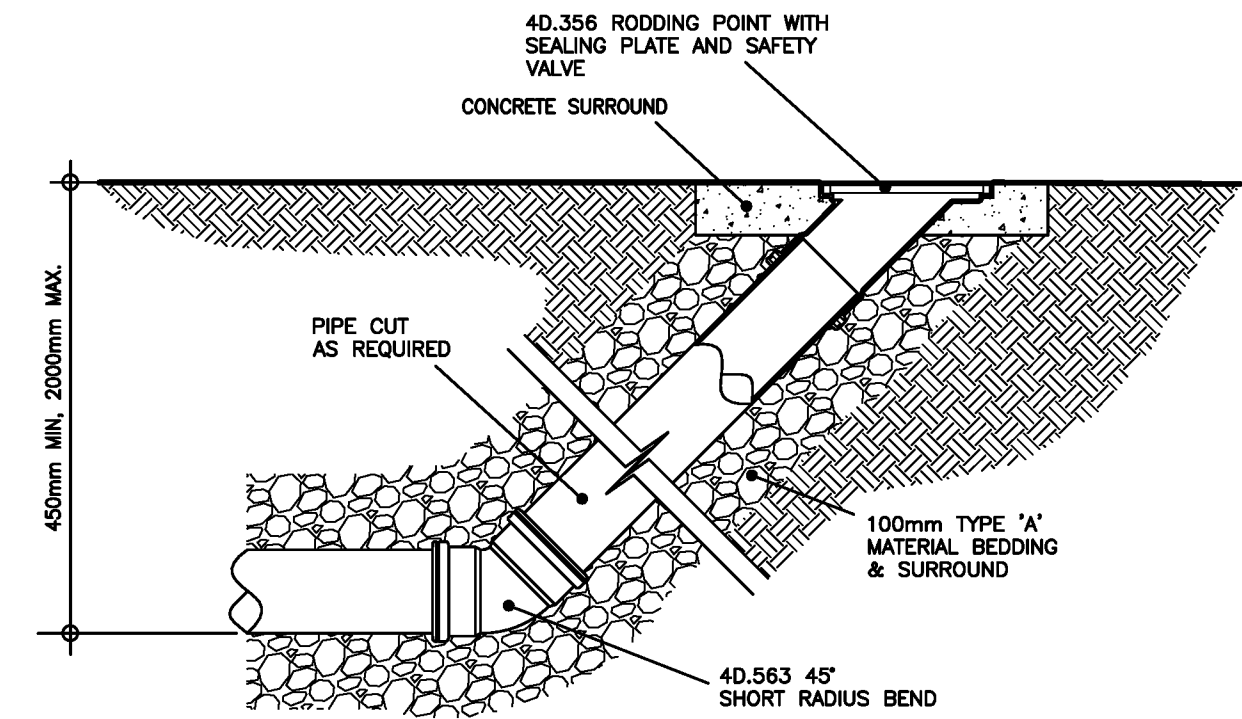
**YARD GULLY DETAIL (TYPE 1)
(1:20 Typical)**



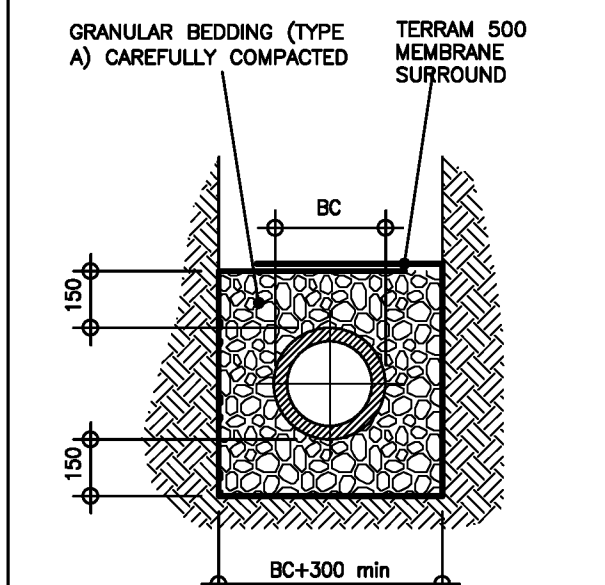
**CHANNEL DRAIN DETAIL
(1:10 typical)**



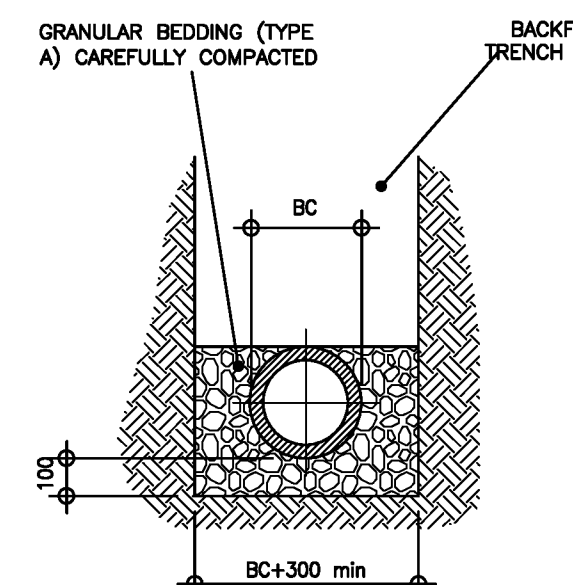
**TYPICAL POROUS INLET DETAIL
(MARKED DT ON LAYOUT)**



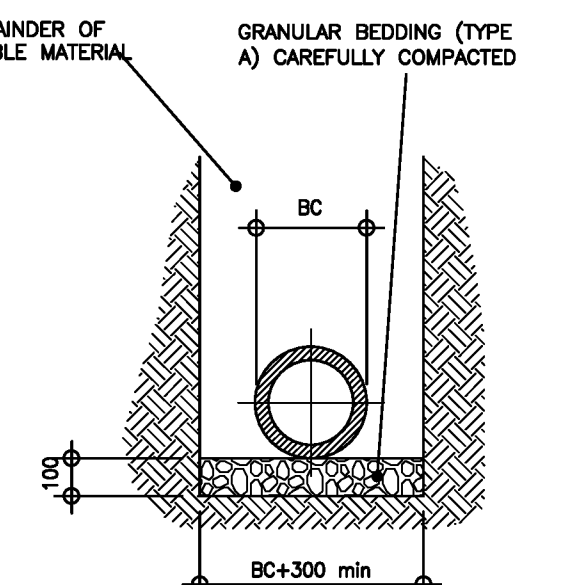
**TYPICAL RODDING POINT DETAIL
(1:10 typical)**



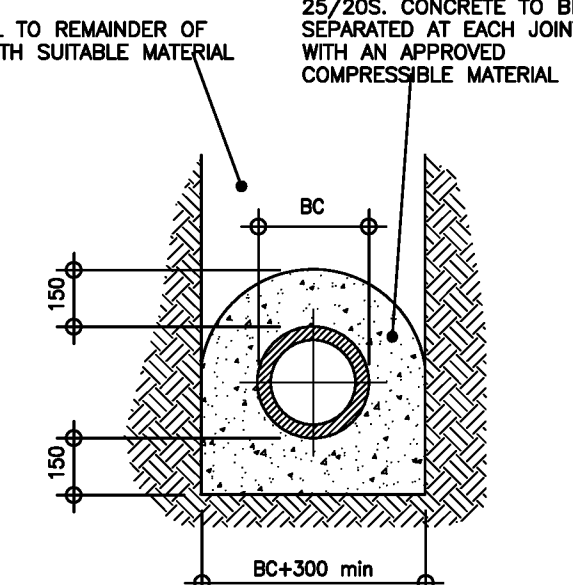
GRANULAR SURROUND
TO BE USED WHERE PIPE PASSES WITHIN 3M OF NEW OR EXISTING TREES UNLESS PIPE REQUIRED CONCRETE SURROUND



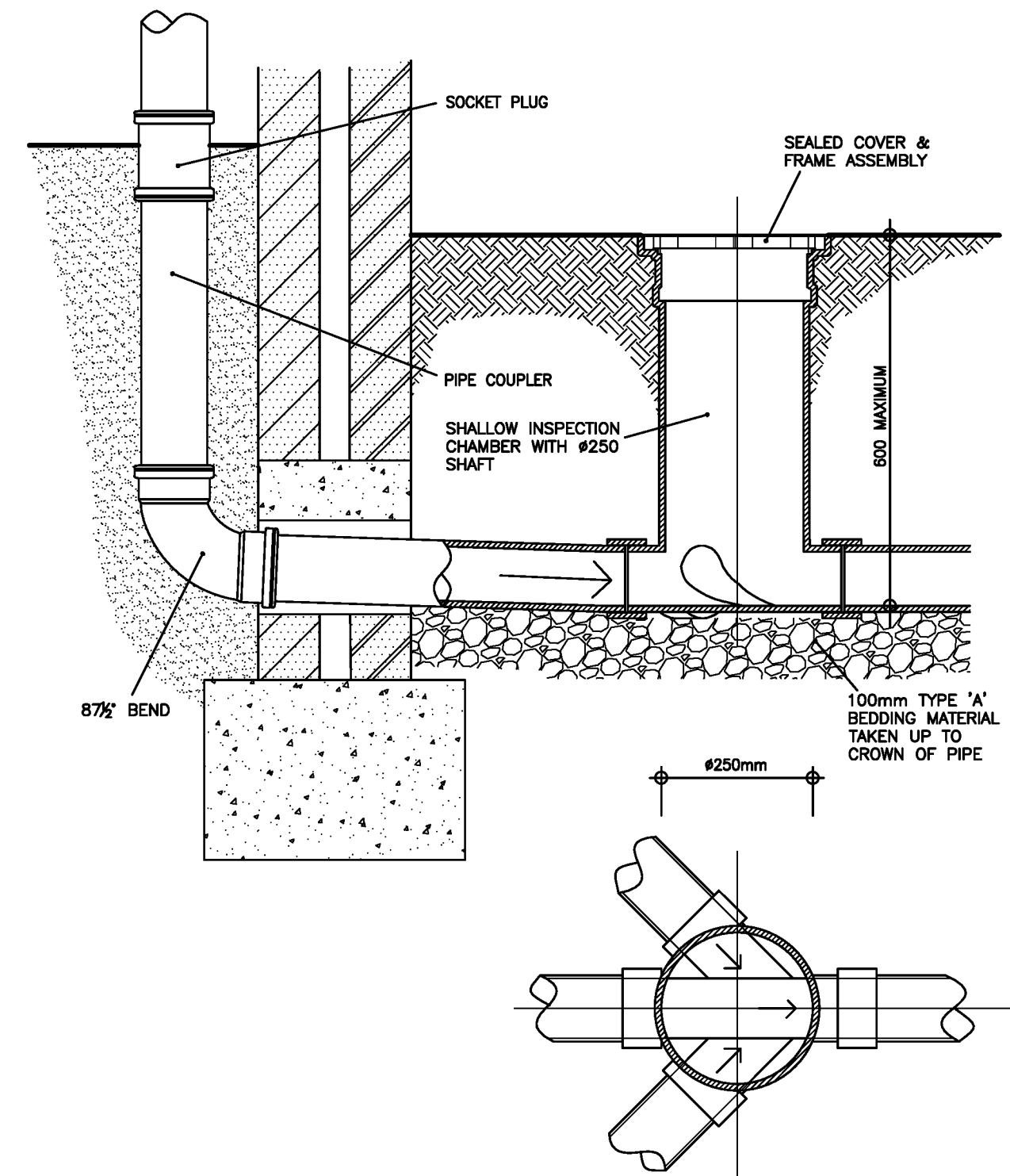
GRANULAR SIDE FILL
TO BE USED WHERE COVER TO CROWN OF PIPE IS GREATER THAN 900mm UNDER ROADS, FOOTWAYS & HARDSTANDINGS



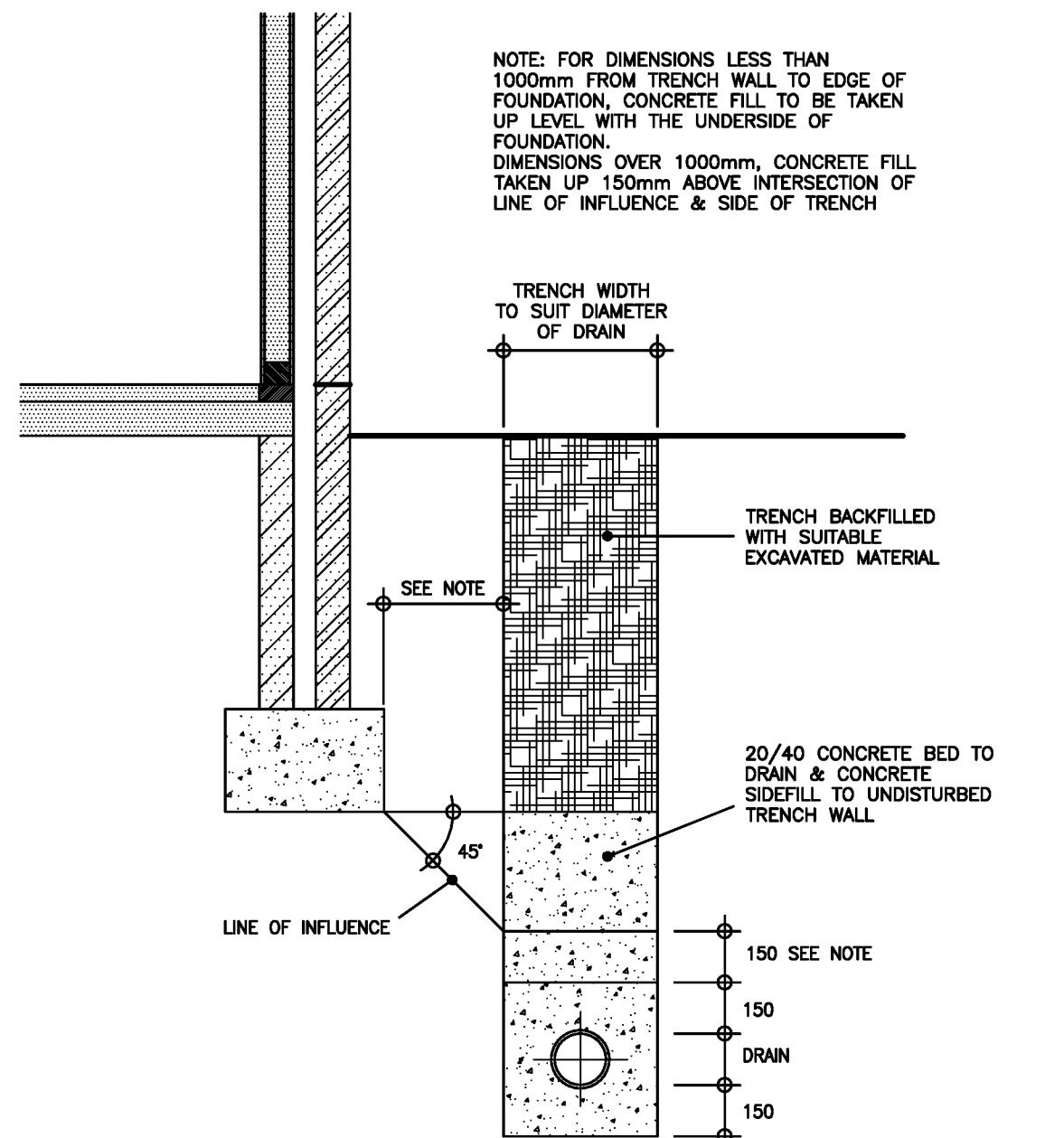
GRANULAR BED
TO BE USED WHERE COVER TO CROWN OF PIPE IS GREATER THAN 900mm IN LANDSCAPED AREAS



CONCRETE SURROUND
TO BE USED WHERE COVER TO CROWN OF PIPE IS LESS THAN 900mm UNDER ROADS, FOOTWAYS & HARDSTANDINGS AND LESS THAN 600mm IN LANDSCAPED AREAS



**TYPICAL TYPE 'X' SHALLOW ACCESS
INSPECTION CHAMBER (1:10 typical)**



**CONCRETE BACKFILL IN TRENCHES
ADJACENT TO FOUNDATIONS (1:20 typical)**

- GENERAL NOTES:**
1. All dimensions to be checked on site. All details and dimensions relating to sub-contractors or suppliers work must be checked and agreed between the sub-contractor or supplier and the main contractor.
 2. This drawing is to be read in conjunction with all relevant architects, services and engineers drawings and specifications.
 3. The location, size, depth and identification of existing services that may be shown or referred to on this drawing have been assessed from non intrusive observations, record drawings or the like. The contractor shall safely carry out intrusive investigations, trial holes or soundings prior to commencing work to satisfy himself that it is safe to proceed and that the assessments are accurate. Any discrepancies shall be notified to gap prior to works commencing.
 4. Tender or billing drawings shall not be used for construction or the ordering of materials.
 5. Do not scale. All dimensions and levels to be site confirmed.
 6. Copyright : This drawing must not be copied, amended nor reproduced without the prior written agreement of gap.

P2	23.12.19	Updated to Latest Scheme	MR	SXL	GO
P1	06.11.19	INITIAL ISSUE	CM	MR	GO
REV	DATE	DESCRIPTION	BY	CHKAPP	

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16/17 BOUNDARY ROAD, HOVE,
EAST SUSSEX BN3 4EF
TELEPHONE 01273 414413
E-MAIL: mail@gpsphove.co.uk
Website: www.gyourself.com
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BARNHAM

**PRIVATE DRAINAGE
CONSTRUCTION DETAILS
SHEET 1 OF 2**

JOB No.	SCALE @ A1	DATE
H19812	NTS	NOVEMBER 2019

DRAWN	ENGINEER	CHECKED	APP
GS	M ROBERTS		

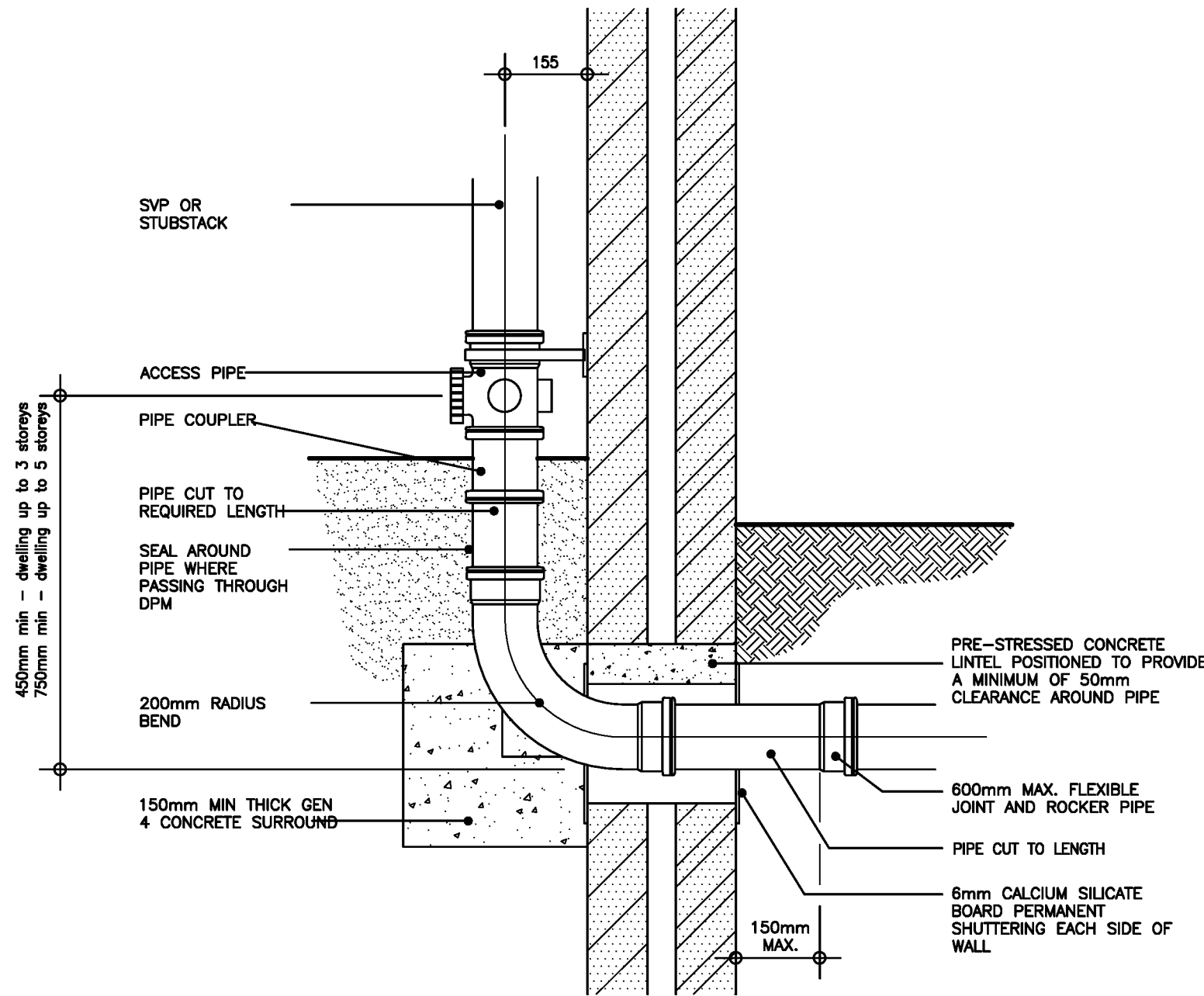
D1 SUITABLE FOR COORDINATION

P2 STAGE 4 – TECHNICAL DESIGN

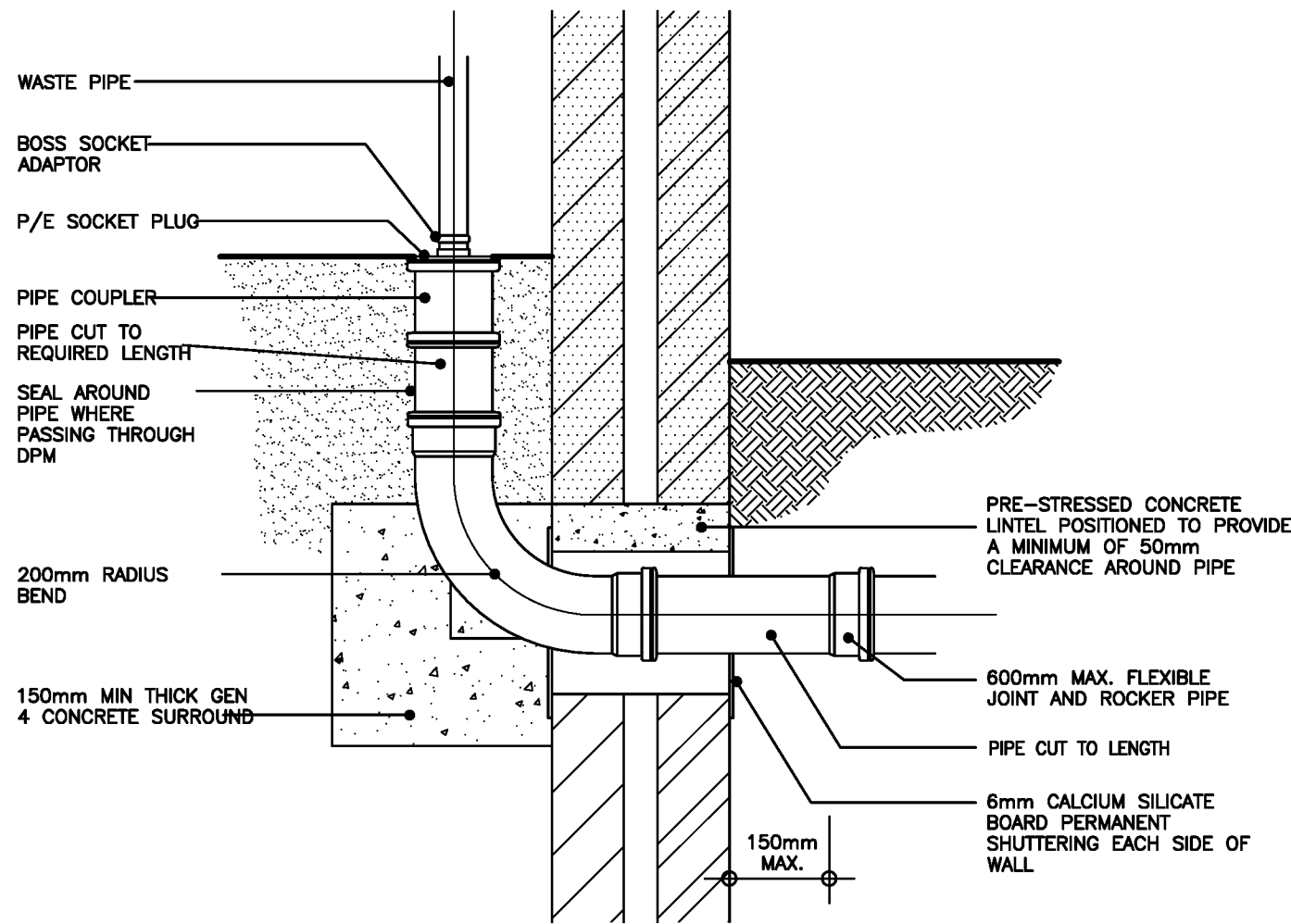
19812-GS-Z1-XX-DR-C-5101

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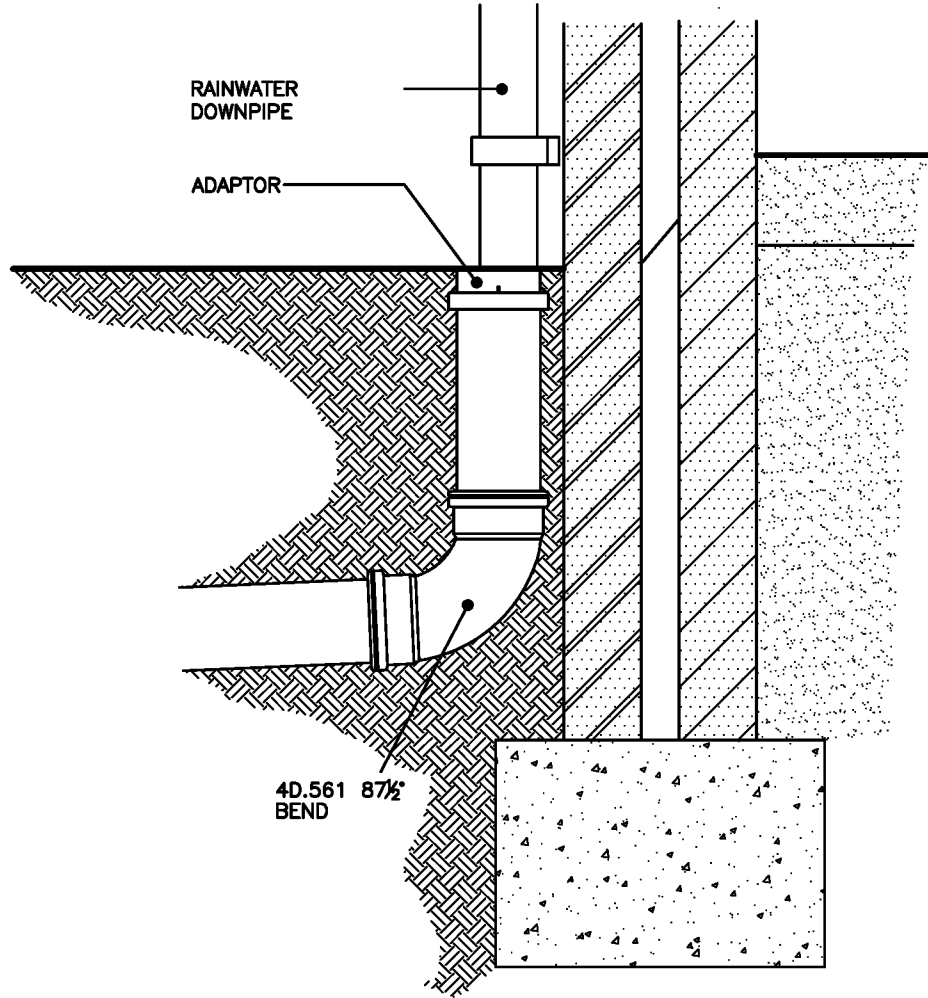
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2. This drawing is to be read in conjunction with all relevant architects, services and engineers drawings and specifications.
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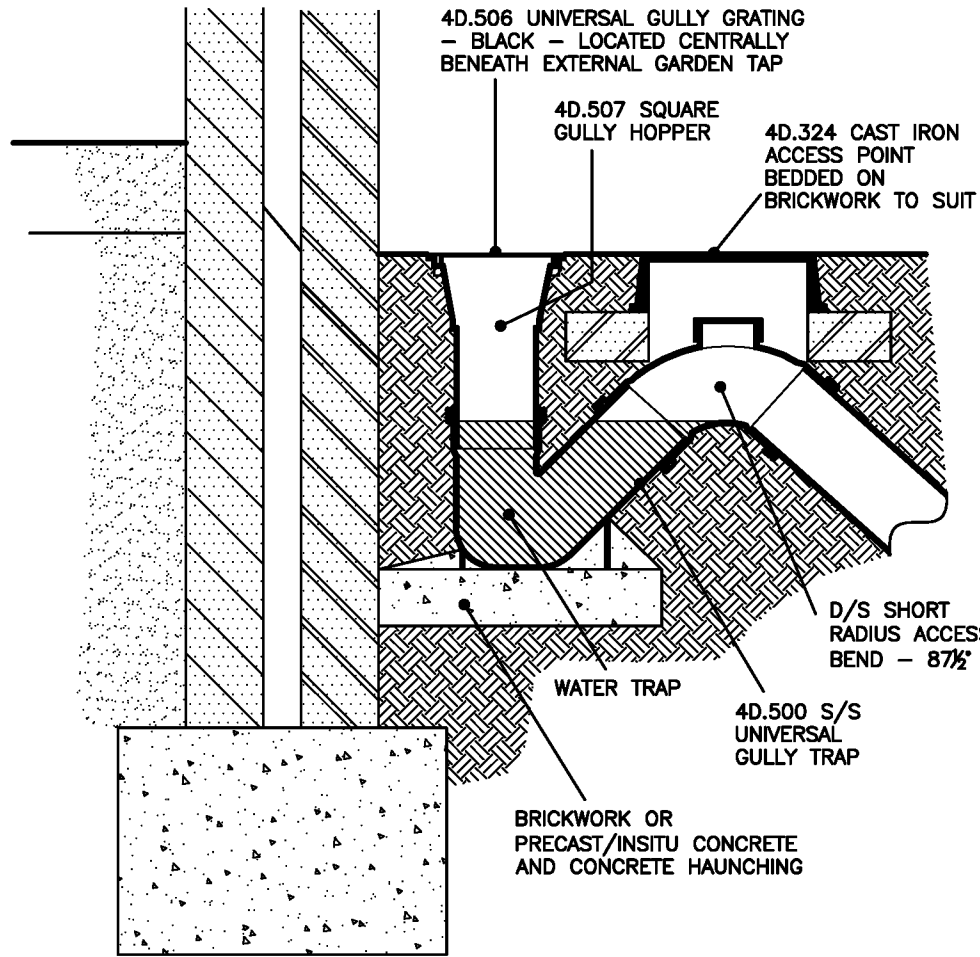
INTERNAL SVP/SS OUTLET
(1:10 typical)



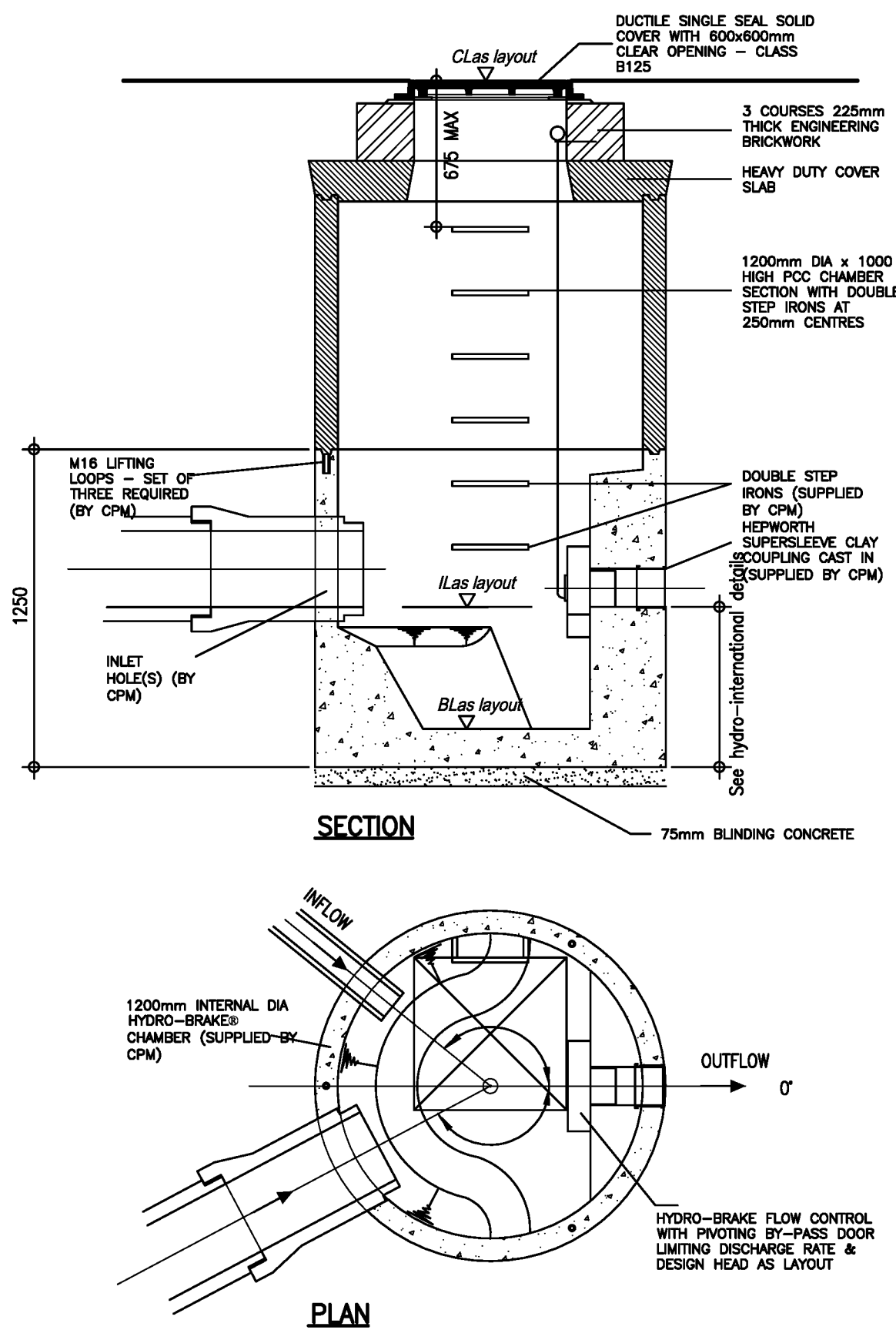
INTERNAL FLOOR OUTLET
(1:10 typical)



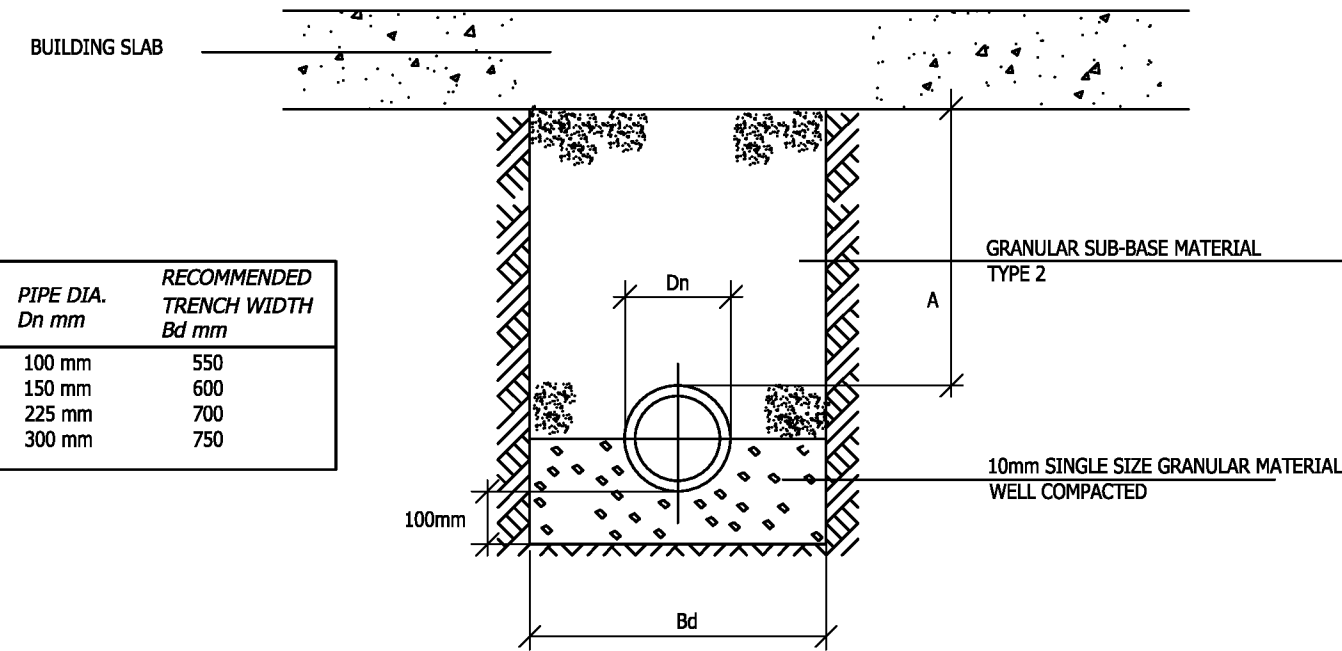
EXTERNAL RAINWATER DOWNPIPE
TO DRAIN (1:10 typical)



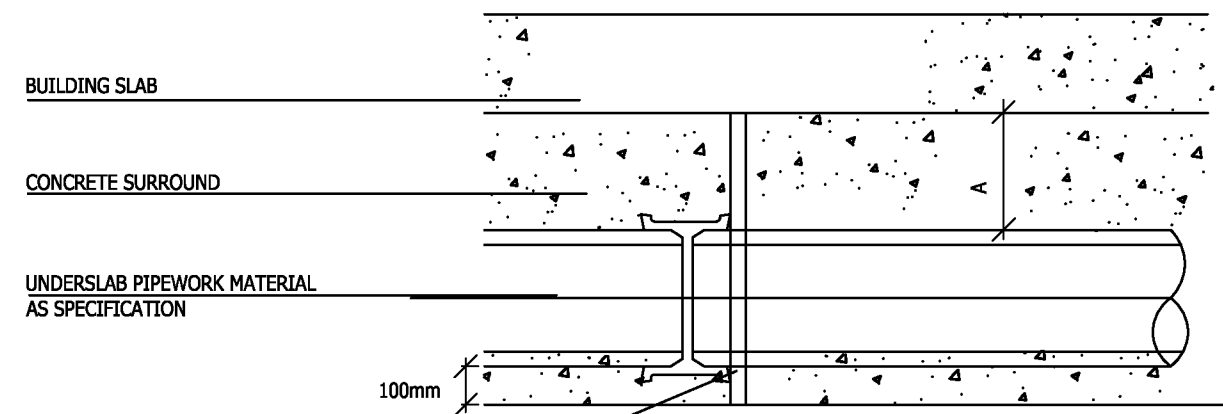
EXTERNAL TAP GULLY(1:10 typical)



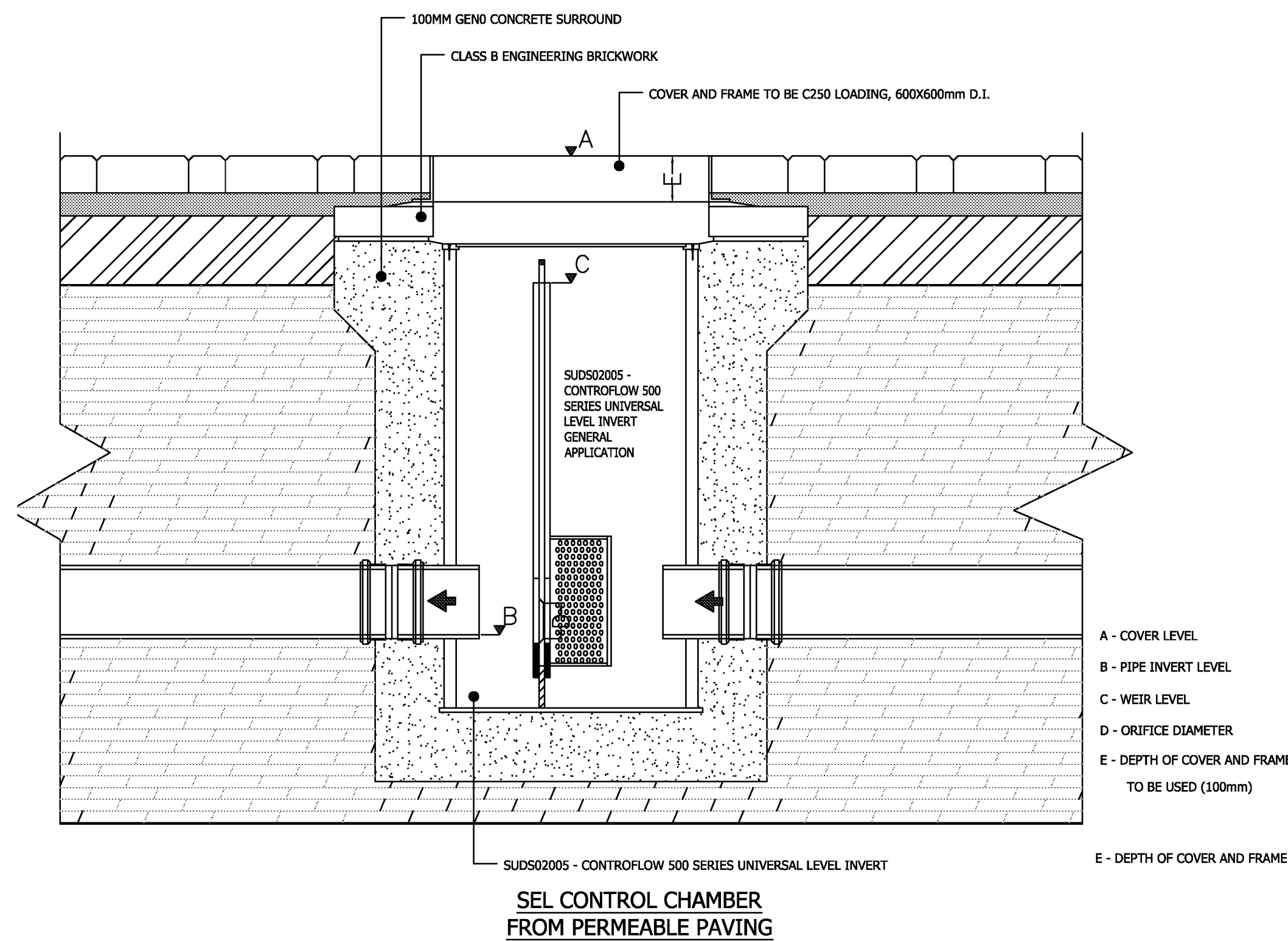
PRECAST CONCRETE CONTROL CHAMBER



GRANULAR BED
(* 'A' IS GREATER THAN 300mm)



DRAIN BEDDING DETAILS - D300.0
FOR PIPE UNDERBUILDING



P2	23.12.19	Updated to Latest Scheme	MR	SD	GO
P1	06.11.19	INITIAL ISSUE	CM	MR	GO
REV	DATE	DESCRIPTION	BY CHKAPP		
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CLIENT  REDROW HOMES ARCHITECT RH PARTNERSHIP					
JOB TITLE ANGEL & HYDE NURSERIES YAPTON ROAD BARNHAM					
DRAWING TITLE PTIVATE DRAINAGE CONSTRUCTION DETAILS SHEET 2 OF 2					
JOB No.		SCALE @ 1:1	DATE		
H19812		NTS	NOVEMBER 2019		
DRAWN	ENGINEER	CHECKED	APP		
GS	M ROBERTS				
STATUS					
D1		SUITABLE FOR COORDINATION			
REVISION		RIBA STATUS			
P2		STAGE 4 – TECHNICAL DESIGN			
DRAWING No.					
19812-GS-Z1-XX-DR-C-5102					

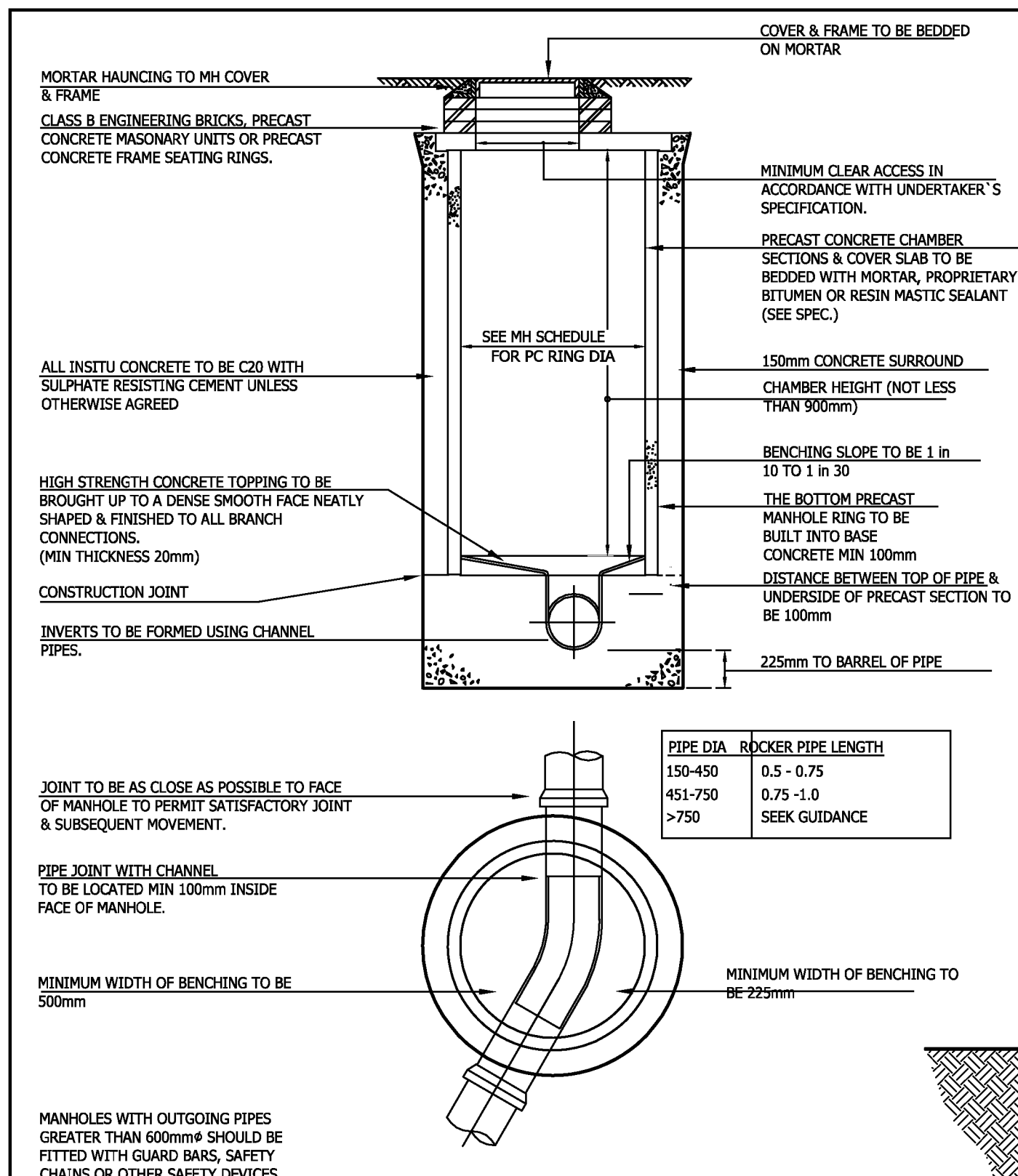


FIG 2.5 SFA 6 - CIRCULAR PCC MANHOLE TYPE B
DEPTH 1.45m - 3m

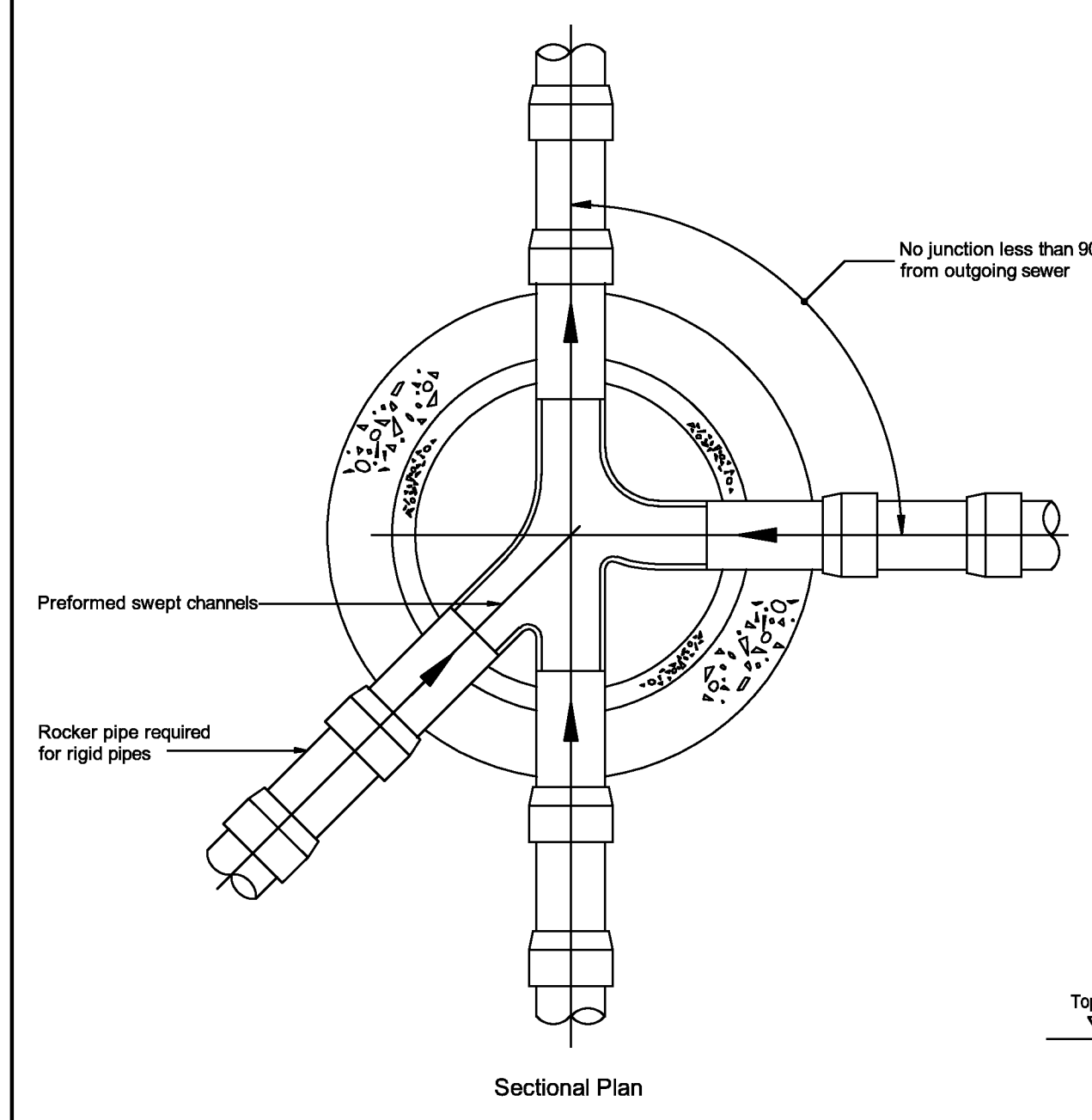


FIG 2.9 SFA 6 - TYPICAL ARRANGEMENT OF PIPE JUNCTIONS WITHIN MANHOLES (NTS)

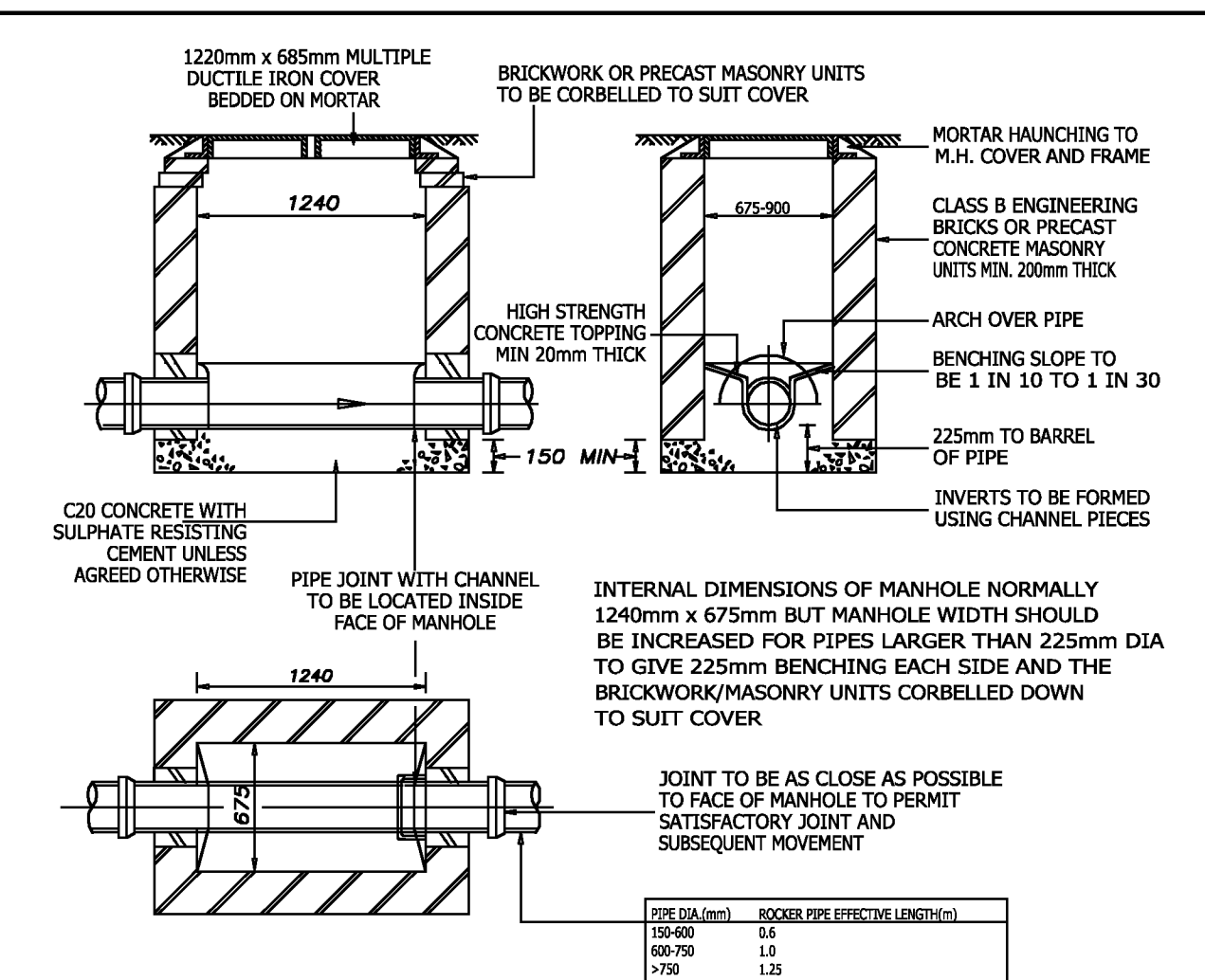
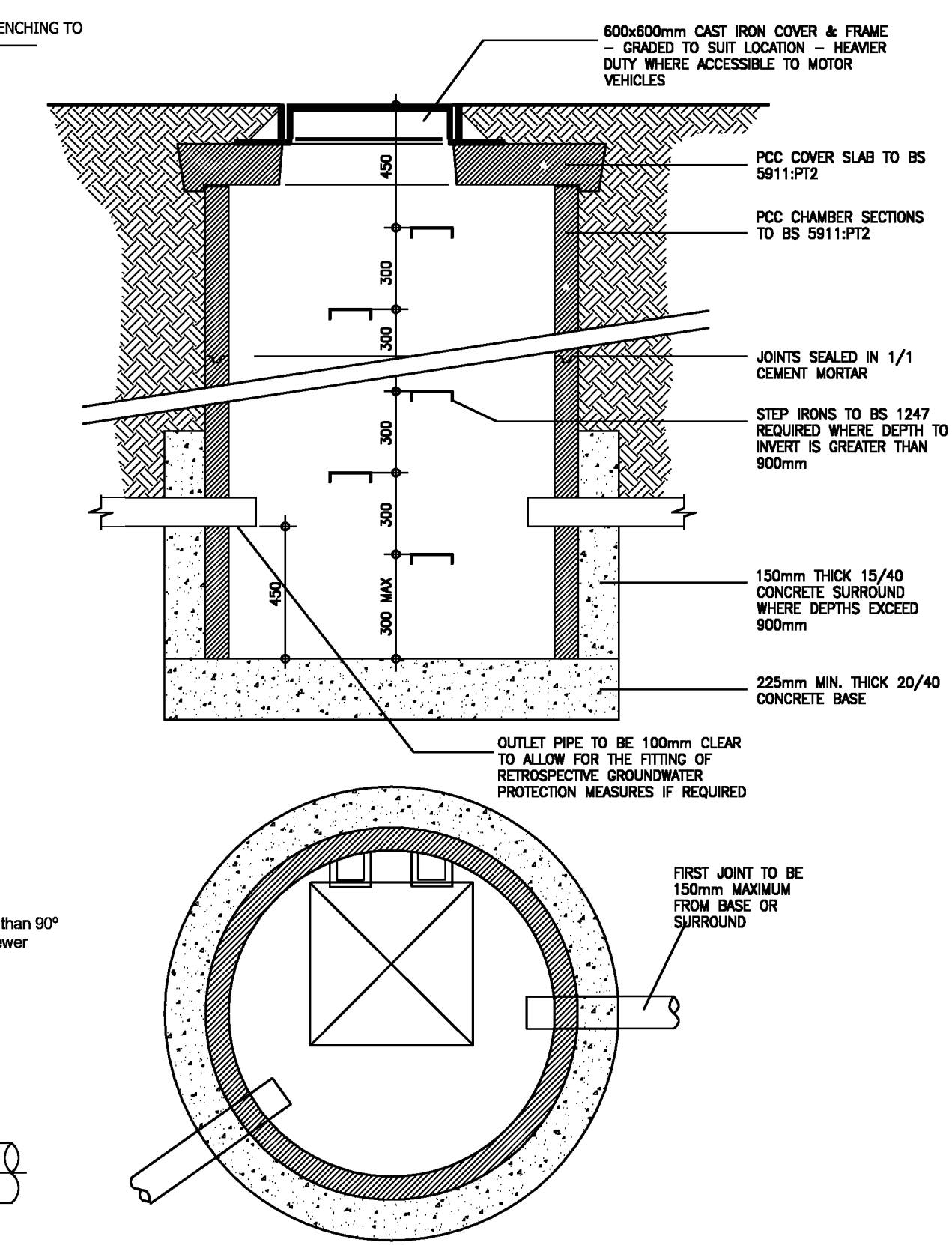
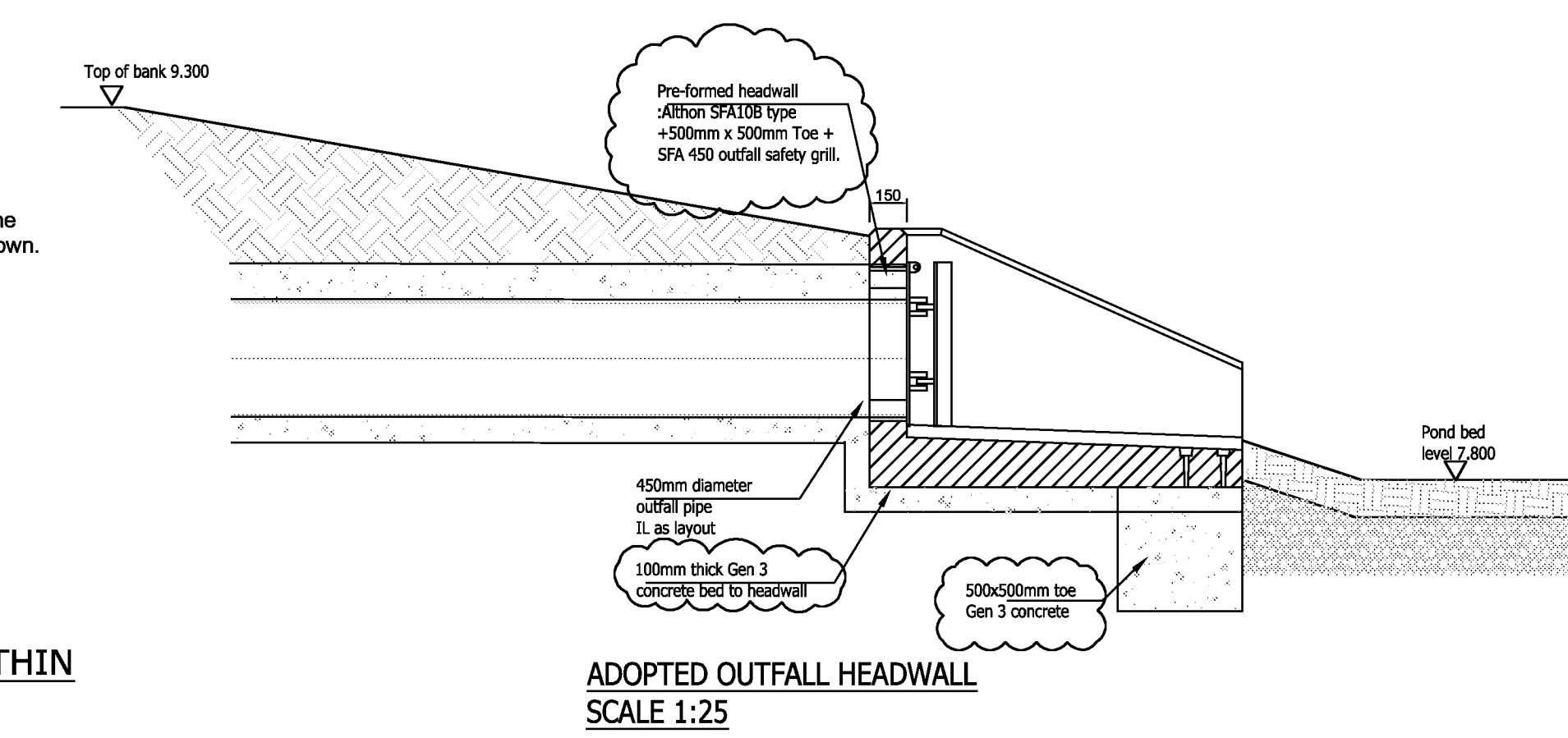


FIG 2.6 SFA 6 - MANHOLE TYPE C (NTS)



TYPICAL PRECAST CONCRETE CATCHPIIT



ADOPTED OUTFALL HEADWALL
SCALE 1:25

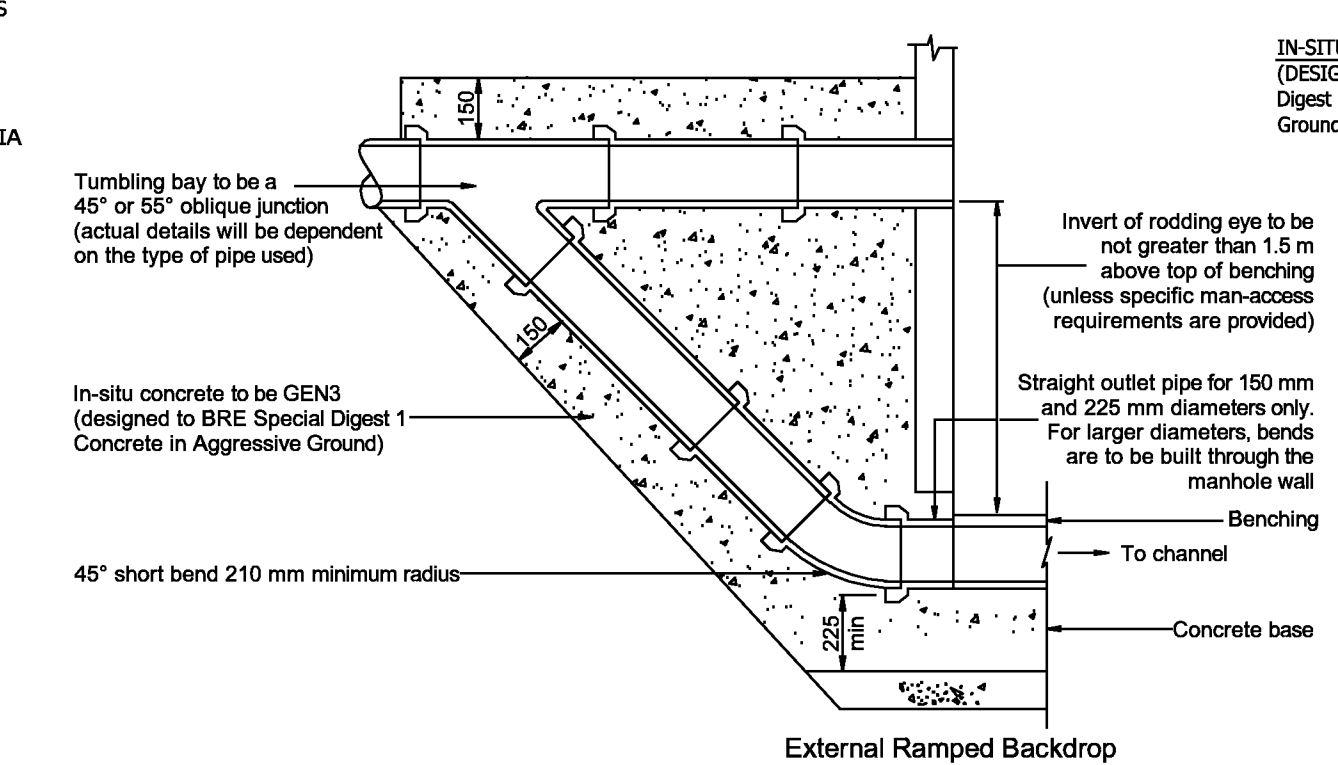
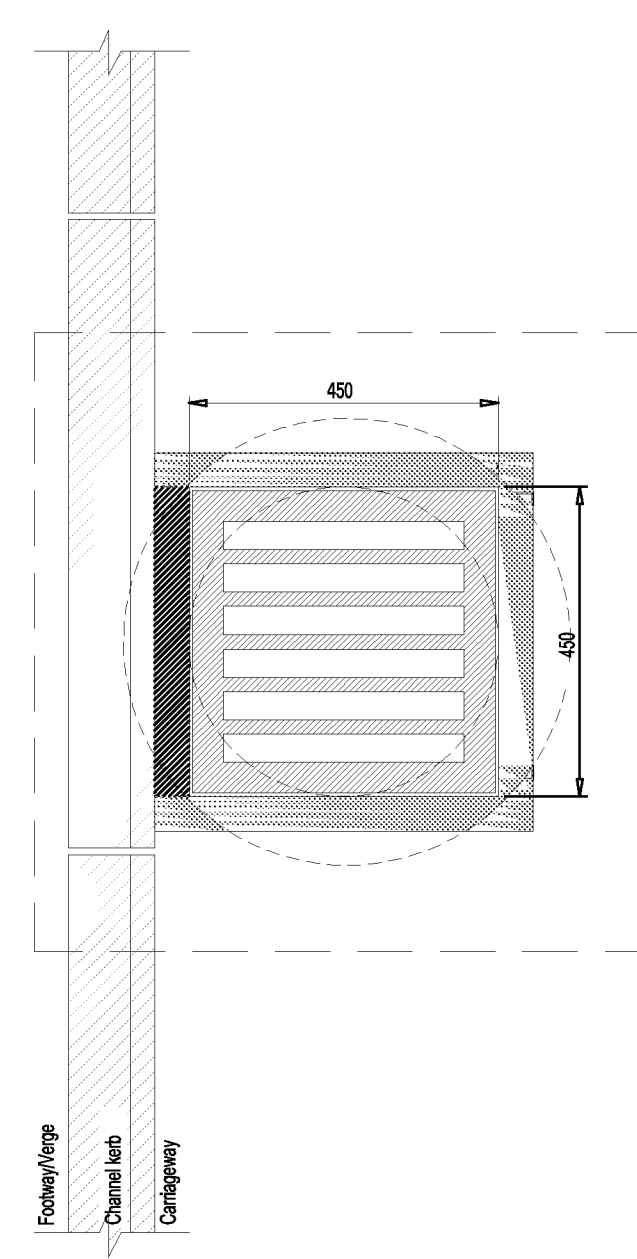
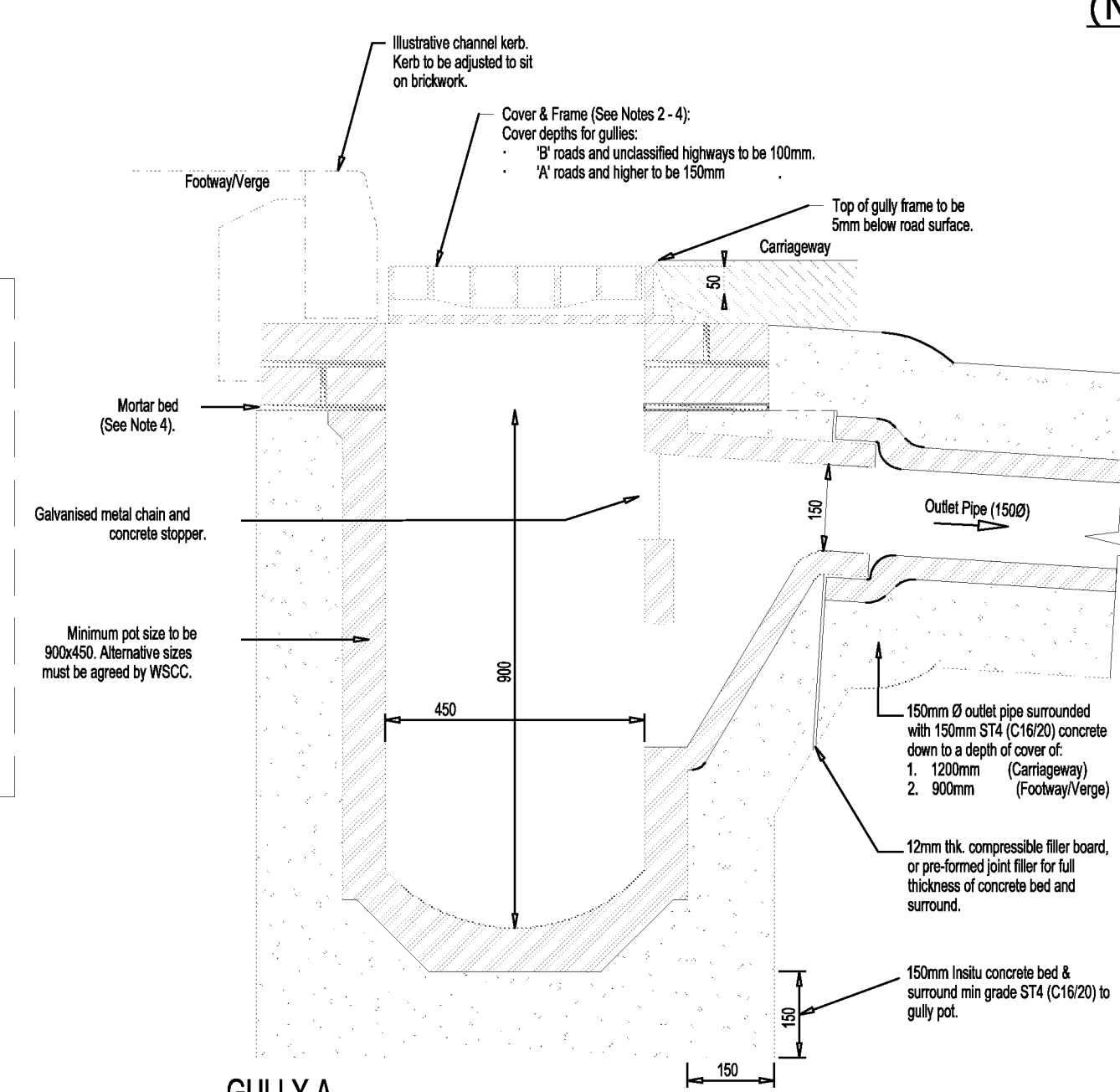


FIG 2.10 SFA 6 - EXTERNAL RAMPED BACKDROP



GULLY A TYPE: PRECAST CONCRETE PLAN (1:10)

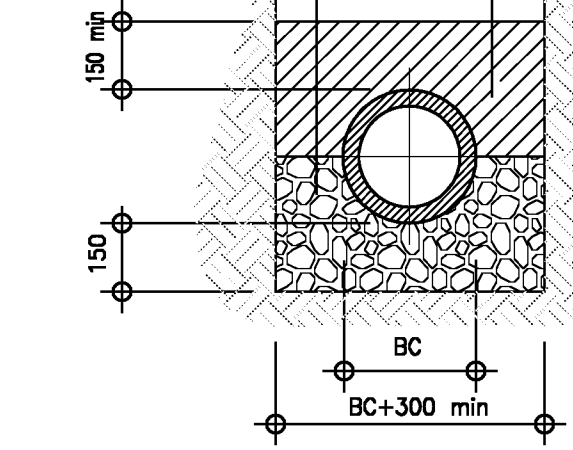


GULLY A TYPE: PRECAST CONCRETE SECTION (1:10)

ROAD GULLY D208.1

SIDE AND BACKFILL: SELECTED SUITABLE AS-DUG MATERIAL ABOVE PIPES, FREE FROM COHESIVE LUMPS GREATER THAN 75mm AND STONES GREATER THAN 40mm WITH A OF VALUE OF 0.30 MAX AS DETERMINED BY A COMPACTION FRACTION TEST TAKEN ON A REPRESENTATIVE SAMPLE OF THE SELECTED MATERIAL

PIPE BEDDING MATERIAL: ANGULAR AGGREGATE OF 10,14,20 OR 40mm CRUSHED ROCK TO BS882 OR 14-5mm, 20-5mm OR 40-5mm GRADED AGGREGATE MAY BE USED

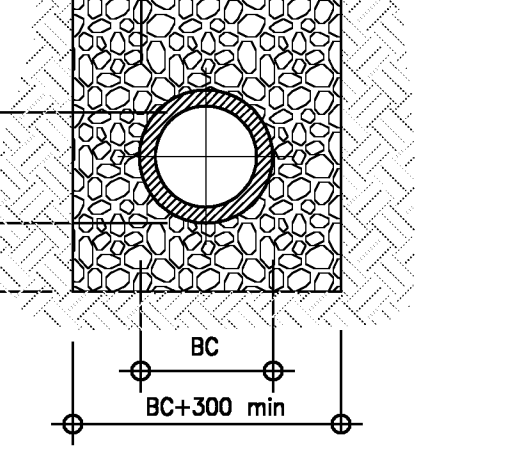


CLASS B BEDDING

FOR USE WHERE COVER TO CROWN OF PIPE IS GREATER THAN 900mm UNDER VERGES, FOOTWAYS & CYCLEWAYS

PIPE BEDDING MATERIAL: PLAIN CONCRETE MAX S7.2. CONCRETE TO BE SEPARATED AT EACH JOINT WITH AN APPROVED COMPRESSIBLE MATERIAL

BACKFILL TO REMAINDER OF TRENCHES TO BE SELECTED SUITABLE AS-DUG MATERIAL AS REQUIRED BY ADOPTING AUTHORITY

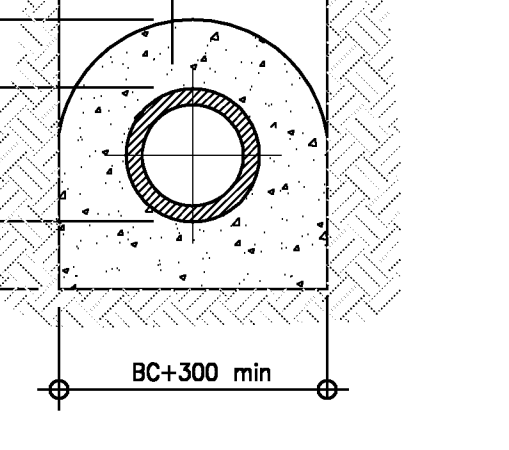


CLASS S BEDDING

FOR USE WHERE COVER TO CROWN OF PIPE IS GREATER THAN 1200mm UNDER CARRIAGEWAYS

PIPE BEDDING MATERIAL: PLAIN CONCRETE MAX S7.2. CONCRETE TO BE SEPARATED AT EACH JOINT WITH AN APPROVED COMPRESSIBLE MATERIAL

BACKFILL TO REMAINDER OF TRENCHES TO BE SELECTED SUITABLE AS-DUG MATERIAL AS REQUIRED BY ADOPTING AUTHORITY



CLASS Z BEDDING

FOR USE WHERE COVER TO CROWN OF PIPE IS LESS THAN 1200mm UNDER CARRIAGEWAYS, OR LESS THAN 900mm UNDER OTHER AREAS

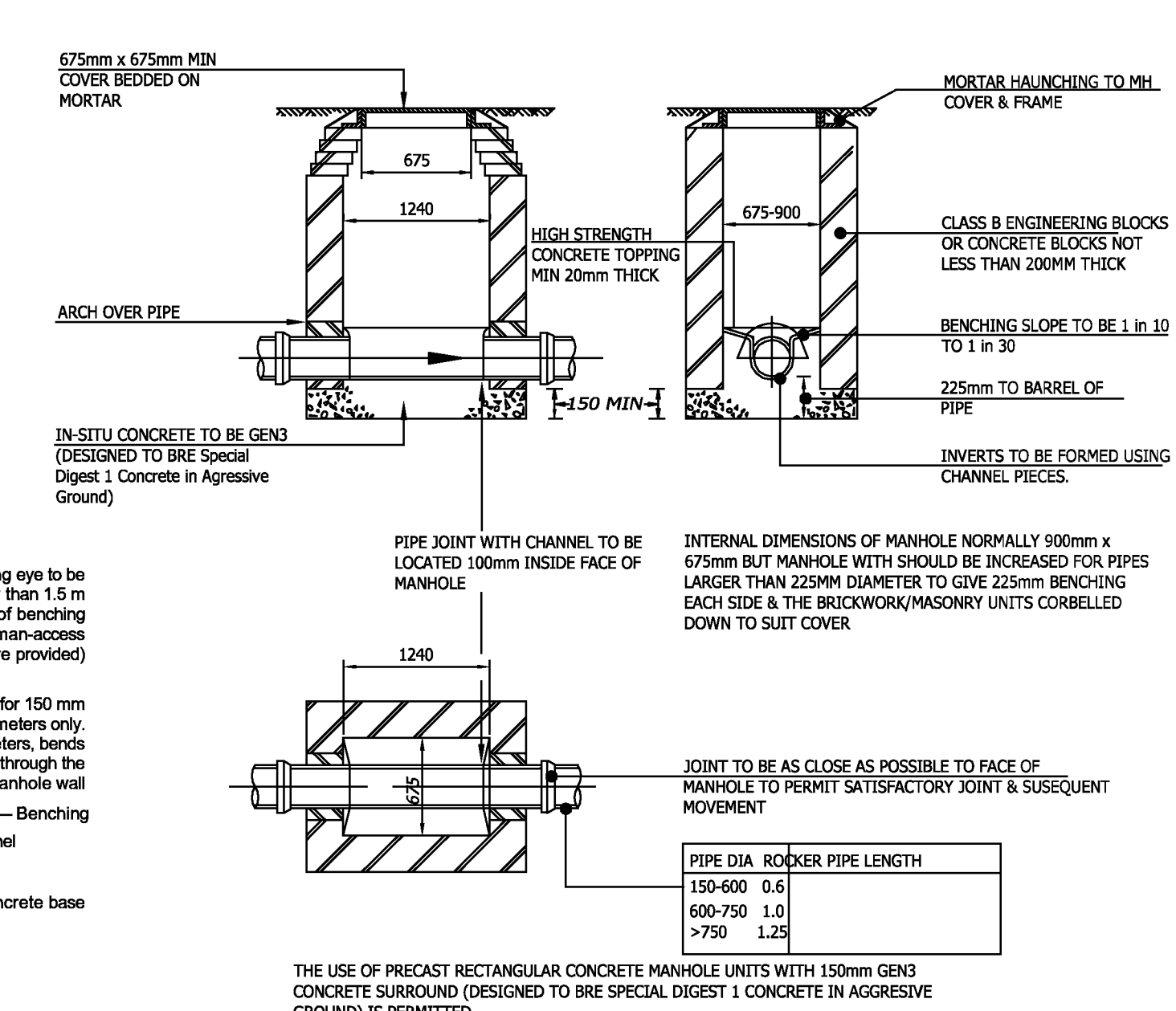


FIG 2.7 SFA 6 - MANHOLE TYPE D DEPTH TO SOFFIT <1M (NTS)

THE USE OF PRECAST RECTANGULAR CONCRETE MANHOLE UNITS WITH 150mm GEN3 CONCRETE SURROUND (DESIGNED TO BRE SPECIAL DIGEST 1 CONCRETE IN AGGRESSIVE GROUND) IS PERMITTED

- NOTES
- Do not scale from this drawing.
 - All gully grating and frames to be 'fringed' heavy duty ductile iron minimum grade D400 in accordance with BS EN12419:1994 & Section 506 of the Specification of Highway Works.
 - All ironwork shall carry a BSI kite mark.
 - Frames shall be bedded on a gauged Class 1 (3:1) sand/cement mortar to C24/32 of SHW Mortar Designation (I) and either 2 or 3 courses of Engineering Brickwork Class 2 to BS EN 771-1:2011.
 - Gully pots used for carriageway gullies shall be of precast concrete using Sulphate Resisting Cement (SRC) in accordance with BS 5911, part 230, 2004.
 - All gullies to be trapped. Any variations to this i.e. 'non-trapped', gully chutes or 'grit' must be qualified and WSCC shall review each location on an individual basis.
 - Selection of gully grating type shall be to suit the application area i.e. carriageway, footway/cycleway and to the satisfaction of the highway inspector.
- SURFACE WATER PIPES
- Permitted Types as follows:
- CLAY: (1500min-3000max)
All pipe shall be Vitrified Clayware to BS EN 285-1:1991.
- UPVC: (1500min-9000max) (*)
All pipes shall be to BS EN 14011:1998.
All pipes shall be ribbed 'twin wall' to provide a suitable network (pipes & couplings).
- CONCRETE: (3000min-9000max) (*)
All pipes shall be made with Sulphate resistant Cement to BS 5911-1:2002.
- ALL jointing and installation shall be undertaken to manufacturers specification.
- ALL materials shall be BBA certified.
- ALL materials shall comply with the Specification for Highway Works.

- GENERAL NOTES:
- All dimensions to be checked on site. All details and dimensions relating to sub-contractors or suppliers work must be checked and agreed between the sub-contractor or supplier and the main contractor.
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 - Do not scale. All dimensions and levels to be site confirmed.
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REV	DATE	DESCRIPTION	BY	CHK	APP
P4	21.02.20	Headwall Detail revised	GS	SDL	GO
P3	30.01.20	Ramp Detail added	GS	MR	GO
P2	23.12.19	Updated to latest scheme	GS	MR	GO
P1	06.11.19	INITIAL ISSUE	GS	MR	GO

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CONSULTING ENGINEERS

18/17 BOUNDARY ROAD, HOVE,
EAST SUSSEX BN3 4EF
TELEPHONE 01273 414413
E-MAIL: mail@gyouryself.co.uk
Website: www.gyouryself.com
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JOB TITLE
**ANGEL & HYDE NURSERIES
YAPTON ROAD
BARNHAM**

DRAWING TITLE
**MAIN DRAINAGE
DETAILS**

JOB NO. H19812	SCALE @ A1 NTS	DATE NOVEMBER 2019
DRAWN GS	DESIGNED MR	CHECKED APP

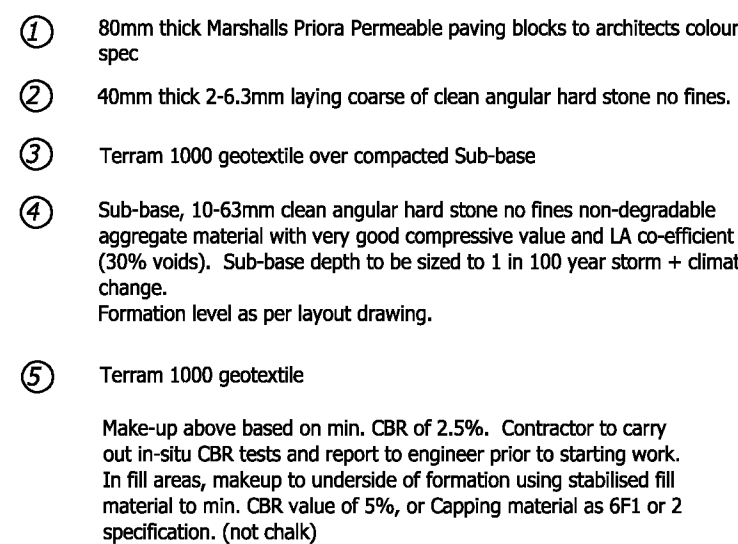
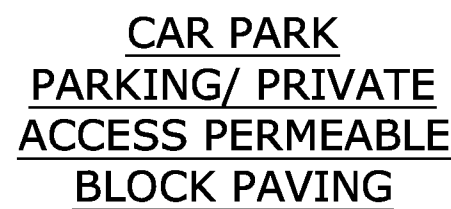
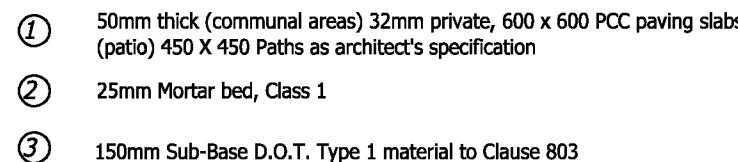
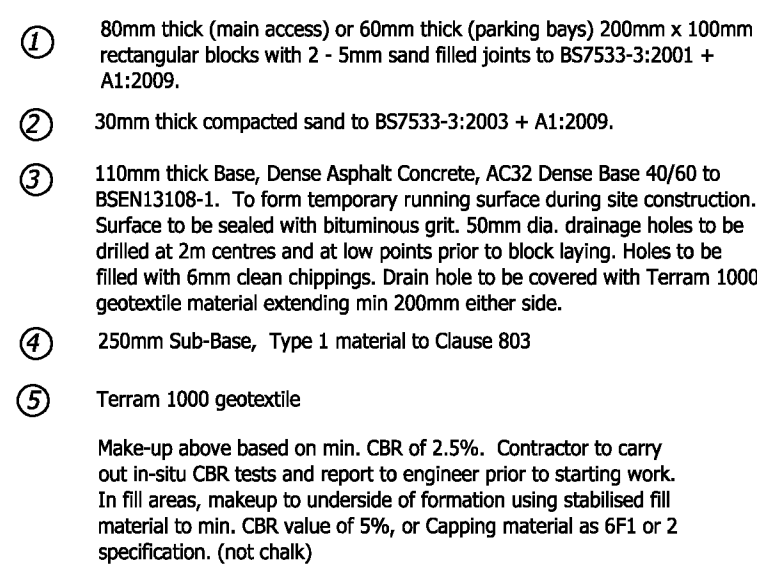
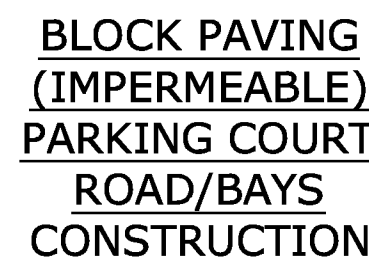
STATUS
D1

DRAWING AVAILABILITY
SUITABLE FOR COORDINATION

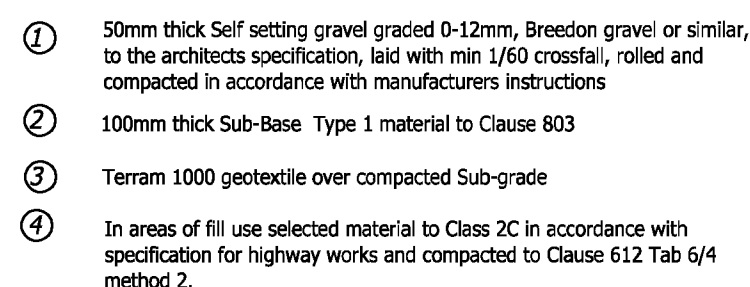
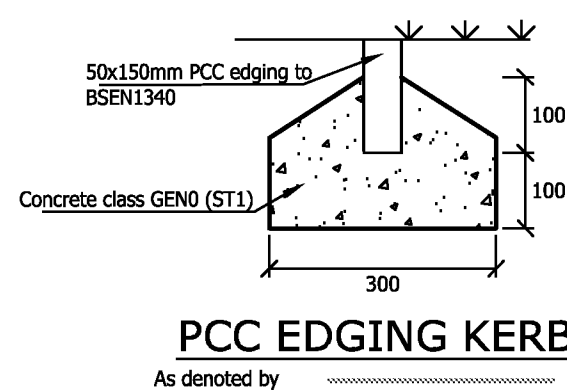
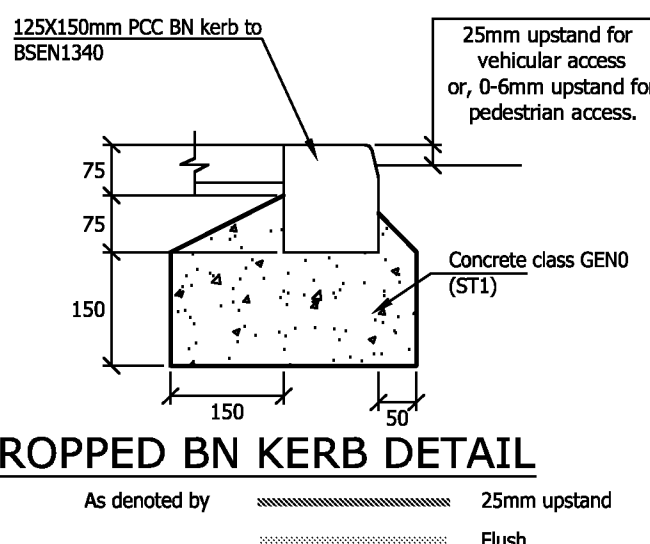
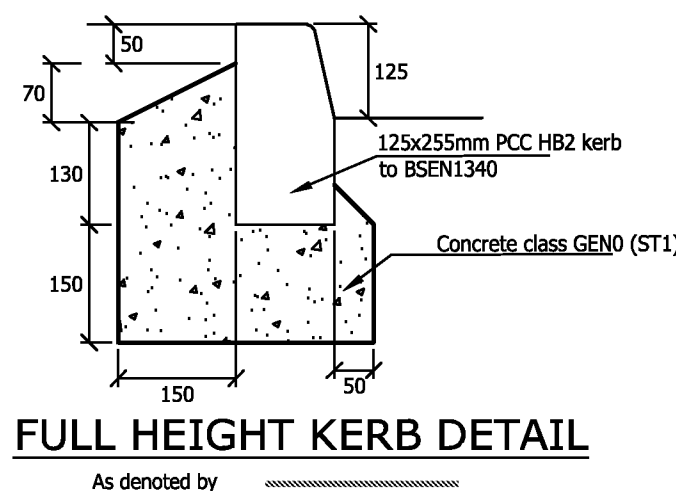
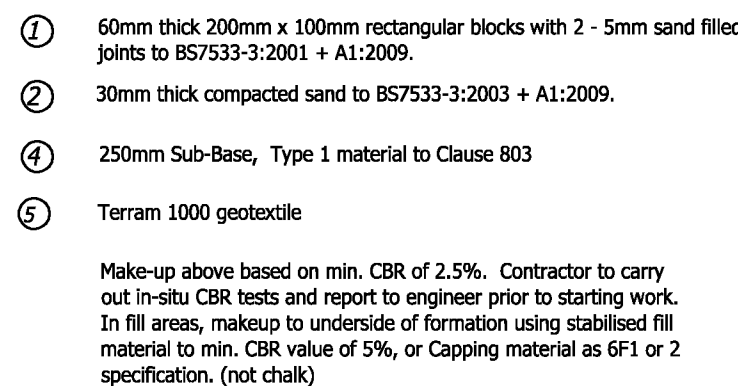
REVISION
P4

REVISION
STAGE 4 - TECHNICAL DESIGN

DRAWING NO.
19812-GS-Z1-XX-DR-C-5105



Note:
Permeable blocks to be laid in Herringbone pattern with double stretcher bond against kerblines.



GENERAL NOTES:

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5. Do not scale. All dimensions and levels to be site confirmed.

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REV	DATE	DESCRIPTION	BY	CHKF
P3	21.02.20	Hatch on key amended	GS	SDL
P2	23.12.19	Updated to Latest Scheme	MR	SDL
P1	06.11.19	INITIAL ISSUE	CM	MR, GS

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CONSULTING ENGINEERS

16/17 BOUNDARY ROAD, HOVE
EAST SUSSEX BN3 4EF
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Also at Fareham and St Albans

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HOMES

ARCHITECT

RH PARTNERSHIP

JOB TITLE	
-----------	--

ANGEL & HYDE NURSERIES
YAPTON ROAD
BARNHAM

DRAINING TITLE

PRIVATE EXTERNAL WORKS CONSTRUCTION DETAILS

JOB No.
H19812

SCALE ● A1
N

DATE NOVEMBER 2019

CRAMN	GS
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ENGINEER
M. ROBERTS

	AF
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STATUS	
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DRAWING SUITABILITY

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D

SUITAB

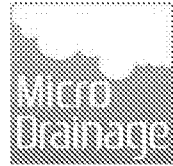
REVISION	
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STAGE 4 – TECHNICAL DESIGN

DRAWING

19812-GS-Z1-XX-DR-C-5103

APPENDIX C – MICRO DRAINAGE OUTPUTS

GTA Civils Ltd		Page 0
Gloucester House 66a Church Walk Burgess Hill, BN43 6LB	Angels Nursery Yapton 7033 SW network results	
Date 21/05/2018 File 1805 Site SW.mdx	Designed by MCR Checked by	
XP Solutions	Network 2018.1	

STORM SEWER DESIGN by the Modified Rational Method

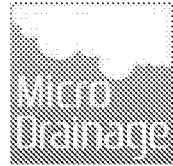
Network Design Table for Surface Network 1

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	23.738	0.158	150.2	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	⊗
1.001	16.267	0.108	150.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	⊗
2.000	2.121	0.014	151.5	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	⊗
2.001	9.967	0.066	151.0	0.030	0.00	0.0	0.600	o	150	Pipe/Conduit	⊗
1.002	29.454	0.131	224.8	0.081	0.00	0.0	0.600	o	300	Pipe/Conduit	⊗

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	I.Area (ha)	Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.37	8.766	0.000	0.0	0.0	0.0	1.06	42.3	0.0
1.001	50.00	5.63	8.698	0.000	0.0	0.0	0.0	1.06	42.3	0.0
2.000	50.00	5.04	8.659	0.000	0.0	0.0	0.0	0.81	14.4	0.0
2.001	50.00	5.25	8.636	0.030	0.0	0.0	0.0	0.82	14.4	4.1
1.002	50.00	6.10	8.500	0.111	0.0	0.0	0.0	1.04	73.8	15.0

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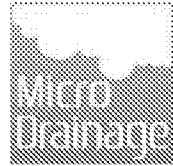
STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Surface Network 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.003	18.012	0.042	428.9	0.036	0.00	0.0	0.600	o	450	Pipe/Conduit	⚙
3.000	2.077	0.045	46.2	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	⚙
3.001	8.745	0.078	112.1	0.096	0.00	0.0	0.600	o	150	Pipe/Conduit	⚙
1.004	18.084	0.045	401.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	⚙
4.000	1.493	0.025	59.7	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	⚙
4.001	5.547	0.193	28.7	0.156	0.00	0.0	0.600	o	150	Pipe/Conduit	⚙

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.003	50.00	6.40	8.369	0.147	0.0	0.0	0.0	0.98	155.1	19.9
3.000	50.00	5.02	8.800	0.000	0.0	0.0	0.0	1.48	26.2	0.0
3.001	50.00	5.18	8.755	0.096	0.0	0.0	0.0	0.95	16.8	13.0
1.004	50.00	6.70	8.327	0.243	0.0	0.0	0.0	1.01	160.3	32.9
4.000	50.00	5.02	8.405	0.000	0.0	0.0	0.0	1.30	23.0	0.0
4.001	50.00	5.07	8.410	0.156	0.0	0.0	0.0	1.89	33.3	21.1

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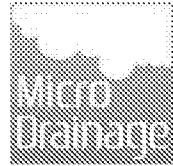
STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Surface Network 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.005	18.849	0.047	401.0	0.018	0.00	0.0	0.600	o	450	Pipe/Conduit	⚙
1.006	48.674	0.123	395.7	0.108	0.00	0.0	0.600	o	450	Pipe/Conduit	⚙
1.007	7.243	0.019	381.2	0.037	0.00	0.0	0.600	o	450	Pipe/Conduit	⚙
5.000	55.320	0.369	149.9	0.074	5.00	0.0	0.600	o	150	Pipe/Conduit	⚙
5.001	14.409	0.085	169.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	⚙
6.000	75.012	0.441	170.1	0.056	5.00	0.0	0.600	o	225	Pipe/Conduit	⚙

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.005	50.00	7.01	8.282	0.417	0.0	0.0	0.0	1.01	160.5	56.5
1.006	50.00	7.81	8.235	0.525	0.0	0.0	0.0	1.02	161.6	71.1
1.007	50.00	7.93	8.111	0.562	0.0	0.0	0.0	1.04	164.6	76.1
5.000	50.00	6.13	8.737	0.074	0.0	0.0	0.0	0.82	14.5	10.0
5.001	50.00	6.44	8.368	0.074	0.0	0.0	0.0	0.77	13.6	10.0
6.000	50.00	6.25	8.737	0.056	0.0	0.0	0.0	1.00	39.7	7.6

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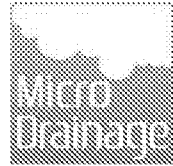
STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Surface Network 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.008	65.131	0.047	1385.8	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	⚙
1.009	18.796	0.123	152.8	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	⚙
7.000	2.919	0.100	29.2	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	⚙
7.001	12.041	0.113	106.6	0.096	0.00	0.0	0.600	o	150	Pipe/Conduit	⚙
8.000	3.756	0.033	113.8	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	⚙
8.001	9.630	0.066	145.9	0.057	0.00	0.0	0.600	o	150	Pipe/Conduit	⚙

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.008	45.34	9.95	8.092	0.692	0.0	0.0	0.0	0.54	85.5	85.0
1.009	44.89	10.14	8.053	0.692	0.0	0.0	0.0	1.64	261.2	85.0
7.000	50.00	5.03	9.300	0.000	0.0	0.0	0.0	1.87	33.1	0.0
7.001	50.00	5.23	8.820	0.096	0.0	0.0	0.0	0.97	17.2	13.0
8.000	50.00	5.07	8.750	0.000	0.0	0.0	0.0	0.94	16.6	0.0
8.001	50.00	5.26	8.717	0.057	0.0	0.0	0.0	0.83	14.7	7.7

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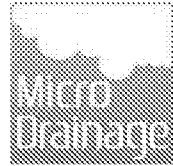
STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Surface Network 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
8.002	9.705	0.065	149.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	⊗
8.003	11.219	0.075	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	⊗
8.004	10.616	0.071	149.5	0.046	0.00	0.0	0.600	o	150	Pipe/Conduit	⊗
7.002	73.310	0.179	409.6	0.124	0.00	0.0	0.600	o	450	Pipe/Conduit	⊗
7.003	10.108	0.028	361.0	0.082	0.00	0.0	0.600	o	450	Pipe/Conduit	⊗
1.010	20.472	0.070	292.5	0.141	0.00	0.0	0.600	o	150	Pipe/Conduit	⊗

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL E (m)	I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
8.002	50.00	5.46	8.684	0.057	0.0	0.0	0.0	0.82	14.5	7.7
8.003	50.00	5.69	8.619	0.057	0.0	0.0	0.0	0.82	14.5	7.7
8.004	50.00	5.90	8.544	0.103	0.0	0.0	0.0	0.82	14.5	13.9
7.002	50.00	7.13	8.407	0.323	0.0	0.0	0.0	1.00	158.8	43.7
7.003	50.00	7.28	8.228	0.405	0.0	0.0	0.0	1.06	169.2	54.8
1.010	43.59	10.73	7.955	1.238	0.0	0.0	0.0	0.58	10.3	146.1

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Online Controls for Surface Network 1

Orifice Manhole: 4, DS/PN: 2.001, Volume (m³): 0.2

Diameter (m) 0.030 Discharge Coefficient 0.600 Invert Level (m) 8.636

Orifice Manhole: 6, DS/PN: 3.001, Volume (m³): 0.2

Diameter (m) 0.020 Discharge Coefficient 0.600 Invert Level (m) 8.755

Orifice Manhole: 7, DS/PN: 4.001, Volume (m³): 1.4

Diameter (m) 0.030 Discharge Coefficient 0.600 Invert Level (m) 8.410

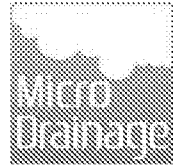
Hydro-Brake® Optimum Manhole: S6, DS/PN: 1.007, Volume (m³): 9.8

Unit Reference	MD-SHE-0067-2500-1630-2500	Sump Available	Yes
Design Head (m)	1.630	Diameter (mm)	67
Design Flow (l/s)	2.5	Invert Level (m)	8.111
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	100
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.630	2.5	Kick-Flo®	0.600	1.6
Flush-Flo™	0.297	2.0	Mean Flow over Head Range	-	1.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should

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Hydro-Brake® Optimum Manhole: S6, DS/PN: 1.007, Volume (m³): 9.8

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.6	0.600	1.6	1.600	2.5	2.600	3.1	5.000	4.2	7.500	5.1
0.200	1.9	0.800	1.8	1.800	2.6	3.000	3.3	5.500	4.4	8.000	5.2
0.300	2.0	1.000	2.0	2.000	2.7	3.500	3.5	6.000	4.6	8.500	5.4
0.400	1.9	1.200	2.2	2.200	2.9	4.000	3.8	6.500	4.7	9.000	5.5
0.500	1.8	1.400	2.3	2.400	3.0	4.500	4.0	7.000	4.9	9.500	5.7

Orifice Manhole: 16, DS/PN: 7.001, Volume (m³): 0.2

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 9.200

Orifice Manhole: 20, DS/PN: 8.002, Volume (m³): 0.3

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 8.684

Hydro-Brake® Optimum Manhole: S11, DS/PN: 7.003, Volume (m³): 13.8

Unit Reference MD-SHE-0067-2500-1600-2500	Sump Available Yes
Design Head (m) 1.600	Diameter (mm) 67
Design Flow (l/s) 2.5	Invert Level (m) 8.228
Flush-Flo™	Calculated Minimum Outlet Pipe Diameter (mm) 100
Objective Minimise upstream storage	Suggested Manhole Diameter (mm) 1200
Application Surface	

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Hydro-Brake® Optimum Manhole: S11, DS/PN: 7.003, Volume (m³): 13.8

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	2.5	Kick-Flo®	0.601	1.6
Flush-Flo™	0.297	2.0	Mean Flow over Head Range	-	1.9

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.6	0.600	1.6	1.600	2.5	2.600	3.1	5.000	4.2	7.500	5.1
0.200	1.9	0.800	1.8	1.800	2.6	3.000	3.3	5.500	4.4	8.000	5.3
0.300	2.0	1.000	2.0	2.000	2.8	3.500	3.6	6.000	4.6	8.500	5.4
0.400	1.9	1.200	2.2	2.200	2.9	4.000	3.8	6.500	4.8	9.000	5.6
0.500	1.8	1.400	2.3	2.400	3.0	4.500	4.0	7.000	5.0	9.500	5.7

Hydro-Brake® Optimum Manhole: S12, DS/PN: 1.010, Volume (m³): 5.9

Unit Reference	MD-SHE-0117-7300-1600-7300	Sump Available	Yes
Design Head (m)	1.600	Diameter (mm)	117
Design Flow (l/s)	7.3	Invert Level (m)	7.955
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	150
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

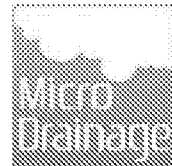
Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	7.3	Kick-Flo®	0.982	5.8
Flush-Flo™	0.479	7.3	Mean Flow over Head Range	-	6.4

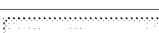
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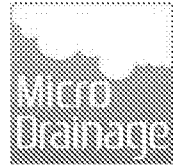
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<u>Hydro-Brake® Optimum Manhole: S12, DS/PN: 1.010, Volume (m³): 5.9</u> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>4.1</td><td>0.600</td><td>7.2</td><td>1.600</td><td>7.3</td><td>2.600</td><td>9.2</td><td>5.000</td><td>12.5</td><td>7.500</td><td>15.2</td></tr><tr><td>0.200</td><td>6.4</td><td>0.800</td><td>6.8</td><td>1.800</td><td>7.7</td><td>3.000</td><td>9.8</td><td>5.500</td><td>13.1</td><td>8.000</td><td>15.6</td></tr><tr><td>0.300</td><td>7.0</td><td>1.000</td><td>5.9</td><td>2.000</td><td>8.1</td><td>3.500</td><td>10.6</td><td>6.000</td><td>13.6</td><td>8.500</td><td>16.1</td></tr><tr><td>0.400</td><td>7.2</td><td>1.200</td><td>6.4</td><td>2.200</td><td>8.5</td><td>4.000</td><td>11.2</td><td>6.500</td><td>14.2</td><td>9.000</td><td>16.6</td></tr><tr><td>0.500</td><td>7.3</td><td>1.400</td><td>6.9</td><td>2.400</td><td>8.8</td><td>4.500</td><td>11.9</td><td>7.000</td><td>14.7</td><td>9.500</td><td>17.0</td></tr></table>			Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	4.1	0.600	7.2	1.600	7.3	2.600	9.2	5.000	12.5	7.500	15.2	0.200	6.4	0.800	6.8	1.800	7.7	3.000	9.8	5.500	13.1	8.000	15.6	0.300	7.0	1.000	5.9	2.000	8.1	3.500	10.6	6.000	13.6	8.500	16.1	0.400	7.2	1.200	6.4	2.200	8.5	4.000	11.2	6.500	14.2	9.000	16.6	0.500	7.3	1.400	6.9	2.400	8.8	4.500	11.9	7.000	14.7	9.500	17.0
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																															
0.100	4.1	0.600	7.2	1.600	7.3	2.600	9.2	5.000	12.5	7.500	15.2																																																															
0.200	6.4	0.800	6.8	1.800	7.7	3.000	9.8	5.500	13.1	8.000	15.6																																																															
0.300	7.0	1.000	5.9	2.000	8.1	3.500	10.6	6.000	13.6	8.500	16.1																																																															
0.400	7.2	1.200	6.4	2.200	8.5	4.000	11.2	6.500	14.2	9.000	16.6																																																															
0.500	7.3	1.400	6.9	2.400	8.8	4.500	11.9	7.000	14.7	9.500	17.0																																																															
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<u>Storage Structures for Surface Network 1</u>					
<u>Porous Car Park Manhole: 3, DS/PN: 2.000</u>					
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	8.550	Depression Storage (mm)	5
Max Percolation (l/s)	202.7	Width (m)	4.8	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	152.0	Membrane Depth (mm)	0
<u>Complex Manhole: S2, DS/PN: 1.003</u>					
<u>Porous Car Park</u>					
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	8.800	Depression Storage (mm)	5
Max Percolation (l/s)	54.7	Width (m)	4.8	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	41.0	Membrane Depth (mm)	0
<u>Porous Car Park</u>					
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	8.800	Depression Storage (mm)	5
Max Percolation (l/s)	75.0	Width (m)	10.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	27.0	Membrane Depth (mm)	0
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XP Solutions	Network 2018.1				
<u>Porous Car Park Manhole: 5, DS/PN: 3.000</u>					
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	8.800	Depression Storage (mm)	5
Max Percolation (l/s)	147.2	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	106.0	Membrane Depth (mm)	0
<u>Porous Car Park Manhole: 6, DS/PN: 4.000</u>					
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	8.700	Depression Storage (mm)	5
Max Percolation (l/s)	313.8	Width (m)	4.2	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	269.0	Membrane Depth (mm)	0
<u>Porous Car Park Manhole: 15, DS/PN: 5.000</u>					
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	9.100	Depression Storage (mm)	5
Max Percolation (l/s)	9.6	Width (m)	4.8	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	7.2	Membrane Depth (mm)	0
<u>Porous Car Park Manhole: 15, DS/PN: 7.000</u>					
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	9.300	Depression Storage (mm)	5
Max Percolation (l/s)	147.2	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	106.0	Membrane Depth (mm)	0
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XP Solutions	Network 2018.1																																																									
<u>Porous Car Park Manhole: 19, DS/PN: 8.000</u> <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Porosity</td><td>0.30</td><td>Slope (1:X)</td><td>0.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Invert Level (m)</td><td>8.750</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Max Percolation (l/s)</td><td>156.0</td><td>Width (m)</td><td>15.6</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Length (m)</td><td>36.0</td><td>Membrane Depth (mm)</td><td>0</td></tr></table> <u>Porous Car Park Manhole: S10, DS/PN: 7.002</u> <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Porosity</td><td>0.30</td><td>Slope (1:X)</td><td>0.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Invert Level (m)</td><td>8.800</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Max Percolation (l/s)</td><td>158.6</td><td>Width (m)</td><td>15.6</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Length (m)</td><td>36.6</td><td>Membrane Depth (mm)</td><td>0</td></tr></table> <u>Tank or Pond Manhole: S12, DS/PN: 1.010</u> Invert Level (m) 8.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>292.0</td><td>1.200</td><td>922.0</td></tr></table>			Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0	Membrane Percolation (mm/hr)	1000	Invert Level (m)	8.750	Depression Storage (mm)	5	Max Percolation (l/s)	156.0	Width (m)	15.6	Evaporation (mm/day)	3	Safety Factor	2.0	Length (m)	36.0	Membrane Depth (mm)	0	Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0	Membrane Percolation (mm/hr)	1000	Invert Level (m)	8.800	Depression Storage (mm)	5	Max Percolation (l/s)	158.6	Width (m)	15.6	Evaporation (mm/day)	3	Safety Factor	2.0	Length (m)	36.6	Membrane Depth (mm)	0	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	292.0	1.200	922.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0																																																					
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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

			Water Surcharged Flooded								Pipe	Status
PN	US/MH Name	Event	US/CL (m)	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Infil. Flow (l/s)	Maximum Vol (m³)	Discharge Vol (m³)	Flow (l/s)	
7.003	S11	120 minute 100 year Summer I+40%	9.865	9.329	0.651	0.000	0.02		13.014	26.914	2.0	SURCHARGED
1.010	S12	1440 minute 100 year Summer I+40%	9.200	9.116	1.011	0.000	0.75		623.727	1016.144	7.3	FLOOD RISK