



◆ **DAVID SMITH ASSOCIATES** ◆ Consulting Structural & Civil Engineers ◆

◆ London ◆ Northampton ◆ Cirencester ◆

www.dsagroup.co.uk

BELL FARM CHURCH
SOUTH ROAD, WEST DRAYTON
SURFACE WATER DRAINAGE REPORT

Client: Bell Farm Christian Centre

Prepared By: Richard Jones

Date: February 2016

Reference: 15/19693

Revision: -

VAT Registration No.: 670 8636 12

Eur Ing **David Smith** BSc(Hons), CEng, MICE, MStructE, IMaPS, MFPWS, FCABE, ACI Arb, **Alison Smith**

Hitesh Jethwa BScEng(Hons), I.Eng, AMIStructE **Steven Ainge** BEng(Hons), I.Eng, AMIStructE

Richard Jones HNC, TMICE, Eng.Tech, **John Mills** MA(Cantab), CEng, MICE, MStructE



London
16 Upper Woburn Place
London
WC1H 0AF
0203 7418098
london@dsagroup.co.uk

Northampton
8 Duncan Close
Moulton Park
Northampton NN3 6WL
01604 782620
northampton@dsagroup.co.uk

Cirencester
Waterloo House
The Waterloo
Cirencester GL7 2PY
01285 657328
cirencester@dsagroup.co.uk



CONTENTS

CONTENTS	1
1 INTRODUCTION	1
1.1 Purpose of Document	1
1.2 Ground Conditions	1
1.3 Development Proposals	1
2 EXISTING DRAINAGE.....	2
2.1 On-Site Drainage	2
3 DESIGN PROPOSALS	2
3.1 Surface Water Drainage Design.....	2
3.1.1 General.....	2
3.2 Drainage Maintenance Regime.....	3
3.2.1 General.....	3
3.2.2 Pipe drainage systems.....	3
3.2.3 Cellular Soakaway System	4
3.2.4 Manhole Soakaway System.....	4
4 CONCLUSIONS.....	5
5 CERTIFICATION	6
APPENDIX A	1
David Smith Associates Drawings	1
APPENDIX B	2
Ground Investigation	2
APPENDIX C	3
Drainage Calculations	3

1 INTRODUCTION

1.1 Purpose of Document

David Smith Associates have been commissioned on behalf of Bell Farm Christian Centre to carry out a Surface Water Drainage Assessment for the proposed development at Bell Farm Church, South Road, West Drayton.

This provides information required for condition 7 of The Council of the London Borough of Hillingdon Planning Permission dated 10th December 2015, planning ref: 4962/APP/2014/3418.

The report is based on the following:

David Smith Associates drawings 15/19693/03, 04, 12, 13, 21, 22 & 23.

Southern Testing Environmental & Geotechnical, Soakaway test results dated 23/02/15

1.2 Ground Conditions

Southern Testing Environmental & Geotechnical investigations indicate that the soils beneath the site are firm to stiff, brown, silty CLAY to 2.4m depth.

At 2.4m depth to the end of investigation at 3.0m depth, the soils are medium dense, brown-orange, clayey, fine to coarse SAND and fine to coarse, subangular to subrounded, flint GRAVEL.

Soil Infiltration rate testing was carried out which provided a soil infiltration rate of 1.91×10^{-4} m/s in the sand and gravel at 2.4 to 3.0m depth.

1.3 Development Proposals

The proposed development is in three phases indicated on DSA drawings 15/19693/03, 12 and 21.

It is proposed to extend the existing building and provide an outdoor paved area and car park.

2 EXISTING DRAINAGE

2.1 On-Site Drainage

There is an existing drainage system serving the existing building on the site. This flows out of the site in the direction of Fir Tree Avenue to the south.

The existing drainage system shall not be affected by the proposals, and shall continue operating as existing.

3 DESIGN PROPOSALS

3.1 Surface Water Drainage Design

3.1.1 General

It is proposed to discharge surface water from the proposed development areas to new soakaways. These will be situated to make use of the favourable soil infiltration rates at 2.4m below ground level.

For Phase 1 and 2, a cellular soakaway system is proposed in an area of open space at the north of the site.

For Phase 3, a manhole type soakaway is proposed in the new car park.

The soakaways have been designed to accommodate the 100 year storm event, including 30% additional rainfall as an allowance for climate change.

Small areas of paving on Phase 1 are proposed to run-off to grip drains around the perimeter, to infiltrate to the surrounding soils over time.

3.2 Drainage Maintenance Regime

3.2.1 General

The Client shall be responsible for maintaining drainage systems for the lifetime of the development and the existence of the impermeable areas of roofs and external paving.

3.2.2 Pipe drainage systems

Pre-Handover

- Provide the client with the full handover pack.
- Brief the occupier's maintenance team on the layout of the drainage and access points.

6 monthly , when extreme rainfall is forecast, and after significant storm events

- Clear leaves litter and debris from all areas of the site and from visible surface features of the drainage system.
- Inspect all manholes, road gullies and threshold drains. Collect and dispose of any silt present. Monitor the speed of silt build up and increase frequency of maintenance if required.

At 5 year intervals

- CCTV survey of entire drainage system. Removal of silt and debris as required. Replace or repair any areas of failure.

It is recommended that pipework is regularly flushed through with a hosepipe of similar to ensure it is flowing satisfactorily.

If blockages are noted, this may require more robust rodding, or a CCTV and jetting service. A CCTV survey could identify damage to pipes that would need repair.

3.2.3 Cellular Soakaway System

Pre-Handover

- Provide the client with the full handover pack.
- Brief the occupier's maintenance team on the layout of the drainage and the location of the cellular storage system.

At 36 month intervals

- CCTV survey of the inlet/outlet pipework and the access tunnels of the cellular storage units.
- If silt build up is over 20% of the overall depth, the system shall be excavated and replaced with a like-for-like system.

At 10 year intervals

- Carry out a soil infiltration test in the soakaway to BRE Digest 365.
- It is possible that the soil infiltration rate has reduced as a result of siltation. Depending on an expert analysis of the results, it may be necessary to consider additional or replacement cellular units to maintain the design capacity.

3.2.4 Manhole Soakaway System

Pre-Handover

- Provide the client with the full handover pack.
- Brief the occupier's maintenance team on the layout of the drainage and the location of the manhole soakaway system.

At 6 month intervals

Carry out inspection and silt removal as Piped Drainage System in 3.2.2

At 10 year intervals

- Carry out a soil infiltration test in the manhole soakaway to BRE Digest 365.
- It is possible that the soil infiltration rate has reduced as a result of siltation. Depending on an expert analysis of the results, it may be necessary to consider a secondary overflow soakaway chamber to maintain the design capacity.

4 CONCLUSIONS

The proposals for the site increase the impermeable area and amount of surface water runoff that will be generated.

The use of soakaway drainage systems aims to prevent any increase in surface water flowing off-site. This has been simulated in the 100 year storm event, including 30% additional rainfall as an allowance for climate change.

The maintenance regimes included in the report aim to ensure that drainage systems and soakaways operate to their maximum capacity for the lifetime of the development.

5 **CERTIFICATION**

We trust that this report is satisfactory for your present requirements. However, should you require any further information or clarification, please do not hesitate to contact the undersigned.

Prepared by

Richard Jones T.M.I.C.E, Eng. Tech

Date: 8th February 2016

David Smith Associates

8 Duncan Close

Moulton Park

Northampton

NN3 6WL

Tel: 01604-782620

Fax: 01604-782629

APPENDIX A

David Smith Associates Drawings

15/19693/03 – Proposed Surface Water Drainage & External Works – Phase 1

15/19693/04 – Proposed Drainage & External Works Construction Details– Phase 1

15/19693/12 – Proposed Surface Water Drainage & External Works – Phase 2

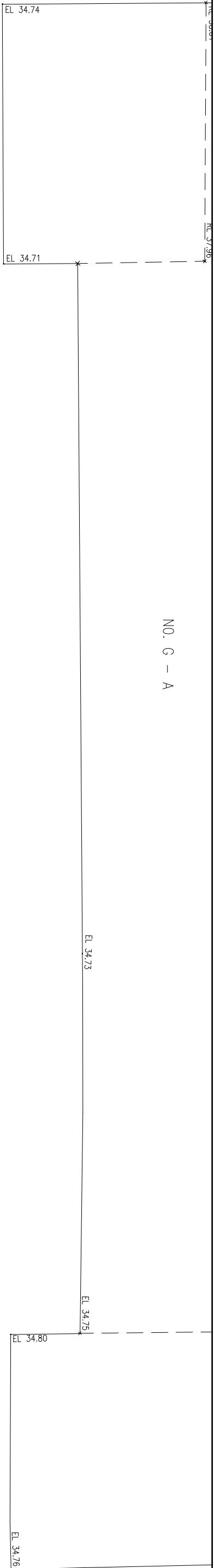
15/19693/13 – Proposed Drainage & External Works Construction Details– Phase 2

15/19693/21A – Proposed Surface Water Drainage & External Works – Phase 3

15/19693/22 – Proposed Drainage & External Works Construction Details 1 of 2 – Phase 3

15/19693/23 – Proposed Drainage & External Works Construction Details 2 of 2 – Phase 3

NO. G - A

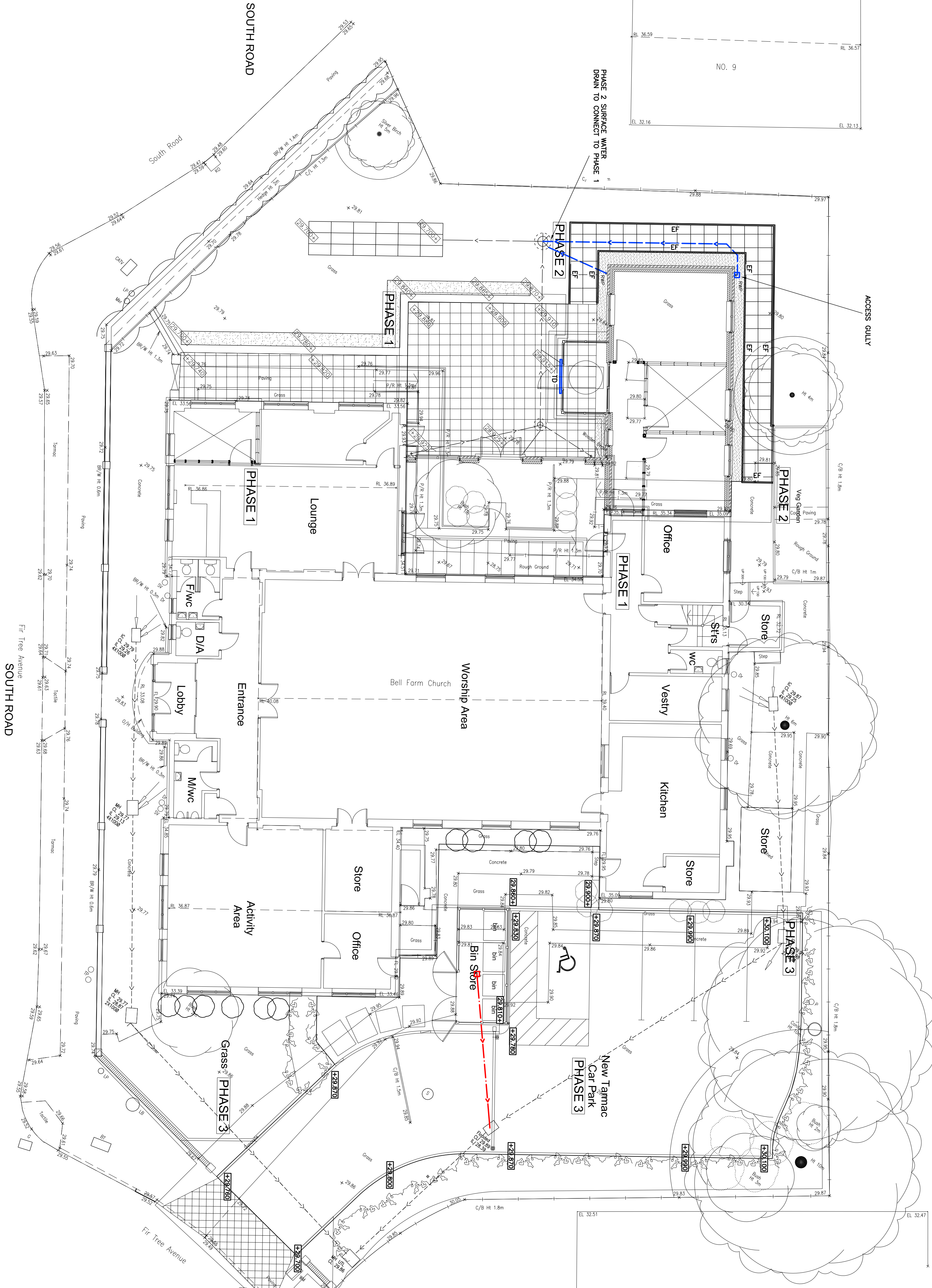


- KEY
- IC MANHOLE TYPE 2 (C) (700mm DEEP)
- PROPOSED SURFACE WATER DRAIN, 100# UNLESS SHOWN OTHERWISE
- TD THRESHOLD DRAIN
- EF PCC FLAT TOP EDGING
- PROPOSED LEVEL
- PCC SLAB CONSTRUCTION

- Notes
1. IF IN DOUBT - ASK !!! DO NOT SCALE
 2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ARCHITECTS AND ENGINEERS DRAWINGS.
 3. ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH THE RELEVANT BRITISH STANDARDS, CODES OF PRACTICE AND BUILDING PRACTICE.
 4. ALL DIMENSIONS TO BE CHECKED PRIOR TO STARTING THE WORKS ON SITE. ANY DISCREPANCIES TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
 5. CONTRACTOR TO ASCERTAIN THE LOCATION OF SERVICES ON SITE PRIOR TO STARTING THE WORK.
 6. ALL DIMENSIONS FOR CONSTRUCTION ARE TO BE OBTAINED FROM SITE MEASUREMENTS OR ARCHITECTS SETTING OUT DRAWINGS PRIOR TO MANUFACTURE/BUILDING.
 7. THE SOAKAWAY HAS BEEN SIZED ON AN SOIL INFILTRATION RATE OF 1.91x10⁻⁷m/s PROVIDED BY CLIENT.
 8. LOCATION OF SOAKAWAY TO BE MIN. 5.0m FROM ALL BUILDINGS TO OUTER EDGE OF TYPE B8 FILL MATERIAL.
 9. EXISTING PREWORK TO BE ABANDONED SHALL BE BROKEN OUT, OR BACKFILLED WITH CLASS C20 CONCRETE WITH ENDS GROUTED UP.
 10. EXISTING PAVING AND SURFACING TO BE REINSTATED USING WORKS TAKE PLACE.
 11. ALL PREWORK TO BE 100# UNLESS SHOWN OTHERWISE.

DRAINAGE NOTES

1. ALL PREWORK TO BE VITRIFIED CLAY TO BS EN 295-1:1991 OR PLASTIC TO BS4660:2000 AND BS EN 405-1:1998 UNLESS SPECIFIED OTHERWISE. ONLY CLAY PIPES TO BE USED WHERE MANHOLE/SOIL WASTE IS PERMITTED.
2. BACK FILL TO PIPE TRENCHES SHALL BE PLACED AND COMPACTED TO SHW CLAUSE 505.
3. MANHOLE COVER LEVELS SHALL BE ADJUSTED WHERE NECESSARY TO SUIT FINISHED LEVELS.
4. TRAFFICKED AREAS: CLASS D400, CLASS B125 AND CLASS B125 (DOUBLE SEAL AND GREASE TO FOUL WATER).
5. MANHOLE ACCESS SIZE: DEPTH UP TO 1.2m = 430x430 DEPTH OVER 1.2m = 300x300 MAX.
6. BRICKWORK SHALL BE IN CLASS 'P' ENGINEERING BRICK TO BS 3921 IN ENGLISH BOND SET IN CLASS 1 MORTAR.
7. ALL PRECAST CONCRETE COMPONENTS SHALL BE IN ACCORDANCE WITH BS 5911 PART 2:2011:1994.
8. CEMENT - SULPHATE RESISTING CEMENT TO BS4027:1991 SHALL BE USED IN ALL CASES INCLUDING PRECAST LOCAL AUTHORITY.
9. CONCRETE - CONCRETE MIX DESIGNS SHALL HAVE A MINIMUM CEMENT/FAIR RATIO 350KG/m³, A MAXIMUM FREE WATER/CEMENT RATIO 0.50 AND 20mm NOMINAL MAXIMUM SIZE AGGREGATE.
10. ALL MANHOLES TO BE MARKED WITH FW OR SW AS APPROPRIATE.



TENDER

CLIENT
BELL FARM CHRISTIAN CENTRE

CONTRACT
BELL FARM CHURCH
SOUTH ROAD, WEST DRAYTON
MIDDLESEX

TITLE
PROPOSED SURFACE WATER
DRAINAGE AND EXTERNAL
WORKS. PHASE 2

ARCHITECT
STIMPSON WALTON BOND

DRAWN CHD DATE SCALE
RDJ APRIL '15 1:100 @ A1

David Smith Associates
Consulting Structural & Civil Engineers

Tel: (01804) 782620 8 Duncan Close
Fax: (01804) 782629 Moulton Park
Email: post@dsacgroup.co.uk Northampton NN3 6WL

DRAWING NUMBER 15 19693/12 REVISION

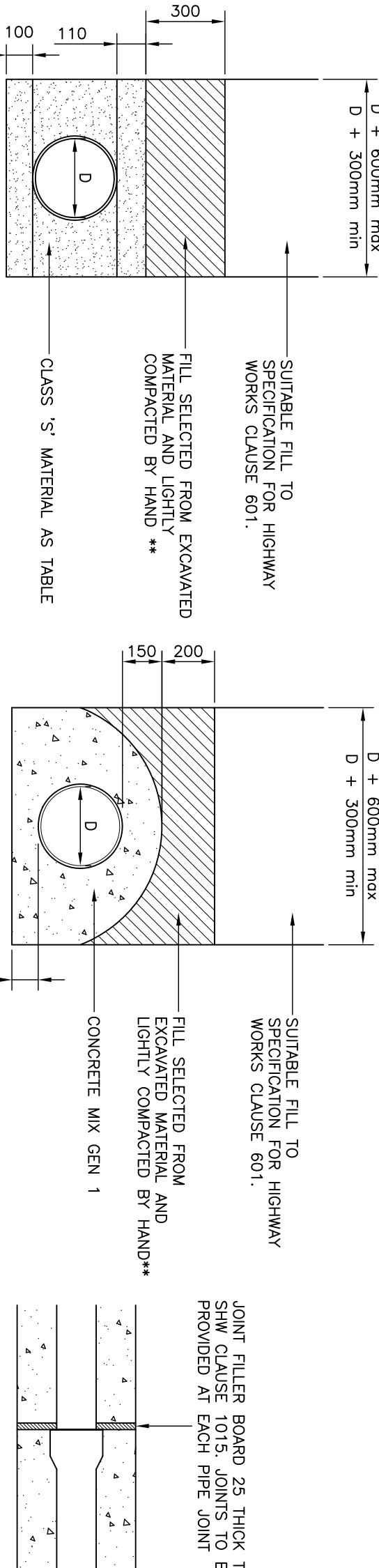
02.04.14

Notes

1. IF IN DOUBT – ASK !!! DO NOT SCALE
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ARCHITECTS AND ENGINEERS DRAWINGS.
3. ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH THE RELEVANT BRITISH STANDARDS, CODES OF PRACTICE AND BUILDING PRACTICE.
4. ALL DIMENSIONS TO BE CHECKED PRIOR TO STARTING THE WORKS ON SITE. ANY DISCREPANCIES TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
5. CONTRACTOR TO ASCERTAIN THE LOCATION OF SERVICES ON SITE PRIOR TO STARTING THE WORK.
6. ALL DIMENSIONS FOR CONSTRUCTION ARE TO BE OBTAINED FROM SITE MEASUREMENTS OR ARCHITECTS SETTING OUT DRAWINGS PRIOR TO MANUFACTURE/BUILDING.

KERBSING NOTES

1. ALL KERBS TO BE IN ACCORDANCE WITH BS 7263 PART 1, AND HYDRAULICALLY PRESSED.
2. KERBS FOUNDATIONS FOR TYPES HB, SP, BN AND RAMPED KERBS SHALL BE NOT LESS THAN 150mm THICK, AND SHOULD BE SEATED ON OR IN THE SUB-BASE THIS FOUNDATION TO BE CONSTRUCTED ON PAVEDMENT CONSTRUCTION THICKNESS ADOPTED.
3. ALL KERBS SHALL BE LAID ON A BED OF MORTAR (1) SET IN BED OF CONCRETE (2) TO A MINIMUM OF THE SPECIFICATION FOR HIGHWAY WORKS, 2404 OF THE SPECIFICATION.
4. ADEQUATE BOND SHALL BE PROVIDED BETWEEN KERBS AND PAVEDMENT, PREFERRED METHODS OF BONDING ARE:
 - 1) STEEL REINFORCEMENT HOOPS AT 900mm CENTRES
 - ii) STEEL REINFORCEMENT MESHOR ANY OTHER METHOD TO BE APPROVED BY THE ENGINEER.
5. MORTAR JOINTS BETWEEN KERBS NOT TO BE PROVIDED UNLESS SPECIFIED. GAPS BETWEEN KERBS TO BE 1-2mm. KERBS SHALL BE MANUFACTURED TO A STANDARD LENGTH OF 15m CENTRES WHEN LAID ADJACENT TO OR ON CONCRETE PAVEDMENT.
6. FOR RADIUSSED WORK KERBS SHALL BE AS FOLLOWS:
 - RADIUS 12m OR LESS – KERBS MANUFACTURED TO AN APPROPRIATE RADIUS.
 - RADIUS 12m TO 20m – STRAIGHT KERBS OF NOT MORE THAN 600mm LENGTH.
 - RADIUS 20m OR GREATER – STRAIGHT KERBS OF A STANDARD LENGTH.
7. PRECAST TRANSITION UNITS, INTERNAL AND EXTERNAL ANGLE UNITS, AND QUADRANT UNITS TO BE USED AS REQUIRED.
8. FOR ANY UNIT WEIGHT GREATER THAN 20KG, MECHANICAL LIFTING METHODS MAY BE REQUIRED.



CLASS S BEDDING DETAILS

CLASS Z BEDDING DETAILS

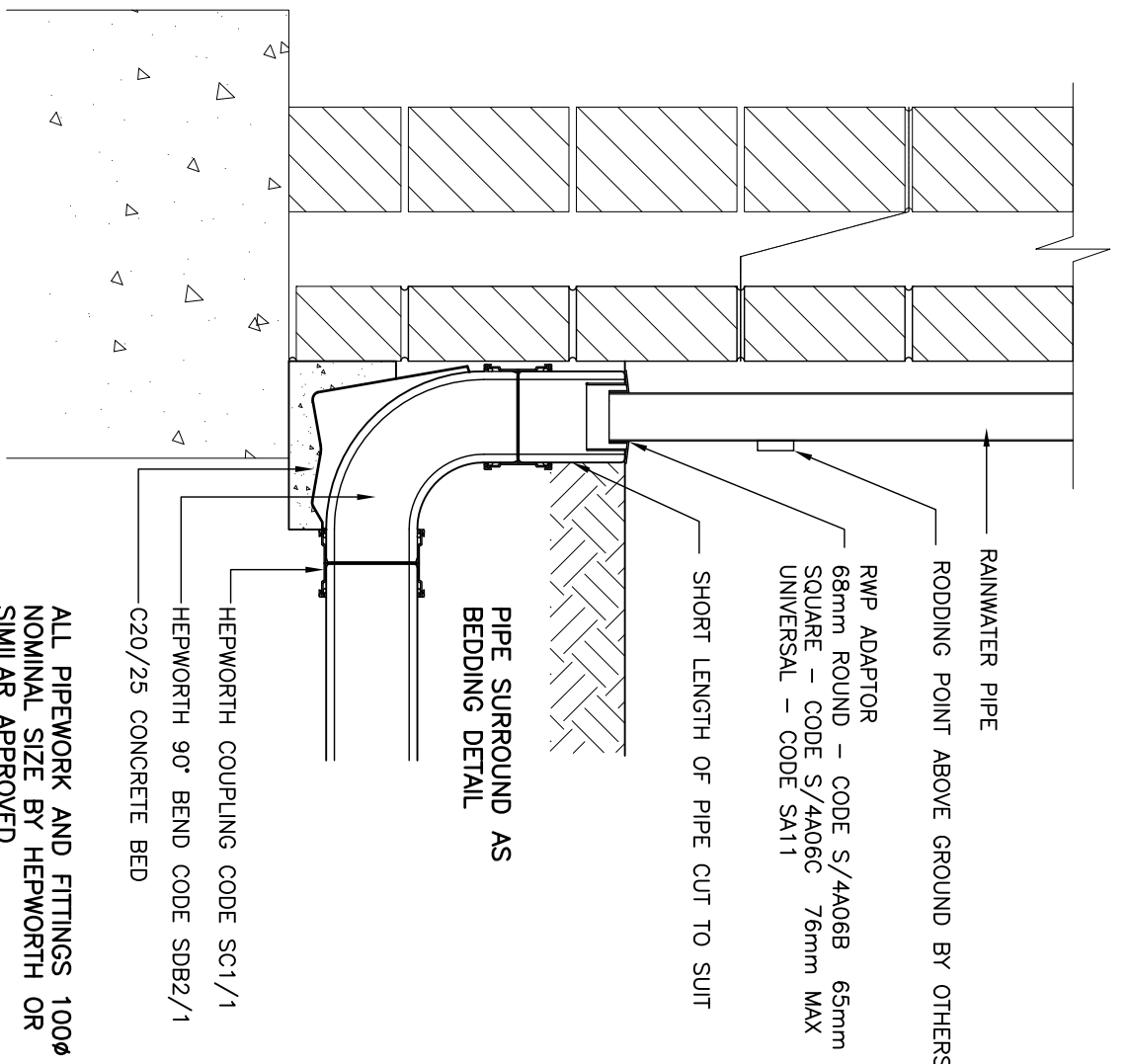
CONCRETE SURROUND PIPE DETAIL

CLASS 'S' BEDDING AND SURROUND			
NOMINAL PIPE Ø (mm)	BS882:1992 COARSE AGGREGATE (TABLE 3)		
	GRADED AGGREGATE RANGES (mm)	SINGLE SIZED AGGREGATE RANGES (mm)	
NOT EXCEEDING 140	—	10	
EXCEEDING 140 BUT NOT EXCEEDING 400	20 to 5 or 14 to 5	10, 14 or 20	
EXCEEDING 400	14 to 5, 20 to 5 or 40 to 5	10, 14 20 or 40	

SELECTED FILL : SELECTED FILL SHOULD BE READILY COMPACTABLE, ** FREE FROM TWIGS, FROZEN MATERIAL, VEGETABLE AND FOREIGN MATTER AND SHOULD BE SETTLING AND STABILISED ON A 100mm SIEVE AND STONES RETAINED ON A 40mm SIEVE.

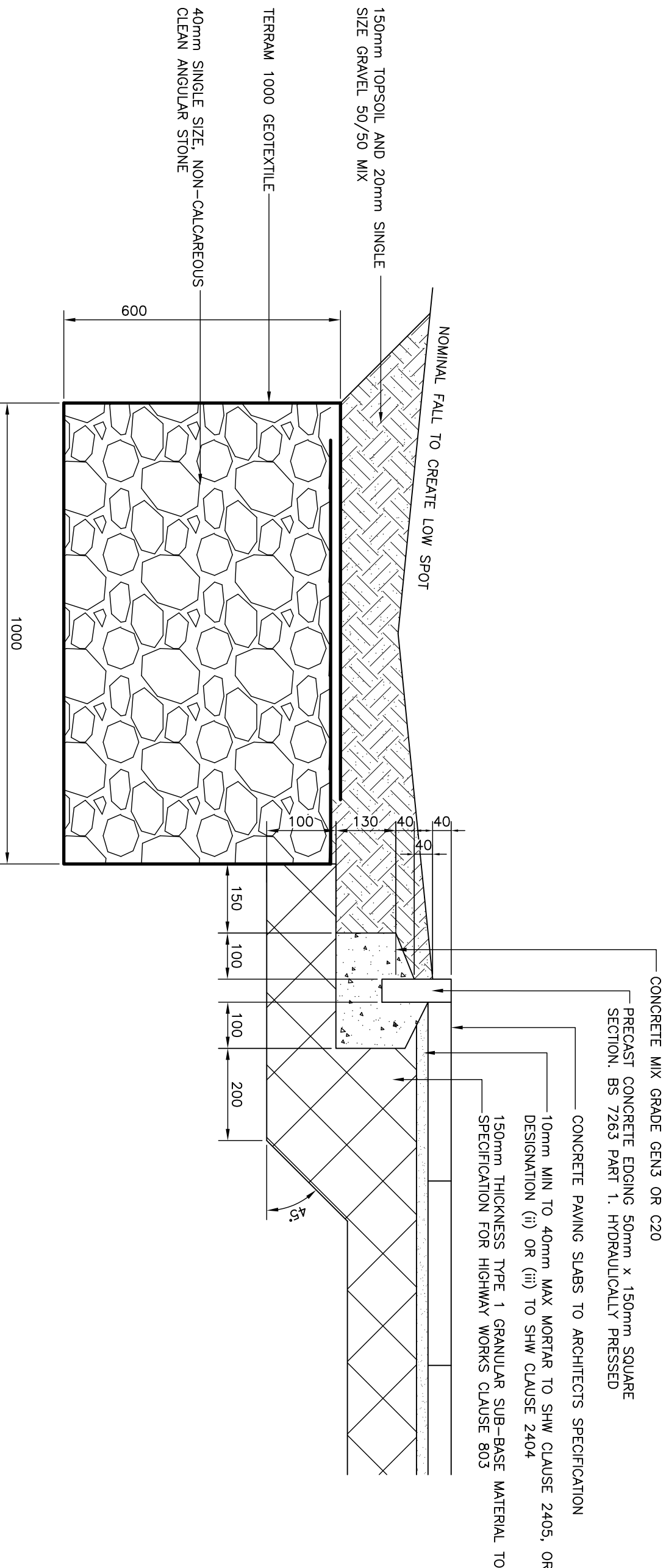
BACKFILL AND BEDDING DETAILS TO PIPES

1:20



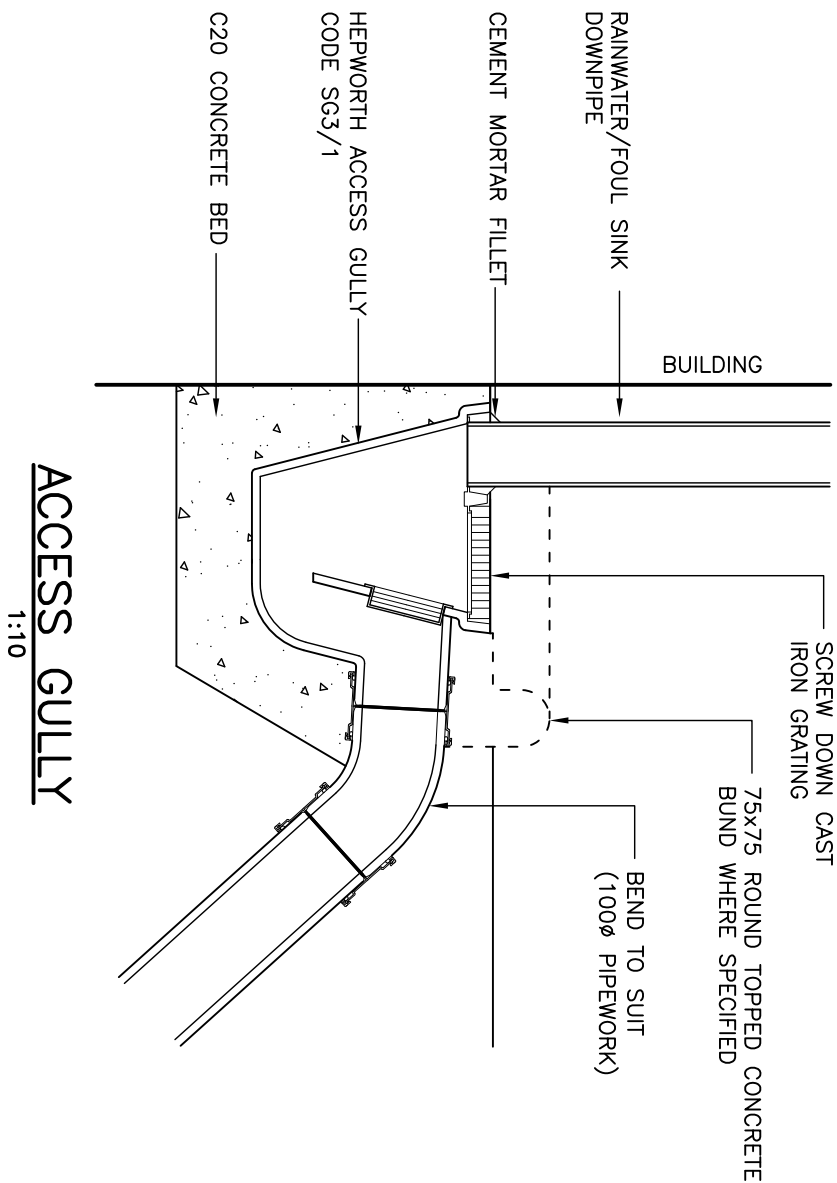
EXTERNAL RAINWATER PIPE DIRECT CONNECTION DETAIL

1:10



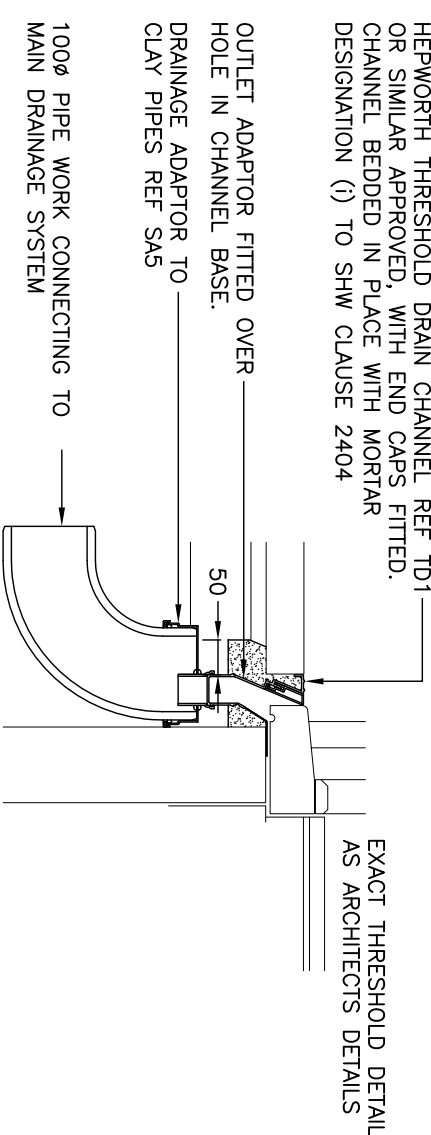
CONCRETE PAVING SLAB, FOOTWAY EDGING AND GRIP DRAIN

1:10



ACCESS GULLY

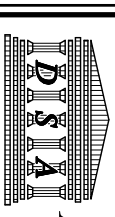
1:10



THRESHOLD DRAIN

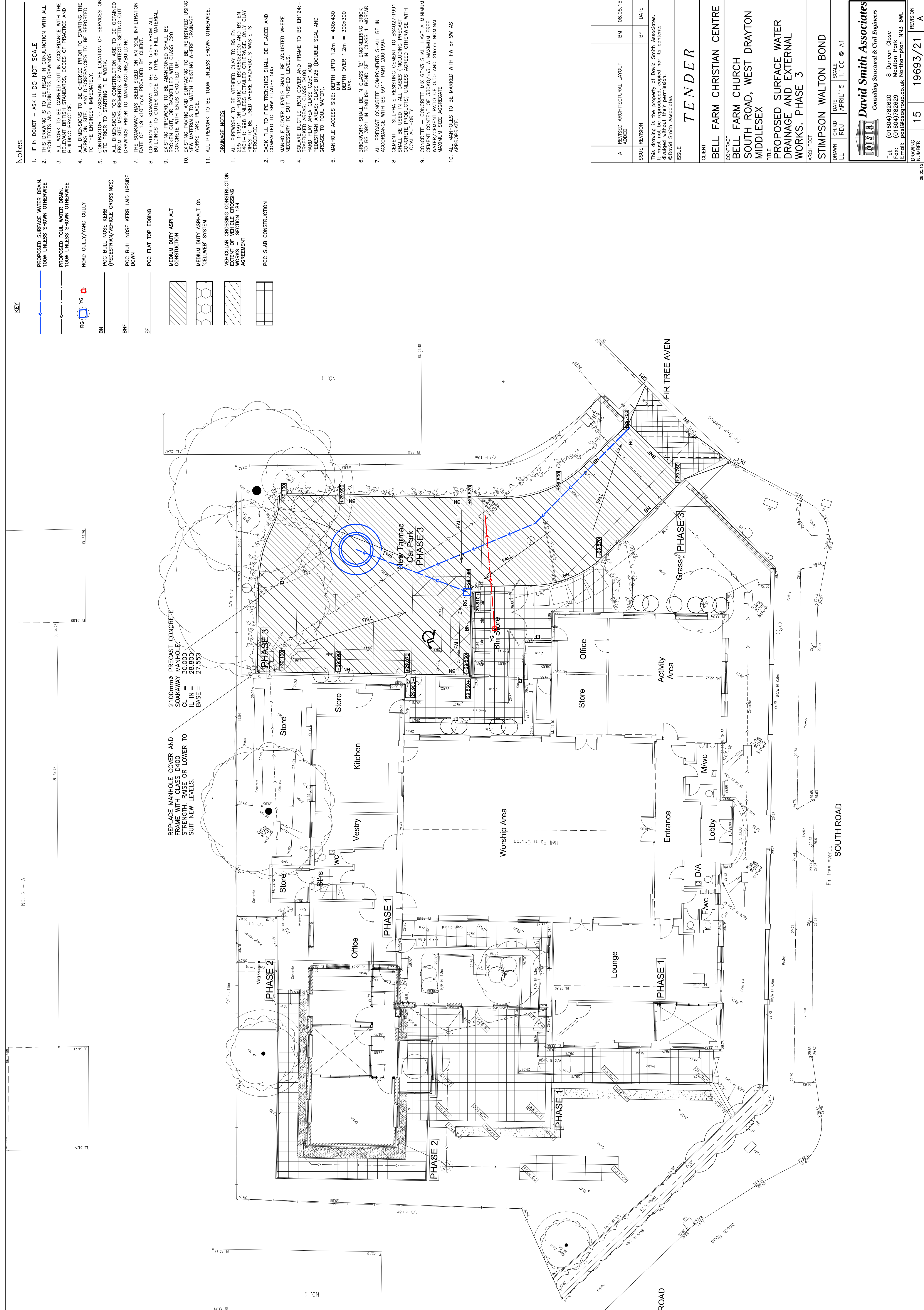
1:10

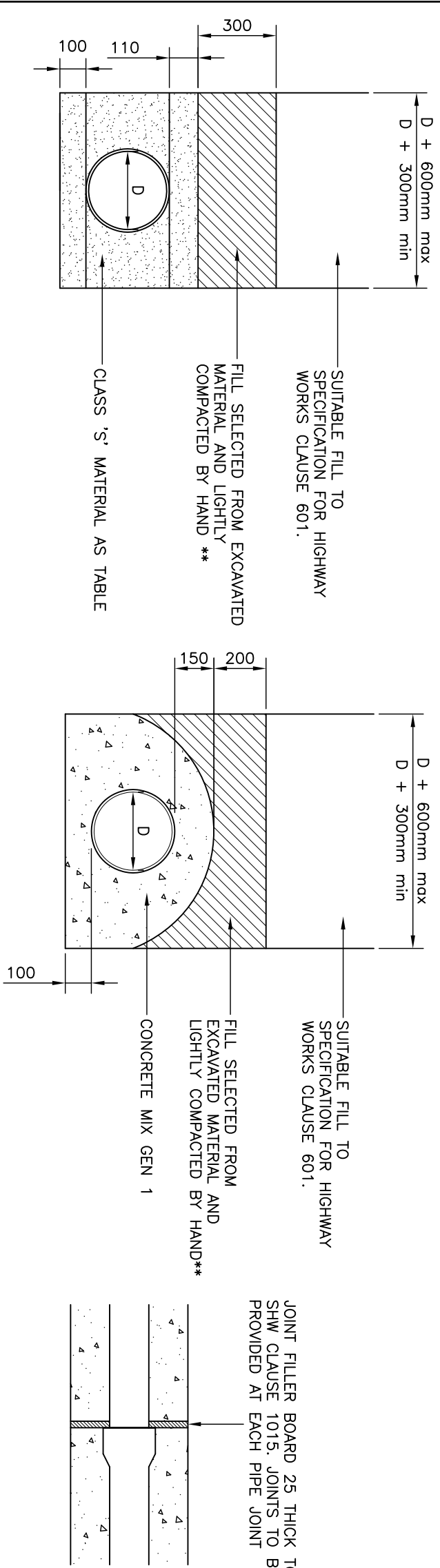
ISSUE	REVISION	BY	DATE
This drawing is the property of David Smith Associates. It must not be reproduced, copied nor its contents disclosed without their permission. © David Smith Associates			
CLIENT			
BELL FARM CHRISTIAN CENTRE			
CONTRACT			
BELL FARM CHURCH SOUTH ROAD, WEST DRAYTON MIDDLESEX			
TITLE			
PROPOSED DRAINAGE AND EXTERNAL CONSTRUCTION DETAILS. PHASE 2			
ARCHITECT			
STIMPSON WALTON BOND			
DRAWN			
LT	CHAD	DATE	SCALE
RDJ	APRIL '15	AS SHOWN	@ A1



David Smith Associates
Consulting Structural & Civil Engineers

Tel: (01804)782620 8 Duncan Close
Fax: (01804)782629 Moulton Park
Email: post@dsacgroup.co.uk Northampton NN3 6WL





CLASS S BEDDING DETAILS

CLASS Z BEDDING DETAILS

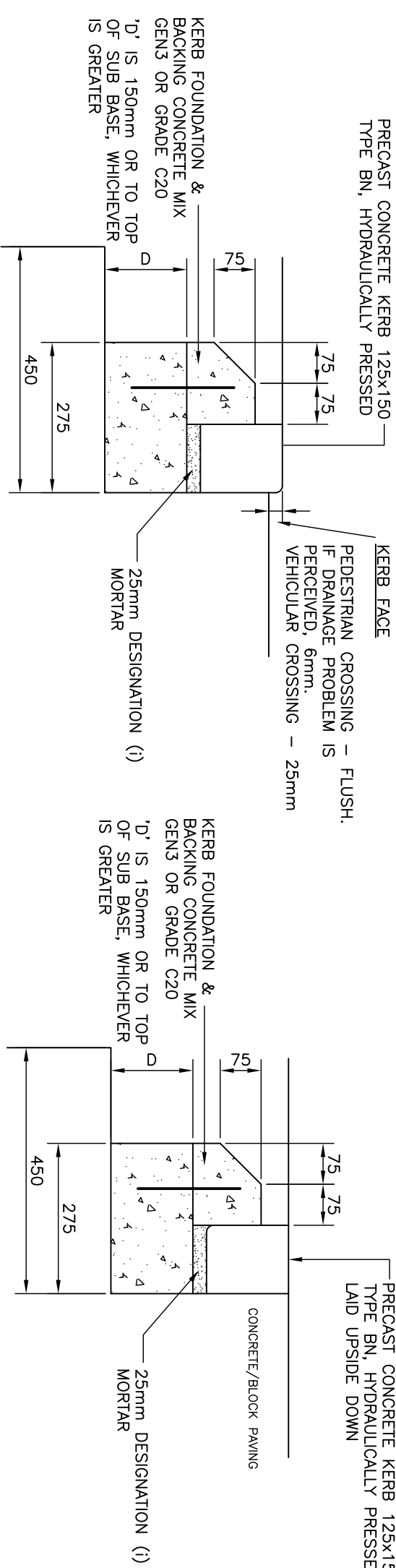
CONCRETE SURROUND PIPE DETAIL

CLASS "C" BEDDING AND SURROUND			
NOMINAL PIPE Ø (mm)	B882:1992 COARSE AGGREGATE (TABLE 3)		SINGLE SIZED AGGREGATE RANGES (mm)
	GRADED AGGREGATE RANGES (mm)		
NOT EXCEEDING 140	—		10
EXCEEDING 140 BUT NOT EXCEEDING 400	20 to 5 or 14 to 5		10, 14 or 20
EXCEEDING 400	14 to 5, 20 to 5 or 40 to 5		10, 14 20 or 40

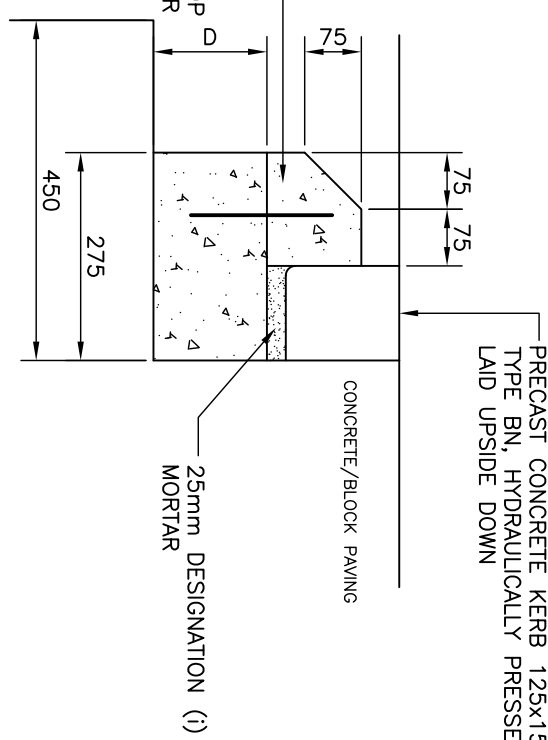
SITUATION AND COVER DEPTH Cover is from crown of pipe to finished ground surface (m)		BEDDING CLASS
MIN	MAX	PLASTIC
PERIMATE AREAS		
0.6	5.5	S
LESS THAN 0.6 OR WITHIN 100mm OF ANY NEW FOUNDATIONS AND GULLY CONNECTIONS		Z

SELECTED FILL : SELECTED FILL SHOULD BE READILY COMPACTABLE,
** FREE FROM TIMBER, FROZEN MATERIAL, VEGETABLE AND FOREIGN
MATTER AND EXCLUDE HARD LUMPS OF CLAY RETAINED ON A 100mm
SIEVE AND STONES RETAINED ON A 40mm SIEVE.

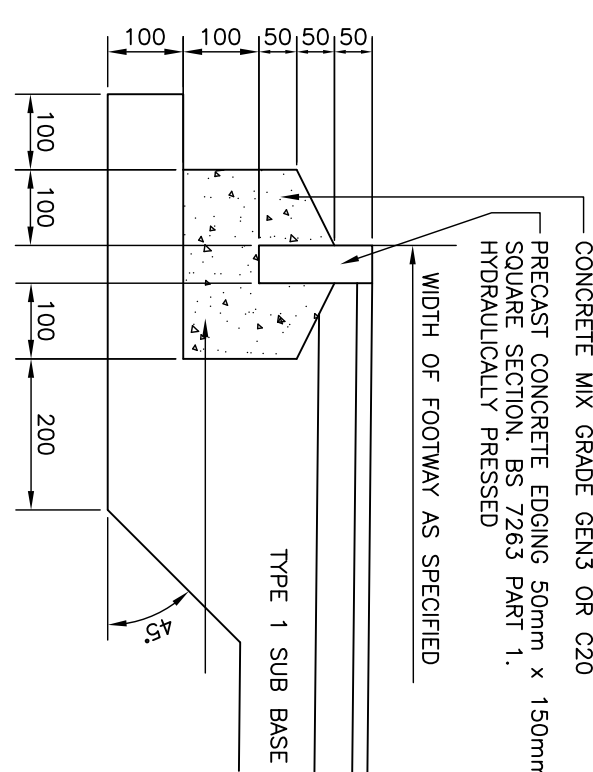
BACKFILL AND BEDDING DETAILS TO PIPES



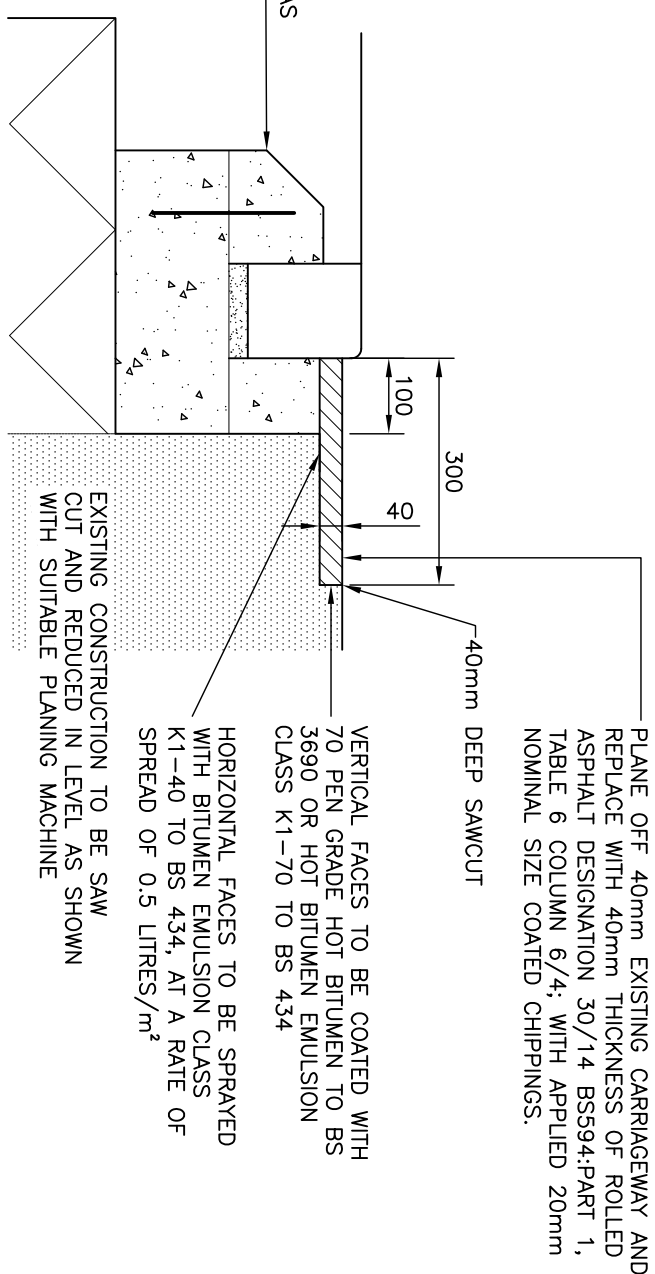
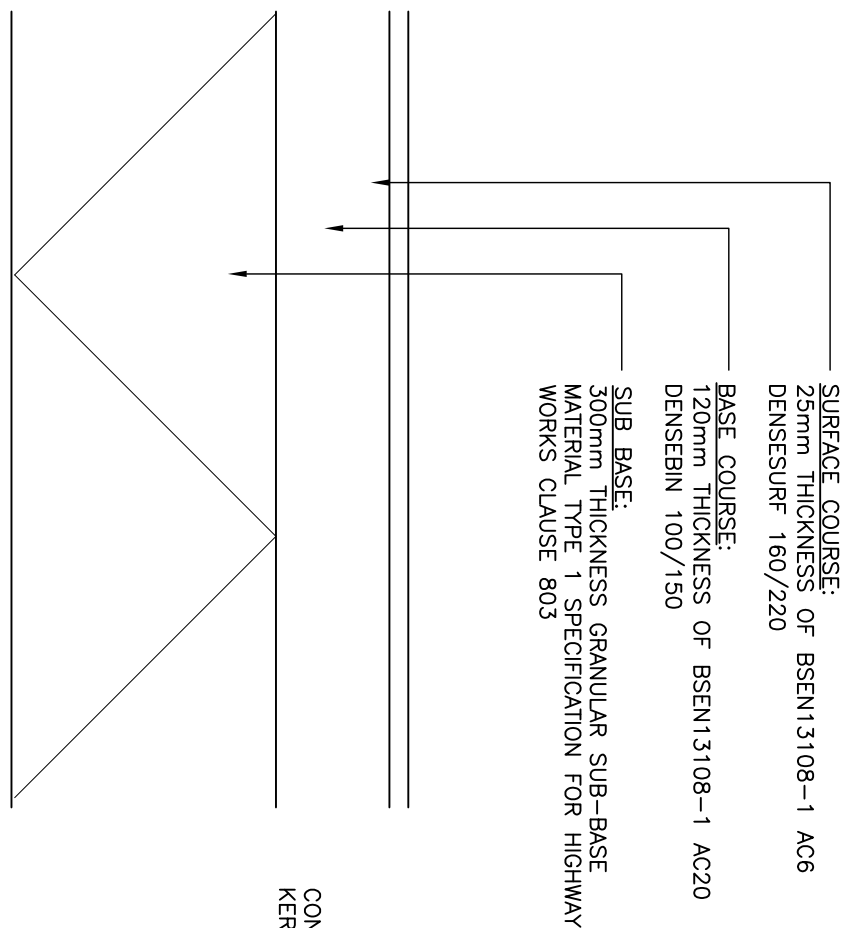
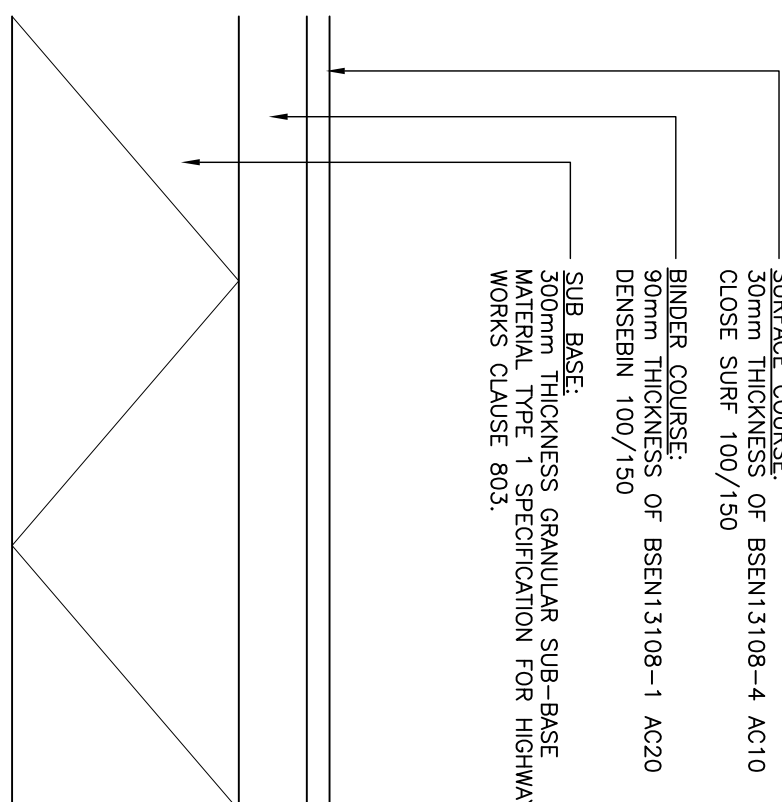
KERBING TYPE BN
1:10



KERBING TYPE BNF
1:10



KERBING TYPE EF
1:10



MEDIUM DUTY TARMAC CONSTRUCTION
(CARPARK AREA)

ASPHALT VEHICULAR CROSSING CONSTRUCTION

NEW P.C.C. KERBING IN
EXISTING CARRIAGEWAY

1. IF IN DOUBT - ASK !!! DO NOT SOLE
2. THE DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ARCHITECTS AND ENGINEERS DRAWINGS.
3. ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH ALL RELEVANT BRITISH STANDARDS, CODES OF PRACTICE AND BUILDING PRACTICE.
4. ALL DIMENSIONS TO BE CHECKED PRIOR TO STARTING THE WORKS ON SITE. ANY DISCREPANCIES TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
5. CONTRACTOR TO ASCERTAIN THE LOCATION OF SERVICES ON SITE PRIOR TO STARTING THE WORK.
6. ALL DIMENSIONS FOR CONSTRUCTION ARE TO BE OBTAINED FROM SITE MEASUREMENTS OF ARCHITECTS SETTING OUT DRAWINGS PRIOR TO MANUFACTURE/BUILDING.

KERBING NOTES

1. ALL KERBS TO BE IN ACCORDANCE WITH BS 7563 PART 1, AND HYDRAULICALLY PRESSED.
2. KERB FOUNDATIONS FOR TYPES 4B, SP, BN AND RAMPED KERBS SHALL BE NOT LESS THAN 150mm THICK, AND SHOULD BE SETTED ON OR IN THE SUB-BASE THIS DRAINAGE OR PAVEMENT CONSTRUCTION THICKNESS ADOPTED.
3. ALL KERBS SHALL BE LAID ON A BED OF MORTAR DRESSING, 100mm THICK, OR AS SPECIFIED IN THE SPECIFICATION FOR HIGHWAY WORKS.
4. JOINTS AND BOND SHALL BE PROVIDED BETWEEN KERBS, TO MATCH, PREPARED METHODS OF BONDING ARE:
 - i) STEEL REINFORCEMENT HOOPS AT 900mm CENTRES
 - ii) STEEL REINFORCEMENT MESH
 - OR ANY OTHER METHOD TO BE APPROVED BY THE ENGINEER.
5. JOINTS BETWEEN KERBS NOT TO BE PROVIDED UNLESS SPECIFIED, JOINTS BETWEEN KERBS TO BE 12mm MINIMUM, JOINTS BETWEEN KERBS TO BE PAVED IN 15m CENTRES WHEN LAID ADJACENT TO OR ON CONCRETE PAVEMENT.
6. FOR RAISED WORK KERBS SHALL BE AS FOLLOWS:
 - a) RADII 12m OR LESS – KERBS MANUFACTURED TO AN APPROPRIATE RADIUS –
 - b) RADII 12m TO 20m – STRAIGHT KERBS OF NOT MORE THAN 600mm LENGTH,
 - c) RADII 20m OR GREATER – STRAIGHT KERBS OF A STANDARD LENGTH.
7. PRECAST TRANSITION UNITS, INTERNAL AND EXTERNAL ANGLE UNITS, AND QUADRANT UNITS TO BE USED AS REQUIRED.
8. FOR ANY UNIT WEIGHT GREATER THAN 20KG, MECHANICAL LIFTING METHODS MAY BE REQUIRED.

ISSUE	REVISION	BY	DATE

This drawing is the property of David Smith Associates. It must not be reproduced, copied nor its contents divulged without their permission.

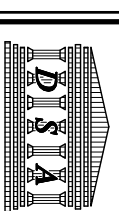
TENDER

CLIENT	BELL FARM CHRISTIAN CENTRE
CONTRACT	BELL FARM CHURCH SOUTH ROAD, WEST DRAYTON MIDDLESEX

PROPOSED DRAINAGE AND
EXTERNAL CONSTRUCTION
DETAILS 1/2. PHASE 3

ARCHITECT
STIMPSON WALTON BOND

DRAWN	CH:KD	DATE	SCALE
LL	RDU	APRIL'15	AS SHOWN @ A1



David Smith Associates
Consulting Structural & Civil Engineers

Tel: (01604)782620 8 Duncan Close
Fax: (01604)782629 Moulton Park
Email: post@dsagroup.co.uk Northampton NN1

02.4

1. IF IN DOUBT – ASK !!! DO NOT SCALE
 2. THE DRAWING IS TO BE READ IN ACCORDANCE WITH ALL ARCHITECTS AND ENGINEERS' DRAWINGS.
 3. ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH THE RELEVANT BRITISH STANDARDS, CODES OF PRACTICE AND BUILDING PRACTICE.
 4. ALL DIMENSIONS TO BE CHECKED PRIOR TO STARTING THE WORKS ON SITE. ANY DISCREPANCIES TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
 5. CONTRACTOR TO ASCERTAIN THE LOCATION OF SERVICES ON SITE PRIOR TO STARTING THE WORK.
 6. ALL DIMENSIONS FOR CONSTRUCTION ARE TO BE OBTAINED FROM SITE MEASUREMENTS OF ARCHITECTS SETTING OUT DRAWINGS PRIOR TO MANUFACTURING/BUILDING.
- KEEPING NOTES**
1. ALL KEYS TO BE IN ACCORDANCE WITH BS 7583 PART 1, AND HYDRAULICALLY PRESSED.
 2. KEEP FOUNDATIONS FOR TYPES HB, SP, BN AND RAMPED KEYS SHALL BE NOT LESS THAN 150mm THICK, AND SHOULD BE SETTED ON OR IN THE SUB-BASE THIS SPECIFICATION FOR PAVENTMENT CONSTRUCTION THICKNESS ADAPTED.
 3. ALL KEYS SHALL BE LAID ON A BED OF MORTAR SPECIFICATION FOR HIGHWAY WORKS.
 4. ADEQUATE BOND SHALL BE PROVIDED BETWEEN BONDING ARE.
 5. STEEL REINFORCEMENT HOOPS AT 900mm CENTRES
 - i) STEEL REINFORCEMENT MESH
 - ii) OTHER METHOD TO BE APPROVED BY THE ENGINEER.
 5. MORTAR JOINTS BETWEEN KEYS NOT TO BE PROVIDED UNLESS SPECIFIED, GAPS BETWEEN KEYS TO BE 1-2mm THEREBY JOINTING IS REQUIRED. EXTENSION JOINTS SHALL BE USED WHERE NECESSARY. JOINTS SHALL BE 15m CENTRES WHEN LAID DIRECTLY TO OR ON CONCRETE PAVEMENT.

6. FOR RADUSED WORK KERBS SHALL BE AS FOLLOWS

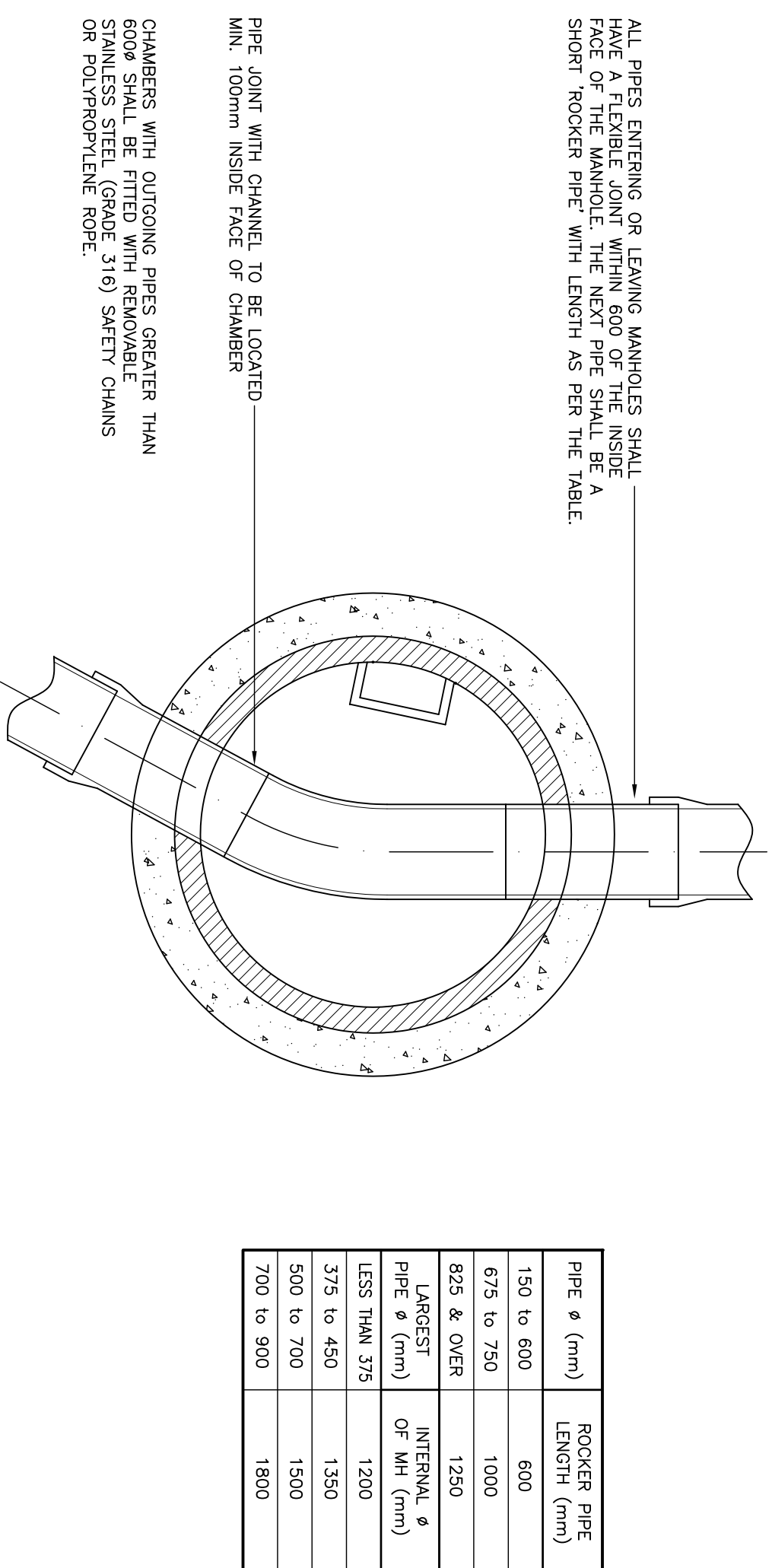
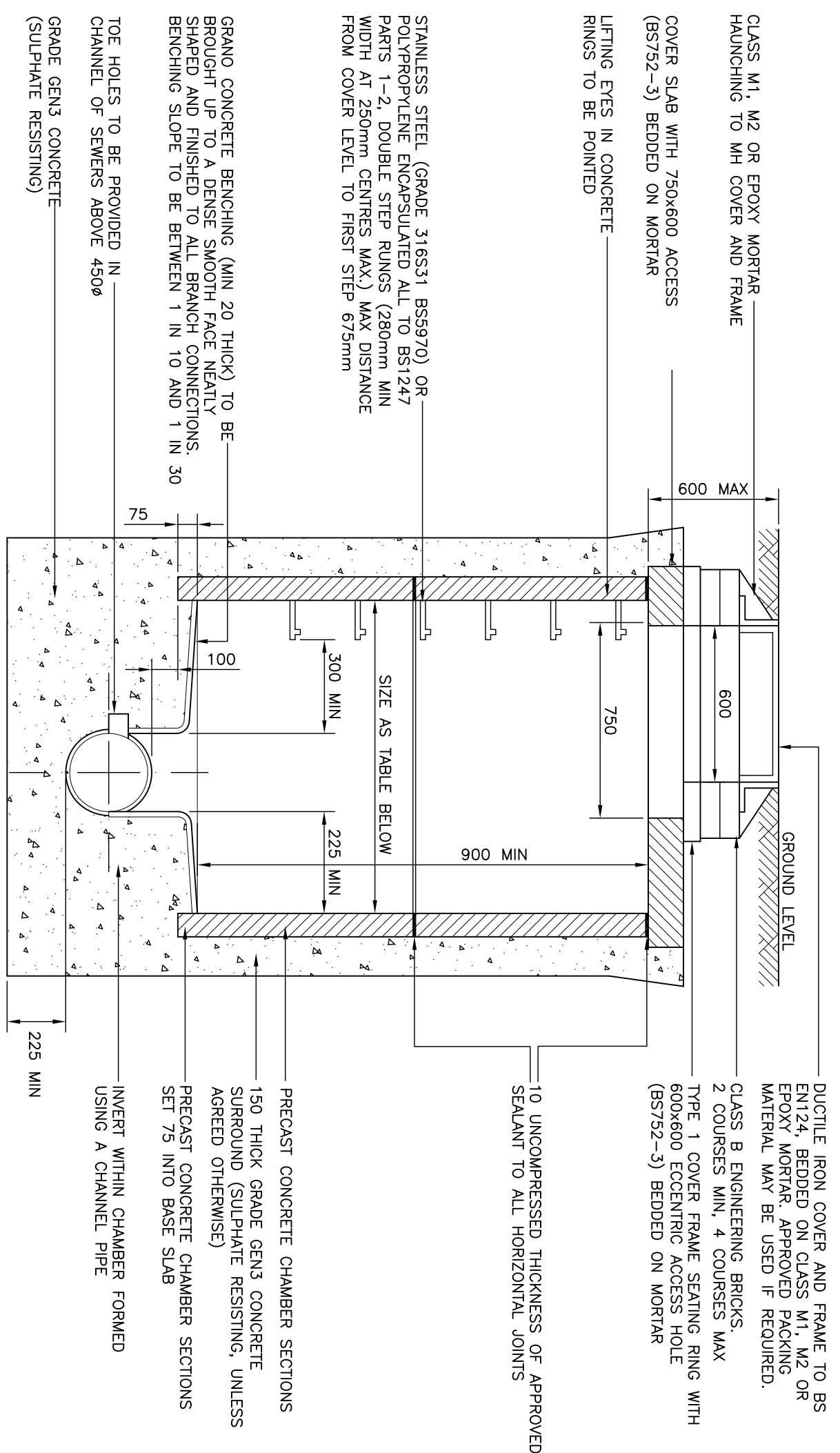
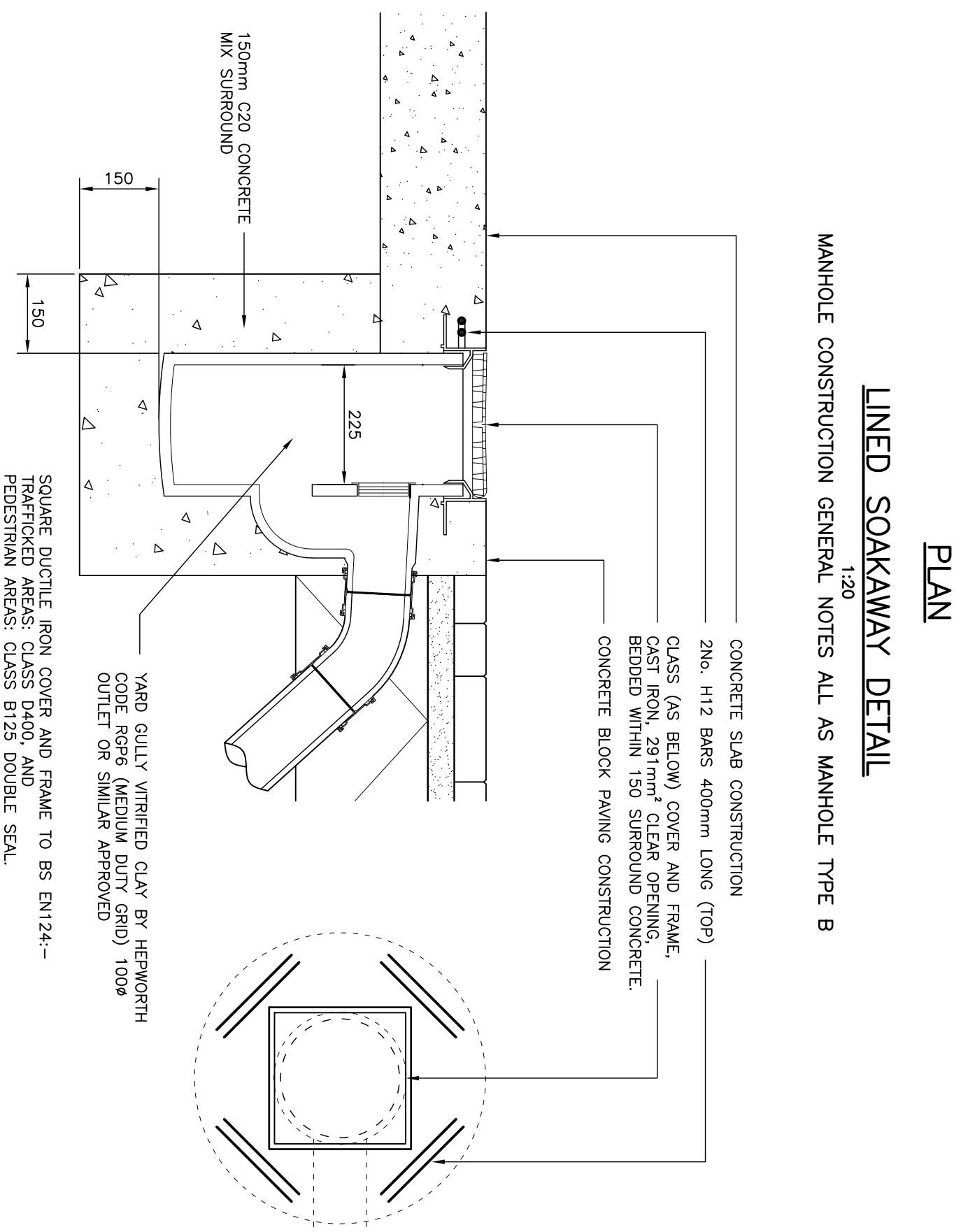
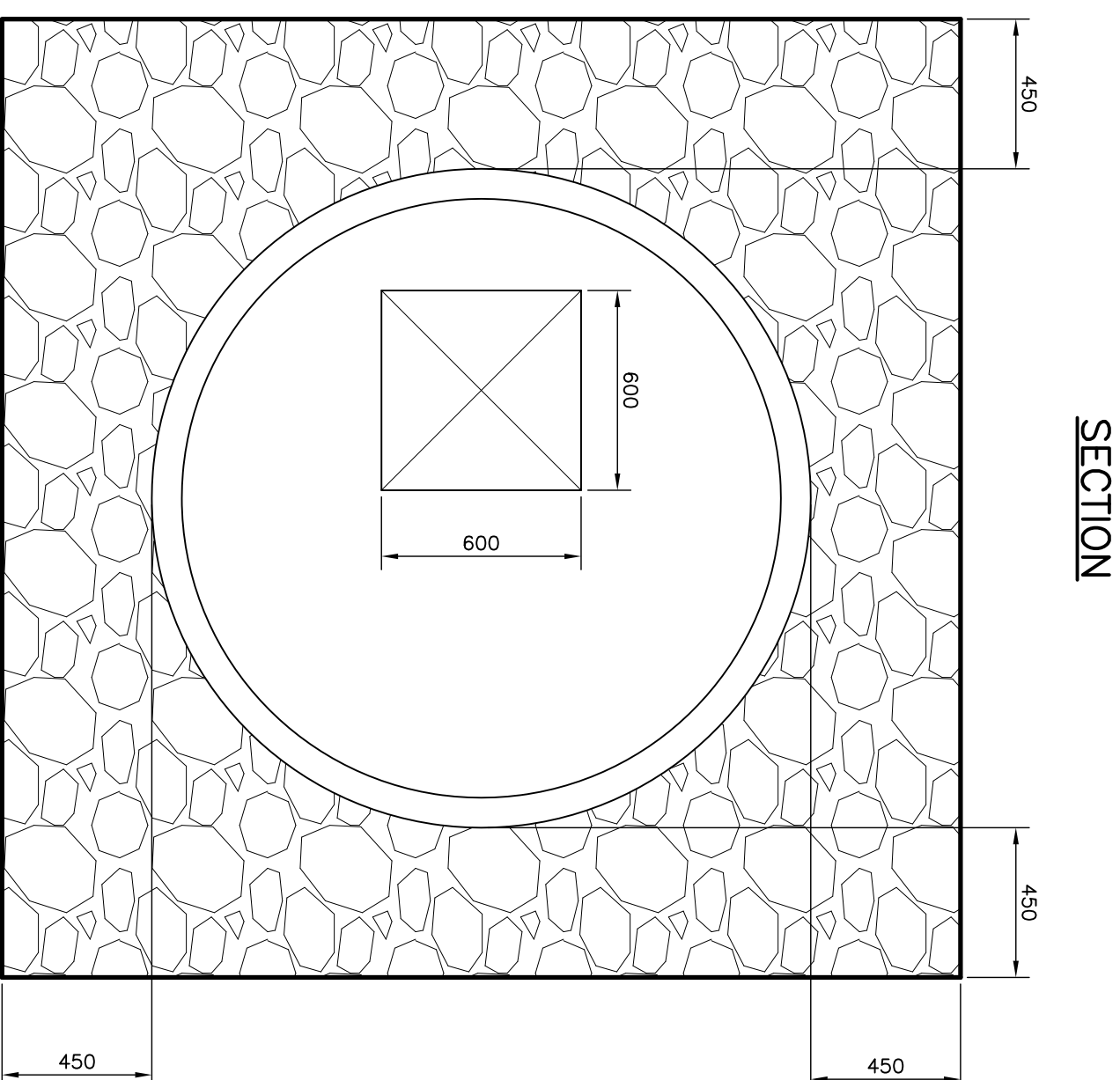
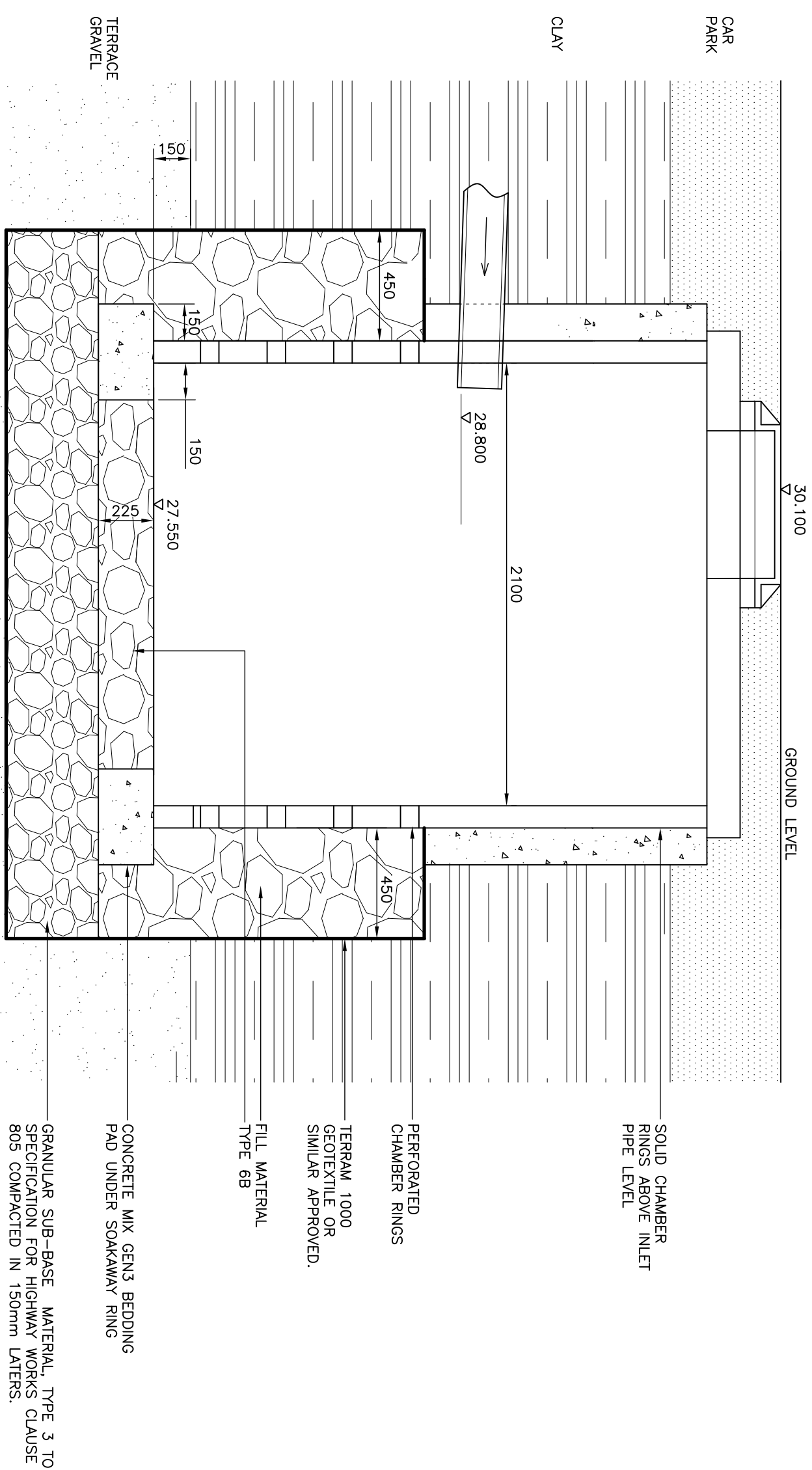
RADIUS 12m OR LESS - KERBS MANUFACTURED TO AN APPROPRIATE RADIUS.

RADIUS 12m TO 20m - STRAIGHT KERBS OF NOT MORE THAN 600mm LENGTH.

RADIUS 20m OR GREATER - STRAIGHT KERBS OF A STANDARD LENGTH.

7. PRECAST TRANSITION UNITS, INTERNAL AND EXTERNAL ANGLE UNITS, AND QUADRANT UNITS TO BE USED AS REQUIRED.

8. FOR ANY UNIT WEIGHT GREATER THAN 20KG, MECHANICAL LIFTING METHODS MAY BE REQUIRED.



1. IF IN DOUBT – ASK !!! DO NOT SOLE
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE ARCHITECTS AND ENGINEERS DRAWINGS.
3. ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH THE RELEVANT BRITISH STANDARDS, CODES OF PRACTICE AND BUILDING PRACTISE.
4. ALL DIMENSIONS TO BE CHECKED PRIOR TO STARTING THE WORKS ON SITE. ANY DISCREPANCIES TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
5. THE CONTRACTOR TO ASSIGN/ALIA THE LOCATION OF SERVICES SITE PRIOR TO STARTING THE WORK.
6. ALL DIMENSIONS FOR CONSTRUCTION ARE TO BE OBTAINED FROM SITE MEASUREMENTS OR ARCHITECTS SETTING OUT DRAWINGS PRIOR TO MANUFACTURE/BUILDING.

KERBING NOTES

1. ALL KERBS TO BE IN ACCORDANCE WITH BS 7263 PART 1, AND HYDRAULICALLY PRESSED.
2. KERB FOUNDATIONS FOR TYPES 4B, SP, BN AND RAMPED KERBS SHALL BE NOT LESS THAN 500mm THICK, AND SHOULD BE SETTED ON OR IN THE SUB-BASE TO THE SPECIFICATION FOR PAVEMENT CONSTRUCTION THICKNESS ADOPTED.
3. ALL KERBS SHALL BE LAID ON A BED OF MORTAR 1:2:4 (CEMENT: SAND: GRAVEL) TO A MINIMUM OF 25mm SPECIFICATION FOR HIGHWAY WORKS.
4. ADEQUATE BOND SHALL BE PROVIDED BETWEEN KERBS AND PAVEMENT. PREFERRED METHODS OF BONDING ARE:
 - i) STEEL REINFORCEMENT HOOPS AT 900mm CENTRES
 - ii) STEEL REINFORCEMENT MESHOR ANY OTHER METHOD TO BE APPROVED BY THE ENGINEER.
5. MORTAR JOINTS BETWEEN KERBS NOT TO BE PROVIDED UNLESS SPECIFIED, GAPS BETWEEN KERBS TO BE 1-2mm.
6. FOR DISCRETE KERBS, BED AND BACKING AT 15m CENTRES WHEN LAID ADJACENT TO OR ON CONCRETE PAVEMENT.
6. FOR DISCRETE WORK, KERBS SHALL BE AS FOLLOWS:
 - a) RADIUS 12m OR LESS – KERBS MANUFACTURED TO AN APPROPRIATE RADIUS.
 - b) RADIUS 12m TO 20m – STRAIGHT KERBS OF NOT MORE THAN 600mm LENGTH.
 - c) RADIUS 20m OR GREATER – STRAIGHT KERBS OF A STANDARD LENGTH.
7. PRECAST TRANSITION UNITS, INTERNAL AND EXTERNAL, ANGLE UNITS, AND QUADRANT UNITS TO BE USED AS REQUIRED.
8. FOR ANY UNIT WEIGHT GREATER THAN 20KG, MECHANICAL LIFTING METHODS MAY BE REQUIRED.

PIPE Ø (mm)	ROCKER PIPE LENGTH (mm)
150 to 600	600
675 to 750	1000
825 & OVER	1250
LARGEST PIPE Ø (mm)	INTERNAL Ø OF MH (mm)
LESS THAN 375	1200
375 to 450	1350
500 to 750	1500
700 to 900	1800

ISSUE / REVISION	BY	DATE

This drawing is the property of David Smith Associates. It must not be reproduced, copied nor its contents divulged without their permission.
 ©David Smith Associates

TENDER

BELL FARM CHRISTIAN CENTRE
CONTRACT
BELL FARM CHURCH
SOUTH ROAD, WEST DRAYTON
MIDDLESEX

PROPOSED DRAINAGE AND
EXTERNAL CONSTRUCTION
DETAILS 2/2. PHASE 3

ARCHITECT
STIMPSON WALTON BOND

DRAWN	CH, KD	DATE	SCALE
LL	RDJ	APRIL '15	AS SHOWN @ A1


David Smith Associates
Consulting Structural & Civil Engineers

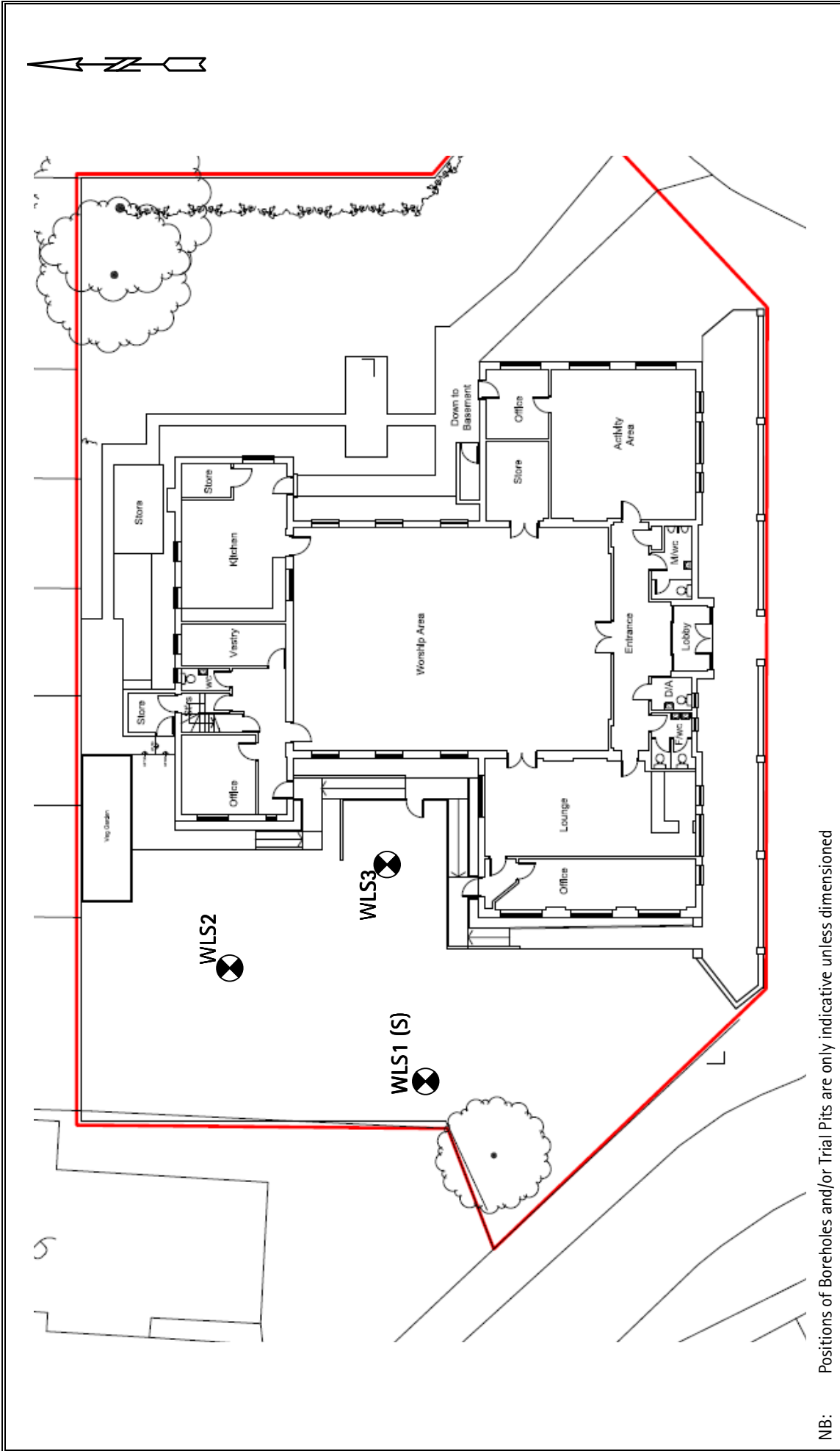
Tel: (01604) 782620
Fax: (01604) 782629
Email: post@dsagroup.co.uk

8 Duncan Close
Moulton Park
Northampton NN3 6WL

APPENDIX B

Ground Investigation

Southern Testing Environmental & Geotechnical, Soakaway test results dated 23/02/15



NB: Positions of Boreholes and/or Trial Pits are only indicative unless dimensioned

Site:	Bell Farm Church, West Drayton	STL: JN0673	Fig No: 1
Date:	27 February 2015	Fieldwork Location Plan.	
 Southern Testing Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4OA ST Consult: Twigden Barns, Brixworth Road, Creaton, Northampton NN6 8NN  ST Consult			

Project Name: Bell Farm Church

Dates: 23/02/2015

Location: West Drayton

NGR: -

Client: FK Howard

Level: -

Logged By
ADM

Well	Water Strikes	Samples & In Situ Testing			Level (m AOD)	Thickness	Legend	Depth (m)	Stratum Description
		Depth (m)	Type	Results					
		0.15	ES			0.20		0.20	Brown, slightly silty, slightly sandy clayey TOPSOIL, with occasional flint gravel and rootlets. (MADE GROUND)
		0.40	ES			0.30		0.50	MADE GROUND composed of brown, sandy CLAY, with occasional flint gravel, rootlets and charcoal fragments. (MADE GROUND)
		0.80	D			1.90			Firm to stiff (medium to high strength), brown, silty CLAY. (BRICKEARTH)
		1.00		UCS = 300					
		1.50							
		1.50	D	UCS = 250					
		2.00		UCS = 180		0.60			
		2.30		UCS = 200					
		2.50	D					2.40	Medium dense, brown-orange, clayey, fine to coarse, SAND and fine to coarse, subangular to subrounded, flint GRAVEL. (RIVER TERRACE)
								3.00	End of Borehole at 3.00 m

Hole Diameters			Type	Results	Water Strikes					General Remarks:
Depth (m)	Hole (mm)	Casing (mm)	Date	Water (m)	Casing (m)	Time (mins)	Rose to (m)	Sealed (m)		Falling Head Soakage Test.

PT = Equilant Standard Penetration Test , UCS = Unconfined Compressive Strength (kN/m2) by Hand Penetrometer , HV = Hand Vane Result (kPa)

Project Name: Bell Farm Church

Dates: 23/02/2015

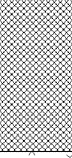
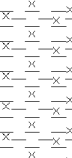
Location: West Drayton

NGR: -

Client: FK Howard

Level: -

Logged By
ADM

Well	Water Strikes	Samples & In Situ Testing			Level (m AOD)	Thickness	Legend	Depth (m)	Stratum Description
		Depth (m)	Type	Results					
		0.15	ES			0.20		0.20	Brown, sandy, clayey TOPSOIL, with occasional rootlets and flint gravel. (MADE GROUND)
						0.45			MADE GROUND composed of brown-orange, sandy CLAY, with occasional flint gravel, brick and charcoal fragments. (MADE GROUND)
		0.90		UCS = 200				0.65	Firm (medium strength), brown, silty CLAY, with occasional rootlets. (BRICKEARTH)
		1.00	D						
						1.70			
		1.80	D						
		2.00	PT	N=46 UCS = 180					
		2.00							
								2.35	Medium dense to dense, brown, clayey, fine to coarse SAND and fine to coarse, subangular to subrounded, flint GRAVEL. (RIVER TERRACE)
		2.50	D			0.65			
								3.00	End of Borehole at 3.00 m

			Type	Results																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
--	--	--	------	---------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

PT = Equilant Standard Penetration Test , UCS = Unconfined Compressive Strength (kN/m2) by Hand Penetrometer , HV = Hand Vane Result (kPa)



Southern Testing
Environmental & Geotechnical

ST Consult
Environmental & Geotechnical

Tel: 01342 333100

Project No.
JN0673

Hole Type
WLS

Borehole No
WLS3
Sheet 1 of 1

Project Name: Bell Farm Church

Dates: 23/02/2015

Location: West Drayton

NGR: -

Client: FK Howard

Level: -

Logged By
ADM

Well	Water Strikes	Samples & In Situ Testing			Level (m AOD)	Thickness	Legend	Depth (m)	Stratum Description
		Depth (m)	Type	Results					
		0.15	ES			0.20		0.20	Brown, slightly silty clayey TOPSOIL. (MADE GROUND)
		0.50	ES			0.60			MADE GROUND composed of brown, sandy CLAY, with occasional flint gravel, brick, ash, concrete and crushed brick at the base. (MADE GROUND)
		0.80		UCS = 200				0.80	Firm to stiff (medium to high strength), brown silty CLAY. (BRICKEARTH)
		1.00	PT	N=8					
		1.20	D						
		1.50		UCS = 200		1.50			
		2.00	PT	N=37					
		2.20	D						
		3.00	PT			1.15			
		3.00	D	N=53					
								2.30	Medium dense to dense, brown-orange, slightly silty, clayey, fine to coarse SAND and fine to coarse, subangular to subrounded flint GRAVEL. (RIVER TERRACE)
								3.45	End of Borehole at 3.45 m

Hole Diameters			Water Strikes					General Remarks:	
Depth (m)	Hole (mm)	Casing (mm)	Date	Water (m)	Casing (m)	Time (mins)	Rose to (m)	Sealed (m)	

PT = Equilant Standard Penetration Test , UCS = Unconfined Compressive Strength (kN/m2) by Hand Penetrometer , HV = Hand Vane Result (kPa)

Summary Sheet

Results of BRE Digest 365 Soakage Tests

Site : Bell Farm Church, West Drayton				Job No : JN0673			
Client : David Smith Associates				O S Reference : TQ 070 792			
Tested By : ADM		Engineer: ADM		Test Date :			
Hole No	Test No	Hole Depth <i>m</i>	Soakage Rate for Each Test <i>litre/m²/min</i>	Soakage Rate for Each Hole <i>litre/m²/min m/sec</i>		Water Level at Finish of Test	Remarks
WS1	No 1	2.76	96.23	11.49 1.91E-4		Nearly empty pit.	Depth to top of permeable soils was 2.4m.
WS1	No 2	2.76	21.17			Nearly empty pit.	
WS1	No 3	2.76	11.49			Nearly empty pit.	
Mean Value of All Calculated Soakage Rates :				11.49 1.91E-4 <i>litre/m²/min m/sec</i>			

APPENDIX C

Drainage Calculations

Proposed Cellular Soakaway System

Proposed Manhole (lined) Soakaway System

All include 30% additional rainfall for climate change

David Smith Associates				Page 1																																																																																																																																																																																																																
8 Duncan Close Moulton Park Northampton NN3 6WL		BELL FARM CHURCH 15/19693																																																																																																																																																																																																																		
Date FEB'16 File 19693_SOAKAWAY_1...		Designed by RDJ Checked by																																																																																																																																																																																																																		
Micro Drainage		Source Control W.12.6																																																																																																																																																																																																																		
<u>Summary of Results for 100 year Return Period (+30%)</u> Half Drain Time : 86 minutes. <table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>0.490</td><td>0.490</td><td>0.8</td><td>4.2</td><td>O K</td></tr><tr><td>30 min Summer</td><td>0.617</td><td>0.617</td><td>0.8</td><td>5.3</td><td>O K</td></tr><tr><td>60 min Summer</td><td>0.684</td><td>0.684</td><td>0.8</td><td>5.8</td><td>O K</td></tr><tr><td>120 min Summer</td><td>0.664</td><td>0.664</td><td>0.8</td><td>5.7</td><td>O K</td></tr><tr><td>180 min Summer</td><td>0.621</td><td>0.621</td><td>0.8</td><td>5.3</td><td>O K</td></tr><tr><td>240 min Summer</td><td>0.573</td><td>0.573</td><td>0.8</td><td>4.9</td><td>O K</td></tr><tr><td>360 min Summer</td><td>0.481</td><td>0.481</td><td>0.8</td><td>4.1</td><td>O K</td></tr><tr><td>480 min Summer</td><td>0.396</td><td>0.396</td><td>0.8</td><td>3.4</td><td>O K</td></tr><tr><td>600 min Summer</td><td>0.319</td><td>0.319</td><td>0.8</td><td>2.7</td><td>O K</td></tr><tr><td>720 min Summer</td><td>0.252</td><td>0.252</td><td>0.8</td><td>2.2</td><td>O K</td></tr><tr><td>960 min Summer</td><td>0.148</td><td>0.148</td><td>0.8</td><td>1.3</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>0.052</td><td>0.052</td><td>0.8</td><td>0.4</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>0.037</td><td>0.037</td><td>0.6</td><td>0.3</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>0.029</td><td>0.029</td><td>0.4</td><td>0.3</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>0.021</td><td>0.021</td><td>0.3</td><td>0.2</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>0.017</td><td>0.017</td><td>0.3</td><td>0.1</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>0.014</td><td>0.014</td><td>0.2</td><td>0.1</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>0.012</td><td>0.012</td><td>0.2</td><td>0.1</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>0.011</td><td>0.011</td><td>0.2</td><td>0.1</td><td>O K</td></tr><tr><td>15 min Winter</td><td>0.559</td><td>0.559</td><td>0.8</td><td>4.8</td><td>O K</td></tr><tr><td>30 min Winter</td><td>0.707</td><td>0.707</td><td>0.8</td><td>6.0</td><td>O K</td></tr><tr><td>60 min Winter</td><td>0.798</td><td>0.798</td><td>0.8</td><td>6.8</td><td>O K</td></tr></tbody></table> <table><thead><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>128.285</td><td>23</td></tr><tr><td>30 min Summer</td><td>84.226</td><td>36</td></tr><tr><td>60 min Summer</td><td>52.662</td><td>62</td></tr><tr><td>120 min Summer</td><td>31.800</td><td>96</td></tr><tr><td>180 min Summer</td><td>23.353</td><td>130</td></tr><tr><td>240 min Summer</td><td>18.644</td><td>164</td></tr><tr><td>360 min Summer</td><td>13.543</td><td>230</td></tr><tr><td>480 min Summer</td><td>10.792</td><td>294</td></tr><tr><td>600 min Summer</td><td>9.043</td><td>356</td></tr><tr><td>720 min Summer</td><td>7.823</td><td>416</td></tr><tr><td>960 min Summer</td><td>6.219</td><td>528</td></tr><tr><td>1440 min Summer</td><td>4.493</td><td>738</td></tr><tr><td>2160 min Summer</td><td>3.241</td><td>1100</td></tr><tr><td>2880 min Summer</td><td>2.568</td><td>1468</td></tr><tr><td>4320 min Summer</td><td>1.847</td><td>2200</td></tr><tr><td>5760 min Summer</td><td>1.461</td><td>2864</td></tr><tr><td>7200 min Summer</td><td>1.217</td><td>3560</td></tr><tr><td>8640 min Summer</td><td>1.048</td><td>4320</td></tr><tr><td>10080 min Summer</td><td>0.923</td><td>4992</td></tr><tr><td>15 min Winter</td><td>128.285</td><td>23</td></tr><tr><td>30 min Winter</td><td>84.226</td><td>36</td></tr><tr><td>60 min Winter</td><td>52.662</td><td>62</td></tr></tbody></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	0.490	0.490	0.8	4.2	O K	30 min Summer	0.617	0.617	0.8	5.3	O K	60 min Summer	0.684	0.684	0.8	5.8	O K	120 min Summer	0.664	0.664	0.8	5.7	O K	180 min Summer	0.621	0.621	0.8	5.3	O K	240 min Summer	0.573	0.573	0.8	4.9	O K	360 min Summer	0.481	0.481	0.8	4.1	O K	480 min Summer	0.396	0.396	0.8	3.4	O K	600 min Summer	0.319	0.319	0.8	2.7	O K	720 min Summer	0.252	0.252	0.8	2.2	O K	960 min Summer	0.148	0.148	0.8	1.3	O K	1440 min Summer	0.052	0.052	0.8	0.4	O K	2160 min Summer	0.037	0.037	0.6	0.3	O K	2880 min Summer	0.029	0.029	0.4	0.3	O K	4320 min Summer	0.021	0.021	0.3	0.2	O K	5760 min Summer	0.017	0.017	0.3	0.1	O K	7200 min Summer	0.014	0.014	0.2	0.1	O K	8640 min Summer	0.012	0.012	0.2	0.1	O K	10080 min Summer	0.011	0.011	0.2	0.1	O K	15 min Winter	0.559	0.559	0.8	4.8	O K	30 min Winter	0.707	0.707	0.8	6.0	O K	60 min Winter	0.798	0.798	0.8	6.8	O K	Storm Event	Rain (mm/hr)	Time-Peak (mins)	15 min Summer	128.285	23	30 min Summer	84.226	36	60 min Summer	52.662	62	120 min Summer	31.800	96	180 min Summer	23.353	130	240 min Summer	18.644	164	360 min Summer	13.543	230	480 min Summer	10.792	294	600 min Summer	9.043	356	720 min Summer	7.823	416	960 min Summer	6.219	528	1440 min Summer	4.493	738	2160 min Summer	3.241	1100	2880 min Summer	2.568	1468	4320 min Summer	1.847	2200	5760 min Summer	1.461	2864	7200 min Summer	1.217	3560	8640 min Summer	1.048	4320	10080 min Summer	0.923	4992	15 min Winter	128.285	23	30 min Winter	84.226	36	60 min Winter	52.662	62
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status																																																																																																																																																																																																															
15 min Summer	0.490	0.490	0.8	4.2	O K																																																																																																																																																																																																															
30 min Summer	0.617	0.617	0.8	5.3	O K																																																																																																																																																																																																															
60 min Summer	0.684	0.684	0.8	5.8	O K																																																																																																																																																																																																															
120 min Summer	0.664	0.664	0.8	5.7	O K																																																																																																																																																																																																															
180 min Summer	0.621	0.621	0.8	5.3	O K																																																																																																																																																																																																															
240 min Summer	0.573	0.573	0.8	4.9	O K																																																																																																																																																																																																															
360 min Summer	0.481	0.481	0.8	4.1	O K																																																																																																																																																																																																															
480 min Summer	0.396	0.396	0.8	3.4	O K																																																																																																																																																																																																															
600 min Summer	0.319	0.319	0.8	2.7	O K																																																																																																																																																																																																															
720 min Summer	0.252	0.252	0.8	2.2	O K																																																																																																																																																																																																															
960 min Summer	0.148	0.148	0.8	1.3	O K																																																																																																																																																																																																															
1440 min Summer	0.052	0.052	0.8	0.4	O K																																																																																																																																																																																																															
2160 min Summer	0.037	0.037	0.6	0.3	O K																																																																																																																																																																																																															
2880 min Summer	0.029	0.029	0.4	0.3	O K																																																																																																																																																																																																															
4320 min Summer	0.021	0.021	0.3	0.2	O K																																																																																																																																																																																																															
5760 min Summer	0.017	0.017	0.3	0.1	O K																																																																																																																																																																																																															
7200 min Summer	0.014	0.014	0.2	0.1	O K																																																																																																																																																																																																															
8640 min Summer	0.012	0.012	0.2	0.1	O K																																																																																																																																																																																																															
10080 min Summer	0.011	0.011	0.2	0.1	O K																																																																																																																																																																																																															
15 min Winter	0.559	0.559	0.8	4.8	O K																																																																																																																																																																																																															
30 min Winter	0.707	0.707	0.8	6.0	O K																																																																																																																																																																																																															
60 min Winter	0.798	0.798	0.8	6.8	O K																																																																																																																																																																																																															
Storm Event	Rain (mm/hr)	Time-Peak (mins)																																																																																																																																																																																																																		
15 min Summer	128.285	23																																																																																																																																																																																																																		
30 min Summer	84.226	36																																																																																																																																																																																																																		
60 min Summer	52.662	62																																																																																																																																																																																																																		
120 min Summer	31.800	96																																																																																																																																																																																																																		
180 min Summer	23.353	130																																																																																																																																																																																																																		
240 min Summer	18.644	164																																																																																																																																																																																																																		
360 min Summer	13.543	230																																																																																																																																																																																																																		
480 min Summer	10.792	294																																																																																																																																																																																																																		
600 min Summer	9.043	356																																																																																																																																																																																																																		
720 min Summer	7.823	416																																																																																																																																																																																																																		
960 min Summer	6.219	528																																																																																																																																																																																																																		
1440 min Summer	4.493	738																																																																																																																																																																																																																		
2160 min Summer	3.241	1100																																																																																																																																																																																																																		
2880 min Summer	2.568	1468																																																																																																																																																																																																																		
4320 min Summer	1.847	2200																																																																																																																																																																																																																		
5760 min Summer	1.461	2864																																																																																																																																																																																																																		
7200 min Summer	1.217	3560																																																																																																																																																																																																																		
8640 min Summer	1.048	4320																																																																																																																																																																																																																		
10080 min Summer	0.923	4992																																																																																																																																																																																																																		
15 min Winter	128.285	23																																																																																																																																																																																																																		
30 min Winter	84.226	36																																																																																																																																																																																																																		
60 min Winter	52.662	62																																																																																																																																																																																																																		
©1982-2011 Micro Drainage Ltd																																																																																																																																																																																																																				

David Smith Associates			Page 2		
8 Duncan Close Moulton Park Northampton NN3 6WL		BELL FARM CHURCH 15/19693			
Date FEB'16 File 19693_SOAKAWAY_1...		Designed by RDJ Checked by			
Micro Drainage		Source Control W.12.6			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
120 min Winter	0.779	0.779	0.8	6.7	O K
180 min Winter	0.718	0.718	0.8	6.1	O K
240 min Winter	0.646	0.646	0.8	5.5	O K
360 min Winter	0.503	0.503	0.8	4.3	O K
480 min Winter	0.372	0.372	0.8	3.2	O K
600 min Winter	0.258	0.258	0.8	2.2	O K
720 min Winter	0.164	0.164	0.8	1.4	O K
960 min Winter	0.053	0.053	0.8	0.5	O K
1440 min Winter	0.037	0.037	0.6	0.3	O K
2160 min Winter	0.027	0.027	0.4	0.2	O K
2880 min Winter	0.021	0.021	0.3	0.2	O K
4320 min Winter	0.015	0.015	0.2	0.1	O K
5760 min Winter	0.012	0.012	0.2	0.1	O K
7200 min Winter	0.010	0.010	0.2	0.1	O K
8640 min Winter	0.009	0.009	0.1	0.1	O K
10080 min Winter	0.008	0.008	0.1	0.1	O K
Storm Event	Rain (mm/hr)		Time-Peak (mins)		
120 min Winter	31.800		104		
180 min Winter	23.353		140		
240 min Winter	18.644		178		
360 min Winter	13.543		248		
480 min Winter	10.792		314		
600 min Winter	9.043		374		
720 min Winter	7.823		428		
960 min Winter	6.219		508		
1440 min Winter	4.493		730		
2160 min Winter	3.241		1100		
2880 min Winter	2.568		1428		
4320 min Winter	1.847		2204		
5760 min Winter	1.461		2936		
7200 min Winter	1.217		3672		
8640 min Winter	1.048		4304		
10080 min Winter	0.923		5120		
©1982-2011 Micro Drainage Ltd					

David Smith Associates		Page 3																																				
8 Duncan Close Moulton Park Northampton NN3 6WL	BELL FARM CHURCH 15/19693																																					
Date FEB'16 File 19693_SOAKAWAY_1...	Designed by RDJ Checked by																																					
Micro Drainage Source Control W.12.6																																						
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>20.000</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.400</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+30</td> </tr> </table> <u>Time / Area Diagram</u> Total Area (ha) 0.021 <table> <thead> <tr> <th>Time (mins)</th> <th>Area (ha)</th> <th>Time (mins)</th> <th>Area (ha)</th> <th>Time (mins)</th> <th>Area (ha)</th> </tr> </thead> <tbody> <tr> <td>0-4</td> <td>0.007</td> <td>4-8</td> <td>0.007</td> <td>8-12</td> <td>0.007</td> </tr> </tbody> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	20.000	Shortest Storm (mins)	15	Ratio R	0.400	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+30	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	0-4	0.007	4-8	0.007	8-12	0.007
Rainfall Model	FSR	Winter Storms	Yes																																			
Return Period (years)	100	Cv (Summer)	0.750																																			
Region	England and Wales	Cv (Winter)	0.840																																			
M5-60 (mm)	20.000	Shortest Storm (mins)	15																																			
Ratio R	0.400	Longest Storm (mins)	10080																																			
Summer Storms	Yes	Climate Change %	+30																																			
Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)																																	
0-4	0.007	4-8	0.007	8-12	0.007																																	
©1982-2011 Micro Drainage Ltd																																						

David Smith Associates		Page 4
8 Duncan Close Moulton Park Northampton NN3 6WL	BELL FARM CHURCH 15/19693	
Date FEB'16 File 19693_SOAKAWAY_1...	Designed by RDJ Checked by	
Micro Drainage	Source Control W.12.6	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.60000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	9.0	9.0	1.200	9.0	23.4

David Smith Associates			Page 1		
8 Duncan Close Moulton Park Northampton NN3 6WL		BELL FARM CHURCH 15/19693			
Date FEB'16 File 19693_soakawayma...		Designed by RDJ Checked by			
Micro Drainage		Source Control W.12.6			
<u>Summary of Results for 100 year Return Period (+30%)</u> Half Drain Time : 38 minutes.					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.876	0.876	1.7	4.7	O K
30 min Summer	1.054	1.054	1.9	5.7	O K
60 min Summer	1.097	1.097	2.0	5.9	O K
120 min Summer	1.018	1.018	1.9	5.5	O K
180 min Summer	0.917	0.917	1.8	5.0	O K
240 min Summer	0.819	0.819	1.7	4.4	O K
360 min Summer	0.655	0.655	1.5	3.5	O K
480 min Summer	0.526	0.526	1.4	2.8	O K
600 min Summer	0.422	0.422	1.3	2.3	O K
720 min Summer	0.338	0.338	1.2	1.8	O K
960 min Summer	0.210	0.210	1.0	1.1	O K
1440 min Summer	0.068	0.068	0.9	0.4	O K
2160 min Summer	0.039	0.039	0.7	0.2	O K
2880 min Summer	0.031	0.031	0.5	0.2	O K
4320 min Summer	0.023	0.023	0.4	0.1	O K
5760 min Summer	0.018	0.018	0.3	0.1	O K
7200 min Summer	0.015	0.015	0.3	0.1	O K
8640 min Summer	0.013	0.013	0.2	0.1	O K
10080 min Summer	0.011	0.011	0.2	0.1	O K
15 min Winter	0.993	0.993	1.9	5.4	O K
30 min Winter	1.203	1.203	2.1	6.5	O K
60 min Winter	1.250	1.250	2.1	6.8	O K
Storm Event	Rain (mm/hr)		Time-Peak (mins)		
15 min Summer	128.285		21		
30 min Summer	84.226		31		
60 min Summer	52.662		48		
120 min Summer	31.800		82		
180 min Summer	23.353		116		
240 min Summer	18.644		150		
360 min Summer	13.543		214		
480 min Summer	10.792		276		
600 min Summer	9.043		336		
720 min Summer	7.823		398		
960 min Summer	6.219		516		
1440 min Summer	4.493		742		
2160 min Summer	3.241		1096		
2880 min Summer	2.568		1468		
4320 min Summer	1.847		2172		
5760 min Summer	1.461		2904		
7200 min Summer	1.217		3608		
8640 min Summer	1.048		4376		
10080 min Summer	0.923		5048		
15 min Winter	128.285		22		
30 min Winter	84.226		32		
60 min Winter	52.662		52		
©1982-2011 Micro Drainage Ltd					

David Smith Associates			Page 2		
8 Duncan Close Moulton Park Northampton NN3 6WL		BELL FARM CHURCH 15/19693			
Date FEB'16 File 19693_soakawayma...		Designed by RDJ Checked by			
Micro Drainage		Source Control W.12.6			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
120 min Winter	1.124	1.124	2.0	6.1	O K
180 min Winter	0.971	0.971	1.8	5.2	O K
240 min Winter	0.831	0.831	1.7	4.5	O K
360 min Winter	0.607	0.607	1.5	3.3	O K
480 min Winter	0.441	0.441	1.3	2.4	O K
600 min Winter	0.314	0.314	1.2	1.7	O K
720 min Winter	0.214	0.214	1.1	1.2	O K
960 min Winter	0.078	0.078	0.9	0.4	O K
1440 min Winter	0.039	0.039	0.7	0.2	O K
2160 min Winter	0.028	0.028	0.5	0.2	O K
2880 min Winter	0.023	0.023	0.4	0.1	O K
4320 min Winter	0.016	0.016	0.3	0.1	O K
5760 min Winter	0.013	0.013	0.2	0.1	O K
7200 min Winter	0.011	0.011	0.2	0.1	O K
8640 min Winter	0.009	0.009	0.2	0.1	O K
10080 min Winter	0.008	0.008	0.1	0.0	O K
Storm Event	Rain (mm/hr)		Time-Peak (mins)		
120 min Winter	31.800		88		
180 min Winter	23.353		124		
240 min Winter	18.644		158		
360 min Winter	13.543		224		
480 min Winter	10.792		286		
600 min Winter	9.043		348		
720 min Winter	7.823		408		
960 min Winter	6.219		516		
1440 min Winter	4.493		734		
2160 min Winter	3.241		1100		
2880 min Winter	2.568		1460		
4320 min Winter	1.847		2156		
5760 min Winter	1.461		2840		
7200 min Winter	1.217		3656		
8640 min Winter	1.048		4400		
10080 min Winter	0.923		5016		
©1982-2011 Micro Drainage Ltd					

David Smith Associates		Page 3																																				
8 Duncan Close Moulton Park Northampton NN3 6WL	BELL FARM CHURCH 15/19693																																					
Date FEB'16 File 19693_soakawayma...	Designed by RDJ Checked by																																					
Micro Drainage Source Control W.12.6																																						
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>20.000</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.400</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+30</td> </tr> </table> <u>Time / Area Diagram</u> Total Area (ha) 0.026 <table> <thead> <tr> <th>Time (mins)</th> <th>Area (ha)</th> <th>Time (mins)</th> <th>Area (ha)</th> <th>Time (mins)</th> <th>Area (ha)</th> </tr> </thead> <tbody> <tr> <td>0-4</td> <td>0.009</td> <td>4-8</td> <td>0.009</td> <td>8-12</td> <td>0.008</td> </tr> </tbody> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	20.000	Shortest Storm (mins)	15	Ratio R	0.400	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+30	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	0-4	0.009	4-8	0.009	8-12	0.008
Rainfall Model	FSR	Winter Storms	Yes																																			
Return Period (years)	100	Cv (Summer)	0.750																																			
Region	England and Wales	Cv (Winter)	0.840																																			
M5-60 (mm)	20.000	Shortest Storm (mins)	15																																			
Ratio R	0.400	Longest Storm (mins)	10080																																			
Summer Storms	Yes	Climate Change %	+30																																			
Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)																																	
0-4	0.009	4-8	0.009	8-12	0.008																																	
©1982-2011 Micro Drainage Ltd																																						

David Smith Associates		Page 4																				
8 Duncan Close Moulton Park Northampton NN3 6WL	BELL FARM CHURCH 15/19693																					
Date FEB'16 File 19693_soakawayma...	Designed by RDJ Checked by																					
Micro Drainage Source Control W.12.6																						
<u>Model Details</u> Storage is Online Cover Level (m) 10.000 <u>Lined Soakaway Structure</u>																						
<table style="width: 100%; border: none;"> <tr> <td style="width: 40%;">Infiltration Coefficient Base (m/hr)</td> <td style="width: 20%;">0.60000</td> <td style="width: 20%;">Ring Diameter (m)</td> <td style="width: 20%;">2.10</td> </tr> <tr> <td>Infiltration Coefficient Side (m/hr)</td> <td>0.60000</td> <td>Pit Multiplier</td> <td>1.5</td> </tr> <tr> <td>Safety Factor</td> <td>2.0</td> <td>Number Required</td> <td>1</td> </tr> <tr> <td>Porosity</td> <td>0.30</td> <td>Cap Volume Depth (m)</td> <td>0.000</td> </tr> <tr> <td>Invert Level (m)</td> <td>0.000</td> <td>Cap Infiltration Depth (m)</td> <td>0.000</td> </tr> </table>			Infiltration Coefficient Base (m/hr)	0.60000	Ring Diameter (m)	2.10	Infiltration Coefficient Side (m/hr)	0.60000	Pit Multiplier	1.5	Safety Factor	2.0	Number Required	1	Porosity	0.30	Cap Volume Depth (m)	0.000	Invert Level (m)	0.000	Cap Infiltration Depth (m)	0.000
Infiltration Coefficient Base (m/hr)	0.60000	Ring Diameter (m)	2.10																			
Infiltration Coefficient Side (m/hr)	0.60000	Pit Multiplier	1.5																			
Safety Factor	2.0	Number Required	1																			
Porosity	0.30	Cap Volume Depth (m)	0.000																			
Invert Level (m)	0.000	Cap Infiltration Depth (m)	0.000																			
©1982-2011 Micro Drainage Ltd																						