

LEGEND:

- DIRTY WATER - [Symbol]
- CLEAN WATER - [Symbol]
- TERRACE - [Symbol]
- DRAIN - [Symbol]
- BERM - [Symbol]
- CULVERT - [Symbol]
- HAUL ROADS - [Symbol]
- ACCESS ROADS - [Symbol]
- MAINTENANCE ROADS - [Symbol]
- 100m FROM STREAM - [Symbol]
- 1:100 FLOODLINES - [Symbol]
- CONCRETE ROADS - [Symbol]
- SILT TRAPS - [Symbol]



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REF. No.	NAME	SIGNATURE	DATE

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Belfast Coal

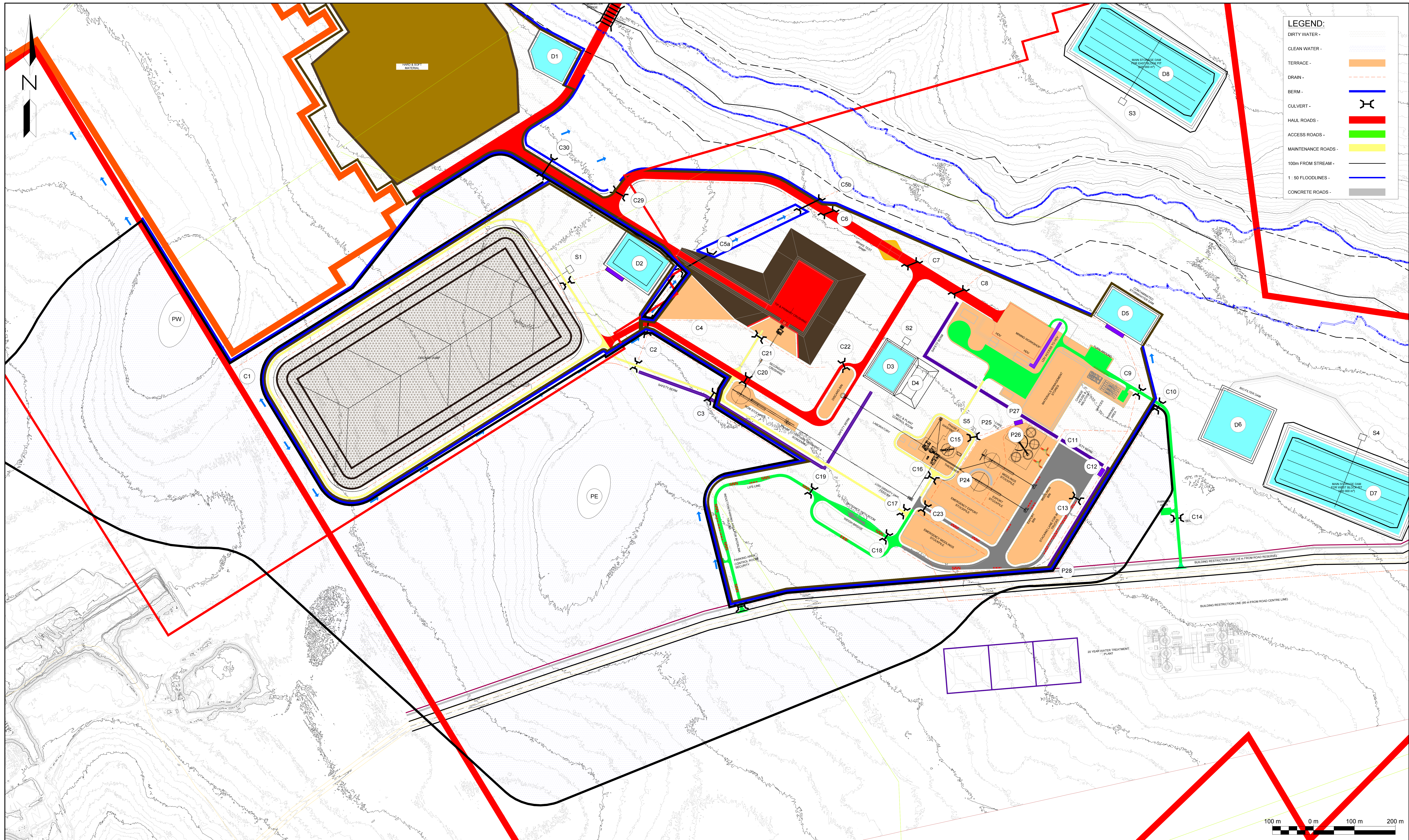
Reg. No. 2000/01107606
www.exxaro.com

Business Unit
Exxaro Resources Ltd.
Registered Office:
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Pretoria West
0183

Postal Address:
P.O. Box 9229
Pretoria
0001

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Fax: +27 12 323 3400

FOR INFORMATION		
BELFAST MINE STORM WATER MANAGEMENT AND ASSOCIATED INFRASTRUCTURE DRAINAGE PLAN		
SCALE	DRAWING NUMBER	REVISION
1:3000	002802-BP-001	0



REV. No.	DATE	REVISIONS	DRAWN	CHECK	APPR.

REFERENCE DRAWINGS	
DRG No.	DESCRIPTION

NAME	SIGNATURE	DATE
PROF. ENG. R. LE ROUX		
DESIGN ENG. R. LE ROUX		
CHECKER J. NEL		
DRAWN J. GELDENHUYS		

NOTE:
THE MASTER HELD AT JEFFARES & GREEN BEARS THE ORIGINAL SIGNATURE OF APPROVAL.

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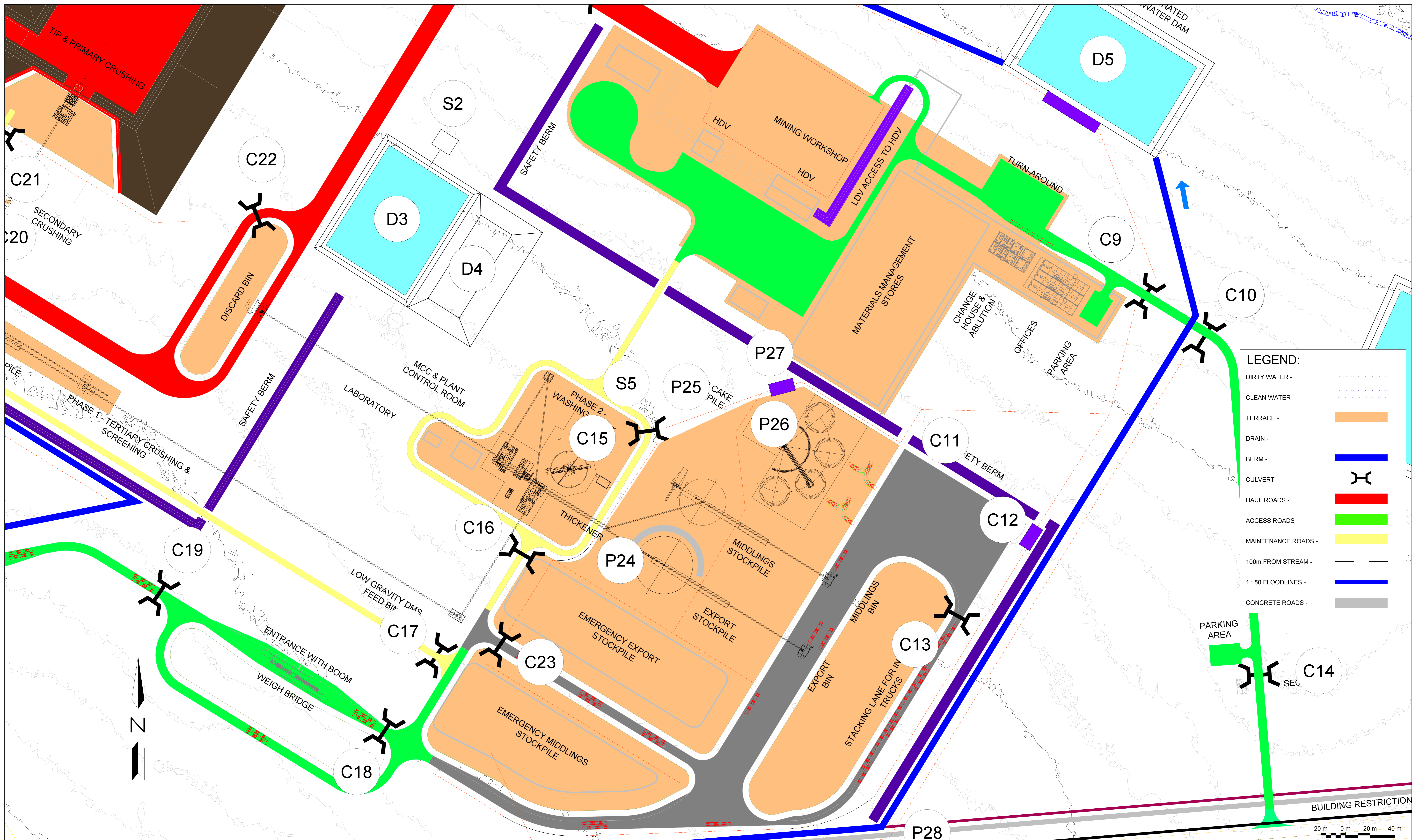
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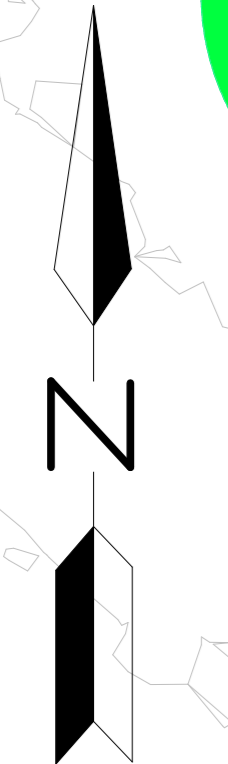
Tel: +27 12 307 5000
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FOR INFORMATION		
BELFAST MINE STORM WATER MANAGEMENT AND ASSOCIATED INFRASTRUCTURE DIRTY AND CLEAN WATER CATCHMENTS		
SCALE 1:3000	DRAWING NUMBER 002802-BP-002	REVISION 0



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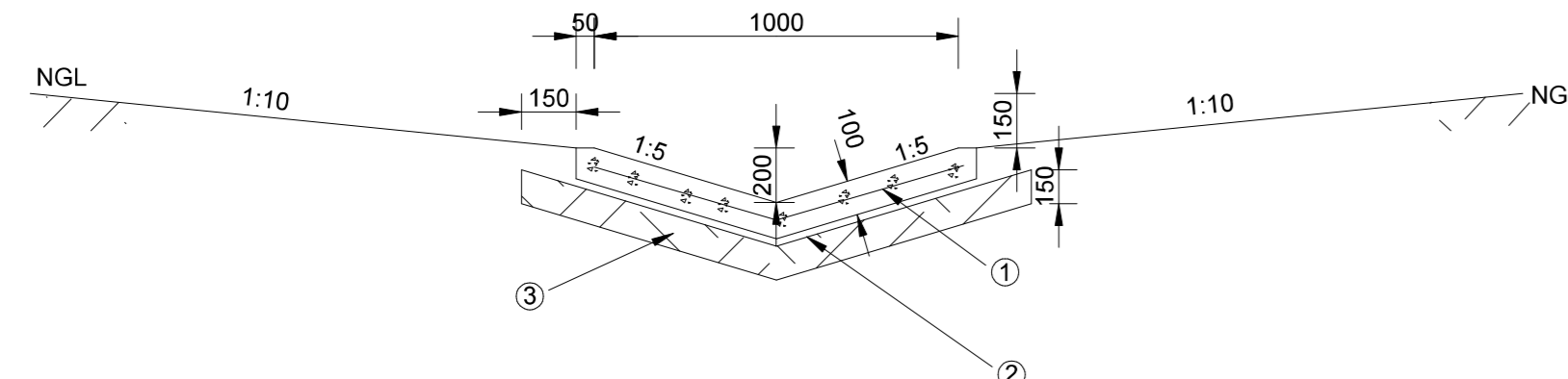
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- CLEAN WATER - [Symbol]
- TERRACE - [Symbol]
- DRAIN - [Symbol]
- BERM - [Symbol]
- CULVERT - [Symbol]
- HAUL ROADS - [Symbol]
- ACCESS ROADS - [Symbol]
- MAINTENANCE ROADS - [Symbol]
- 100m FROM STREAM - [Symbol]
- 1:50 FLOODLINES - [Symbol]
- CONCRETE ROADS - [Symbol]



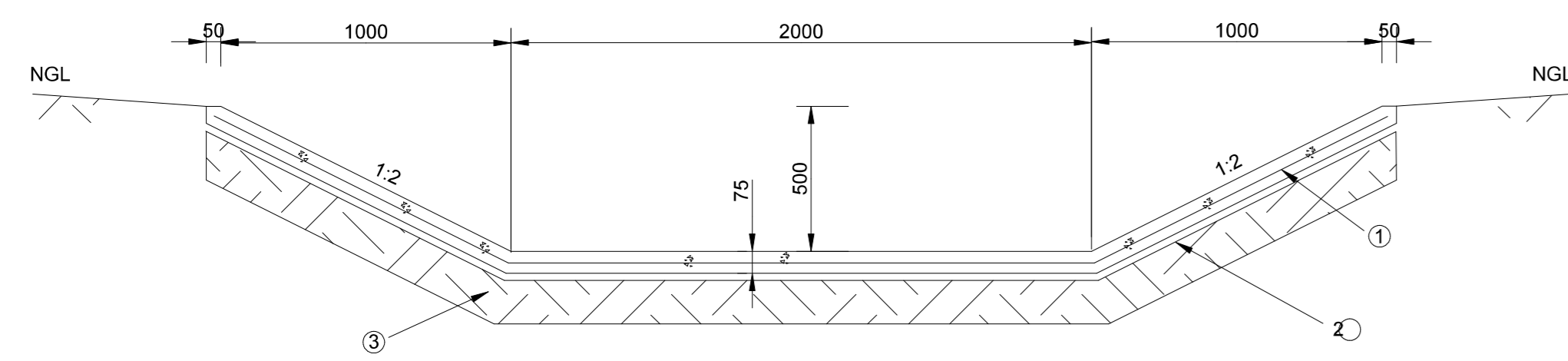
20 m 0 m 20 m 40 m

REV. No.	DATE	REVISIONS	DRAWN	CHECK	APPR.	DRG No.	DESCRIPTION	NAME	SIGNATURE	DATE	NOTICE:	AREA ENGINEER	DRAWN BY	FOR INFORMATION		
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							DESIGN ENG. R. LE ROUX			STRUCTURAL/PIPING		AREA MANAGER	<p>exxaro Belfast Coal</p> <p>Reg. No. 2000/01107606 www.exxaro.com</p> <p>Business Unit Exxaro Resources Ltd.</p>			
							CHECKER J. NEL			CIVIL		MANAGER ENGINEERING	<p>Registered Office: Rodger Dyason Road Pretoria West 0183</p> <p>Tel: +27 12 307 5000 Fax: +27 12 323 3400</p>			
							DRAWN J. GELDENHUYS			ELECTRICAL/INSTRUMENTATION		PROJECT & CONSTRUCTION MANAGER	<p>Postal Address: P.O. Box 9229 Pretoria 0001</p>			
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														1:1000	002802-BP-003	0

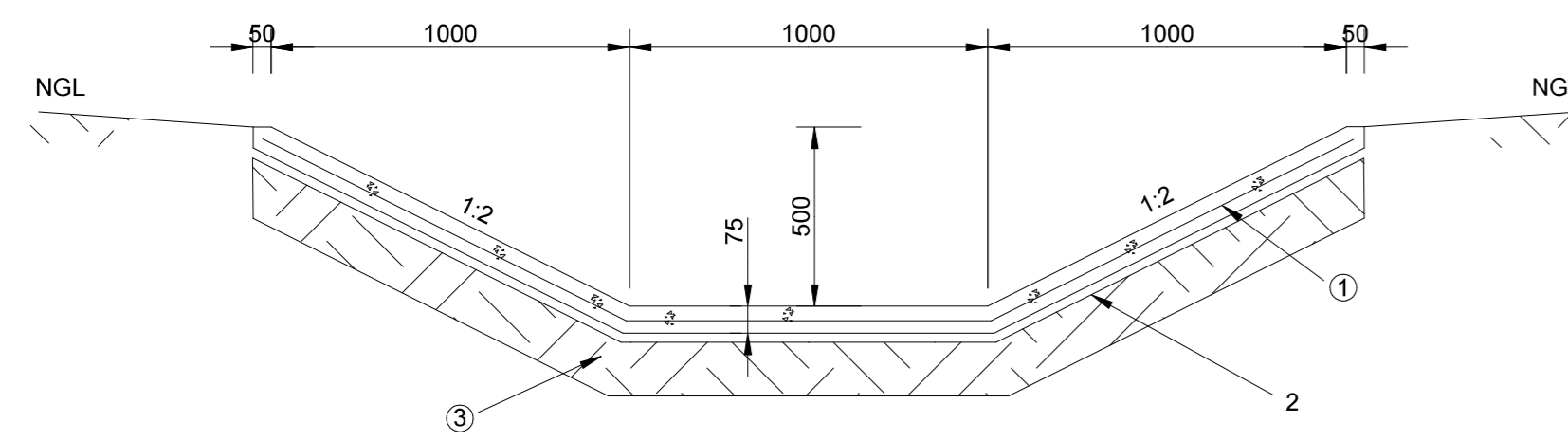
ARMORFLEX 140 SPECIFICATIONS										
CONCRETE QUALITY	DIMENSIONS (Length/Breadth/Height)	NORMAL PLAN SIZE OF BLOCK	NO. BLOCKS /m ²	WEIGHT OF BLOCK	UNIT WEIGHT	OPEN AREA	VOL. MATERIAL TO FILL JOINTS & VOIDS	ARMORFLEX MAT SIZES	CABLE	VERTICAL BENDING RADII
25MPa	L=340mm B=400mm H=55mm	309 x 400mm	8.1	17.5kg ave	140kg/m ² (Mat 6.2m x 2.4m + lifting beam = ± 2.9)	18%	0.017m ³ /m ²	Standard 6.2m x 2.4m (20 blocks x 6 blocks)	Factory assembled - Galvanised steel wire rope or synthetic rope. In situ assembled - Galvanised fencing wire or synthetic rope.	0.5m to 1.0m



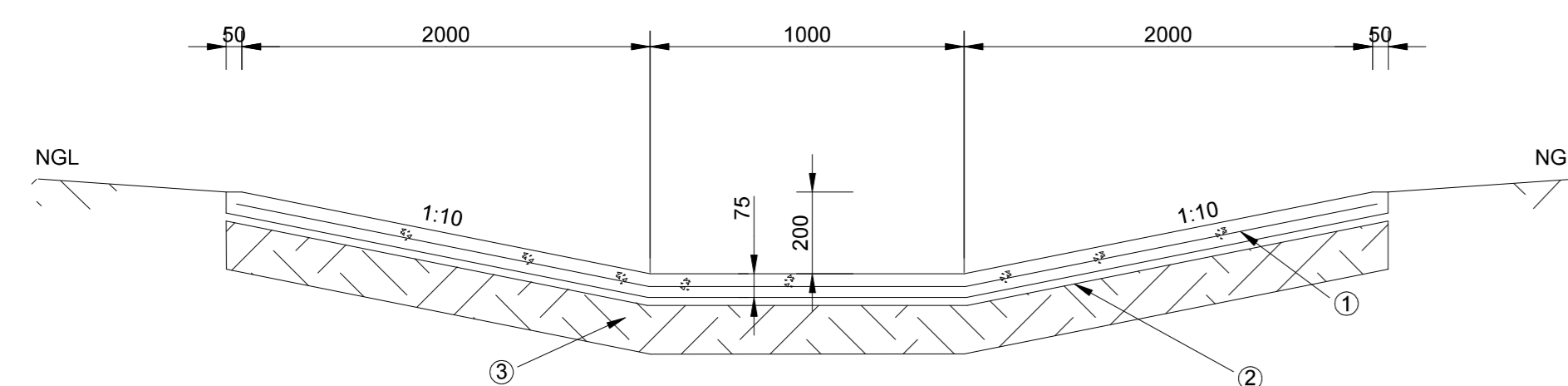
CONCRETE V-DRAIN
DRAIN TYPE 1
N.T.S.



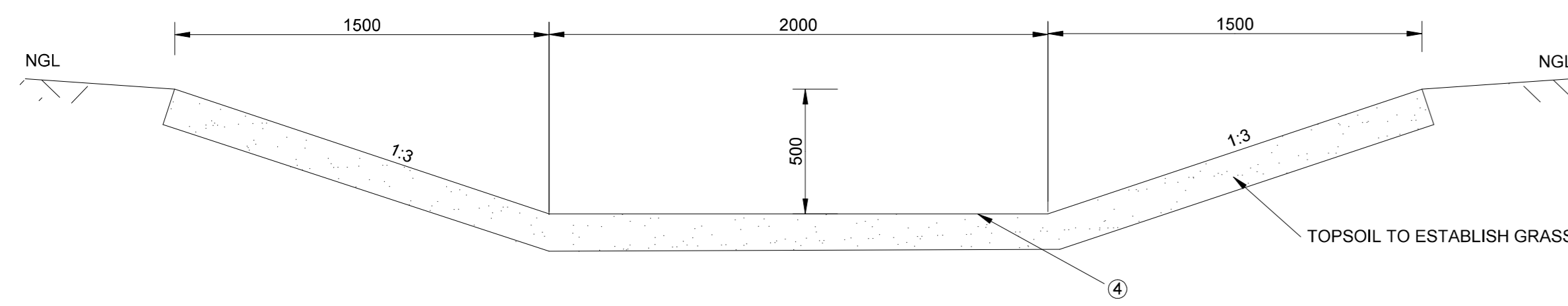
CONCRETE TRAPEZOIDAL DRAIN
DRAIN TYPE 2a
N.T.S.



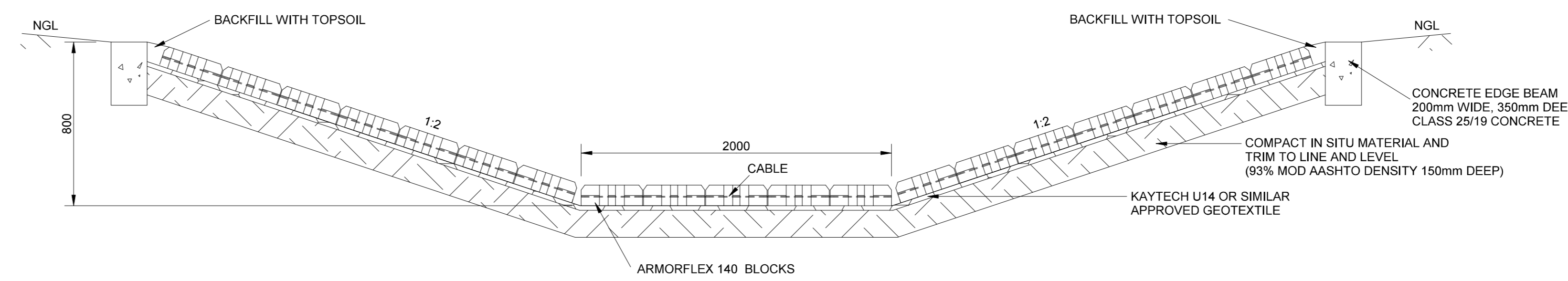
CONCRETE TRAPEZOIDAL DRAIN
DRAIN TYPE 2b
N.T.S.



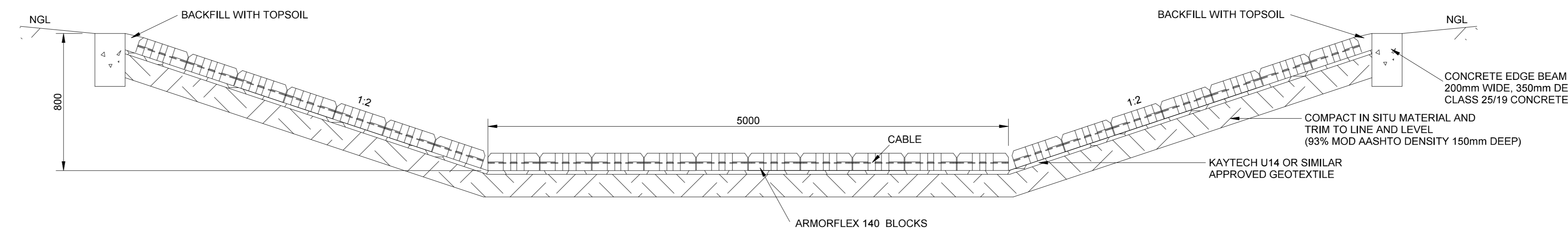
CONCRETE TRAPEZOIDAL DRAIN
DRAIN TYPE 2c
N.T.S.



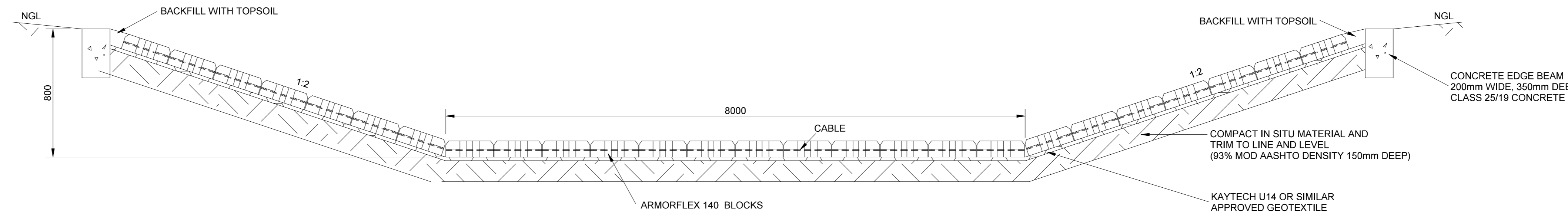
GRASS DRAIN
DRAIN TYPE 3
N.T.S.



TRAPEZOIDAL DRAIN WITH GRASS BLOCK
DRAIN TYPE 4a
N.T.S.



TRAPEZOIDAL DRAIN WITH GRASS BLOCK
DRAIN TYPE 4b
N.T.S.



TRAPEZOIDAL DRAIN WITH GRASS BLOCK
DRAIN TYPE 4c
N.T.S.

NOTES:

- MESH REF. 193 (SABS 1047) CONTINUOUS OVER CONSTRUCTION JOINTS. REINFORCING TO OVERLAP BY 400mm MINIMUM
- 150 MICRON POLYETHYLENE SHEETING SABS 952
- RIP AND RECOMPACT IN SITU MATERIAL TO 93% MOD AASHTO DENSITY 150mm DEEP
- GRASS DRAIN

NOTES:

GENERAL

- ALL MATERIAL AND WORKMANSHIP MUST COMPLY WITH THE REQUIREMENTS OF THE LATEST RELEVANT SABS REQUIREMENTS.
- ALL DIMENSIONS ARE IN MILLIMETERS. (UNLESS OTHERWISE SPECIFIED)
- DO NOT SCALE FROM THESE DRAWINGS.
- ALL DIMENSIONS MUST BE CHECKED AND APPROVED ON SITE.
- ALL CONSTRUCTION TO BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS FOR MUNICIPAL CIVIL ENGINEERING WORKS, SECOND EDITION 1991 AND THE STANDARD (DRAWINGS A-O).
- THESE DRAWINGS MUST BE READ IN CONJUNCTION WITH THE ARCHITECTS DRAWINGS.(IF APPLICABLE)

REINFORCED CONCRETE

- REINFORCED CONCRETE WORK SHALL BE IN STRICT ACCORDANCE WITH SECTIONS 702, 703 AND 704 OF THE STANDARD SPECIFICATIONS.
- ALL EXCAVATIONS FOR BASES AND FOOTINGS MUST BE INSPECTED AND APPROVED IN WRITING BY THE ENGINEER BEFORE CONCRETE IS PLACED.
- REINFORCEMENT AND FORMWORK MUST BE INSPECTED AND APPROVED IN WRITING BY THE ENGINEER BEFORE CONCRETE IS PLACED.
- UNLESS OTHERWISE SPECIFIED OR INDICATED ON THE DRAWINGS, THE FOLLOWING CONCRETE CLASS SHALL APPLY:
(i) BASES AND FOOTINGS: CONCRETE CLASS 25/19
(ii) BEAMS AND SLABS: CONCRETE CLASS 25/19
(iii) COLUMNS: CONCRETE CLASS 30/19
(iv) BLINDING LAYER: CONCRETE CLASS 15/19
- CONCRETE COVER SHALL BE AS INDICATED ON THE DRAWINGS OR SPECIFICATIONS.
- CONCRETE FINISH SHALL BE AS INDICATED ON THE DRAWINGS OR SPECIFICATIONS.

STRUCTURAL STEELWORK

- STRUCTURAL STEELWORK SHALL BE IN STRICT ACCORDANCE WITH SECTION 809 OF THE STANDARD SPECIFICATIONS.
- STRUCTURAL STEEL SHALL BE GRADE 300W UNLESS OTHERWISE INDICATED OR SPECIFIED.
- COLD FORMED SECTIONS SHALL BE MADE FROM COMMERCIAL QUALITY STEEL UNLESS OTHERWISE SPECIFIED.
- HOLDING DOWN BOLTS SHALL BE OF THE GRADE SPECIFIED ON THE DRAWINGS.
- PAINTING OF STRUCTURAL STEELWORK SHALL BE IN STRICT ACCORDANCE WITH THE REQUIREMENTS OF SECTION 806 OF THE STANDARD SPECIFICATIONS. NOTE: THE RATES TENDERED FOR STRUCTURAL STEELWORK SHALL BE DEEMED TO INCLUDE FOR PAINTING AS SPECIFIED IN SECTION 806 OF THE STANDARD SPECIFICATIONS.

ROADS

- KERBING TO BE AS PER STANDARD DETAIL PLANS A AND B AND SECTION 10 OF VOLUME 1 OF CONTRACT DOCUMENT.
- TRAFFIC CONTROL MUST COMPLY WITH THE REQUIREMENTS OF THE SOUTH AFRICAN ROAD TRAFFIC SIGNS MANUAL (THIRD EDITION).
- VERTICAL AND HORIZONTAL ALIGNMENT TO FOLLOW THE EXISTING ROAD SURFACE WITH A MINIMUM CROSS FALL OF 2%(IF APPLICABLE)

STORMWATER

- MINIMUM PIPE DIAMETER TO BE 450mm.
- MINIMUM FALL TO BE 1:150.
- PIPE BEDDING TO BE CLASS B UNLESS OTHERWISE SPECIFIED.
- ALL EXCAVATIONS AND BEDDING MUST BE INSPECTED AND APPROVED BY THE ENGINEER BEFORE LAYING OF ANY PIPES.
- CLEAN EXISTING STORMWATER INLETS AND REPAIR WHERE NECESSARY.(IF APPLICABLE)

REV. No.	DATE	REVISIONS	DRAWN	CHECK	APPR.	REFERENCE DRAWINGS	
						DRG No.	DESCRIPTION

PROF. ENG.	NAME	SIGNATURE	DATE
	R. LE ROUX		
	R. LE ROUX		
	J. NEL		
	J. GELDENHUYS		

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exxaro
Belfast Coal

Reg. No. 2000/01107606 www.exxaro.com

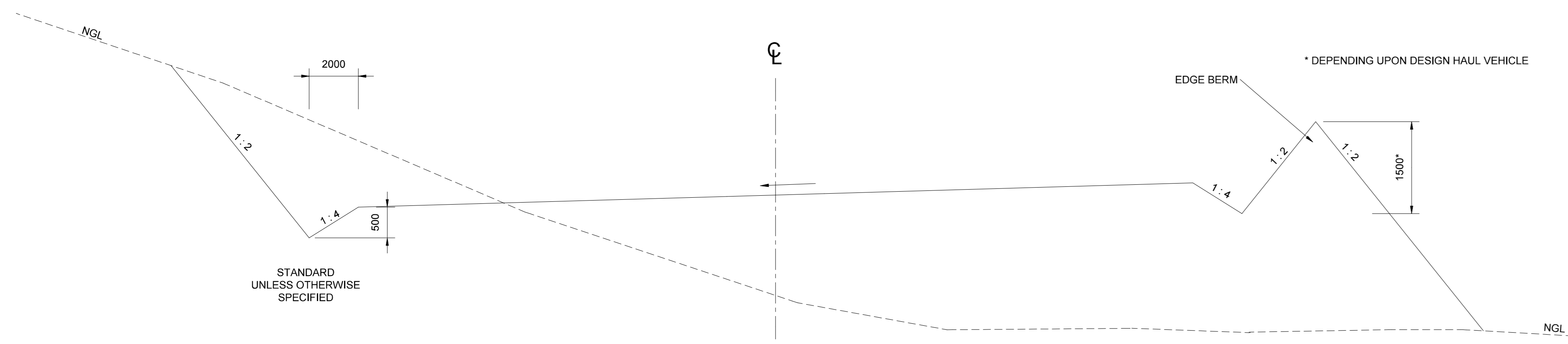
Business Unit
Exxaro Resources Ltd.
P.O. Box 2673
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Registered Office:
Rodger Dyason Road
Pretoria West
0183

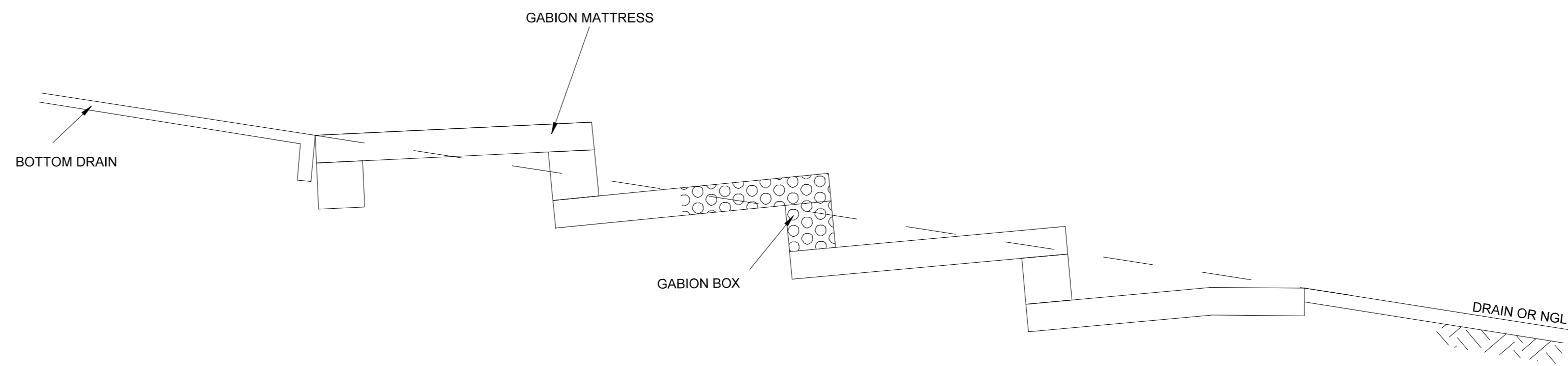
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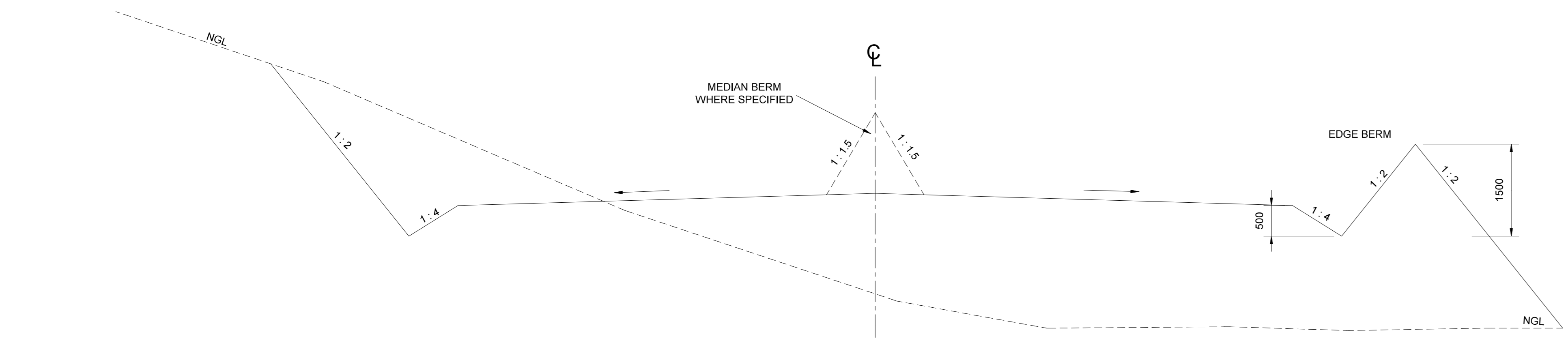
FOR INFORMATION		
BELFAST MINE STORM WATER MANAGEMENT AND ASSOCIATED INFRASTRUCTURE		
TYPICAL DRAINS AND LININGS		
SCALE	DRAWING NUMBER	REVISION
N.T.S.	002802-BP-004	0



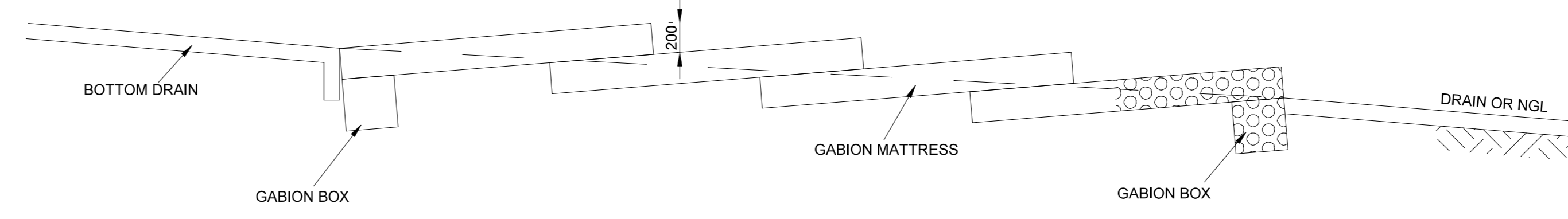
TYPICAL HAUL ROAD SECTION
SUPER-ELEVATED
N.T.S.



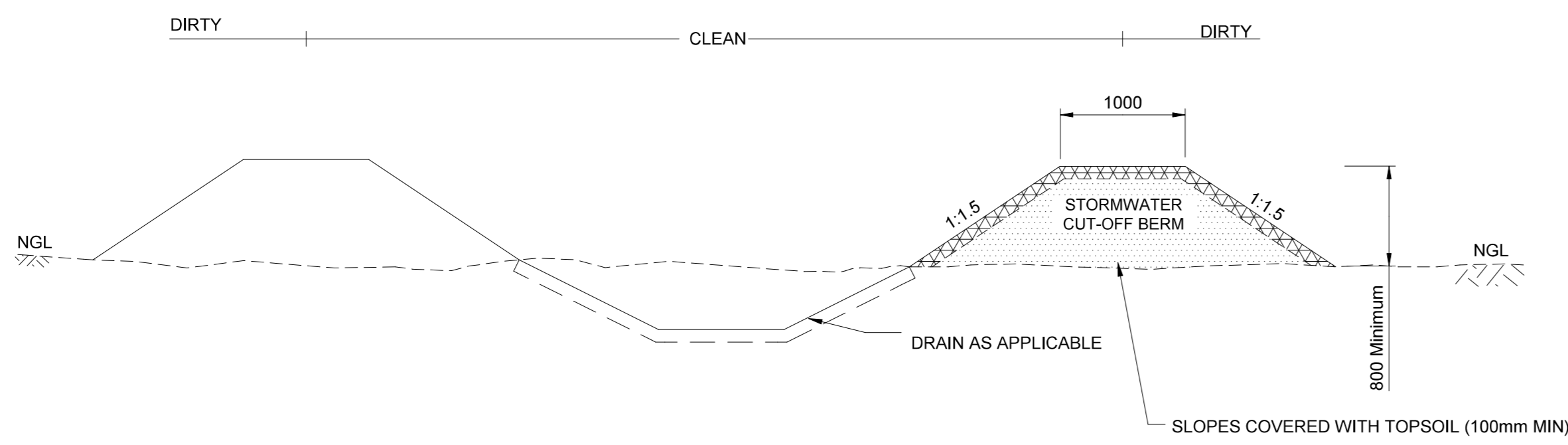
ENERGY DISSIPATION - STEEP SLOPES TYPE 10
GABION BOXES AND MATTRESSES



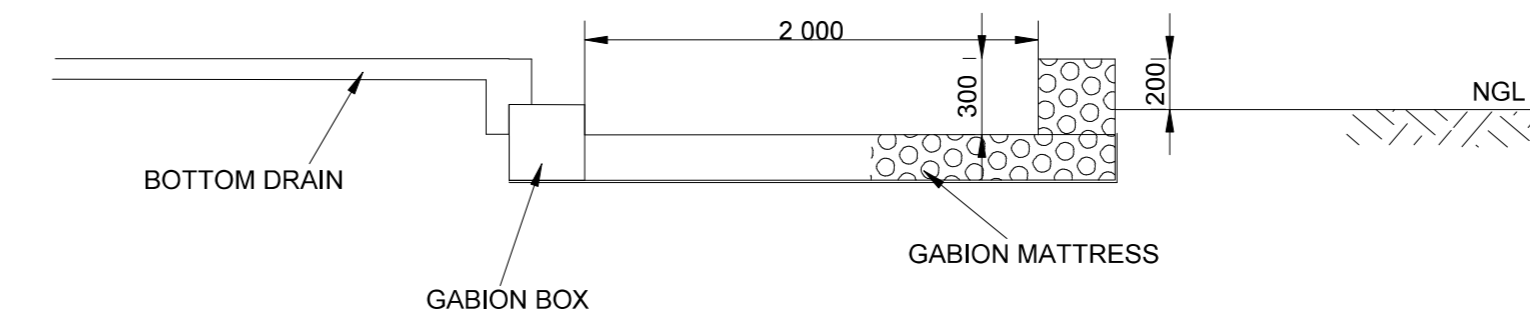
TYPICAL HAUL ROAD SECTION
CAMBER
N.T.S.



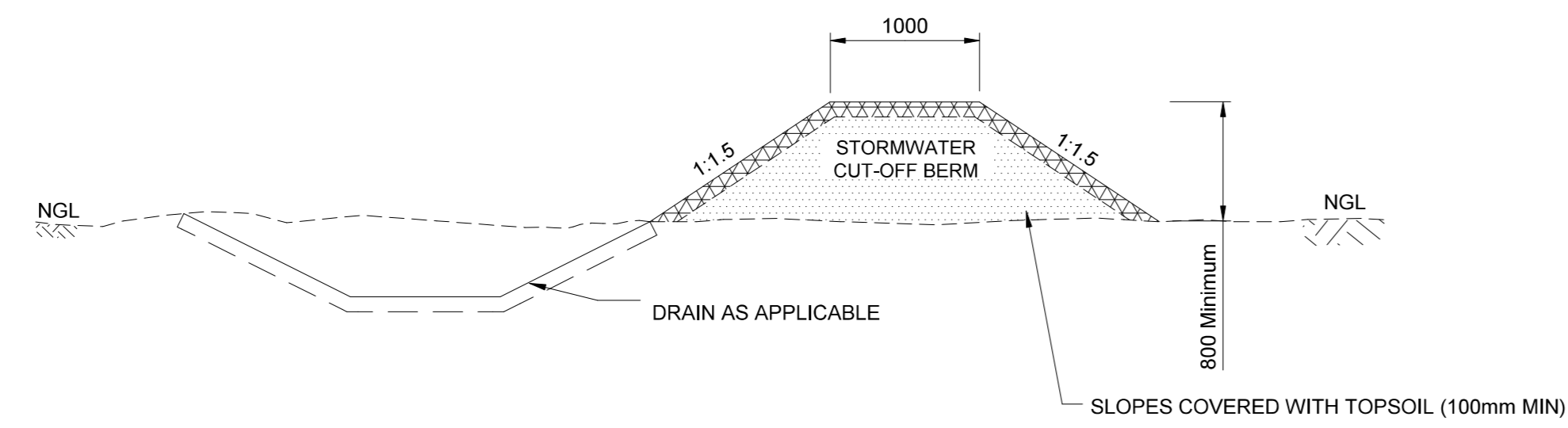
ENERGY DISSIPATION - MODERATE SLOPES TYPE 11
GABION MATTRESSES
N.T.S.



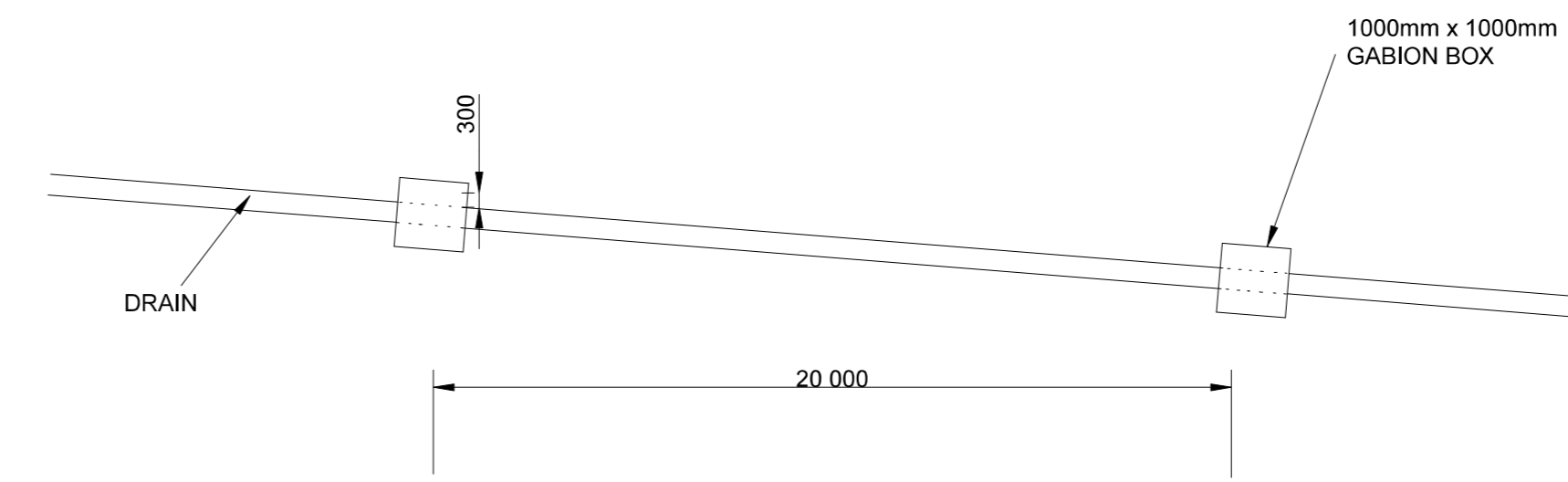
CLEAN WATER DRAIN
THROUGH DIRTY AREAS
CLEAN WATER DRAIN
THROUGH DIRTY AREAS
N.T.S.



STILLING BASIN AT OUTLET
N.T.S.



CUT-OFF BERM AND DRAIN
N.T.S.



ENERGY DISSIPATION - MODERATE SLOPES TYPE 12
GABION BOXES
N.T.S.

NOTES:

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DESIGN ENG. R. LE ROUX		
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DRAWN J. GELDENHUYS		

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PROCESS	CLIENT

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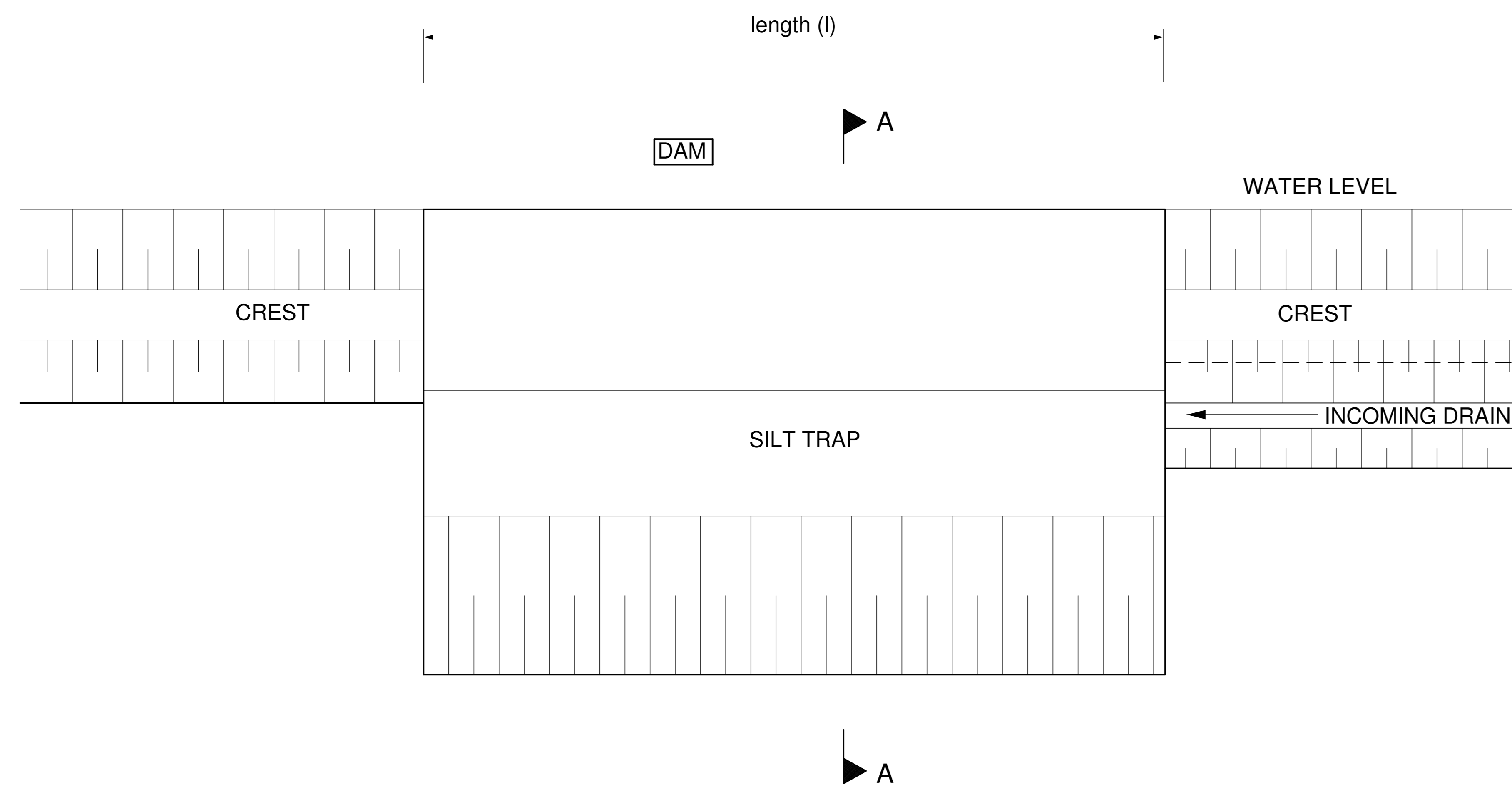
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Exxaro Resources Ltd.

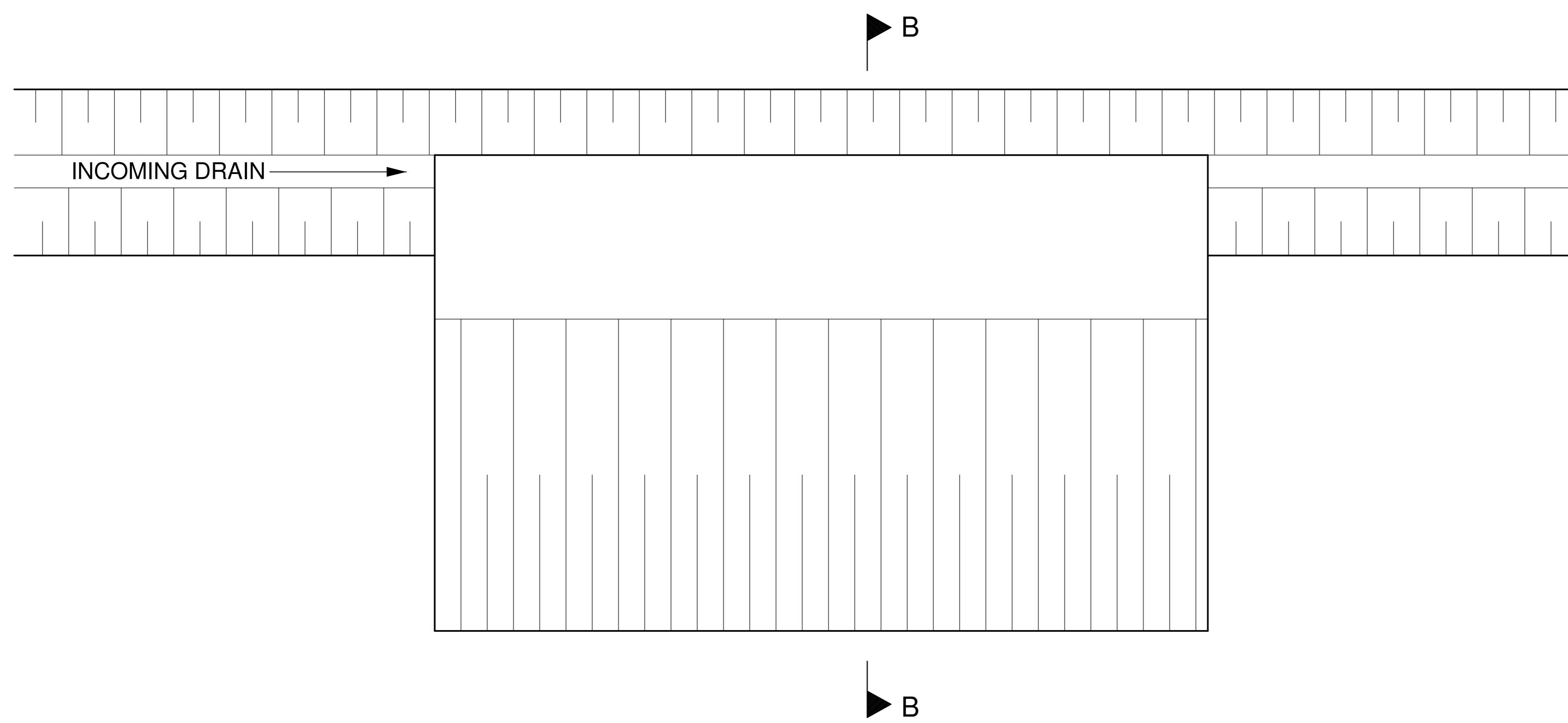
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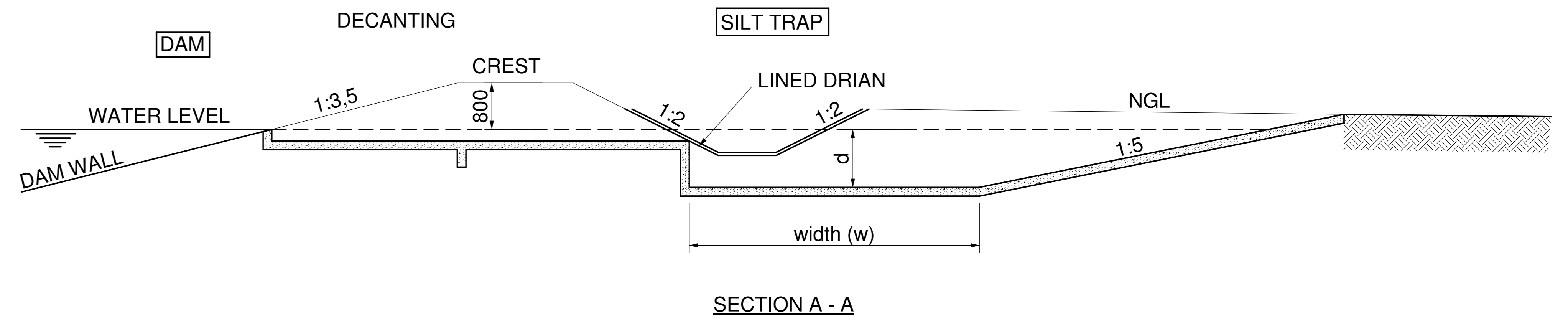
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BELFAST MINE STORM WATER MANAGEMENT AND ASSOCIATED INFRASTRUCTURE		
TYPICAL DRAINS AND STILLING BASINS		
SCALE	DRAWING NUMBER	REVISION
N.T.S.	002802-BP-005	0



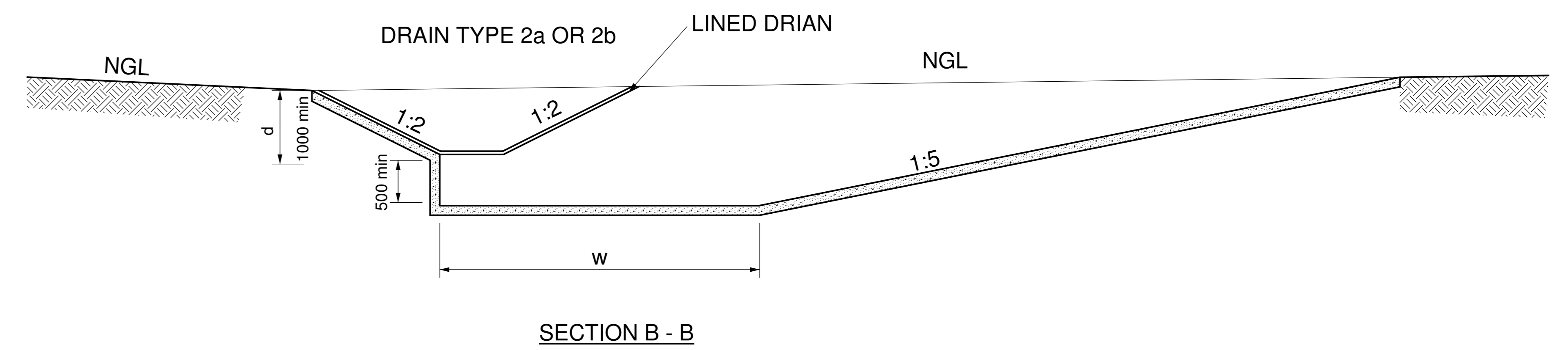
TYPICAL PLAN OF SILT TRAP AT DAMS





TYPICAL PLAN OF SILT TRAP IN DRIANS

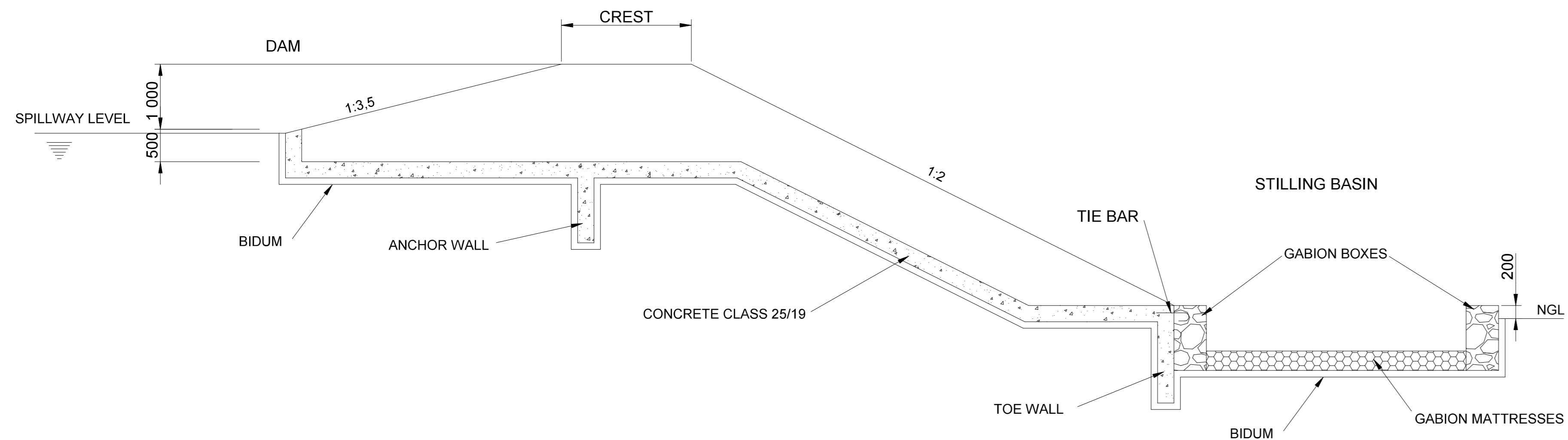


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D2	20	1.2	3
D5	40	1.2	5

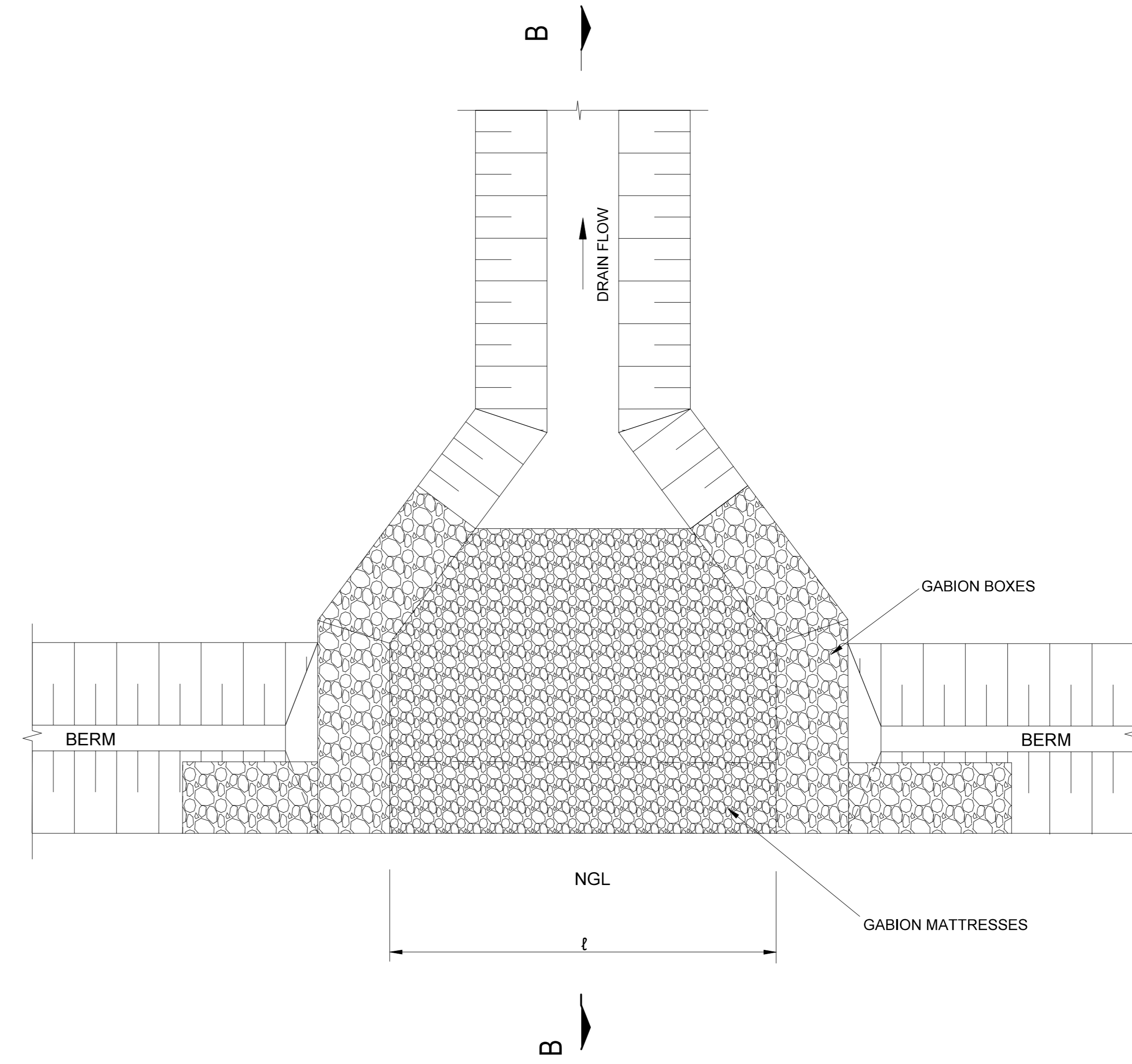


POINT	w (m)	l (m)	d (m)
P27	3	8	1 min
C12	3	8	1 min

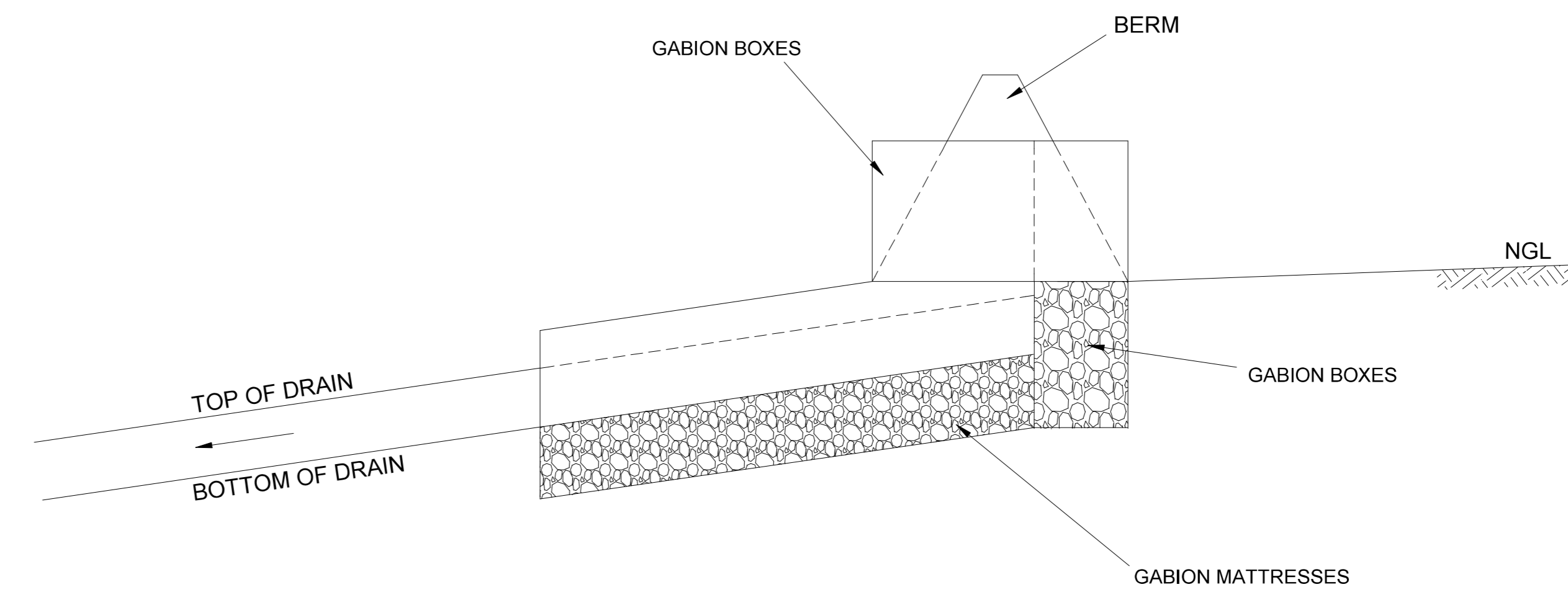
REV. No.	DATE	REVISIONS	DRAWN	CHECK	APPR.	REFERENCE DRAWINGS		NAME	SIGNATURE	DATE	NOTICE:	AREA ENGINEER	DRAWN BY	 JEFFARES & GREEN ENGINEERING AND ENVIRONMENTAL CONSULTING www.jg.co.za	 Belfast Coal www.exxaro.com	FOR INFORMATION												
						DRG No.	DESCRIPTION									SCALE	DRAWING NUMBER	REVISION										
								PROF. ENG. R LE ROUX			THIS DRAWING HAS NOT BEEN PUBLISHED AND IS THE SOLE PROPERTY OF EXXARO RESOURCES AND IS LOANED TO THE BORROWER FOR HIS CONFIDENTIAL USE ONLY, AND IN CONSIDERATION OF THE LOAN OF THIS DRAWING, THE BORROWER PROMISES AND AGREES THAT IT SHALL NOT BE PRODUCED, COPIED, LOANED OR OTHERWISE DISPOSED OF DIRECTLY OR INDIRECTLY NOR USED FOR ANY PURPOSE OTHER THAN THAT FOR WHICH IT IS FURNISHED.	MECHANICAL	CHECKED BY	Physical Address: Landmark Building East 3rd Floor Pretoria Umgazi Road Menlo Park 0081 Tel: +27 12 460 0008 Fax: +27 12 460 2953	Postal Address: P.O. Box 2573 Pretoria 0001	Business Unit: Exxaro Resources Ltd. Registered Office: Rodger Dyason Road Pretoria West 0183 Tel: +27 12 307 5000 Fax: +27 12 323 3400	Postal Address: P.O. Box 9229 Pretoria 0001	BELFAST MINE STORMWATER MANAGEMENT AND ASSOCIATED INFRASTRUCTURE										
										TYPICAL SILT TRAPS																		
NOTE: THE MASTER HELD AT JEFFARES & GREEN BEARS THE ORIGINAL SIGNATURE OF APPROVAL.																												



SECTION THROUGH TYPICAL SPILLWAY



PAN WEST SPILLWAY



SECTION B - B
1:50

NOTE:
ALL GABIONS AND MATTRESSES
TO BE PLACED ON NON WOVEN
NEEDLE PUNCHED GEOTEXTILE

REV. No.	DATE	REVISIONS	DRAWN	CHECK	APPR.	REFERENCE DRAWINGS	
						DRG No.	DESCRIPTION

PROF. ENG.	NAME	SIGNATURE	DATE
	R. LE ROUX		
DESIGN ENG.	R. LE ROUX		
CHECKER	J. NEL		
DRAWN	J. GELDENHUYS		

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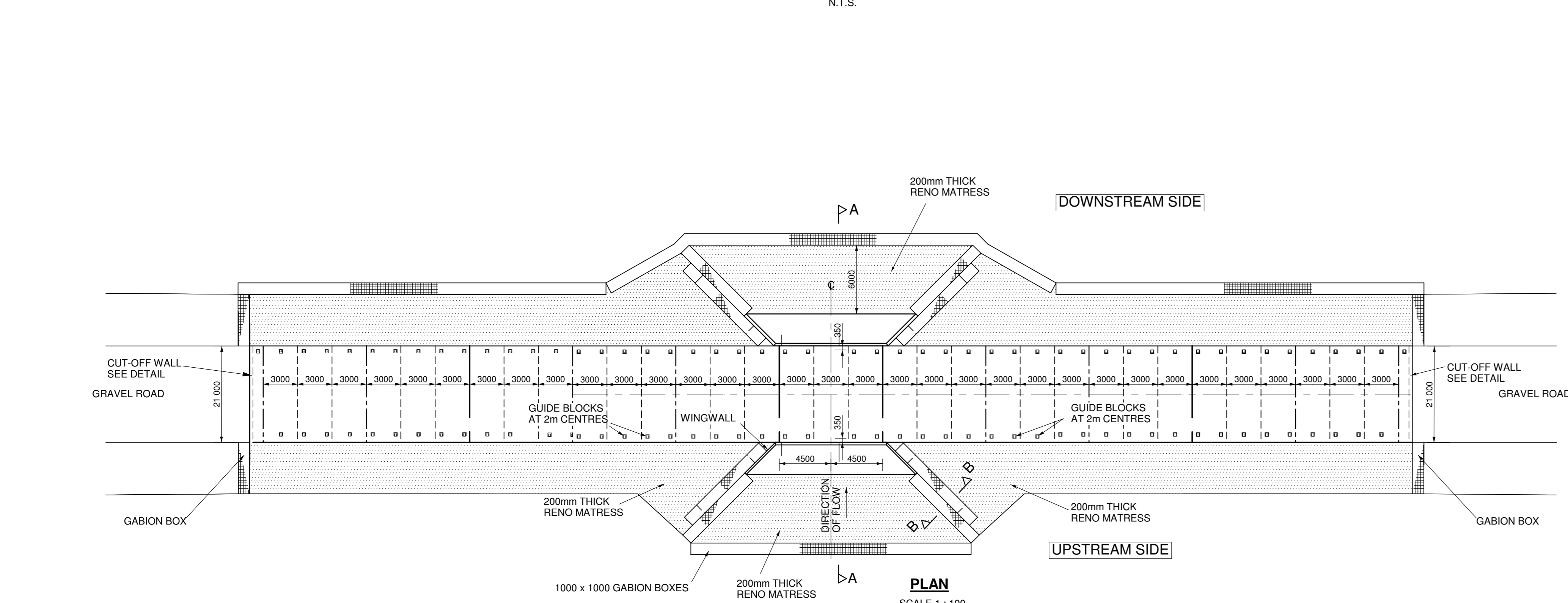
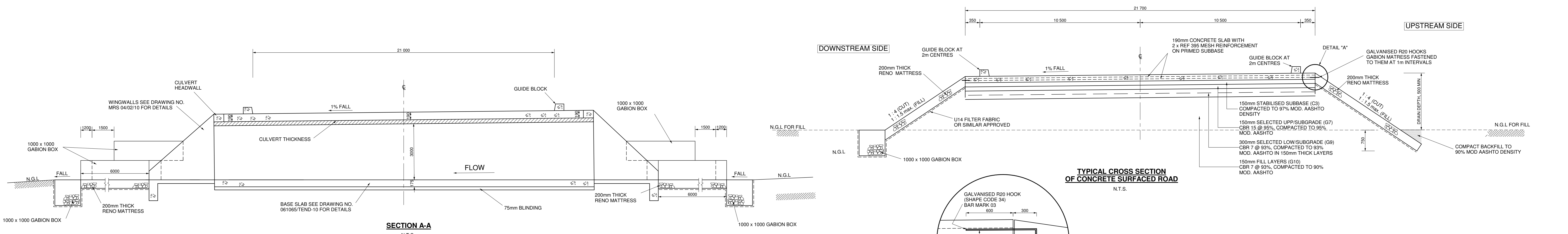
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0183

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P.O. Box 9229
Pretoria
0001

Tel: +27 12 307 5000
Fax: +27 12 323 3400

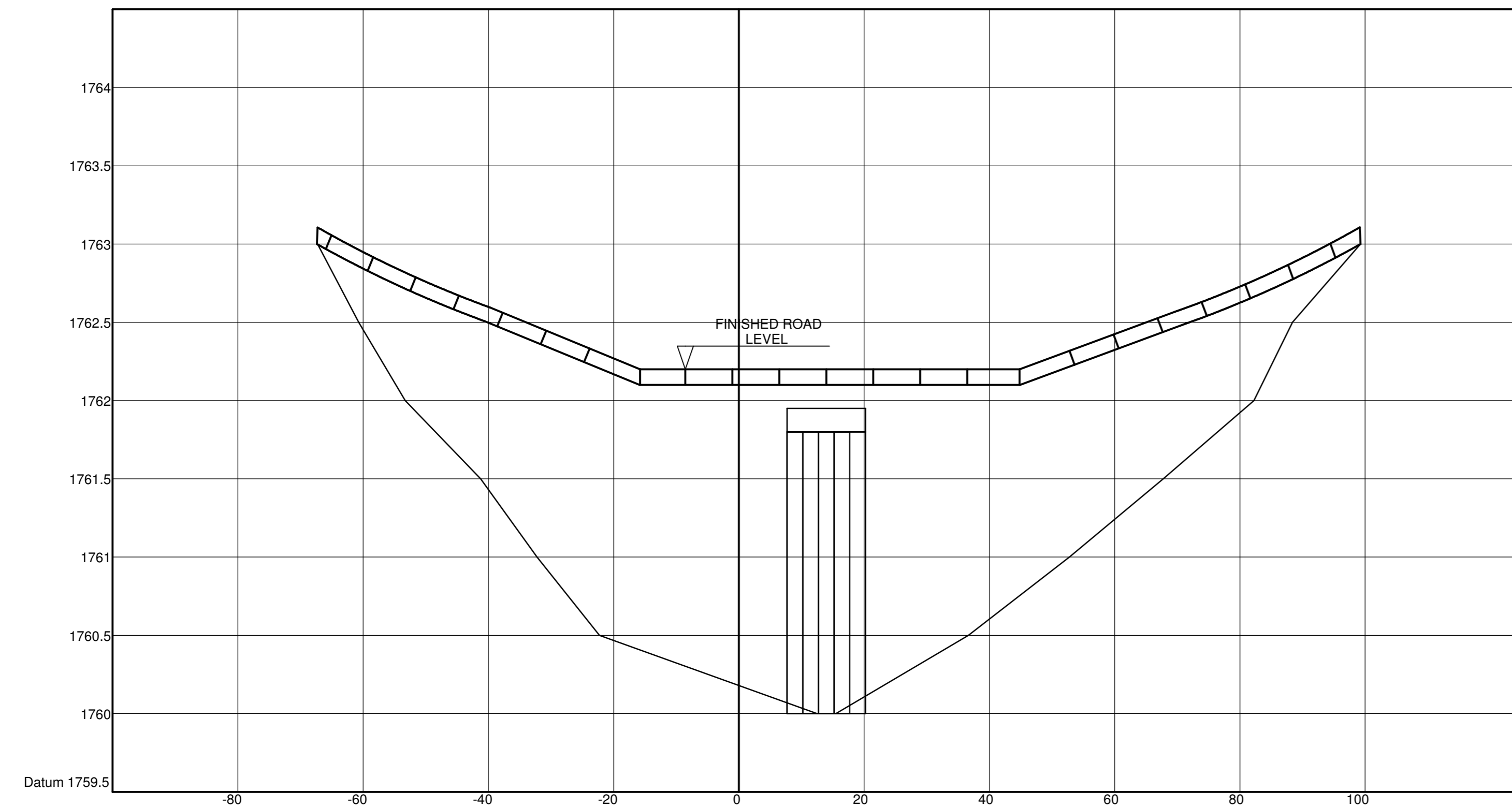
FOR INFORMATION		
BELFAST MINE STORM WATER MANAGEMENT AND ASSOCIATED INFRASTRUCTURE TYPICAL SPILLWAY DETAILS		
SCALE	DRAWING NUMBER	REVISION
N.T.S.	002802-BP-007	0



PLAN OF CONCRETE SURFACED ROAD AT LOW LEVEL CROSSING

LEGEND

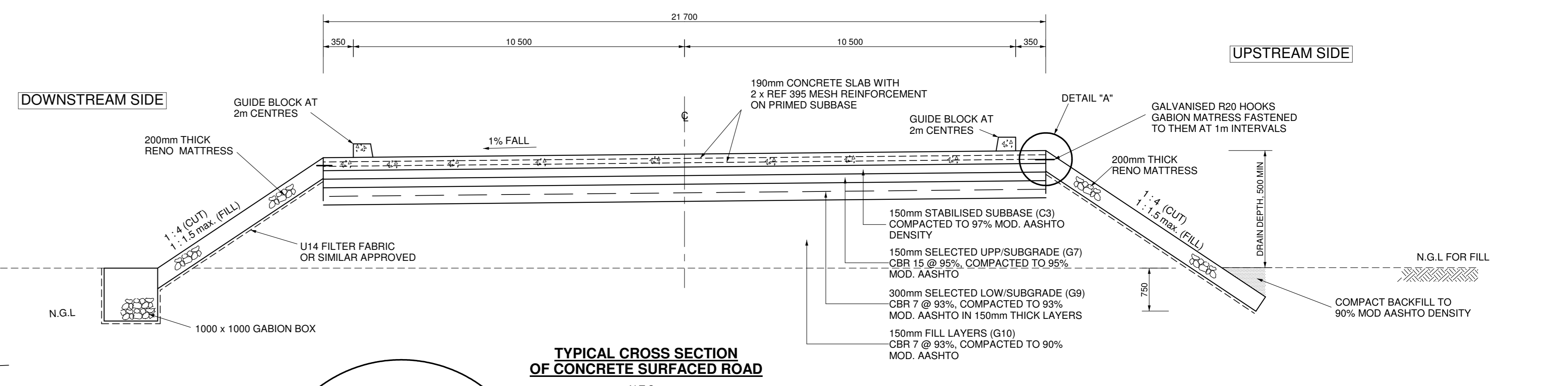
---	CONSTRUCTION JOINT
-	DOWEL JOINT
---	KEYED JOINT



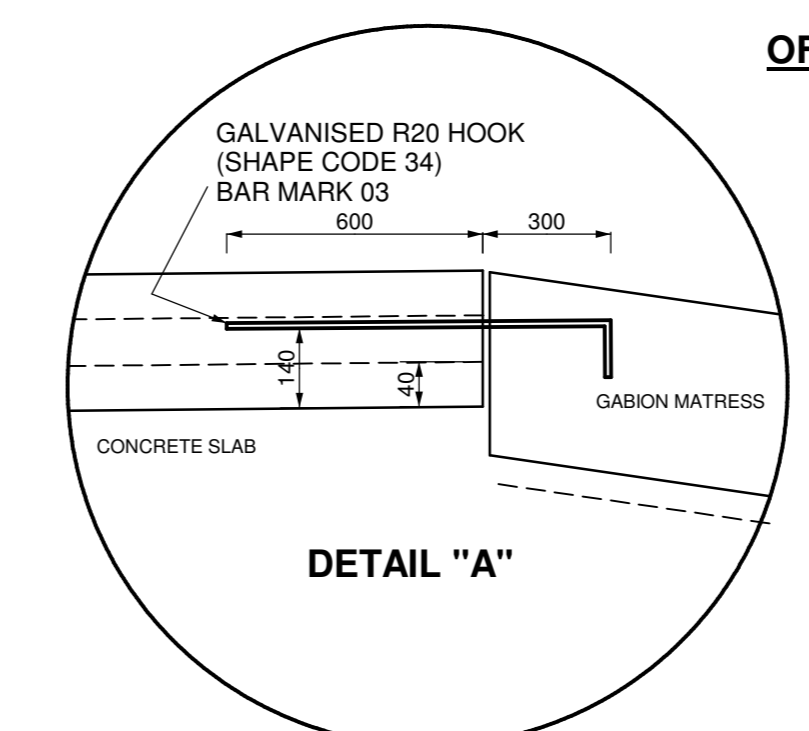
LONGITUDINAL SECTION
HORIZONTAL SCALE 1:250
VERTICAL SCALE 1:25

NOTES : (FOR CONCRETE ROAD)

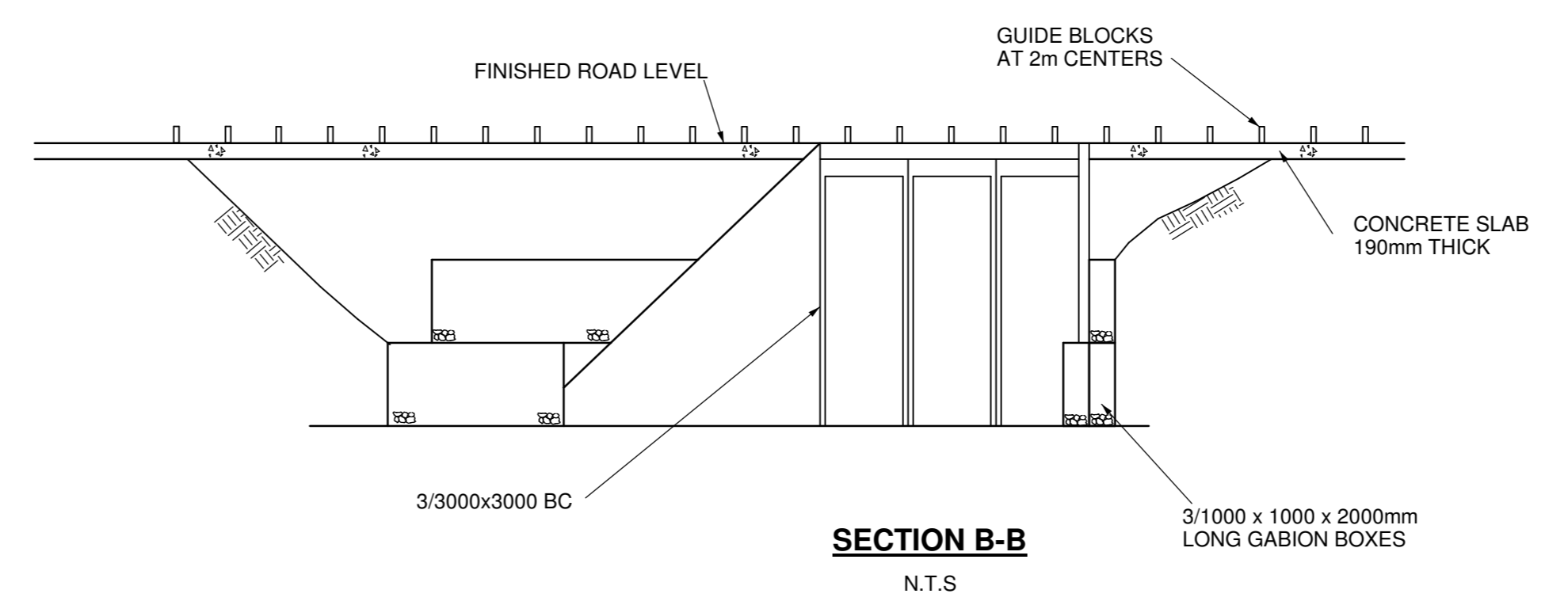
1. CONCRETE STRENGTH = 25MPa/19 AT 28 DAYS
2. CONCRETE FINISH - F2 FOR ALL EXPOSED SURFACES (WOOD FLOAT)
3. NO "HONEY-COMBING" MAY BE RECTIFIED BEFORE INSPECTION AND CONSENT OF THE ENGINEER
4. CONCRETE TO BE CURED FOR A MINIMUM OF 7 DAYS BY APPROVED METHODS
5. REINFORCEMENT IN TOP OF SLAB TO BE SUPPORTED BY STOOLS 1.0m APART
6. CONCRETE COVER TO REINFORCEMENT TO BE A MINIMUM OF 40mm
7. SHUTTERING MAY NOT BE REMOVED WITHIN 3 DAYS AFTER POURING
8. NO SHUTTERING MAY BE STRIPPED WITHOUT THE CONSENT OF THE ENGINEER
9. MINIMUM LAP LENGTH OF 300mm FOR Y10 STEEL
10. CONSTRUCTION TO COMPLY WITH SABS CODES FOR REINFORCED CONCRETE
11. SAW-CUT JOINTS TO BE CUT WITHIN 24 HOURS OF CASTING
12. CASTING TO BE IN ALTERNATIVE 3m PANELS
13. CONCRETE MIX DESIGN TO BE APPROVED BY THE ENGINEER BEFORE CASTING COMMENCES



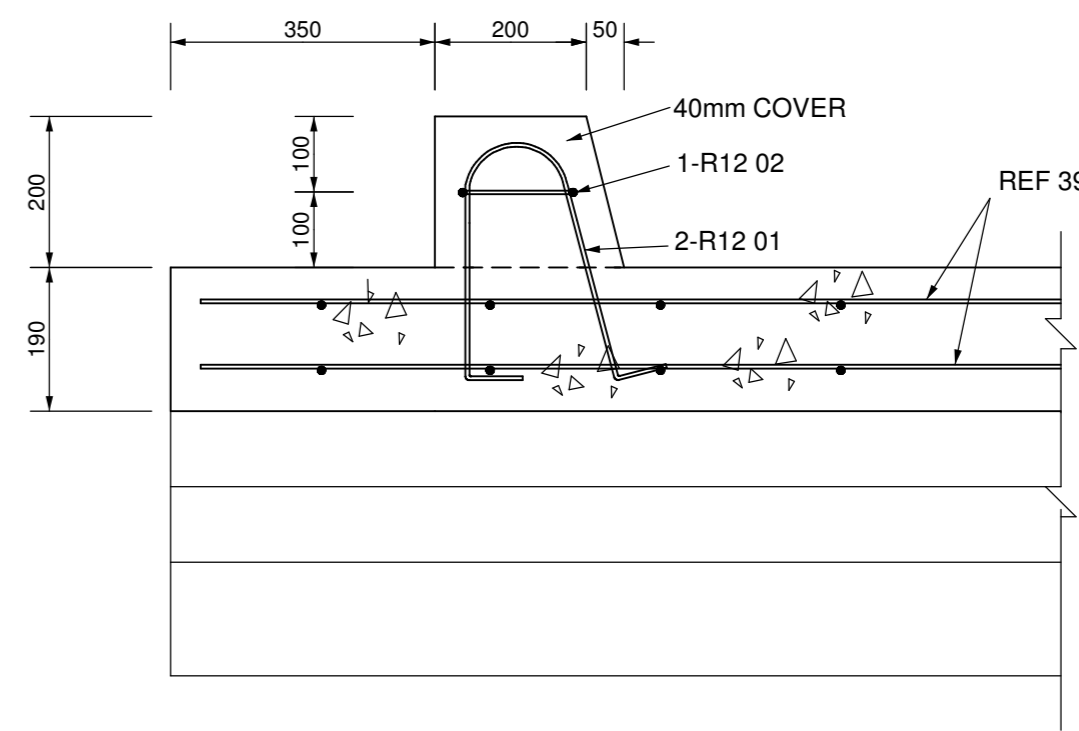
TYPICAL CROSS SECTION OF CONCRETE SURFACED ROAD
N.T.S.



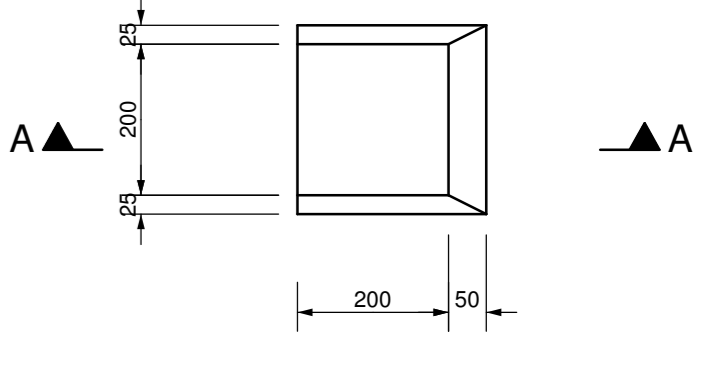
DETAIL "A"



SECTION B-B
N.T.S.

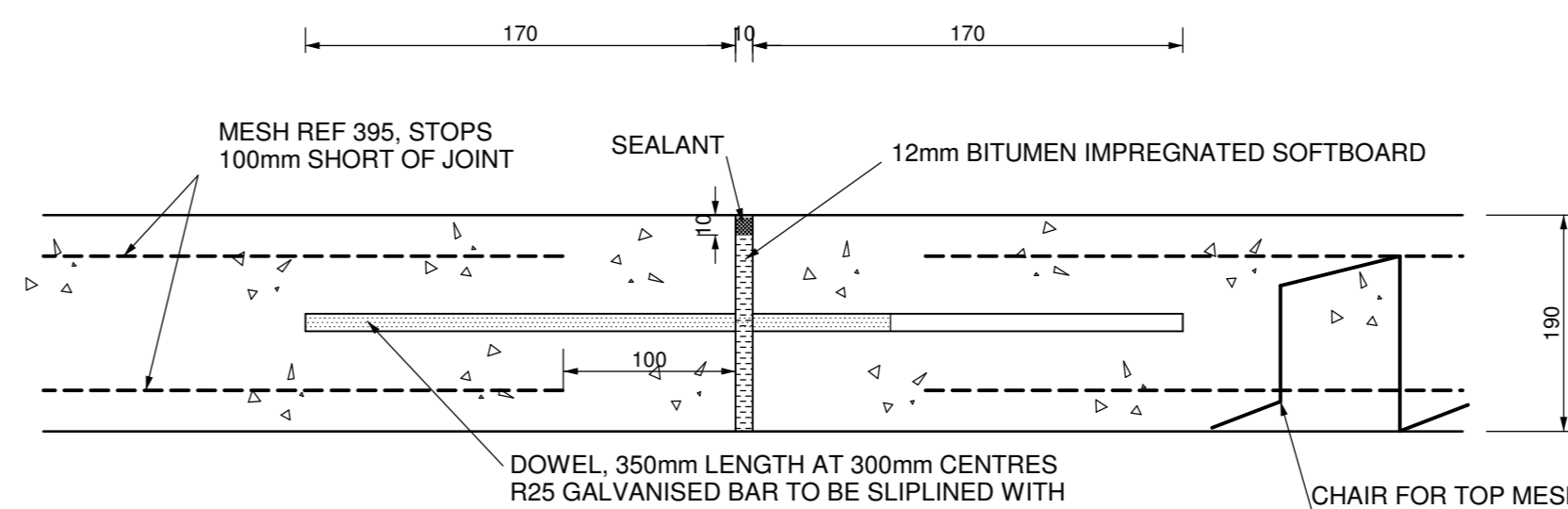


SECTION A-A
SCALE 1:10

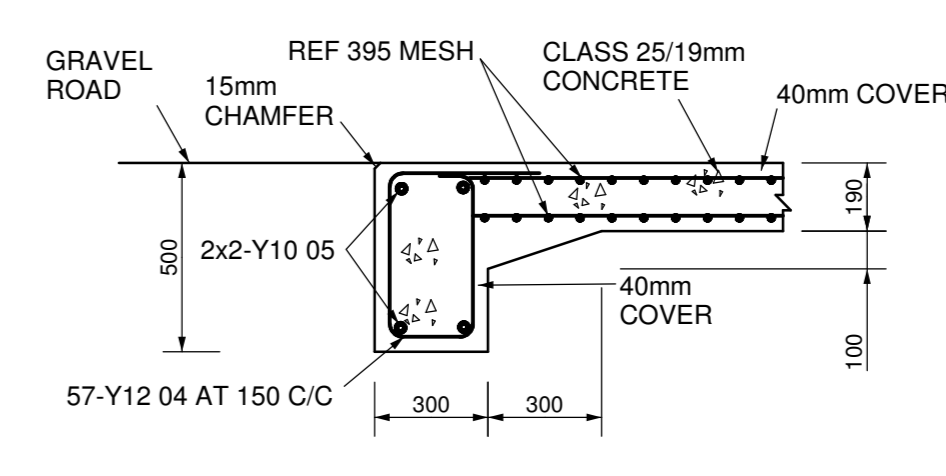


PLAN

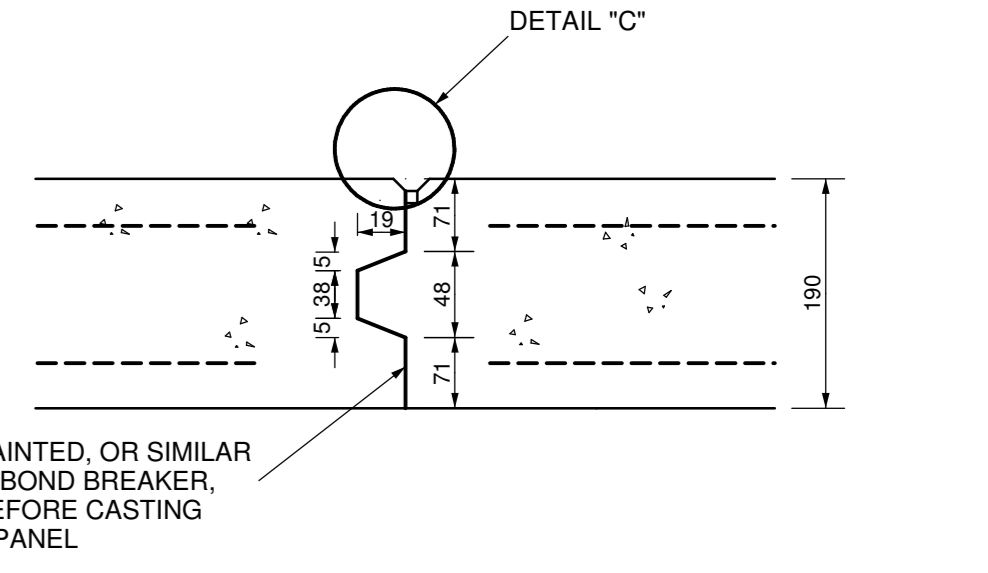
DETAIL OF A GUIDE BLOCK
SCALE 1:10



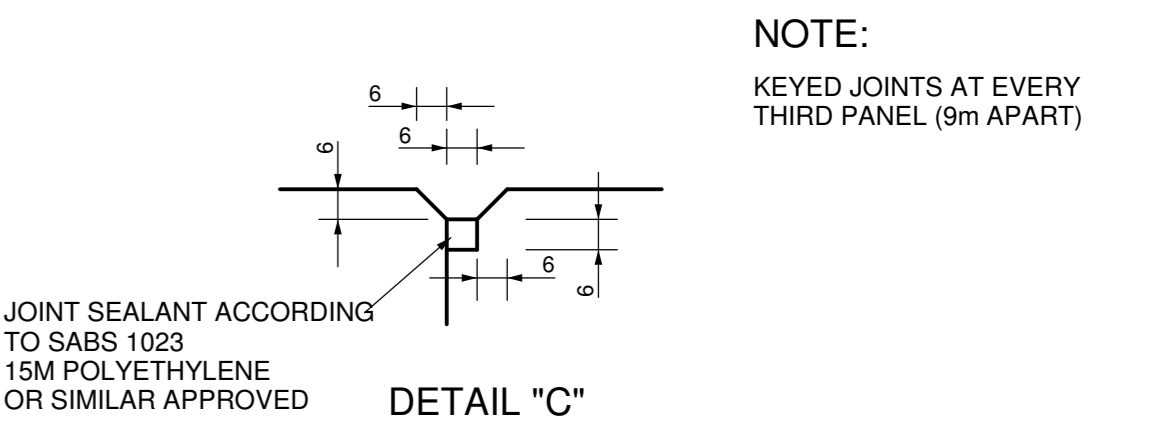
DOWEL JOINT
N.T.S.



DETAIL OF CUT-OFF WALL AT BEGINNING OF APPROACH SLAB
N.T.S.

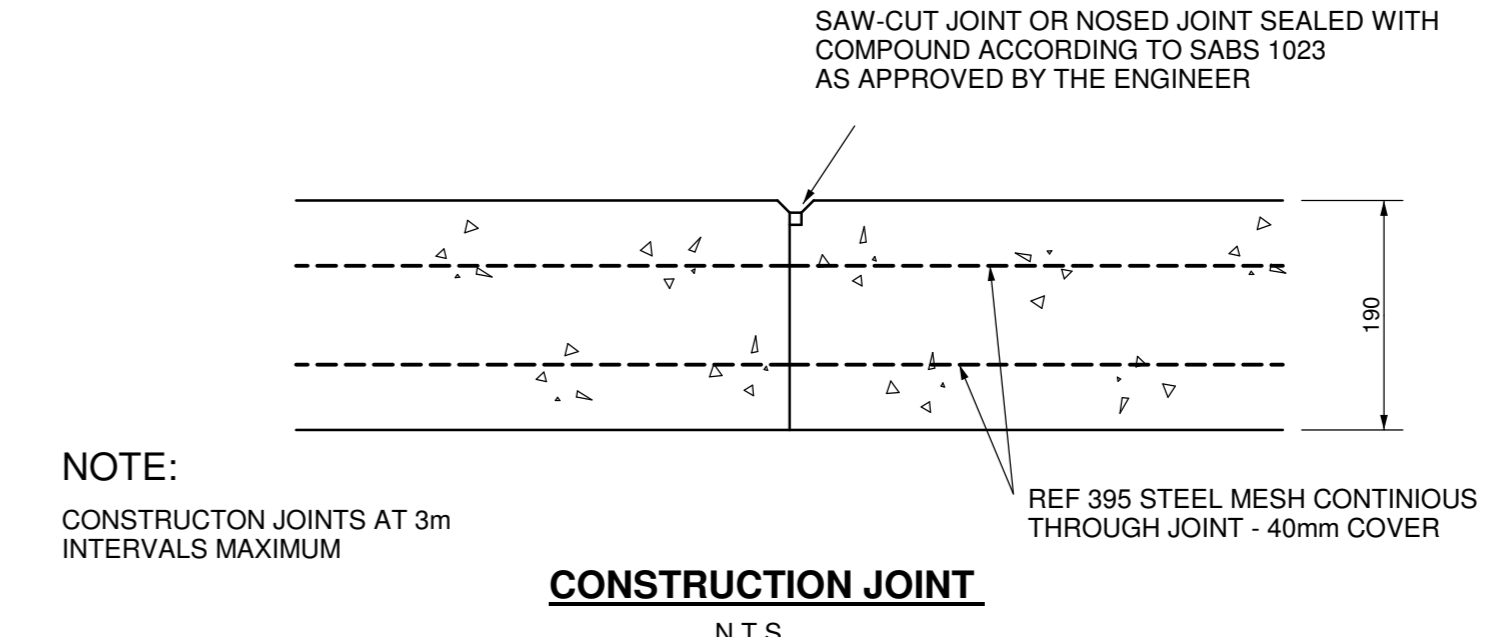


KEYED JOINT
N.T.S.



DETAIL "C"

NOTE:
KEYED JOINTS AT EVERY THIRD PANEL (9m APART)



CONSTRUCTION JOINT
N.T.S.

NOTE :
1. DESIGN TO BE ADJUSTED FOR ABNORMAL LOADS

REV. No.	DATE	REVISIONS	DRAWN	CHECK	APPR.	REFERENCE DRAWINGS	
						DRG No.	DESCRIPTION

NAME	SIGNATURE	DATE
PROF. ENG. R. Le Roux		
DESIGN ENG. R. Le Roux		
CHECKER E. Kyle		
DRAWN R. Ramuthufhi		

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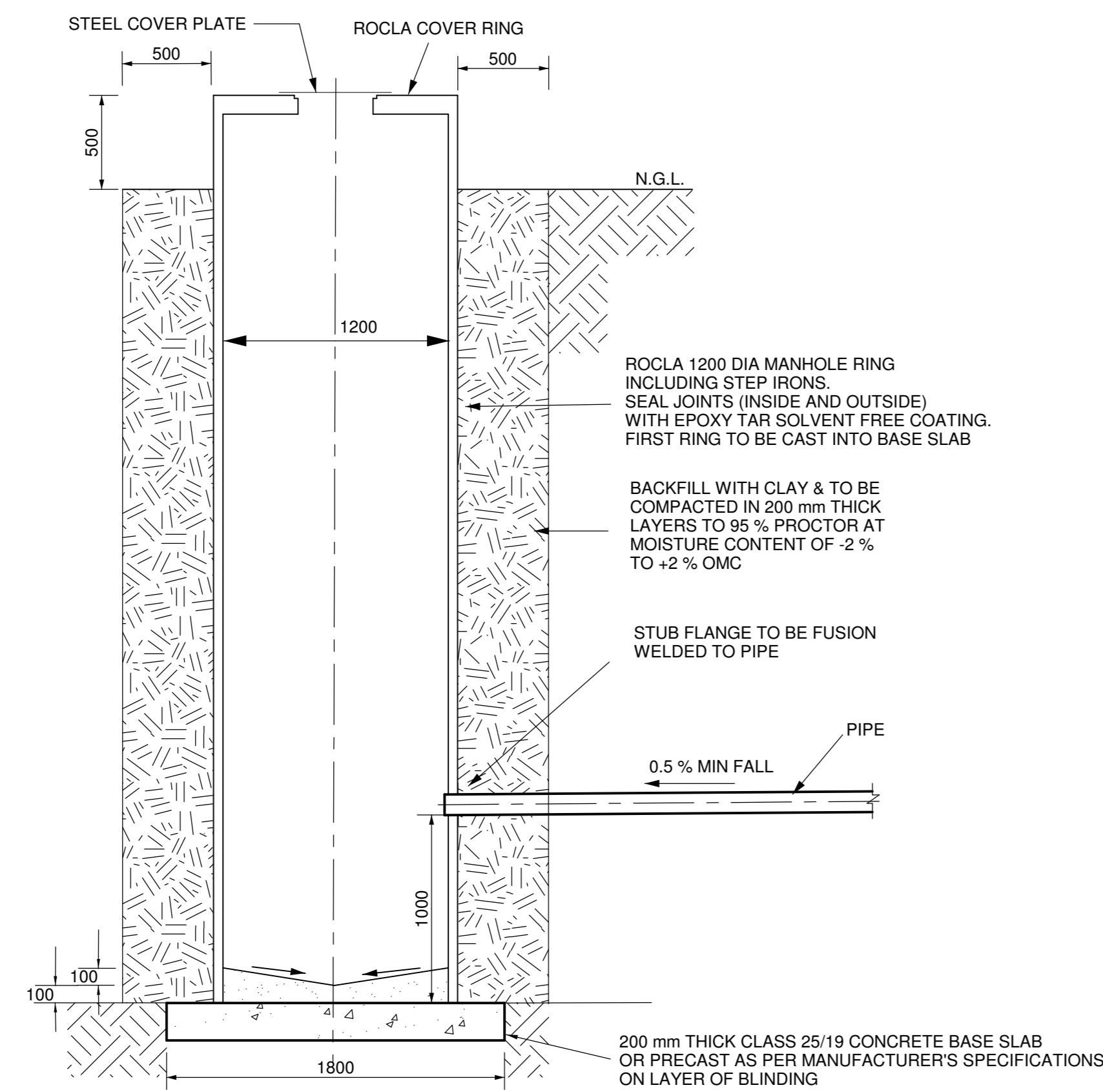
FOR INFORMATION

BELFAST MINE STORMWATER MANAGEMENT AND ASSOCIATED INFRASTRUCTURE

LOW LEVEL STRUCTURE SECTION AND FLOODLINES

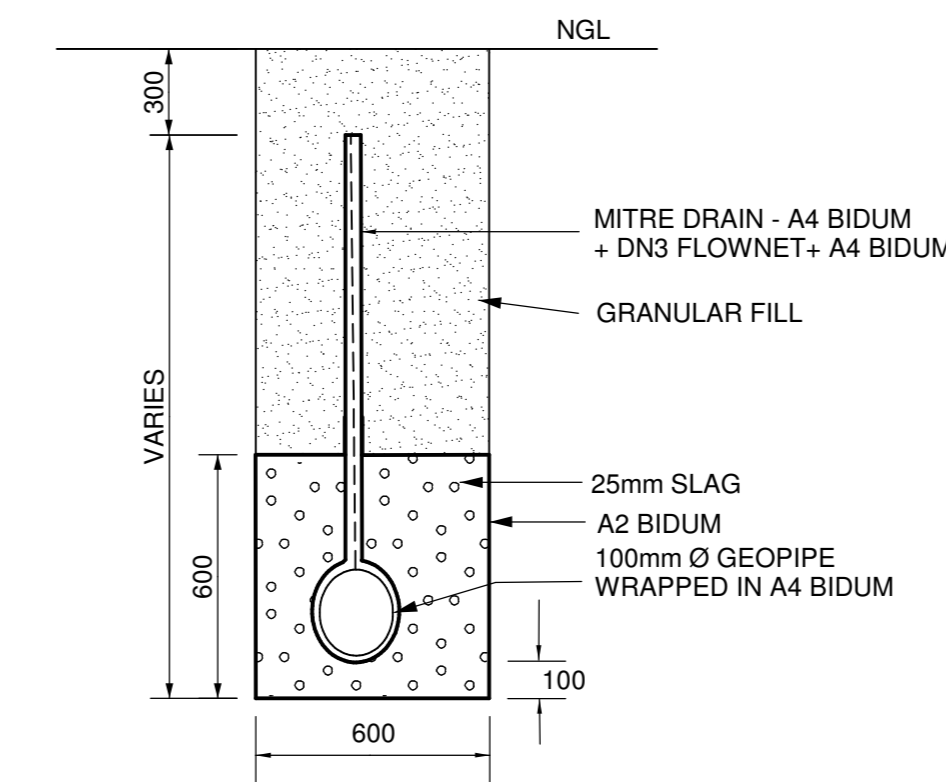
SCALE	DRAWING NUMBER	REVISION
N.T.S.	002802-BP-008	0

W:\022802 - Belfast Stormwater - CC Le Roux\03 Drawings\Working drawings\2802\LN LOW LEVEL CROSSING - 18/02/2011.DWG



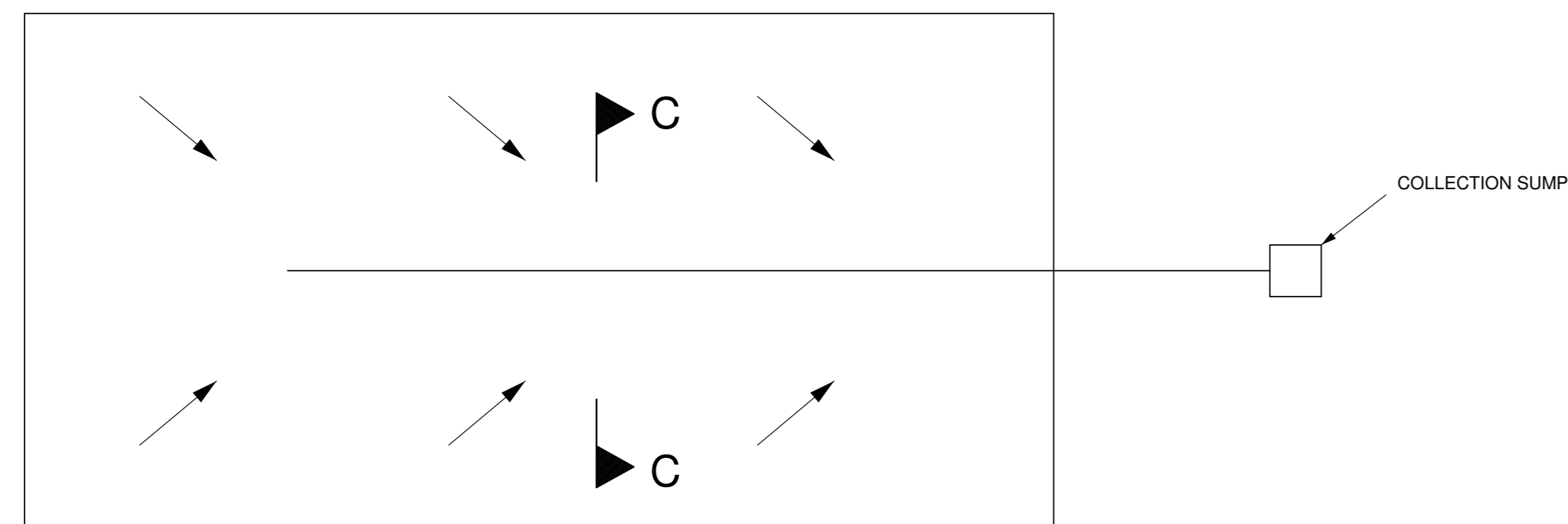
TYPICAL MONITORING MANHOLE / SUMP

N.T.S.



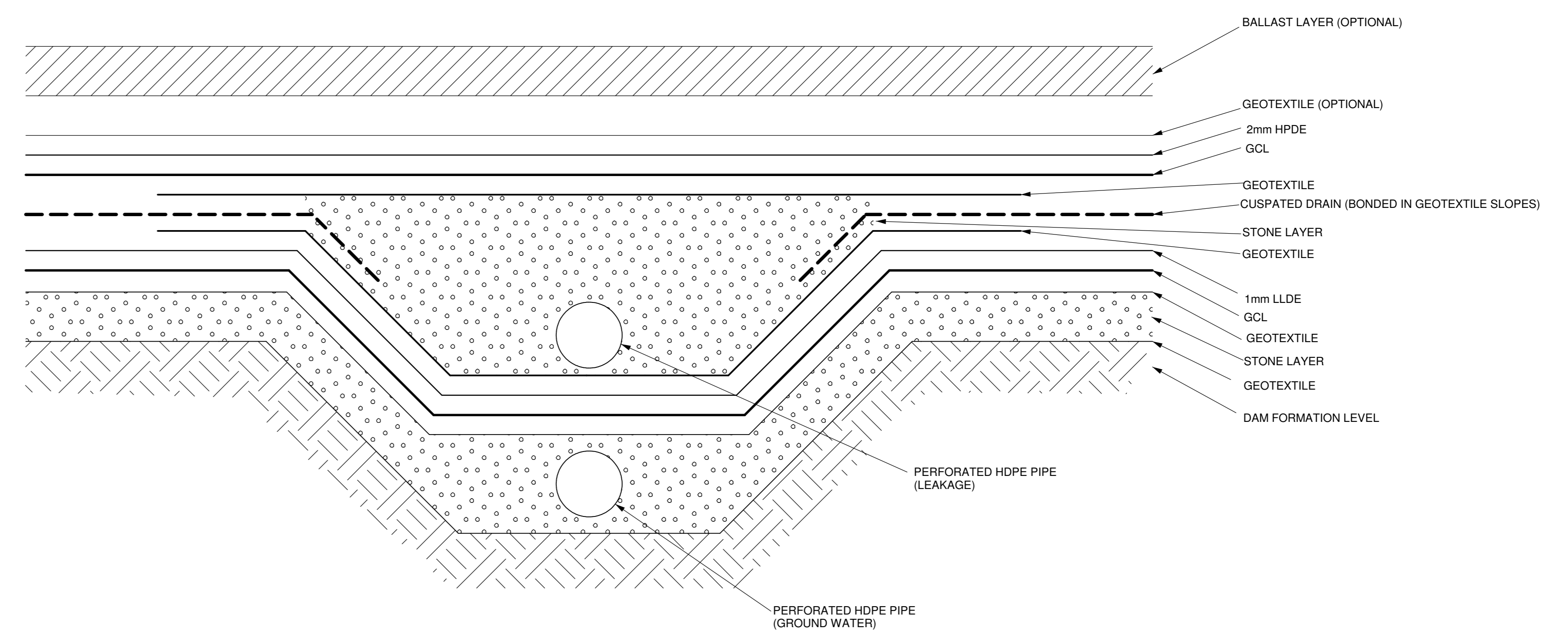
VERTICAL CUT-OFF DRAIN

N.T.S.





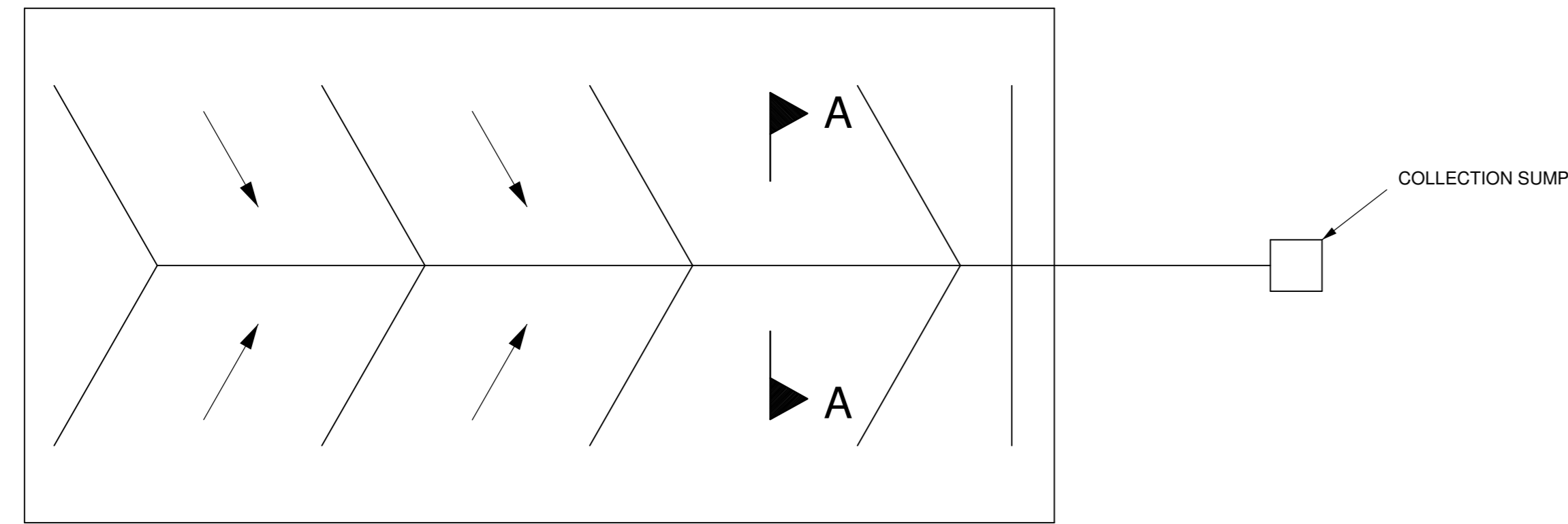
DAM FLOOR - LEAKAGE DETECTION AND SUBSURFACE DRAINAGE

N.T.S.



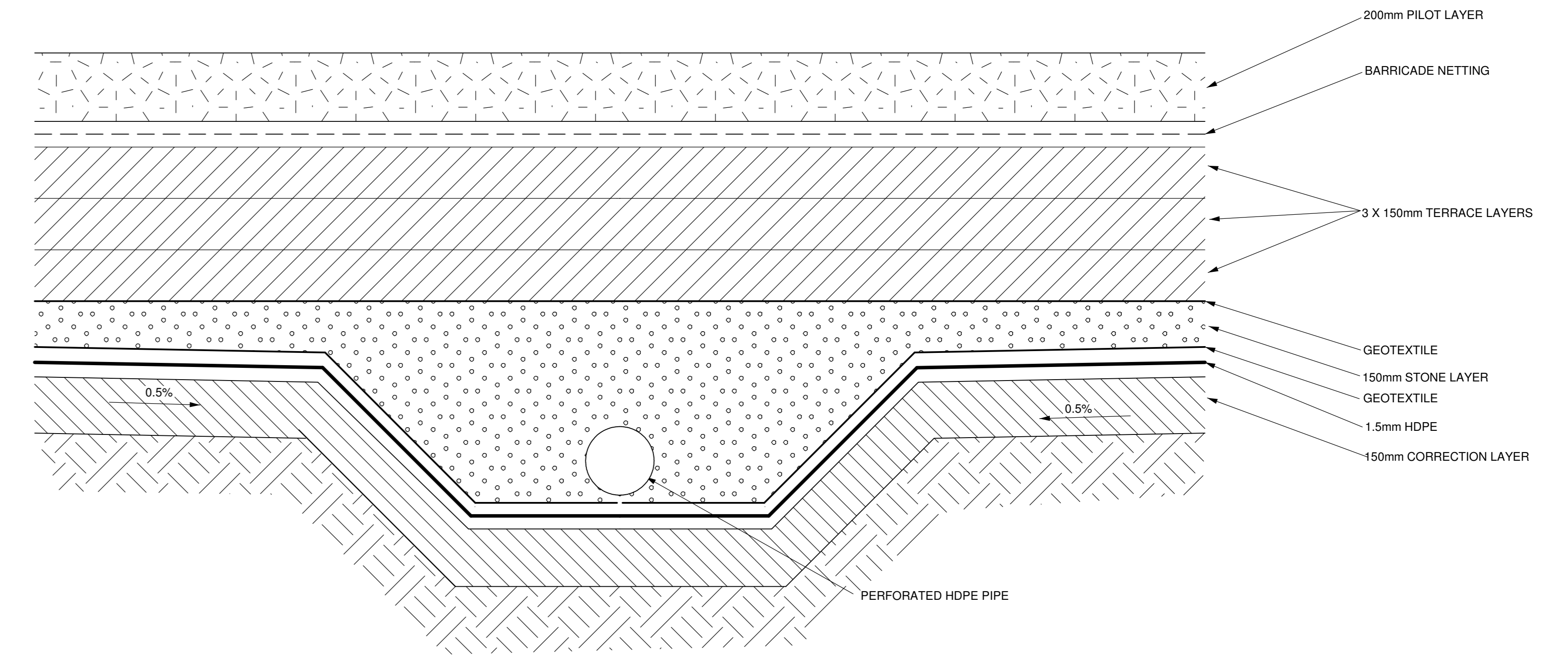
SECTION C - C

REV. No.	DATE	REVISIONS	DRAWN	CHECK	APPR.	DRG No.	DESCRIPTION	NAME	SIGNATURE	DATE	NOTICE:	AREA ENGINEER	DRAWN BY	 www.jgi.co.za	 Belfast Coal	FOR INFORMATION			
								PROF. ENG. R. LE ROUX			THIS DRAWING HAS NOT BEEN PUBLISHED AND IS THE SOLE PROPERTY OF EXXARO RESOURCES AND IS LOANED TO THE BORROWER FOR HIS CONFIDENTIAL USE ONLY. AND IN CONSIDERATION OF THE LOAN OF THIS DRAWING, THE BORROWER PROMISES AND AGREES THAT IT SHALL NOT BE PRODUCED, COPIED, LOANED OR OTHERWISE DISPOSED OF DIRECTLY OR INDIRECTLY NOR USED FOR ANY PURPOSE OTHER THAN THAT FOR WHICH IT IS FURNISHED.	MECHANICAL	CHECKED BY	Physical Address: Landmark Building East 3rd Floor Pretoria Umgazi Road Menlo Park 0081 Tel: +27 12 460 2008 Fax: +27 12 460 2053	Postal Address: P.O. Box 2973 Pretoria 0001	Business Unit Exxaro Resources Ltd. Registered Office: Rodger Dyason Road Pretoria West 0183 Tel: +27 12 307 5000 Fax: +27 12 323 3400	BELFAST MINE STORMWATER MANAGEMENT AND ASSOCIATED INFRASTRUCTURE		
							DESIGN ENG. R. LE ROUX			STRUCTURAL/PIPING		AREA MANAGER	SUBSURFACE DRAINAGE DETAILS						
							CHECKER J. NEL			CIVIL		MANAGER ENGINEERING	SCALE				DRAWING NUMBER	REVISION	
							DRAWN K.A. MASHEGO			ELECTRICAL INSTRUMENTATION		PROJECT & CONSTRUCTION MANAGER	N.T.S.				002802-BP-009	0	
										PROCESS	CLIENT								

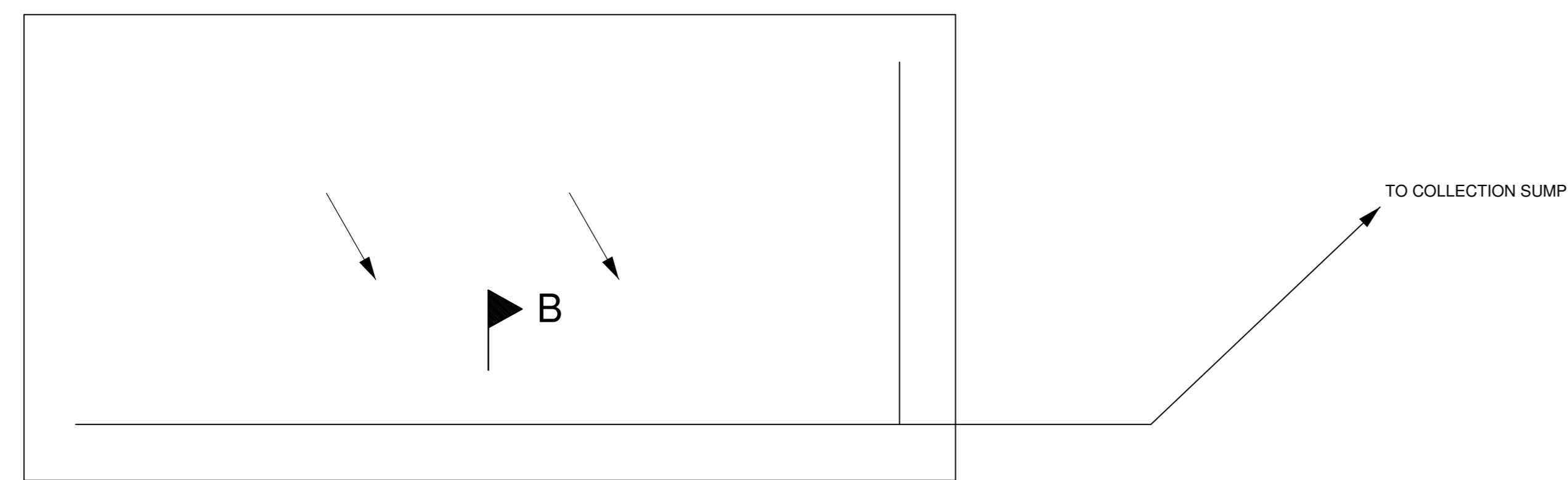


DISCARD FACILITY AREA - SEEPAGE COLLECTION

N.T.S.

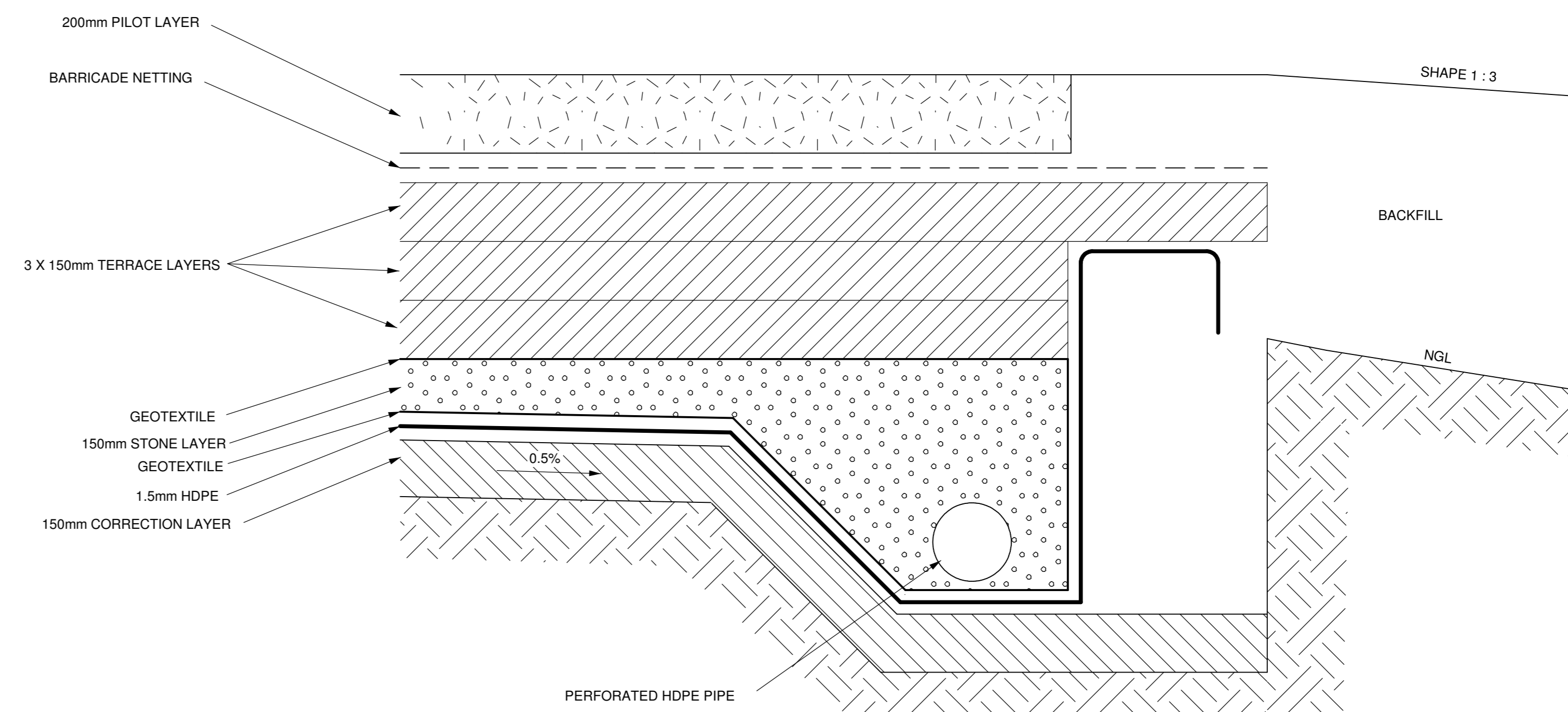


SECTION A - A





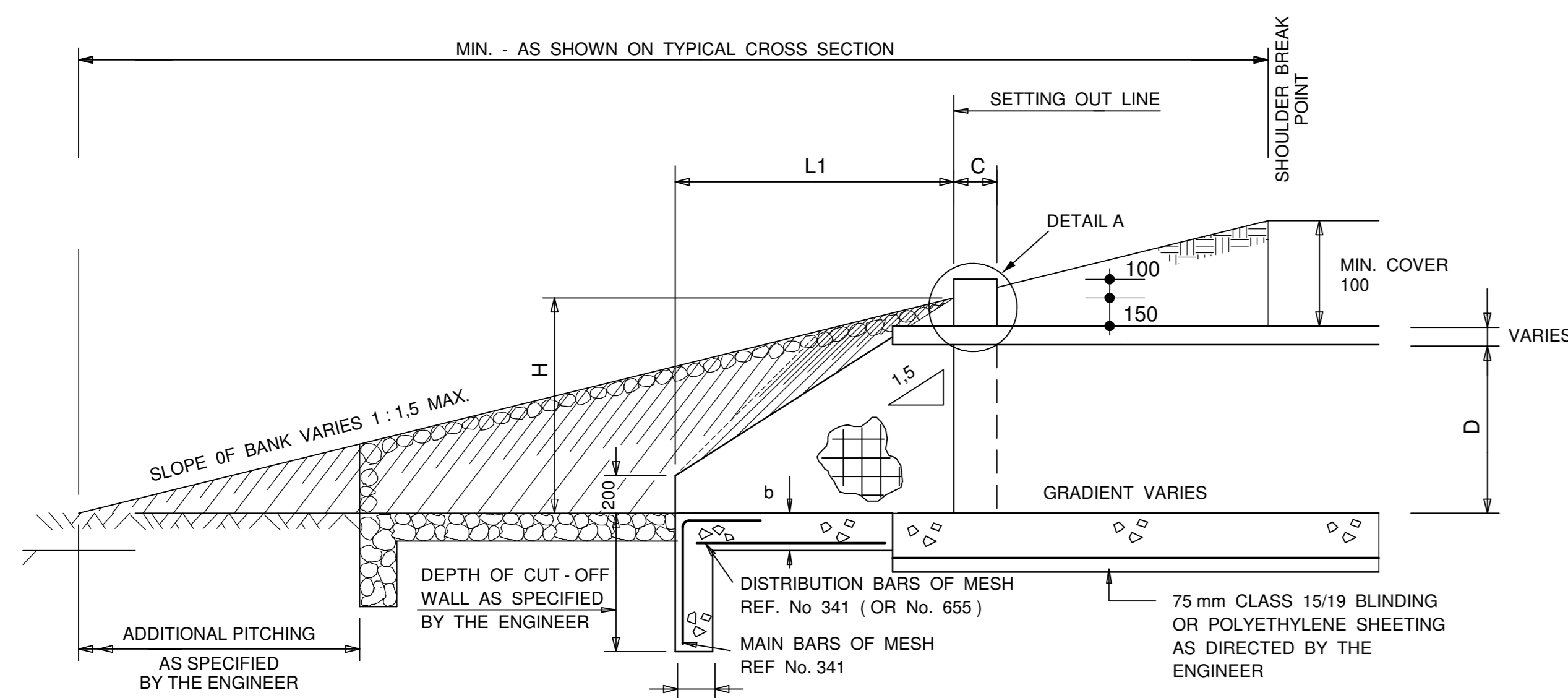
STOCKPILE AREA - SEEPAGE COLLECTION (SMALL AREAS)

N.T.S.

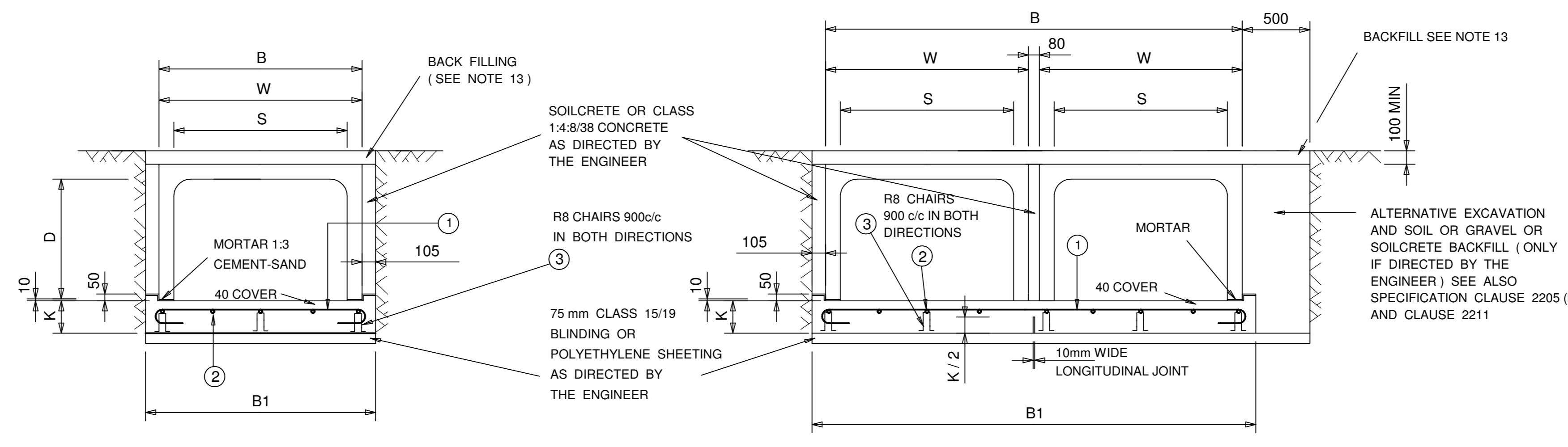


SECTION B - B

REV. No.	DATE	REVISIONS	DRAWN	CHECK	APPR.	DRG No.	DESCRIPTION	NAME	SIGNATURE	DATE	NOTICE:	AREA ENGINEER	DRAWN BY	 www.jgi.co.za Physical Address: Landmark Building East, 3rd Floor Pretoria, Umgazi Road, Menlo Park, 0081 Tel: +27 12 460 2008, Fax: +27 12 460 2053	 www.exxaro.com Business Unit: Exxaro Resources Ltd. Registered Office: Rodger Dyason Road, Pretoria West, 0183 Tel: +27 12 307 5000, Fax: +27 12 323 3400	FOR INFORMATION		
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							DESIGN ENG. R. LE ROUX			STRUCTURAL/PIPING		AREA MANAGER	N.T.S.		002802-BP-010	0		
							CHECKER J. NEL			CIVIL		MANAGER ENGINEERING						
							DRAWN K.A. MASHEGO			ELECTRICAL/INSTRUMENTATION		PROJECT & CONSTRUCTION MANAGER						
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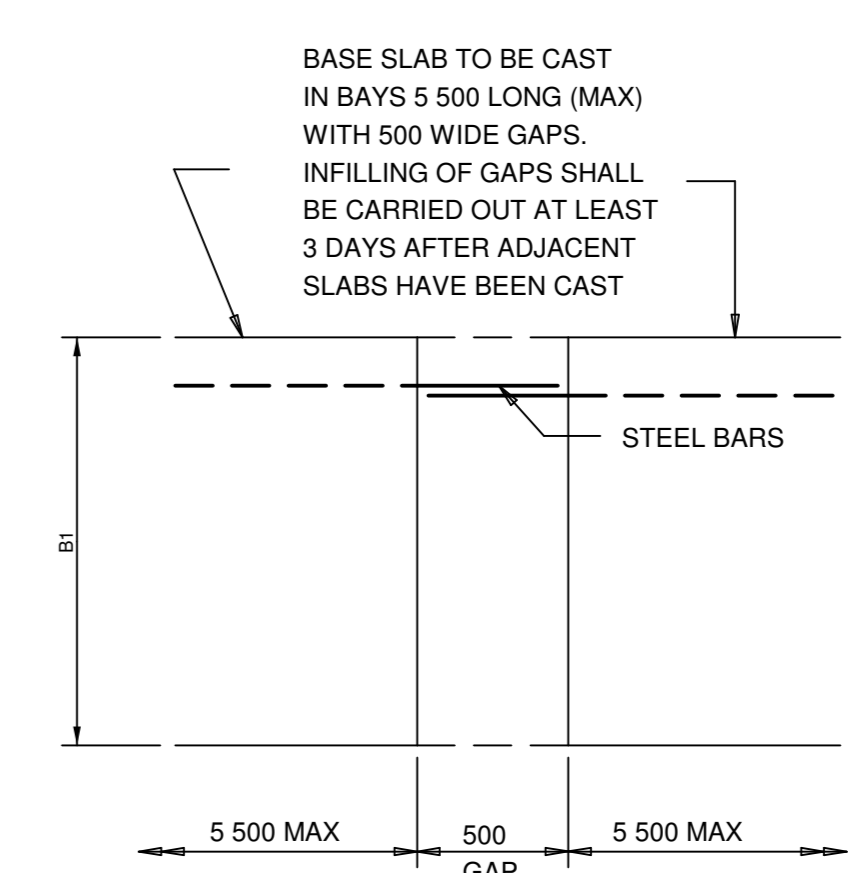


SECTION A - A SINGLE UNIT



SECTION C - C SINGLE UNIT

SECTION C - C MULTIPLE UNIT



CASTING OF BASE SLAB

NOTES:

1. THE ENGINEER MAY ORDER ADDITIONAL EXCAVATION OF POOR QUALITY MATERIAL BELOW THE INVERT SLAB (SUCH AS EXPANSIVE CLAY).
2. THE ENGINEER MAY ORDER REPLACEMENT OF SUCH EXCAVATED MATERIAL WITH SUITABLE GRAVEL COMPACTED TO 90% MOD. AASHTO DENSITY.

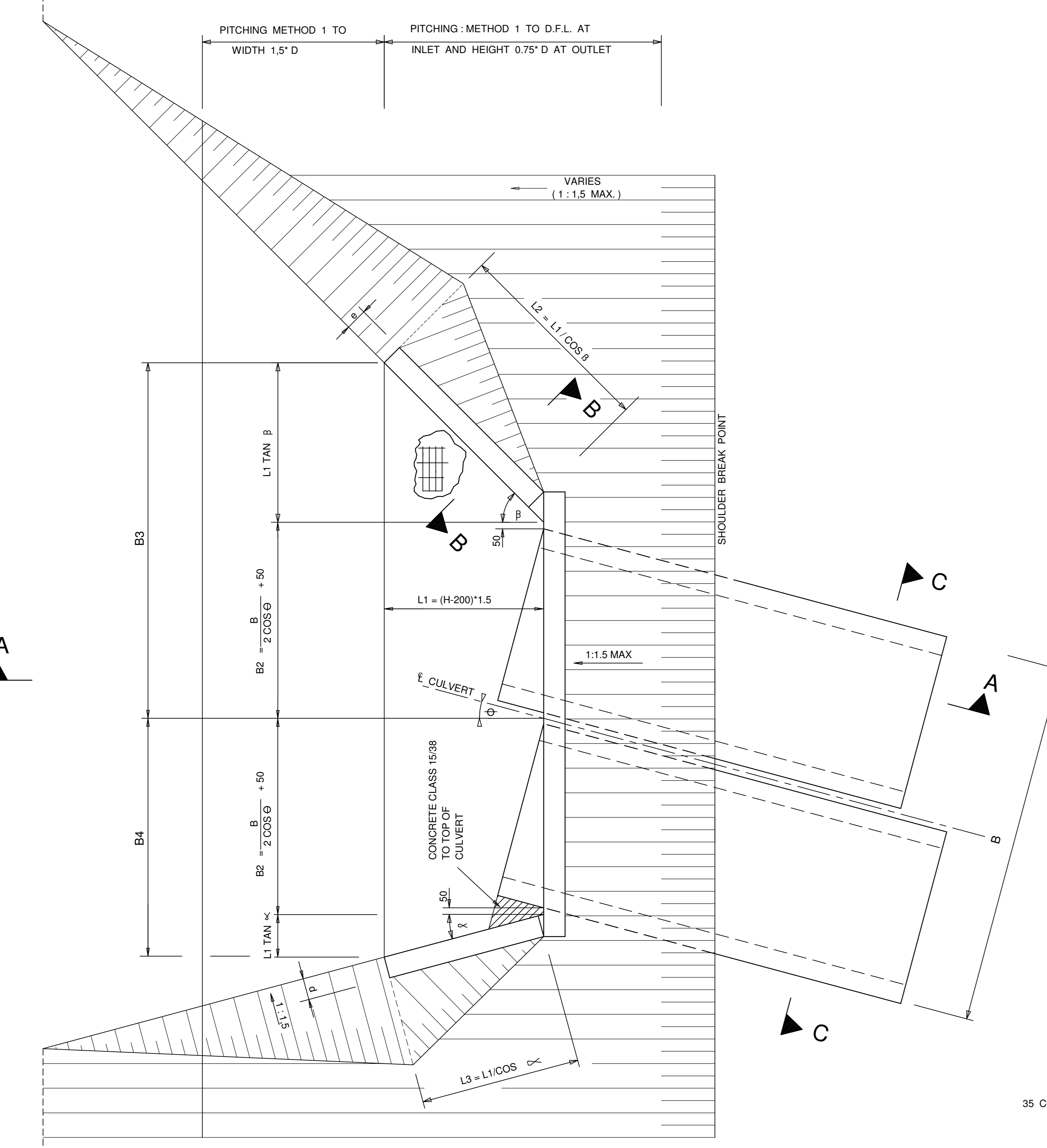
THICKNESSES					
H	A	b	c	d	e
				SHORT OR EQUAL WINGS	LONG WINGS
H<=1200	300	150	200	150	200
1200<H<2000	350	200	250	200	225

$\beta = 30 + \theta$ IF $\theta \leq 30^\circ$
 $\beta = 45 + \theta/2$ IF $\theta > 30^\circ$
 $\alpha = 30 - \theta$ IF $\theta \leq 30^\circ$
 $\alpha = \theta$ IF $\theta > 30^\circ$

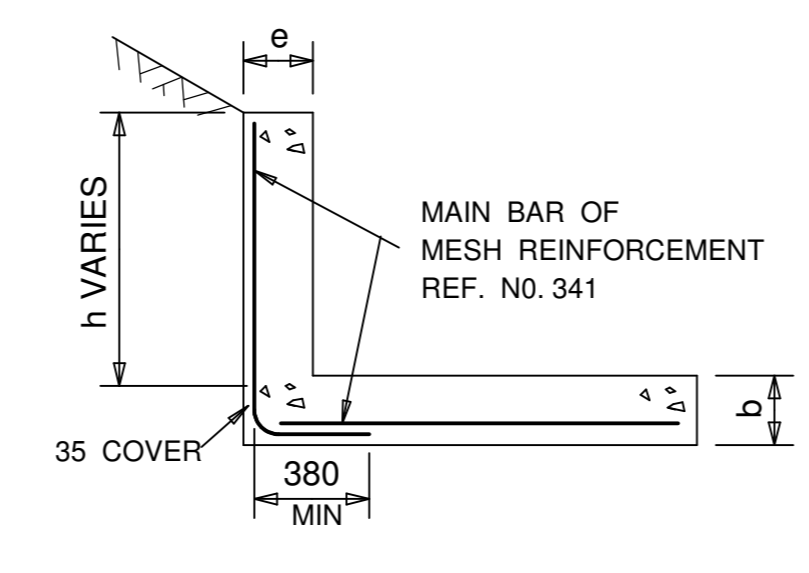
MAXIMUM FILL HEIGHTS OVER CULVERTS		
SPAN S (mm)	MAX. FILL (mm)	S.A.B.S. CLASS
600	6 000	100 S
750	5 000	100 S
900	4 000	100 S
1 200	3 000	100 S
1 500	2 500	C
1 800	2 000	C
2 400	1 500	C

NOTES

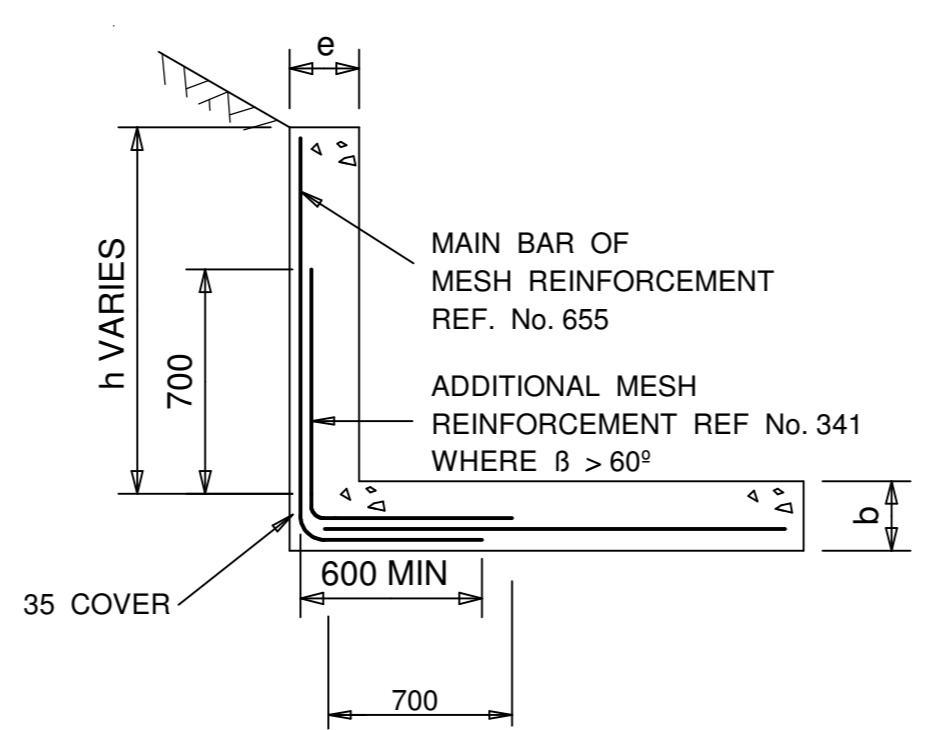
1. LOAD STATEMENT: CULVERT BASES DESIGNED FOR FULL M.O.T. LOADING SEPT. 1931 AND CHECKED FOR ABNORMAL VEHICLE GROUP B LOADING AND NC 30-5-40 LOADING.
2. CONCRETE: CULVERT BASES CLASS 25/19. APRONS CLASS 20/19. BACKFILL CONCRETE CLASS 1:4/8/38.
3. REINFORCING: H.T. WELDED WIRE MESH SHALL COMPLY WITH THE REQUIREMENTS OF S.A.B.S. 1024. MIN. LAP FOR REF. No 341-250mm AND FOR REF. No 655-400mm. BARS SHALL COMPLY WITH THE REQUIREMENTS OF S.A.B.S. 920 TYPE C CLASS 2, GRADE 1. SEE NOTE 'ALTERNATIVE REINFORCING'.
4. COVER TO REINFORCING: BARS MIN. 40mm AND H.T. MESH 35mm
5. DESIGN MASS OF FILL: 1 900 kg/m³ WITH INTERNAL ANGLE FRICTION = 30°
6. LOAD FACTOR: FOR PROOF LOAD OF H.T.(Y) REINFORCING, WORKING STRESS 2075 Mpa.
7. PREFAB. PORTAL CULVERTS: SHALL COMPLY WITH REQUIREMENTS OF S.A.B.S. 986.
8. MIN. AND MAX. HEIGHT OF COVER: MIN = 100mm MAX. SEE TABLE
9. BUTT JOINTS: OF CULVERTS SHALL BE WRAPPED EXTERNALLY WITH TWO LAYERS OF APPROVED SELF-ADHESIVE PLASTIC WRAPPING TAPE AT LEAST 100mm WIDE.
10. DIMENSIONS: THE DIMENSIONS IN THE TABLE MAY NOT CONFORM TO ALL MARKETED UNITS. AMEND DIMENSIONS IN TABLE IF NECESSARY.
11. CHAMFERING: 25mm X 25mm ON EXPOSED CORNERS OF IN-SITU CONCRETE
12. SOILCRETE: SHALL CONSIST OF APPROVED SOIL OR GRAVEL MIXED WITH 5% PORTLAND CEMENT (OF DRY MASS); SEE CLAUSE 2211 OF SPECIFICATIONS.
13. BACKFILL: MATERIAL SHALL BE OF AT LEAST GRAVEL SUBBASE QUALITY AND SHALL BE COMPACTED IN LAYERS (NOT EXCEEDING 150mm THICK AFTER COMPACTION) TO A DENSITY OF AT LEAST THAT REQUIRED FOR THE MATERIAL IN ADJOINING LAYERS OF FILL, SUBGRADE OR SUBBASE. THE DENSITY OF BACKFILLING IN EXCAVATIONS MADE IN NATURAL GROUND SHALL BE AT LEAST 90% OF MOD AASHTO DENSITY. SEE CLAUSE 2211 OF THE SPECIFICATIONS. PROPPING OF LONG LEGS IS NECESSARY DURING BACKFILLING.
14. FORMWORK: TO IN-SITU CONCRETE SHALL PROVIDE THE FOLLOWING SURFACE FINISHES: CONCEALED SURFACES - CLASS F1 EXPOSED SURFACES - CLASS F2
15. UNFORMED SURFACES: (CLAUSE 6209 OF THE SPECIFICATIONS) CLASS U2 SURFACE FINISH ON TOPS OF HEADWALLS, TOPS OF WINGWALLS, INVERTS TO BASE SLABS AND INVERTS TO APRONS.
16. PITCHING: THE EXTENT OF PITCHING MAY BE VARIED AS ORDERED BY THE ENGINEER AND HE MAY ORDER GROUTED STONE PITCHING OR WIRED AND GROUTED STONE PITCHING OR OTHER METHODS OF PROTECTION TO SUIT THE CULVERT SITES.



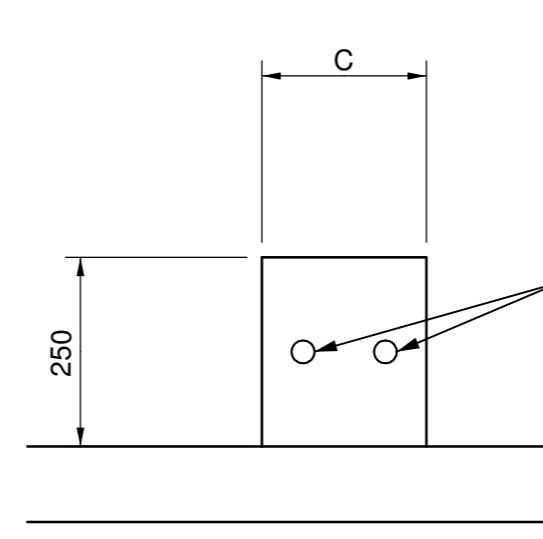
PLAN OF CULVERT WINGWALLS INLET / OUTLET



SECTION B - B
h < 1200



SECTION B - B
1200 < h < 2000

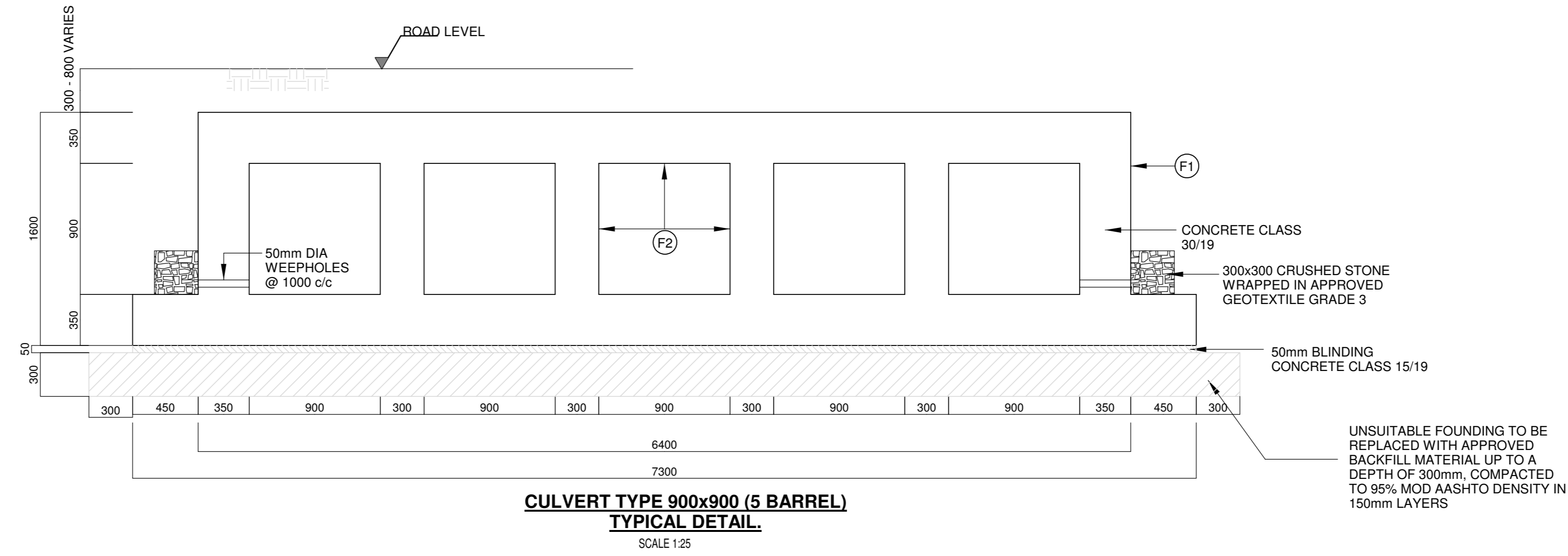
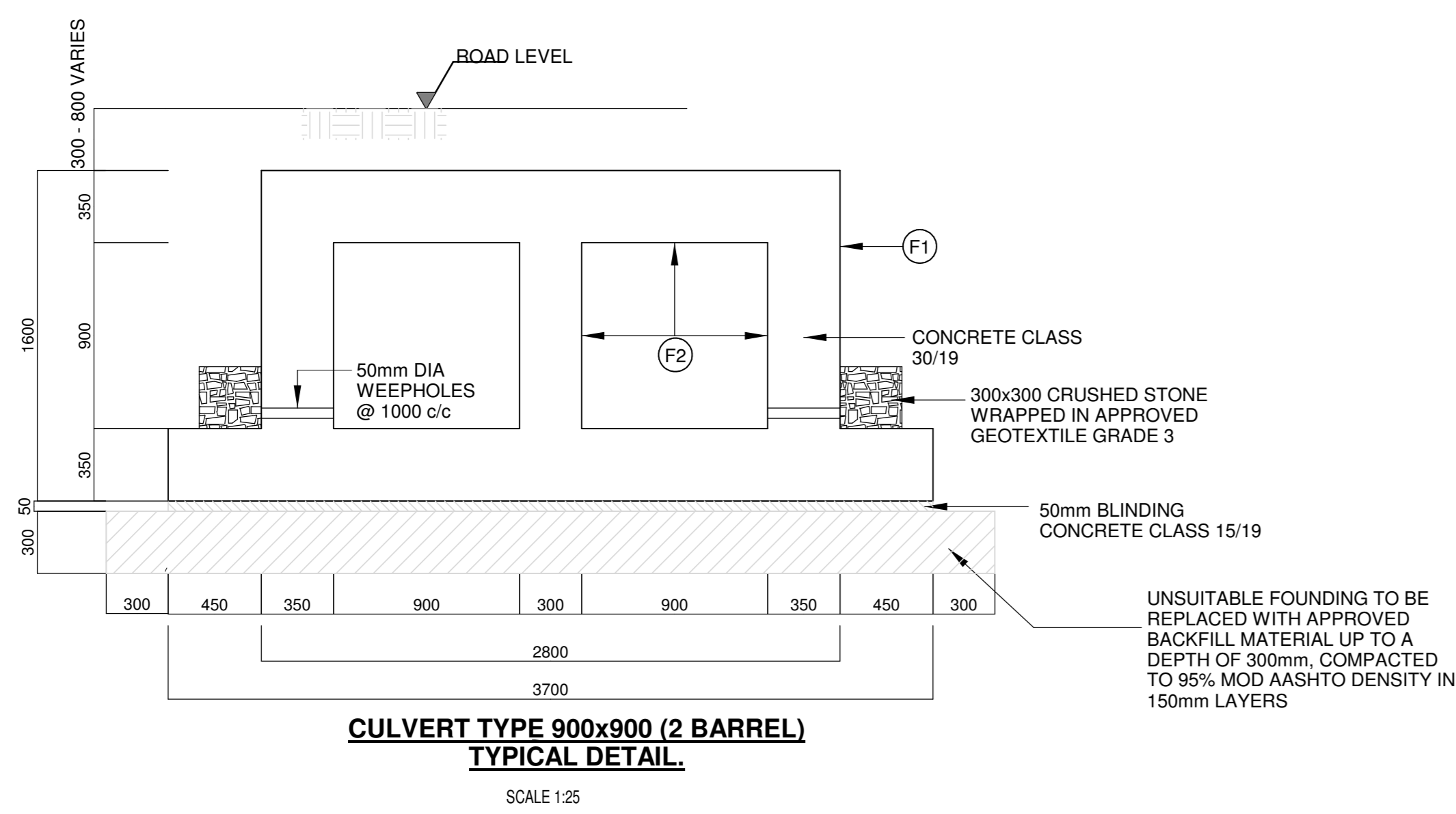
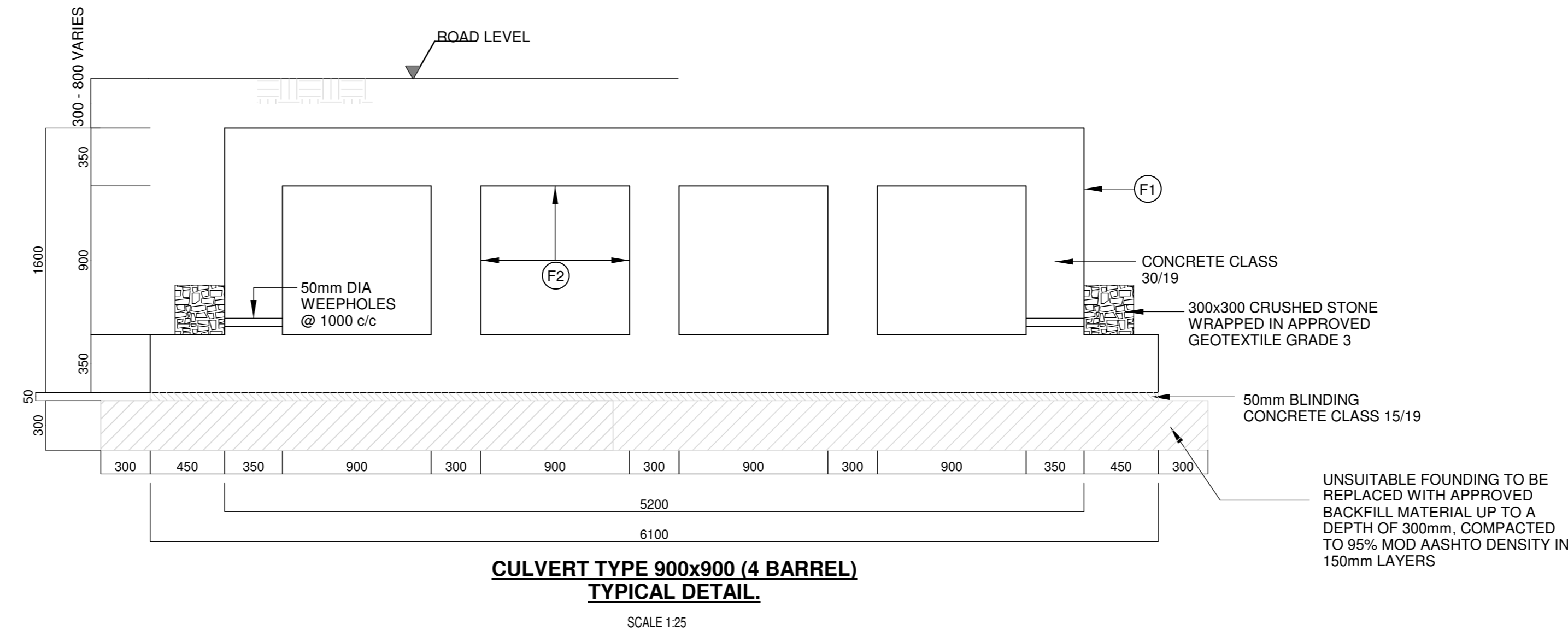
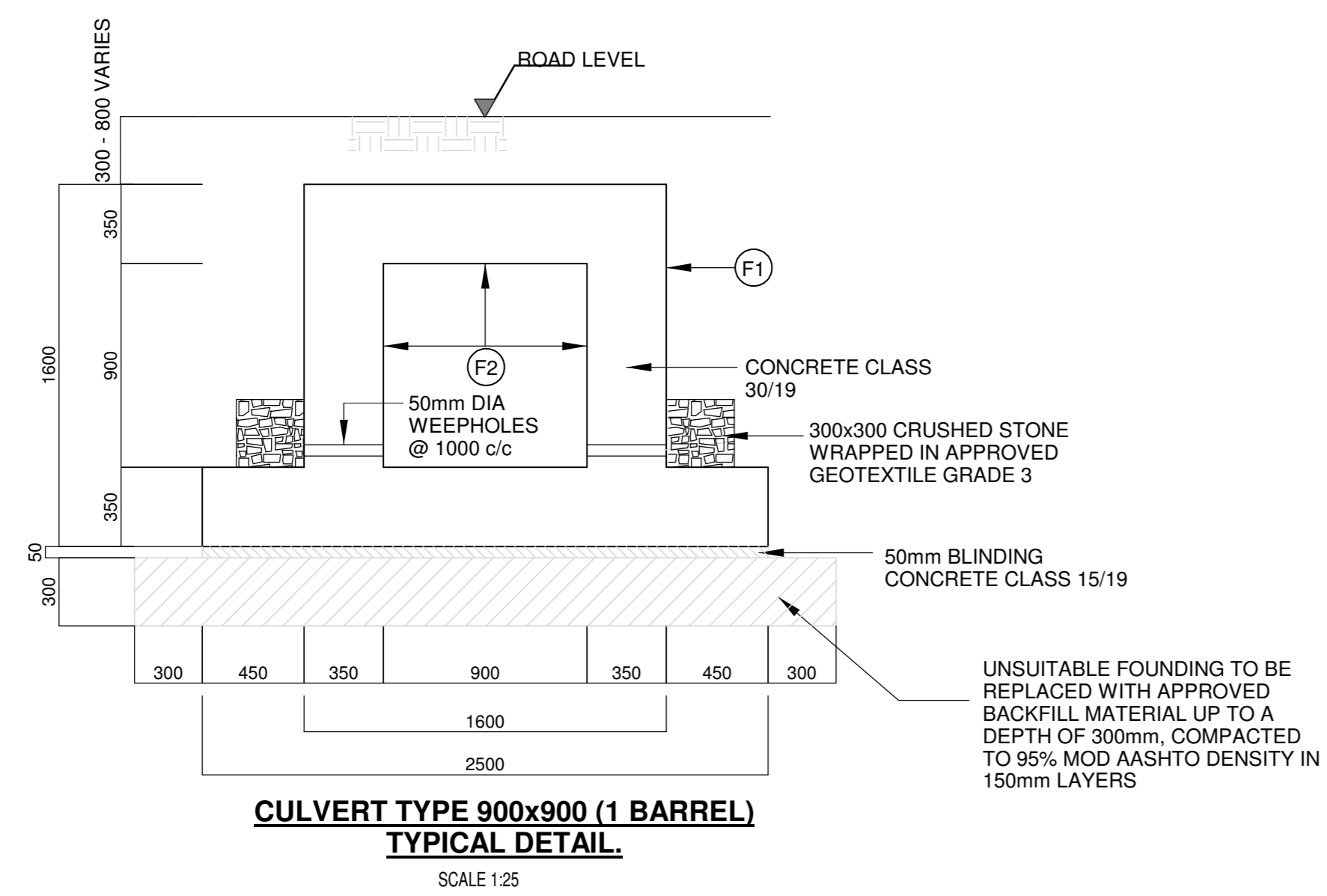


DETAIL A
N.T.S.

BASIS SLAB DATA	DIMENSIONS (m)					REINFORCEMENT												QUANTITIES PER METRE LENGTH					
	S	D	B	B1	K	ITEM ①				ITEM ②				ITEM ③				REINF.	CONCRETE				
						BAR	CUT LENGTH	No	TOTAL MASS	BAR	CUT LENGTH	No	TOTAL MASS	BAR	CUT LENGTH	No	TOTAL MASS						
Y12	600	900	775	985	130	Y12	0.900	1.100	4.44	4.89	4.34	Y10	5	5.90	3.63	Y12	70	0.850	2.5	2.13	0.84	8.81	0.138
						Y12	1.230	1.450	6.25	9.06	8.05	Y10	6	7.10	4.37	Y12	90	0.900	2.9	2.61	1.03	13.45	0.206
			1100	1310	150	Y12	2.410	2.600	6.25	16.25	14.43	250	11	13.00	8.01	Y12	90	0.900	4.5	4.05	1.60	24.04	0.383
						Y12	3.590	3.800	6.25	23.75	21.09	250	15	17.70	10.90	Y12	90	0.900	6.1	5.49	2.17	34.16	0.560
			1460	1860	150	Y12	4.780	4.990	6.25	31.19	27.69	250	21	24.78	15.26	Y12	90	0.900	7.7	6.93	2.73	39.26	0.737
						Y12	5.950	6.160	6.25	38.50	34.19	250	26	30.26	18.64	Y12	90	0.900	9.3	8.37	3.31	44.25	0.914
	1920	2480	150	Y12	7.130	7.330	6.25	45.18	40.68	250	29	36.26	22.34	Y12	90	0.900	10.9	9.81	3.87	66.89	1.091		
				Y12	9.490	9.690	6.25	60.56	53.78	250	40	48.26	29.73	Y12	90	0.900	14.1	12.69	5.01	88.52	1.445		

ITEM	BENDING	NOTES	BAR	kg / m	ALTERNATIVE REINFORCEMENT	
①		PLACE HOOKS ALTERNATELY	R 8	0.395	THE ENGINEER MAY INSTRUCT THAT H.T. MESH MAY BE REPLACED BY H.T. STEEL OR MILD STEEL AS FOLLOWS: MESH 341 MAINS Y8-150 DISTRIBUTION Y8-300 MESH 655 MAINS Y10-125 DISTRIBUTION Y10-300	THE ENGINEER MAY INSTRUCT THAT H.T. STEEL BE REPLACED BY MILD STEEL AS FOLLOWS: Y10 BY R 12 SPACING UNCHANGED Y12 BY R 16 SPACING UNCHANGED Y16 BY R 20 SPACING 0.93 H.T. SPACING
②	STRAIGHT	1 MAX LENGTH 6500 2 ALLOWANCE MADE FOR OVERLAPPING IN TOT LENGTH 4m	Y 10	0.616		
③			Y 12	0.888		
			Y 16	1.578		

REV. No.	DATE	REVISIONS	DRAWN	CHECK	APPR.	DRG No.	DESCRIPTION	NAME	SIGNATURE	DATE	NOTICE:	AREA ENGINEER	DRAWN BY	JEFFARES & GREEN	EXXARO	FOR INFORMATION
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								DESIGN ENG. R. LE ROUX				STRUCTURAL/PIPING	AREA MANAGER	Physical Address: Landmark Building East 3rd Floor Pretoria Umagazi Road Menlo Park 0081	Business Unit Exxaro Resources Ltd. P.O. Box 9229 Pretoria 0183	STORMWATER MANAGEMENT AND ASSOCIATED INFRASTRUCTURE
								CHECKER J. NEL				CIVIL	MANAGER ENGINEERING	Tel: +27 12 460 2008 Fax: +27 12 460 2053	Registered Office: Rodger Dyason Road Pretoria West 0183	TYPICAL BOX CULVERT - NORMAL LOADS
								DRAWN A. MASHEGO				ELECTRICAL/INSTRUMENTATION	PROJECT & CONSTRUCTION MANAGER		Postal Address: P.O. Box 9229 Pretoria 0183	SCALE N.T.S.
								NOTE: THE MASTER HELD AT JEFFARES & GREEN BEARS THE ORIGINAL SIGNATURE OF APPROVAL.				PROCESS	CLIENT		Tel: +27 12 307 5000 Fax: +27 12 323 3400	DRAWING NUMBER 002802-BP-011
																REVISION 0



NOTES

GENERAL NOTES

1. DESIGN METHOD: LIMIT STATE DESIGN ACCORDING TO SABS-0100 (PART 1)

DESIGN DETAIL

- THIS CELL STRUCTURE IS DESIGNED FOR KOMATSU 730E WITH A GMW REAR AXLE WEIGHT OF 2575 kN
- DENSITY OF FILL MATERIAL = 2060 kg/m³
- REINFORCEMENT IS DETAILED ACCORDING TO SANS 0144-1978
- BACKFILL IS REQUIRED TO BE SYMMETRICAL
- DESIGNED AS A CLOSED FRAME ON ELASTIC FOUNDATION
- PARAPETS NOT DESIGNED FOR VEHICLE IMPACT

MATERIALS SPECIFICATION

- CONCRETE CHARACTERISTIC YOUNG'S MODULUS (MPa)

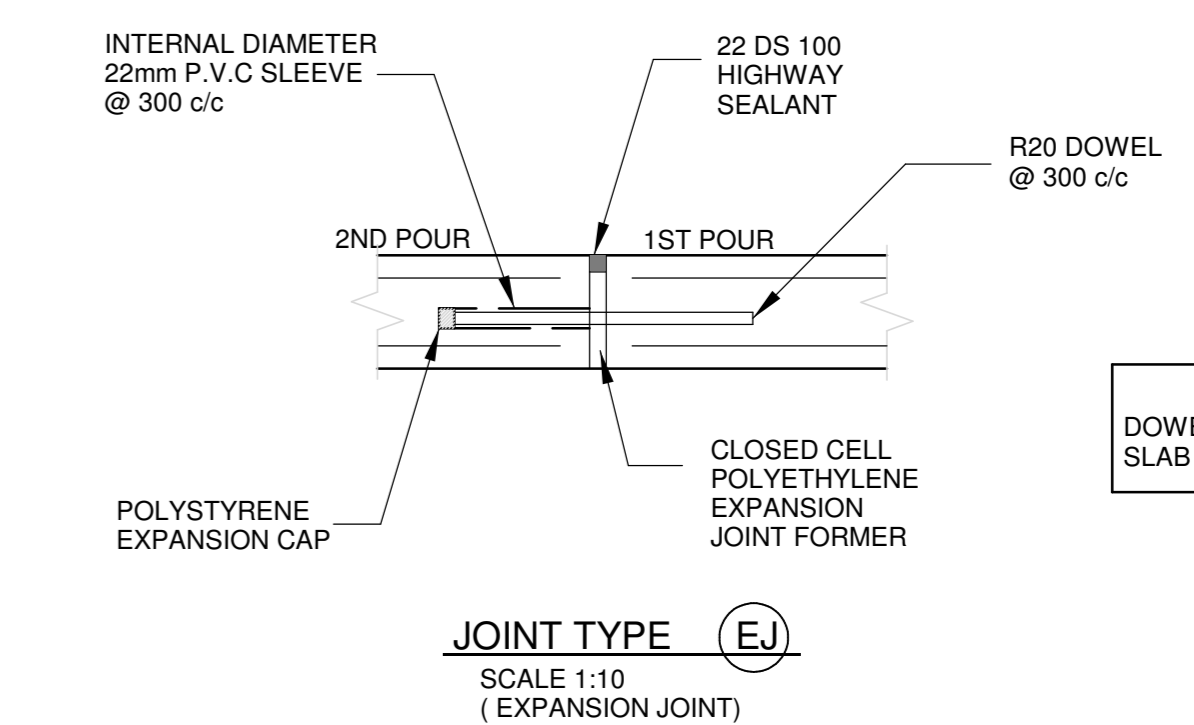
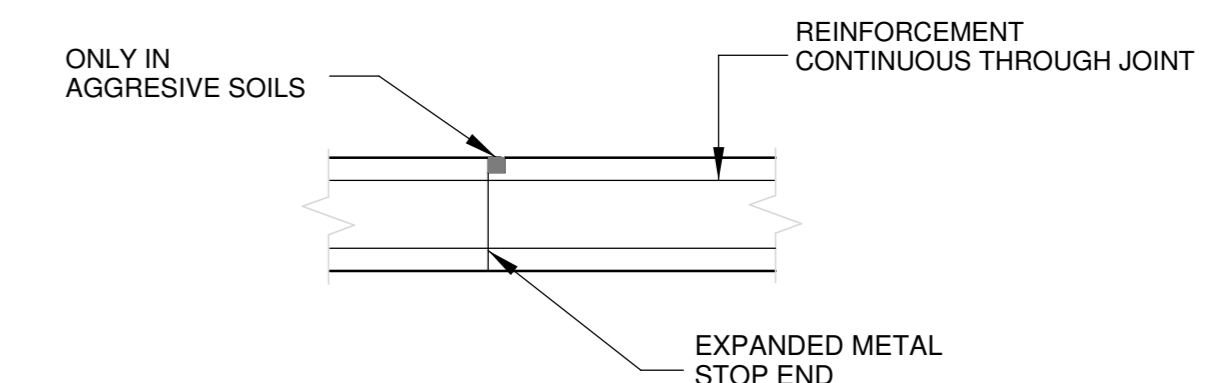
POSITION CLASS	STRENGTH (MPa)	MODULUS (MPa)
STRUCTURE	30/19	30
BLINDING	15/19	20
- REINFORCEMENT (SABS 920-1985) YIELD STRENGTH (MPa)

TYPE	STRENGTH (MPa)
MILD STEEL BARS	250
HIGH TENSILE STEEL BARS	450
- FOUNDING MATERIAL:
 - MAX. ALLOWABLE GROUND PRESSURE: -GRAVEL MATERIAL: 400kPa
 - MAX. CALCULATED GROUND PRESSURE: 350kPa
 - FOUNDING LEVEL AND FOUNDATION IMPROVEMENT TO BE APPROVED BY THE ENGINEER. UNSUITABLE FOUNDING MATERIAL SHALL BE REMOVED TO A DEPTH OF 300mm. REMOVED MATERIAL SHALL BE REPLACED WITH COMPACTED GRANULAR MATERIAL AND TO A WIDTH OF 300mm BEYOND THE FOUNDATION LIMITS OR AS REQUIRED BY THE ENGINEER.

CONSTRUCTION

- ALL VISIBLE CORNERS TO HAVE 20mm X 20mm CHAMFERS
- COVER: 30mm
- CONCRETE FINISH:

NON-VISIBLE SURFACES	- ROUGH (F1)
VISIBLE SURFACES	- SMOOTH (F2)
- CULVERT UNITS AND WINGWALLS
- ALL DIMENSIONS AND LEVELS TO BE VERIFIED ON SITE.



NOTE :

REFER TO TYPICAL BOX CULVERT (NORMAL TRAFFIC) FOR EROSION PROTECT DETAILS

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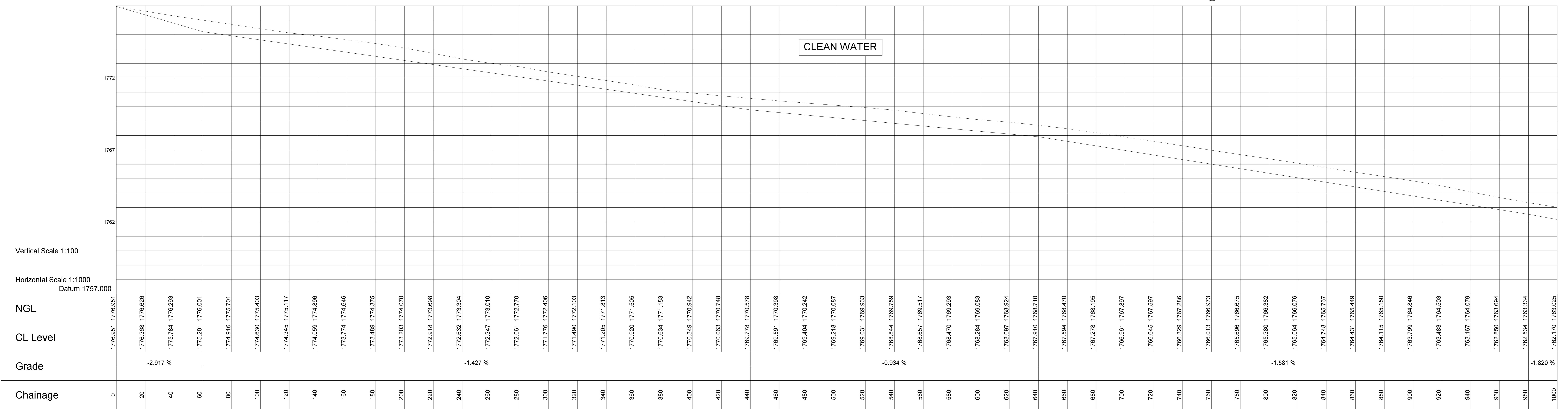
Business Unit
Exxaro Resources Ltd.
Registered Office:
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Pretoria West
0183
Tel: +27 12 307 5000
Fax: +27 12 323 3400

FOR INFORMATION		
BELFAST MINE STORMWATER MANAGEMENT AND ASSOCIATED INFRASTRUCTURE		
TYPICAL CULVERTS - ABNORMAL LOADS		
SCALE N.T.S.	DRAWING NUMBER 002802-BP-012	REVISION 0

ACCESS ROAD (EAST PAN)

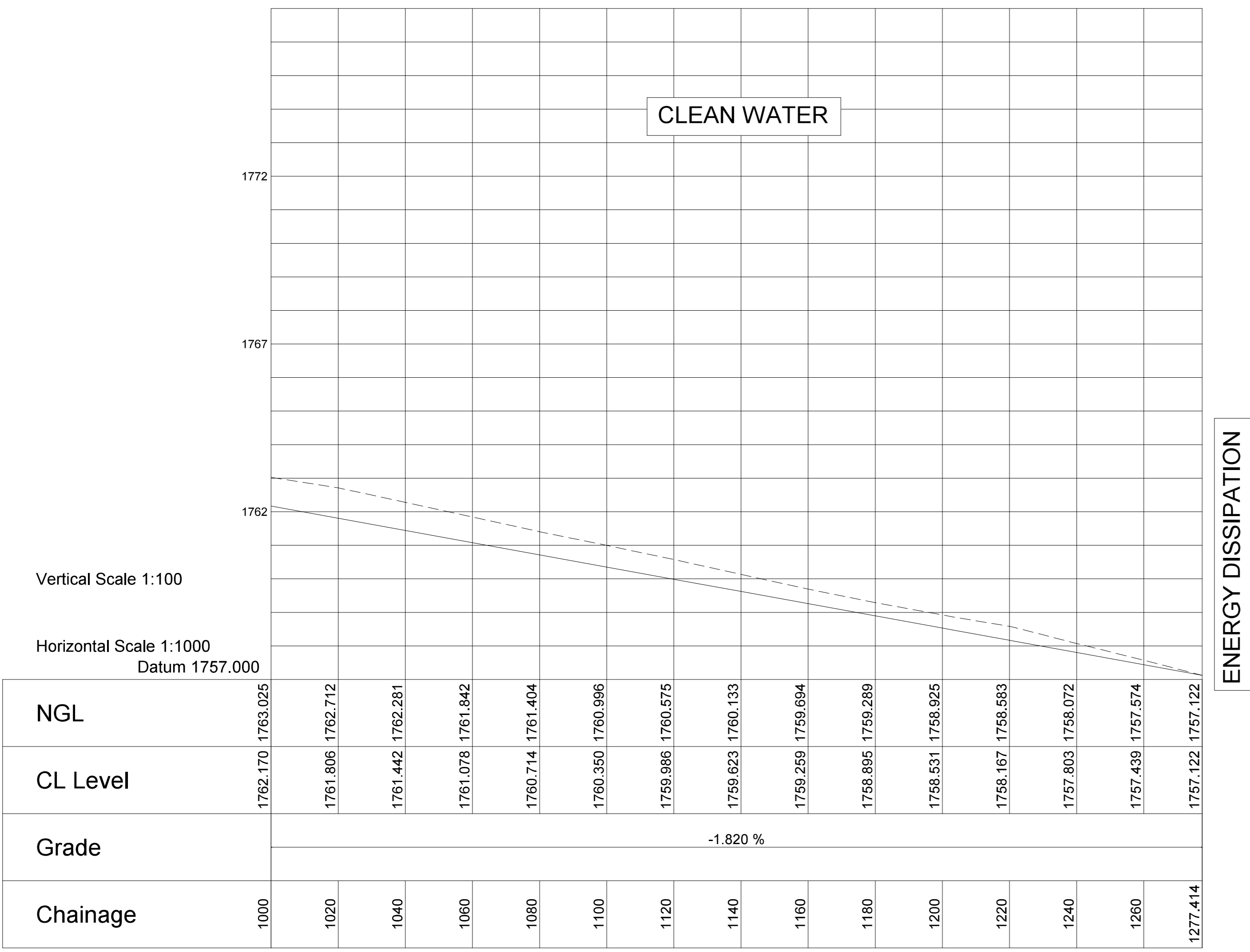
ALONG ROAD D1770

P28



C10

DISCHARGE TO RIVER



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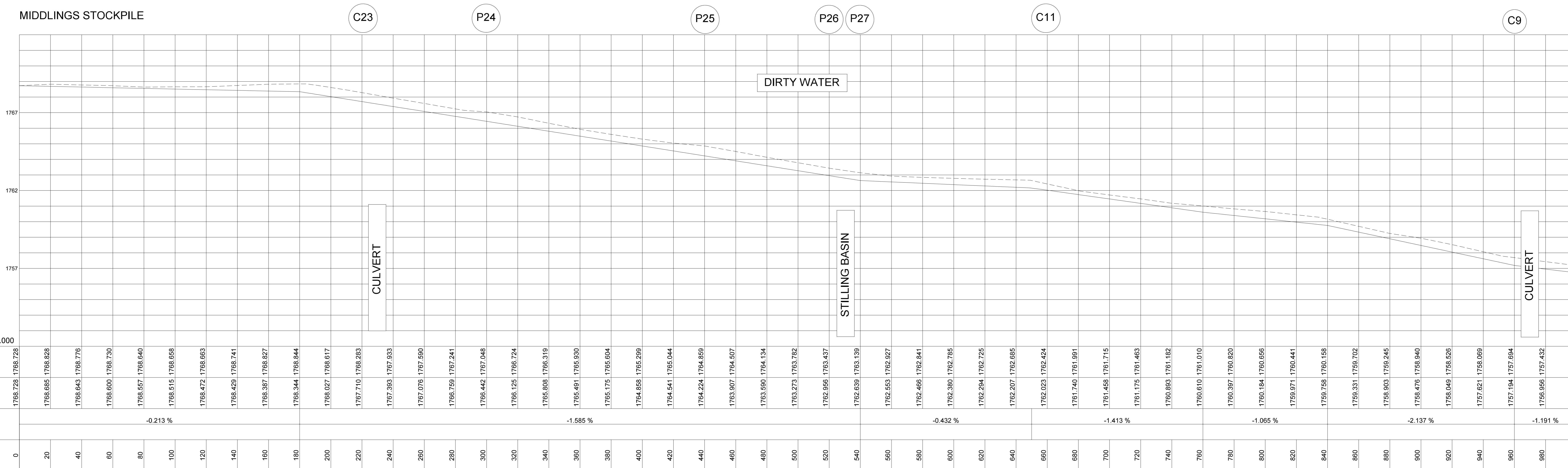
AREA ENGINEER	DRAWN BY	www.jgci.co.za	Reg. No. 2000/01107806	www.exxaro.com

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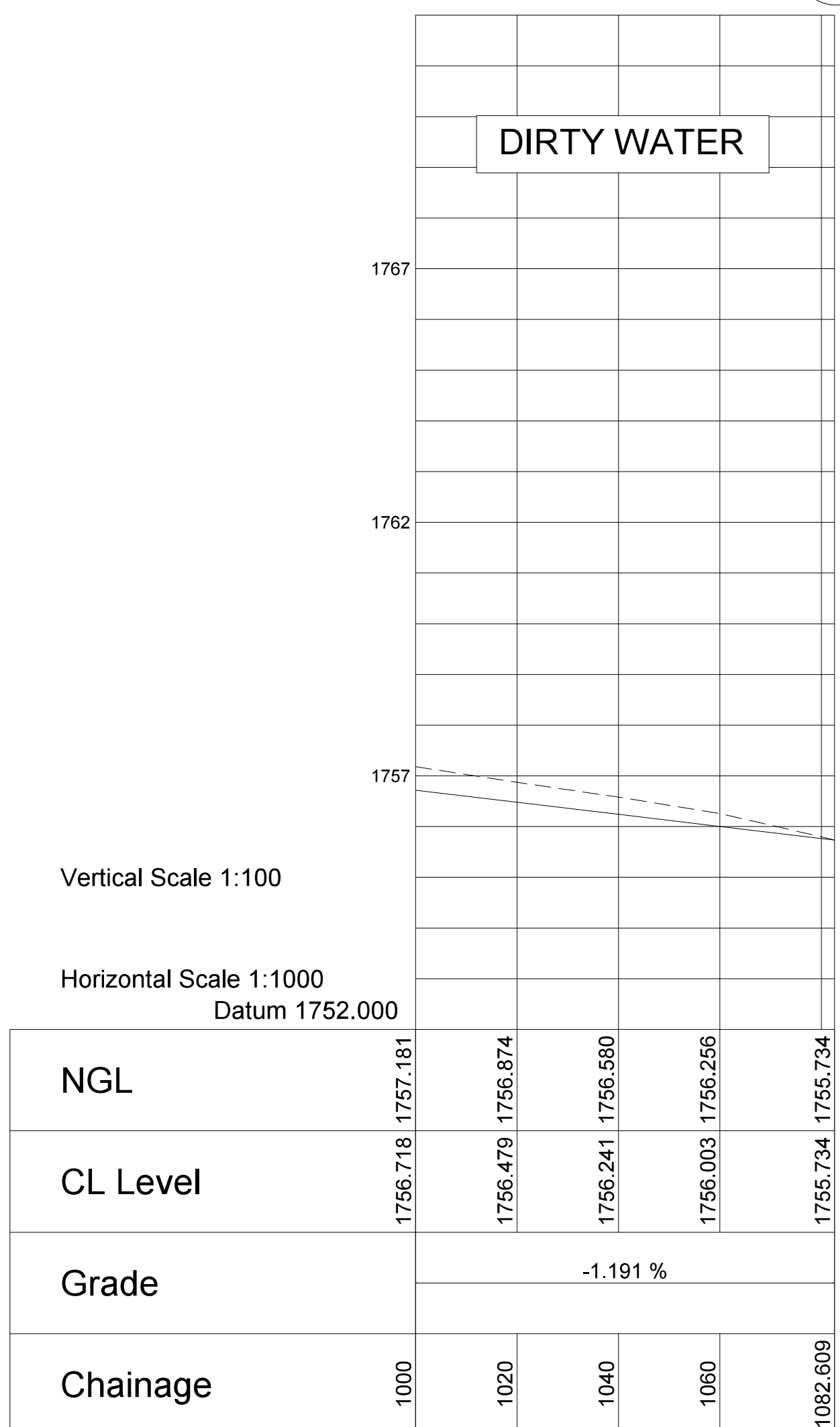
BELFAST MINE
 STORM WATER MANAGEMENT AND ASSOCIATED INFRASTRUCTURE
 LONGITUDINAL SECTION (P28 - C10)

SCALE: AS SHOWN DRAWING NUMBER: 002802-BP-015 REVISION: 0

MIDLINGS STOCKPILE



D5 STORM WATER DAM



REV. No.	DATE	REVISIONS	DRAWN	CHECK	APPR.	DRG No.	DESCRIPTION

PROF. ENG.	NAME	SIGNATURE	DATE
DESIGN ENG.	R. LE ROUX		
CHECKER	J. NEL		
DRAWN	J. GELDENHUYS		

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exxaro
 Belfast Coal

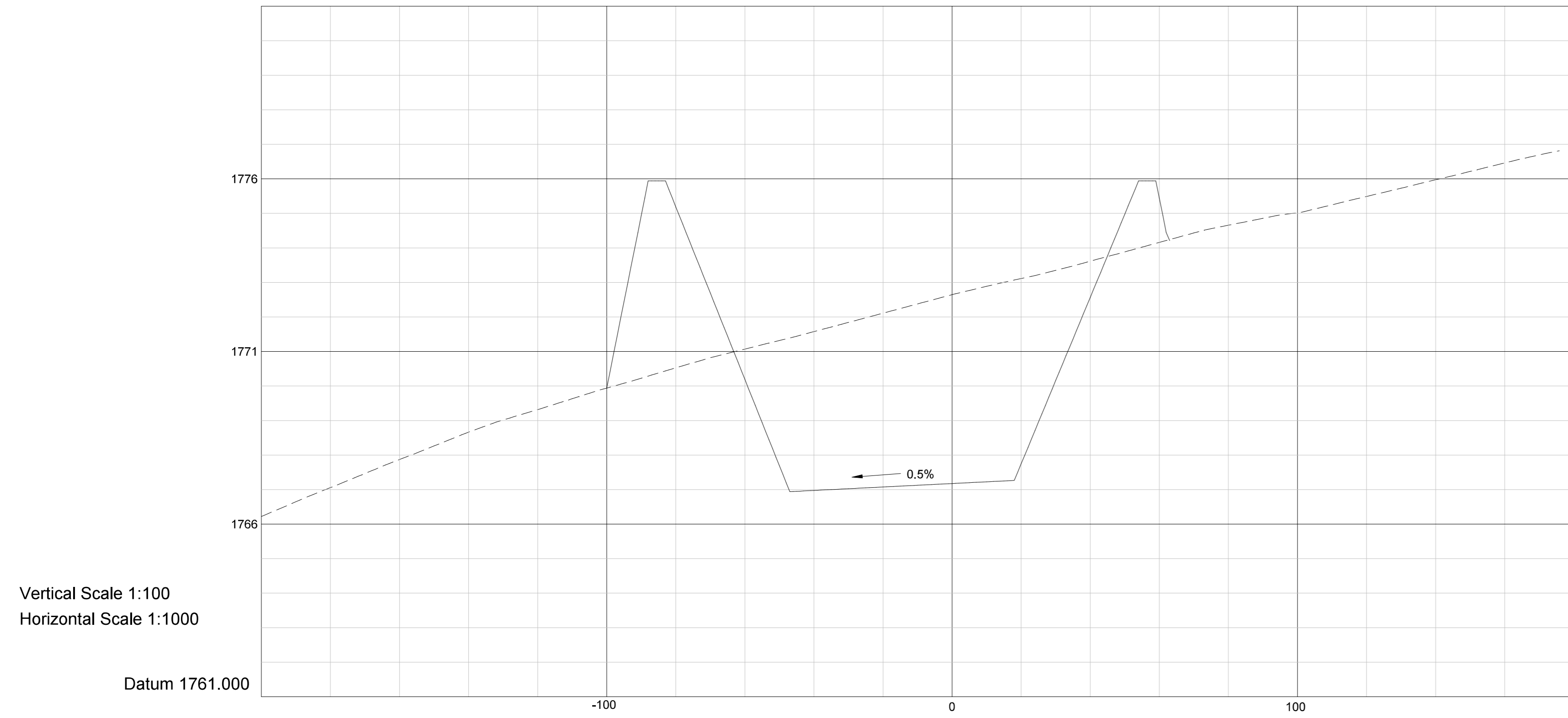
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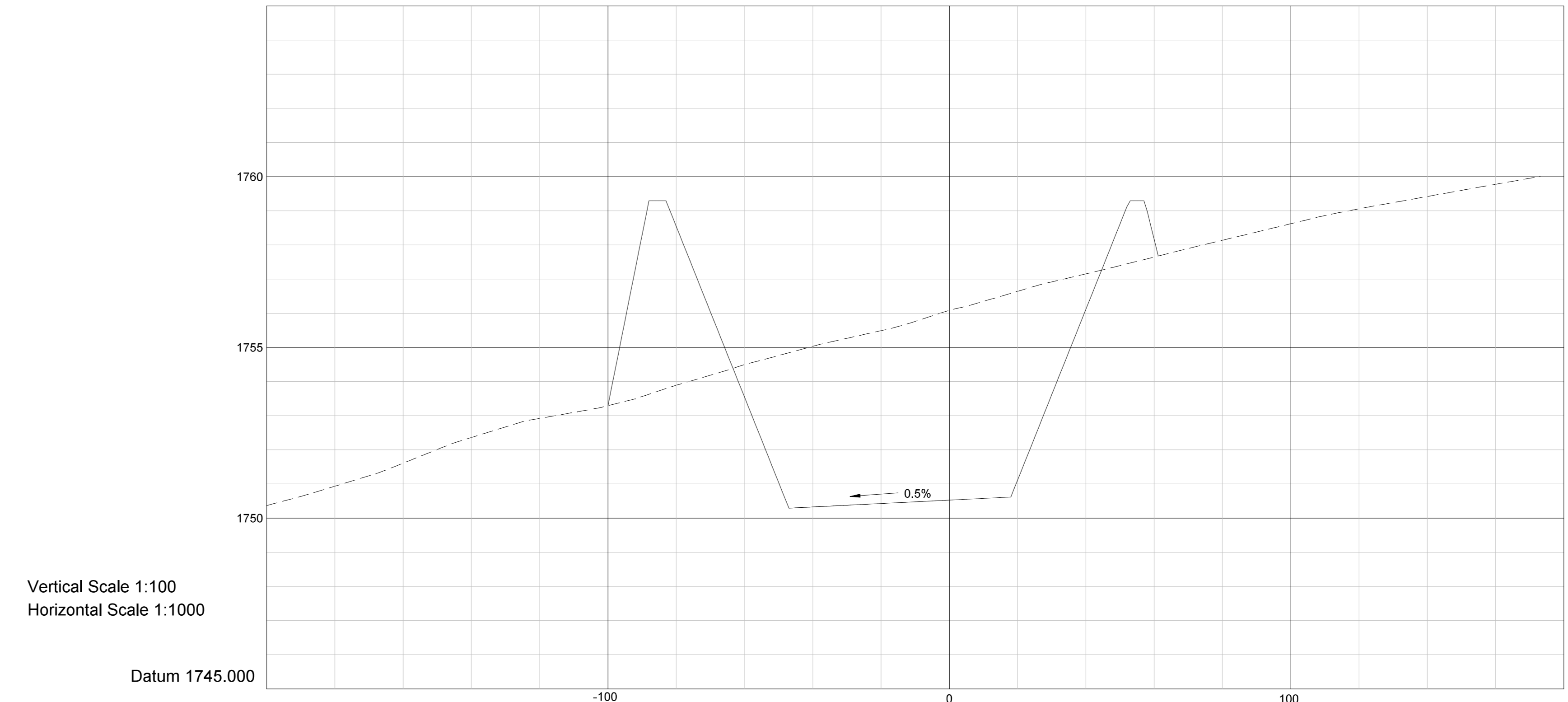
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 STORM WATER MANAGEMENT AND ASSOCIATED INFRASTRUCTURE

LONGITUDINAL SECTION (C23 - D5)

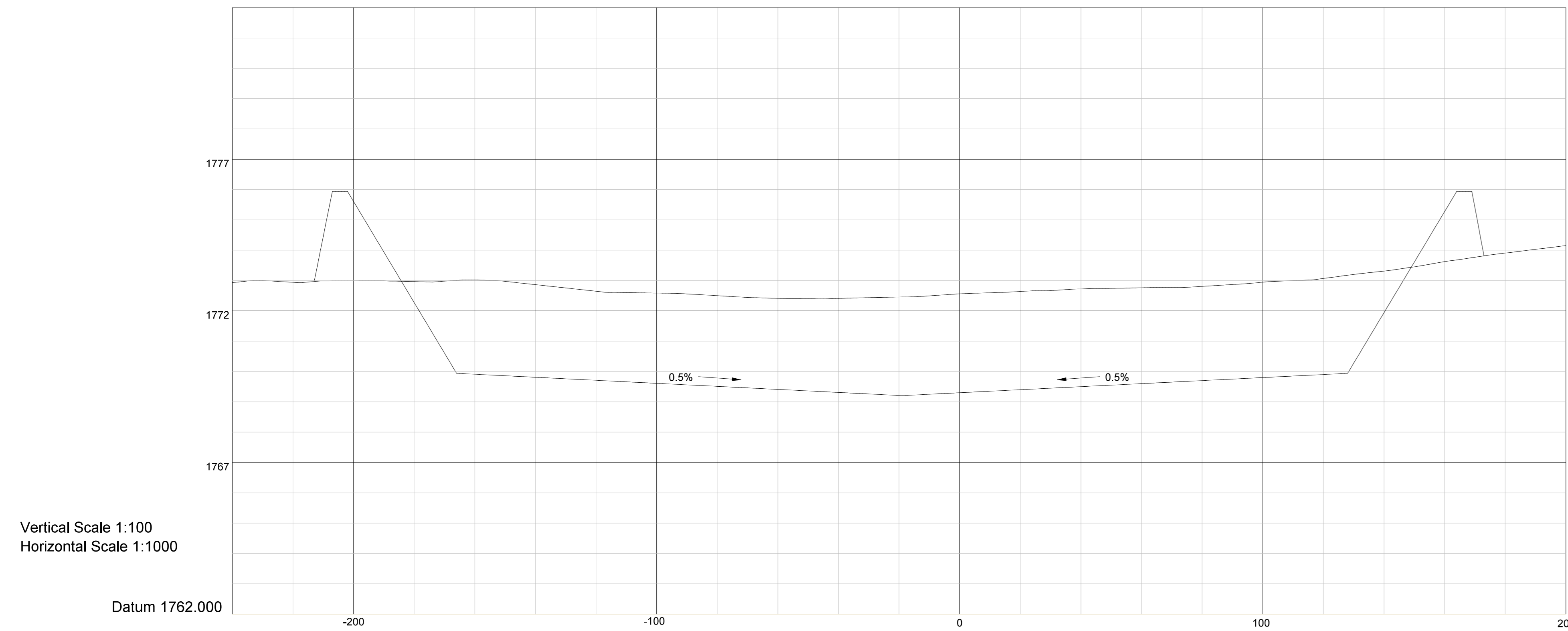
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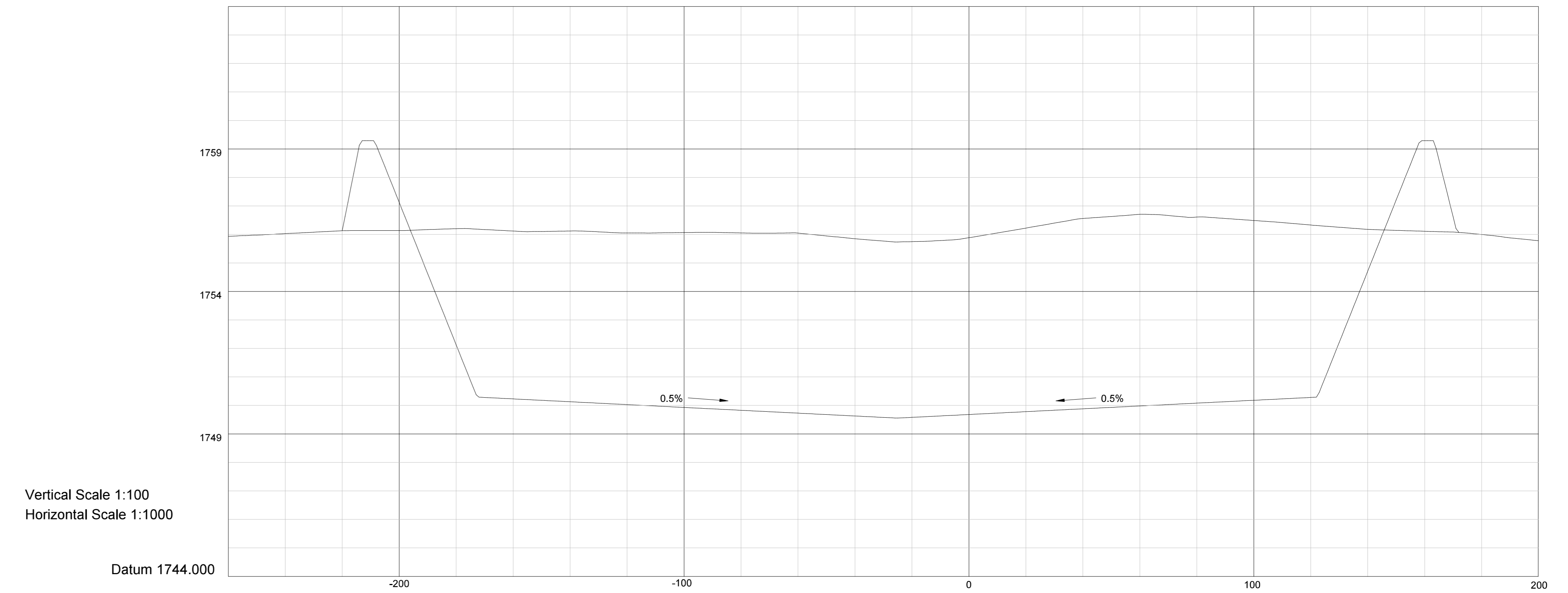
RETURN WATER DAM EAST - NORTH-SOUTH CROSS SECTION



RETURN WATER DAM WEST - NORTH-SOUTH CROSS SECTION



RETURN WATER DAM EAST - EAST-WEST CROSS SECTION



RETURN WATER DAM WEST - EAST-WEST CROSS SECTION

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exxaro
Belfast Coal

www.exxaro.com

Reg. No. 2000/01107606

Business Unit
Exxaro Resources Ltd.

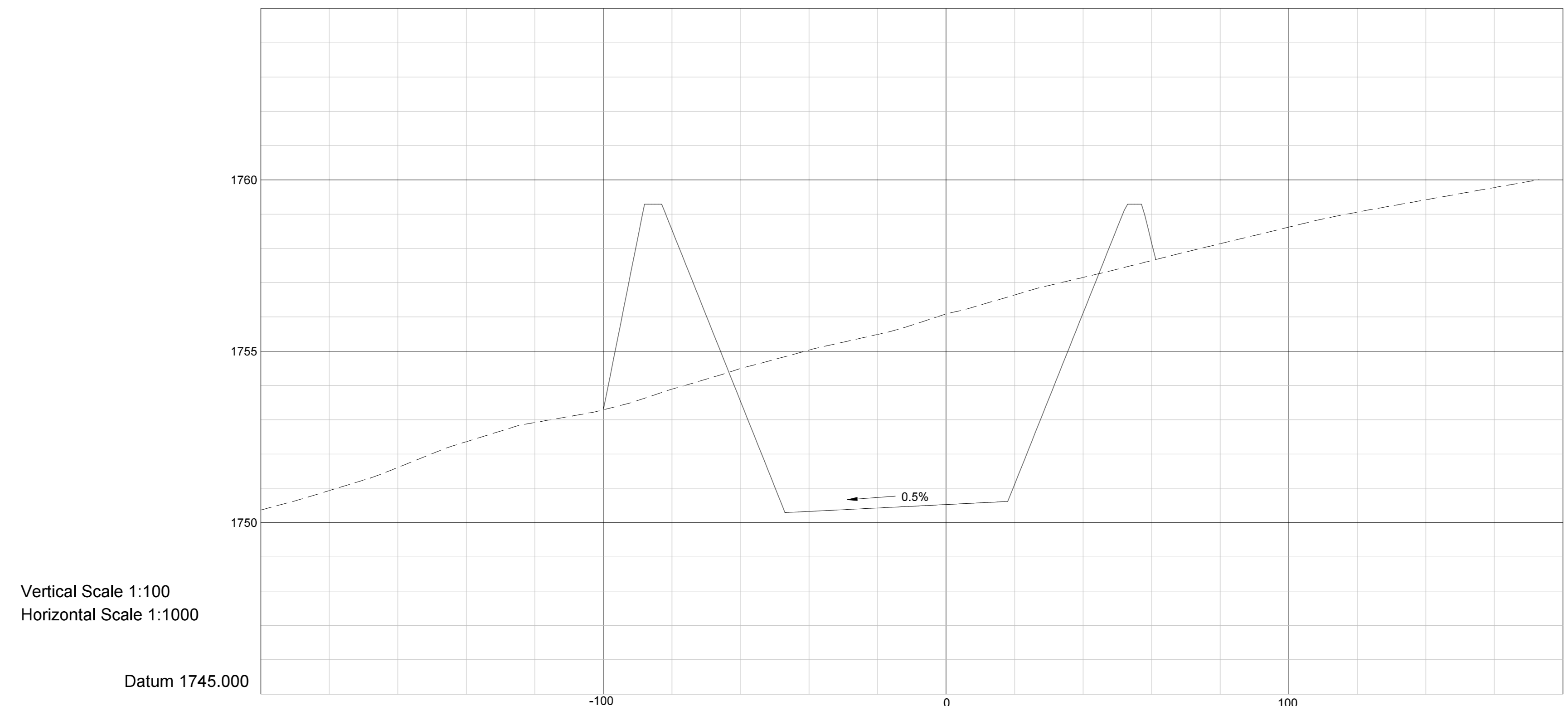
Registered Office:
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Pretoria
0001

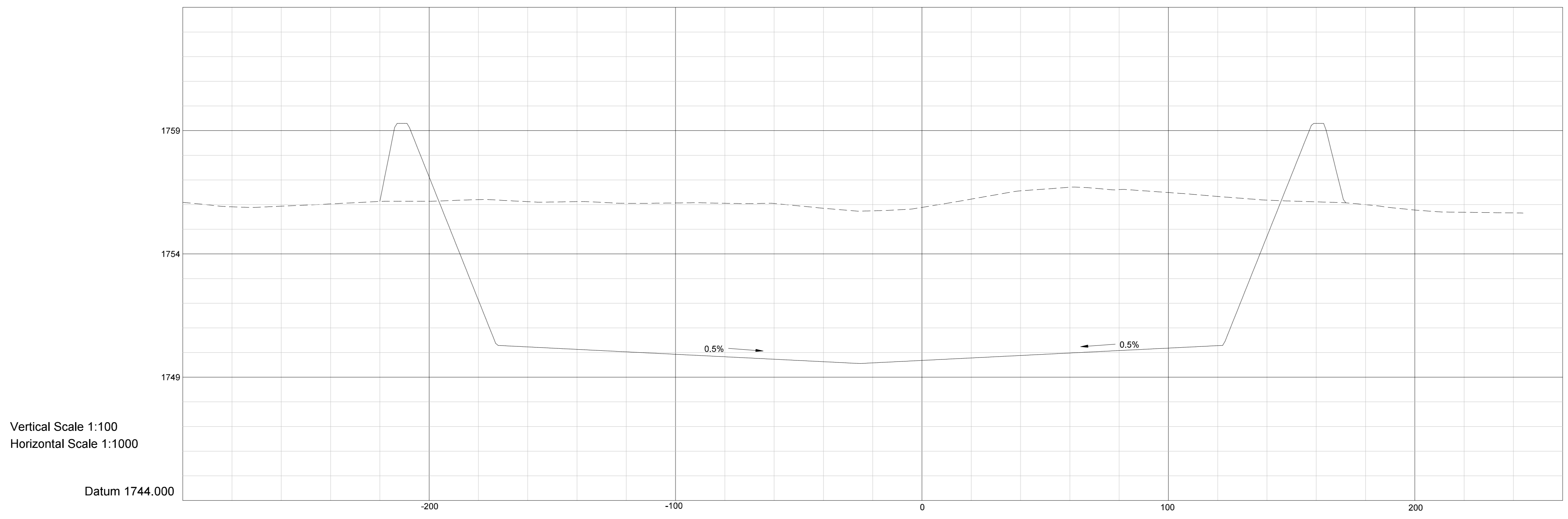
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RETURN WATER DAM SECTIONS (1 OF 2)		
SCALE AS SHOWN	DRAWING NUMBER 002802-BP-017	REVISION 0



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RETURN WATER DAM WEST - NORTH-SOUTH CROSS SECTION



RETURN WATER DAM WEST - EAST-WEST CROSS SECTION

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