CAPRICORN MUNICIPAL DEVELOPMENT GUIDELINES

SUBSURFACE DRAINAGE
GENERAL

C230

CONSTRUCTION SPECIFICATION

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Keeping the Capricorn Municipal Development Guidelines up-to-date

The Capricorn Municipal Development Guidelines are living documents which reflect progress of municipal works in the Capricorn Region. To maintain a high level of currency that reflects the current municipal environment, all guidelines are periodically reviewed with new editions published and the possibility of some editions to be removed. Between the publishing of these editions, amendments may be issued. It is important that readers assure themselves they are using current guideline, which should include any amendments which may have been published since the guideline was printed. A guideline will be deemed current at the date of development approval for construction works.

GENERAL

C230.01 INTRODUCTION

Purpose

1. This is the general specification common and applicable to all types of subsurface drainage and shall be read in conjunction with subsurface drainage specifications:

C231	-	Subsoil and Foundation Drains
C232	-	Pavement Drains
C233	-	Drainage Mats

as applicable to particular contracts.

C230.02 SCOPE

1. The work to be executed under this Specification consists of:

(a) preparation for subsurface drainage construction;

(b) siting of subsurface drainage facilities;

(c) the supply of all materials associated with the provision of the subsurface drainage system;

(d) all activities and quality requirements associated with the supply, placement and compaction of filter material;

(e) the provision of a detailed record of all subsurface drain installations;

(f) the marking on the ground of the location of all subsurface drains.

Quality

2. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in Annexure C230B.

C230.03 REFERENCE DOCUMENTS

Documents Standards Test Methods

1. Documents referenced in this specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated.

(a) Council Specifications

C211	-	Control of Erosion and Sedimentation
C213	-	Earthworks
C271	-	Minor Concrete Works

(b) Australian Standards

AS 1141.11	-	Particle size distribution by dry sieving.
AS 1141.22	-	Wet/dry strength variation.
AS 1289.5.5.1	-	Determination of minimum and maximum dry density of a cohesionless material – standard method.
AS 1477	-	PVC pipes and fittings for pressure applications
AS 2439.1	-	Perforated drainage pipe and associated fittings
AS 2758.1	-	Aggregates and rock for engineering purposes - Concrete aggregates
AS 3705	-	Geotextiles - Identification, marking and general data
AS 3706	-	Geotextiles - Methods of test
AS 3706.11	-	Determination of durability - Resistance to degradation by light and heat

(c) Other

AUSTROADS - Guide to Geotextiles.
ASTM-D2434-68 Test method for permeability of granular soils (Constant Head)

C230.04 TEMPORARY DRAINAGE DURING CONSTRUCTION

1. All drainage works shall comply with the Specification for CONTROL OF EROSION AND SEDIMENTATION C211. ***Erosion Control***

2. Adequate provision shall be made for runoff flows at subsurface drainage works under construction to avoid damage or nuisance due to scour, sedimentation, soil erosion, flooding, diversion of flow, damming, undermining, seepage, slumping or other adverse effects to the works or surrounding areas and structures. ***Contractor's Responsibility***

3. All material and equipment shall be located clear of watercourses or secured so that they will not cause danger or damage in the event of large runoff flows. ***Location of Equipment***

C230.05 EXCAVATION

1. In undertaking trench excavation provision shall be made for any shoring, sheet piling or other stabilisation of the sides necessary to comply with statutory requirements. ***Safety***

2. Where public utilities exist in the vicinity of drainage works approval shall be obtained from the relevant authority/corporation to the method of excavation before commencing excavation. ***Approval by Public Utility Authorities/ Corporations***

3. Excavation by blasting, if permitted, shall be carried out to ensure that the peak particle velocity measured on the ground adjacent to any previously installed drainage structure does not exceed 25 millimetres per second. All other requirements concerning blasting operations in the Specification for EARTHWORKS C213 shall be complied with. ***Blasting Operation***

4. Trenches shall be excavated to the line, grade, width and depth shown on the Drawings. The bottom of the trench shall be constructed so that no localised ponding can occur. All loose material shall be removed. ***Excavation Level***

5. Any material at the bottom of the trench or at foundation level which is deemed to be unsuitable shall be removed and disposed in accordance with the Specification for EARTHWORKS C213 and replaced with backfill material in accordance with the requirements of this Specification. The bottom of the excavated trench or foundation, after any unsuitable material has been removed and replaced, shall be parallel with the specified level or grade of the pipe. ***Unsuitable Material***

6. The excavated material shall be used in the construction of embankments backfilling or spoiled in accordance with the Specification for EARTHWORKS C213. ***Spoil***

C230.06 BACKFILLING

1. Backfilling shall be carried out in accordance with the requirements of the relevant subsurface drainage structures Specifications. ***Detail***

C230.07 OUTLET STRUCTURES FOR SUBSURFACE DRAINAGE

1. Subsurface drainage pipes shall be connected to discharge into gully pits or to outlet structures as shown on the Drawings. ***Discharge***

2. Outlets shall be spaced at a maximum interval of 150m ***Spacing***

3. Outlets, including those discharging into gully pits, shall be made rodent proof using a flap valve in accordance with Standard Drawing SD-D-040. ***Rodent Proof***

4. The outlet shall be located so that erosion of the adjacent areas does not occur or shall be protected by the placement of selected stone or similar treatment. ***Erosion Control***

5. All concrete used in the construction of outlet structures shall conform to the requirements of the Specification for MINOR CONCRETE WORKS C271. ***Concrete Specification***

MATERIALS

C230.08 CORRUGATED PLASTIC PIPE

1. Corrugated plastic pipe shall be Class 1000 complying with AS2439.1 100mm diameter as indicated on the Drawings. All pipes shall be slotted except where shown on the Drawings. ***Specification***

2. Joints, couplings, elbows, tees and caps shall also comply with AS2439.1 and only the manufacturer's recommended fittings shall be used. ***Fittings***

C230.09 FILTER MATERIAL

(a) Type A Filter Material

1. Type A filter material shall be crushed rock complying with the following requirements: ***Grading***

Table 230.09.1 - Type A Filter Material

Test Method	Property	Requirement
AS 1141.11	Material passing AS sieve	Per cent by mass
	6.7mm	100
	4.75mm	85 to 100
	2.36mm	0 to 40
	1.18mm	0 to 5
	425um	0 to 2

(b) Type B Filter Material

1. Type B filter material shall be granular material complying with the following grading requirements: ***Grading***

Table 230.09.2 - Type B Filter Material

Test Method	Property	Requirement
AS 1141.11	Material passing AS sieve	Per cent by mass
	4.75mm	100
	2.36mm	95 to 100
	425um	20 to 80
	300um	0 to 30
	150um	0 to 2
	75um	0 to 0.1

2. In addition to the above grading requirements, Type B filter material shall have a coefficient of saturated permeability, when compacted to its maximum dry density as determined by AS 1289.5.5.1 and then tested in accordance with Test Method ASTM-D2434-68, of at least 8 metres per day after three hours of flow. ***Coefficient of Saturated Permeability***

3. Type B filter material shall not vary from its original grading as a result of compaction processes by more than the following amounts: ***Grading Variation***

Table 230.09.3 - Type B Filter Material Variation

AS Sieve	Variation From Grading Before Treatment (per cent of mass)
2.36mm	± 3
1.18mm	± 1
425um	± 1
300um	± 1
150um	± 0.5
75um	± 0.1

(c) Type C Filter Material

1. Type C filter material shall be crushed rock complying with the following requirements: ***Grading***

Table 230.09.4 - Type C Filter Material

Test Method	Property	Requirement
AS 1141.11	Maximum particle size	37.5mm
	Maximum passing the 9.5mm AS Sieve	5% by mass
	Maximum (D90:D10)*	3
AS 1141.22	Minimum wet strength	100kN
	Maximum 10% fines wet/dry variation	30%

NOTE: The D90 value shall be determined by sieving the material using 75mm, 53mm, 37.5mm, 26.5mm, 19mm, 13.2mm and 9.5mm AS sieves, as appropriate, and then plotting the results on a graph of AS sieve size v percentage passing. The plotted points shall be joined by straight lines and the D90 value shall be determined as the theoretical sieve size corresponding to 90 per cent passing.

D10 denotes the theoretical size of a sieve through which 10 per cent of the material would pass and shall be determined from the same

(d) Type D Filter Material

1. Type D filter material shall be uncrushed river gravel complying with the description of rounded aggregate in Table B1, Appendix B of AS2758.1 and the following requirements: Grading

Table 230.09.5 - Type D Filter Material

Test Method	Property	Requirement
AS 1141.11	Maximum particle size	75mm
	Maximum passing the 9.5mm AS sieve	5% by mass
	Maximum (D90 : D10)	3
AS 1141.22	Minimum wet strength	100kN
	Maximum 10% fines wet/dry variation	30%

C230.10 GEOTEXTILE

(a) General

Properties and Labelling

1. The geotextile, other than seamless tubular filter fabric, shall consist of either a woven or a non-woven type which shall be manufactured from synthetic materials other than polyamide. Rolls of geotextile shall be marked with product identification and supplied with data sheets and information in accordance with the requirements of AS 3705.

2. The geotextile shall be bio-stable and resistant to attack by alkalis, acids, dry heat, steam, moisture, brine, mineral oil, petrol, diesel and detergents when tested in accordance with the appropriate parts of AS 3706.

Ultra Violet Light Resistant

3. The geotextile shall be resistant to ultra-violet light. No geotextile shall be left exposed to sunlight during storage and construction for a period longer than a total of twenty-one days. If exposure in excess of twenty-one days does occur, the geotextile shall be tested in accordance with AS 3706.11 and if its characteristics have deteriorated to or below 90 per cent of the characteristics claimed by the manufacturer or the characteristics determined on unexposed geotextile, whichever is the better, it shall be removed and replaced with a geotextile complying with this Specification.

4. The geotextile material type, strength rating “G”, and minimum mass requirements shall be as shown on the Drawings.

Water Transmission Rate

6. In addition to the above mentioned requirements, geotextiles for curtain drains shall consist either of polyester, polypropylene or polyethylene. When subjected to a pressure of 200 kPa applied at right angles to the plane of the fabric and to a constant head of water no greater than 50 mm applied to the top edge of the fabric, geotextiles for curtain drains shall have a rate of water transmission not less than 20 litres per hour per metre width of fabric through a 300 mm length of the fabric.

(b) Seamless Tubular Filter Fabric

Specification

1. Seamless knitted tubular filter fabric shall be used to enclose all slotted pipes and shall be manufactured from either polypropylene or polyester. The fabric shall be free of imperfections in weave or yarn and have abrasion resistant and weave stability qualities such that it shall not form holes, ladder, deweave, tear or unravel more than 5mm from a cut end.

Fitting

2. Fitting of the seamless tubular filter fabric shall be in accordance with the requirements of Annexure C230A. Filter fabric that is excessively stretched, torn or otherwise damaged during fitting of the fabric, storage, transportation or pipe laying shall be removed and replaced so as to eliminate any damaged lengths.

C230.11 RECORDING OF SUBSURFACE DRAINAGE INFORMATION

1. The Contractor shall keep detailed records of all subsurface drainage pipes and the completed drainage system shall be shown on the “As Constructed” drainage plans.

LIMITS AND TOLERANCES

C230.12 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table 230.12.1 below.

Table 230.12.1 - Summary of Limits and Tolerances

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Excavation by Blasting**		
	Peak particle velocity	≤25mm/sec	C230.05
2.	**Outlets**		
	Spacing	Max 150m	C230.07
3.	**Filter Material**		
	(a) Type A	Table 230.09.1	C230.09
	(b) Type B	Tables C230.2 and C230.3	C230.09
	(c) Type C	Table 230.09.4	C230.09
	(d) Type D	Table 230.09.5	C230.09
4.	**Geotextile**		
	(a) Exposure to sunlight	<21 days If >21 days deterioration not to exceed 10% of claimed characteristics	C230.10
	(b) Curtain Drains Water Transmission	>20 litres/hr/m	C230.10

ANNEXURE

C230A SLOTTED PIPES FITTED WITH SEAMLESS TUBULAR FILTER FABRIC

1. PROCEDURE FOR FITTING SEAMLESS TUBULAR FILTER FABRIC TO SLOTTED PIPE

Seamless tubular filter fabric shall be fitted to slotted pipe immediately before the slotted pipe is to be laid in its final position in the work.

The filter fabric shall be initially pulled over and onto a short length of smooth pipe of internal diameter between 20mm and 30mm greater than the external diameter of the slotted pipe to be enclosed by filter fabric. The short, larger diameter pipe shall be referred to as the 'mandrel'.

The pipe to be enclosed by the filter fabric shall be passed through the mandrel. The filter fabric shall be slipped on to the pipe as the pipe emerges from the mandrel leaving enough overhang of the filter fabric to make a suitable joint with the filter fabric on the adjacent pipe. The filter fabric shall be firmly held to the forward end of the pipe so that it can not slip back along the pipe.

The pipe shall be pulled right through the mandrel allowing the filter fabric to progressively slip over the pipe. The filter fabric shall be restrained from easily slipping off the mandrel thus ensuring the filter fabric is stretch fitted onto the pipe.

When the end of the pipe emerges from the mandrel, the filter fabric shall be clamped to that end of the pipe so that the filter fabric can not slip down the pipe. The filter fabric shall remain clamped to each end of the pipe to ensure the filter fabric remains stretch fitted onto the pipe when the pipe is placed in its final position in the drain. The filter fabric shall be cut cleanly leaving enough overhang off the end of the pipe to make a fully covered join with the filter fabric on the adjacent pipe when the pipes are installed in the drain.

2. PRECAUTIONS TO BE TAKEN WHEN USING SLOTTED PIPE FITTED WITH SEAMLESS TUBULAR FILTER FABRIC

Slotted pipe fitted with seamless tubular filter fabric shall not be dragged over the ground. If carried, the pipe shall be lifted clear of the ground and the filter fabric shall be protected from damage at all times.

Seamless tubular filter fabric which has been so damaged as to affect its filtering properties shall be removed from the pipe and replaced with undamaged filter fabric.

If at any time during the installation of a slotted pipe it is found that the enclosed filter fabric has become loose on the pipe it shall be restretched to its correct position. If restretching causes any damage to the filter fabric, the damaged filter fabric shall be removed from the pipe and replaced with undamaged filter fabric.

ANNEXURE

C230B QUALITY CONTROL TESTING

(Specifications C230, C231, C232)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
MANDATORY TESTING				
Nil				
AUDIT TESTING – IF ORDERED BY COUNCIL				
Material Supply	Material Quality - Supplier's documentary evidence and certification of:			
	Pipe	1 contract/size	1 per type/size	
	Filter Material			
	- Grading (Type A, B, C, D)	1 contract/size	1 per type	AS1141.11
	- Coefficient of Permeability (Type B)	1 contract/size	1 per type	AS1289.E5.1 ASTM-D2434-68
	- Grading Variation after Treatment (Type B)	1 contract/size	1 per type	AS1141.11
	- Wet Strength (Type C, D)	1 contract/size	1 per type	AS1141.22
	- 10% Fines Wet/Dry (Type C, D)	1 contract/size	1 per type	AS1141.22
	Geotextile	1 contract	1 per type	
Excavation - Trench Base	Line and Grade	1 drainage line	1 per drainage line	Survey
	Compaction	1 drainage line	1 per 200 lin m*	AS1289.5.4.1
Bedding and Backfill				
- Filter Material	Compaction	1 drainage line	1 per drainage line	AS1289.5.4.1
- Selected Backfill	Compaction	1 drainage line	1 per 200 lin m*	AS1289.5.4.1
- Earth Backfill	Compaction	1 drainage line	1 per 200 lin m*	AS1289.5.4.1
Drainage Mat	Geometry	2000m^2	1 Cross Section per 25m	Survey

* Note: or part thereof, per lot