

COFFS HARBOUR CITY COUNCIL



**DEVELOPMENT SPECIFICATION
DESIGN**

1171 Subsurface drainage

Version 1 01 January 2009

1171 SUBSURFACE DRAINAGE

1 SCOPE AND GENERAL

1.1 SCOPE

The work to be executed under this worksection consists of:

- preparation for subsurface drainage construction;
- siting of subsurface drainage facilities;
- the supply of all materials associated with the provision of the subsurface drainage system;
- all activities and quality requirements associated with the supply, placement and compaction of filter material;
- the provision of a detailed record of all subsurface drain installations;
- the marking on the ground of the location of all subsurface drains.

This is the general worksection common and applicable to all types of subsurface drainage and shall be read in conjunction with subsurface drainage worksections 1172 *Subsoil and fountain drains*, 1173 *Pavement drains*, 1174 *Drainage mats*, as applicable to particular contracts.

1.2 QUALITY

Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are given in 0161 *Quality (Construction)*.

1.3 REFERENCED DOCUMENTS

The following documents referred to in this worksection shall be deemed as the latest edition of the Australian Standards, including amendments and supplements.

Worksections

0161 *Quality (Construction)*

0310 *Minor concrete works*

1102 *Control of erosion and sedimentation*

1112 *Earthworks (Roadways)*

1172 *Subsoil and fountain drains*

1173 *Pavement drains*

1174 *Drainage mats*

Standards

AS 1141	Methods for sampling and testing aggregates
AS 1141.11	Particle size distribution by dry sieving
AS 1141.22	Wet/dry strength variation
AS 1289	Methods of testing soils for engineering purposes
AS 1289.5.5.1	Soil compaction and density tests—Determination of the minimum and maximum dry density of a cohesionless material—Standard method
AS 2439	Perforated plastics drainage and effluent pipe and fittings
AS 2439.1	Perforated drainage pipe and associated fittings
AS 2758	Aggregates and rock for engineering purposes
AS 2758.1	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, heat and moisture
AS/NZS 1477	PVC pipes and fittings for pressure applications

Other publications

AUSTROADS

AP-3/90 Guide to Geotextiles.

ASTM

D2434 Test method for permeability of granular soils (Constant head)

1.4 EXTENT OF WORK

Details of the work are shown on the Drawings. The requirements of this Contract are summarised as follows:

- [complete/delete]

2 MATERIALS

2.1 SUBSURFACE DRAINAGE PIPES

Approval

Pipes shall not be placed in position until the Contractor has produced documentary evidence to the Superintendent that the pipes conform to the requirements of this worksection.

This action constitutes a HOLD POINT.

The Superintendent's approval of the documentary evidence is required prior to the release of the hold point.

Corrugated circular plastic pipe and fittings

Pipe: Corrugated circular plastic pipe shall comply with AS 2439.1 and shall be Class 1000 of 65 mm or 100 mm diameter as shown on the Drawings. All pipe shall be slotted except where shown on the Drawings.

Fittings: Joints, couplings, elbows, tees and caps shall also comply with AS 2439.1 and only the manufacturer's recommended fittings shall be used.

Certificate of Compliance: The Contractor shall obtain from the supplier a Test Certificate demonstrating compliance with AS 2439.1.

Corrugated flat plastic pipe and fittings

Pipe: Corrugated flat plastic pipe shall be of the 'Stripdrain' or 'Megaflo' type or equivalent as approved by the Superintendent of size as shown on the Drawings and shall be supplied already enclosed in geofabric or seamless tubular filter fabric.

The Superintendent's approval shall be subject to provision of information as set out in **Other types of subsurface drainage pipes**.

Fittings: Only the manufacturer's recommended fittings shall be used.

Thick walled PVC pipe

Pipe: Thick walled PVC pressure pipe shall comply with AS/NZS 1477 and shall have a nominal diameter of 58 mm and a minimum wall thickness of 6.5 mm. All pipe shall be slotted except where shown on the Drawings. Details of slot sizes and spacings shall be in accordance with Annexure A.

Joints: Thick walled PVC pressure pipe shall have square ends and shall be butt jointed.

Certificate of Compliance: The Contractor shall obtain from the supplier a Test Certificate demonstrating compliance with AS/NZS 1477.

2.2 OTHER TYPES OF SUBSURFACE DRAINAGE PIPES

Approval

Where a Contractor wishes to use a subsurface drainage pipe other than the pipes described in **Subsurface drainage pipes**, the Contractor shall submit, for approval by the Superintendent, full details of the type of pipe, certification from the manufacturer of its suitability and quality for use in each particular application.

Certification of the suitability of any pipe will address the crushing strength, flexural strength, jointing system and slotting details.

This action constitutes a HOLD POINT.

The Superintendent's approval of the submitted details is required prior to the release of the hold point.

2.3 FILTER MATERIAL

General

All filter material shall consist of clean, hard, tough, durable particles.

Types

The types of filter material covered by this worksection shall include:

- Type A filter material for use in trench drains and Type B drainage mats.
- Type B filter material for use in trench drains and Type B drainage mats.
- Type C filter material comprising crushed rock for use in Type A drainage mats.
- Type D filter material comprising uncrushed river gravel for use in Type A and Type B drainage mats.

Type A filter material

Type A filter material shall be crushed rock or granular material complying with Table 2.1.

Type B filter material

Grading: Type B filter material shall be granular material complying with Table 2.2.

Coefficient of saturated permeability: 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 ASTM-D2434-68, of at least 8 metres per day after three hours of flow.

Grading variation: Type B filter material shall not vary from its original grading as a result of compaction processes by more than that given in Table 2.3.

Type C filter material

Type C filter material shall comply with Table 2.4

Type D filter material

Type D filter material shall be uncrushed river gravel complying with the description of rounded aggregate in Table B1, Appendix B of AS 2758.1 and Table 2.5.

Table 2.1 Type A filter material

Test method	Property		Requirement
AS 1141.11	Material passing AS sieve		% by mass
	6.7	mm	100
	4.75	mm	85 to 100
	2.36	mm	0 to 40
	1.18	mm	0 to 5
	425	µm	0 to 2

Table 2.2 Type B filter material

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

Table 2.3 Type B filter material variation

AS Sieve	Variation from grading before treatment (% of mass)
2.36 mm	± 3
1.18 mm	± 1

AS Sieve	Variation from grading before treatment (% of mass)
425 µm	± 1
300 µm	± 1
150 µm	± 0.5
75 µm	± 0.1

Table 2.4 Type C filter material

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

Note: The D90 value shall be determined by sieving the material using 75 mm, 53 mm, 37.5 mm, 26.5 mm, 19 mm, 13.2 mm and 9.5 mm 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 % passing. D10 denotes the theoretical size of a sieve through which 10 % of the material would pass and shall be determined from the same graph used to determine the D90 value.

Table 2.5 Type D filter material

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

2.4 GEOTEXTILE

Approval

Geotextiles shall not be placed in position until the Contractor has produced documentary evidence to the Superintendent that the geotextile and installation process conforms to the requirements of this worksection.

This action constitutes a HOLD POINT.

The Superintendent's approval of the documentary evidence is required prior to the release of the hold point.

General

Material and labelling: 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. 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: 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 % 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 worksection.

The geotextile material type, strength rating 'G', and minimum mass requirements shall be as shown on the Drawings. The type, properties, functions, design and construction requirements for a particular application of geotextile installation shall be compatible with recommendations provided by the AUSTROADS *Guide to Geotextiles* as well as requirements indicated on the drawings.

Water transmission rate: In addition to the abovementioned requirements, geotextiles for curtain drains shall consist of either 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.

Seamless tubular filter fabric

Material: Seamless knitted tubular filter fabric shall be manufactured from either polypropylene or polyester and shall be used to enclose slotted pipe of 65 mm or 100 mm diameter. 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 5 mm from a cut end.

Opening size: The representative large opening size of the fabric shall be between 200 and 500 microns.

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

3 CONSTRUCTION

3.1 TEMPORARY DRAINAGE DURING CONSTRUCTION

Erosion control

All drainage works carried out by the Contractor shall comply with 1102 *Control of erosion and sedimentation*.

Runoff overflows during construction

The Contractor shall make adequate provision 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 as a result of the Contractor's activities.

Location of equipment

The Contractor's 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.

3.2 SITING OF WORK

Set-out approval

Before commencing construction of any subsurface drainage activity, the Contractor shall set out on site the position of the work to the location and levels shown on the Drawings, and shall present this set-out for inspection by the Superintendent.

This action constitutes a HOLD POINT.

The Superintendent's approval to the set-out is required prior to the release of the hold point.

Amendments to planned work

The Superintendent may amend the locations or designed levels or the lengths to suit actual site conditions.

Any activity resulting from such amendments by the Superintendent shall be deemed to be included as part of the work covered by the Schedule of Rates. Should the Superintendent require a change to the conditions of installation an appropriate variation shall be ordered.

Proposed changes by contractor

Should the Contractor propose changes to the location, length, designed levels, conditions of installation or cover to suit the Contractor's construction procedures, the Contractor shall present the proposed set-out in addition to the designed set-out for consideration by the Superintendent.

No changes shall be made unless the prior written approval of the Superintendent is obtained.

3.3 EXCAVATION

Safety

In undertaking trench excavation, the Contractor shall provide any shoring, sheet piling or other stabilisation of the sides necessary to comply with statutory requirements.

Approval by public utility authorities

Where public utilities exist in the vicinity of drainage works the Contractor shall obtain the approval of the relevant authority to the method of excavation before commencing excavation.

Blasting operation

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 mm/sec.

The Contractor shall comply with other requirements concerning blasting operations in *1112 Earthworks (Roadways)*.

Excavation level

Trenches shall be excavated to the line, grade, width and depth shown on the Drawings or as directed by the Superintendent. The bottom of the trench shall be constructed so that no localised ponding can occur.

All loose material shall be removed by the Contractor.

This action constitutes a HOLD POINT.

The Superintendent's approval to the trench level is required prior to the release of the hold point.

Unsuitable material

Any material at the bottom of the trench or at foundation level which the Superintendent deems to be unsuitable shall be removed and disposed of in accordance with *1112 Earthworks (Roadways)* by the Contractor and replaced with backfill material in accordance with the requirements of this worksection.

The bottom of the excavated trench or foundation, after any unsuitable material has been removed and replaced, shall be parallel with the specified level and slope of the work.

Excavated material

The excavated material shall be used in the construction of embankments, backfilling or spoiled in accordance with *1112 Earthworks (Roadways)*.

3.4 BACKFILLING

Backfilling shall be carried out in accordance with the requirements of the relevant subsurface drainage worksections with materials as specified in this worksection and materials to the requirements of *1112 Earthworks (Roadways)*.

3.5 OUTLET STRUCTURES FOR SUBSURFACE DRAINAGE PIPES

Discharge and salinity prevention

Subsurface drainage pipes shall be connected to discharge into gully pits or to outlet structures as shown on the Drawings or as directed by the Superintendent.

As a salinity prevention measure, and where practicable, discharge shall be on the downhill side of the embankment or in the cut-fill area so as to reduce the risk of recharge to the subsurface water table.

Spacing

Outlets shall be spaced at an absolute maximum interval of 150 m.

Rodent proof

Outlets, including those discharging into gully pits, shall be made rodent proof using galvanised wire netting in accordance with the Drawings.

Erosion control

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 together with a marker post to indicate location and assist maintenance.

Outlet pipe

Outlet pipes from curtain drains shall be unslotted. At no point shall an outlet pipe be higher than the pipe at the end of the curtain drain.

Concrete Specification

All concrete used in the construction of outlet structures shall conform to the 0310 *Minor concrete works*.

3.6 RECORDING OF SUBSURFACE DRAINAGE INFORMATION**Work as executed plans**

The Contractor shall keep a detailed record of all subsurface drainage pipes and the completed subsurface drainage systems shall be shown on the work-as-executed plans to be returned to the Superintendent upon completion of the Contract.

Information sheet

In addition, the Contractor shall prepare a subsurface drainage information sheet or sheets at the completion of construction of each drain or drainage system and shall submit the subsurface drainage sheet or sheets to the Superintendent within five working days of the completion of the drain or drainage system.

The information to be included in the subsurface drainage information sheets shall include:

- Date of completion of drain construction
- Drain number
- Type of drain
- Pipe size
- Pipe type
- Filter type
- Grade of drain
- Locations of cleanouts
- Locations of outlets
- Geotextile:
 - . Sheet: Yes/No
 - . Seamless tubular filter fabric: Yes/No
- Response Time

Costs of preparation

The costs associated with preparation of Subsurface Drainage Sheets shall be borne by the Contractor.

4 LIMITS AND TOLERANCES

The limits and tolerances applicable to this worksection are summarised in Table 4.1.

Table 4.1 Summary of limits and tolerances

Activity	Limits/Tolerances	Worksection Clause Reference
Filter material		
- Type A	Table 2.1	Filter material
- Type B	Tables 2.2 and 2.3	Filter material
- Type C	Table 2.4	Filter material
- Type D	Table 2.5	Filter material

Activity	Limits/Tolerances	Worksection Clause Reference
Geotextile		
-Exposure to sunlight	<21 days If >21 days deterioration not to exceed 10% of claimed characteristics	Geotextile
-Curtain Drains Water Transmission	>20 litres/hr/m	Geotextile
Excavation by Blasting		
Peak particle velocity	≤25 mm/sec	Excavation
Outlets		
Spacing	Max 150 m	Outlet structures for subsurface drainage pipes

5 MEASUREMENT AND PAYMENT

5.1 MEASUREMENT

Payment shall be made for all the activities associated with completing the work detailed in this worksection and the associated activity specific worksections on a schedule of rates basis in accordance with Pay Items 11711.1 to 1171.5 inclusive.

Pay Items applicable to particular activities are listed in the worksections for these activities.

Common to subsurface drainage works are Filter Material and Outlet Structures and payment for these items shall be made under this worksection.

A Lump Sum price for any of these items shall not be accepted.

If any item, for which a quantity of work is listed in the Schedule of Rates, has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

Erosion and sedimentation control measures are measured and paid in accordance with 1102 *Control of erosion and sedimentation*.

Excavation and geotextile material are measured and paid in accordance with the worksection applicable to the particular activity.

Unsuitable material removal is measured and paid in accordance with 1112 *Earthworks (Roadways)*.

Concrete work for outlet structures is measured and paid in accordance with this worksection and not 0310 *Minor concrete works*.

Miscellaneous minor concrete work not included in the pay items in this worksection shall be in accordance with pay items described in 0310 *Minor concrete works*.

5.2 PAY ITEMS

11711.1 Filter material type 'a' backfill

The unit of measurement shall be the compacted cubic metre.

The volume shall be computed from the actual length and depth of the trench or mat up to the level of the filter material multiplied by the design width of the trench.

The rate shall include the supply, placement and compaction of filter material and the 'capping' of the trench where shown on the Drawings.

The schedule quantity is a provisional quantity.

1171.2 Filter material type 'b' backfill

The unit of measurement shall be the compacted cubic metre.

The volume shall be computed from the actual length and depth of the trench or mat up to the level of the filter material multiplied by the design width of the trench or mat.

The rate shall include the supply, placement and compaction of filter material and the 'capping' of the trench where shown on the Drawings.

The schedule quantity is a provisional quantity.

1171.3 Filter material type 'c' backfill

The unit of measurement shall be the compacted cubic metre.

The volume shall be computed from the actual length and depth of the mat multiplied by the design width of the mat.

The rate shall include the supply, placement and compaction of filter material.

The schedule rate is a provisional quantity.

1171.4 Filter material type 'd' backfill

The unit of measurement shall be the compacted cubic metre.

The volume shall be computed from the actual length and depth of the mat multiplied by the design width of the mat.

The rate shall include the supply, placement and compaction of filter material.

The schedule quantity is a provisional quantity.

1171.5 Outlet structures for subsurface drainage pipes

The unit of measurement shall be 'each' outlet structure, excluding outlets into pits, provided in accordance with this worksection.

The schedule rate under this Pay Item shall include all the operations involved in the construction of the outlet including the forming of the structure, supply of concrete and, where directed by the Superintendent, the provision of erosion control measures.

The schedule quantity is a provisional quantity.

6 ANNEXURE A

6.1 Slotting details for thick walled PVC plastic pipe

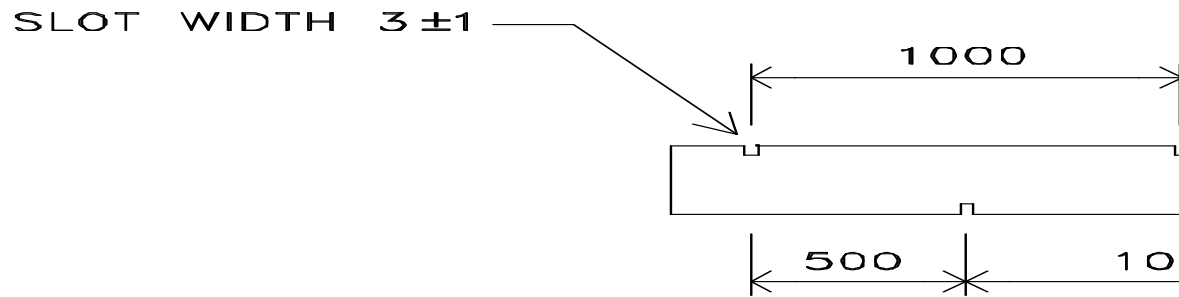


Figure A1 Slotting details for thick walled pvc plastic pipe

7 ANNEXURE B

Slotted pipes fitted with seamless tubular filter fabric

7.1 PROCEDURE FOR FITTING SEAMLESS TUBULAR FILTER FABRIC TO SLOTTED PIPE

Seamless tubular filter fabric may be fitted to slotted pipe on site 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 20 mm and 30 mm 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 joint with the filter fabric on the adjacent pipe when the pipes are installed in the drain.

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.