



AUS-SPEC

Infrastructure Specifications

1121 Open drains

1121 OPEN DRAINS

IMPORTANT: This document has been adapted from the NATSPEC suite of specification templates for use in the Cessnock City Council area by both Council and industry. NATSPEC regularly updates the base templates (currently in April and October each year), and Council may incorporate changes into its version of AUS-SPEC from time to time. To assist in highlighting any changes made by Council to the NATSPEC templates, the following conventions are used.

- See ANNEXURE M at the end of this document which contains (where practical) Cessnock City Council customisations (also known as 'office master' text). References to the Annexure are to also be inserted at relevant clauses in the main body of the document.
- Where content is added to the main body of the document, it is to be shown **in brown text like this**.
- Where content is deleted or excluded from the main body of the document, it is to be shown ~~struck through like this~~. Such clauses are to have no effect.

Where there is a conflict between main body text and Cessnock City Council specific clauses, Council's specific clauses shall prevail.

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide open drains, including unlined and lined open drains, as documented.

1.2 CROSS REFERENCES

General

Requirement: This worksection is not a self-contained specification. In addition to the requirements of this worksection, conform to the following:

- 0136 *General requirements (Construction)*.
- 0152 *Schedule of rates (Construction)*.
- 0161 *Quality management (Construction)*.
- 0257 *Landscape - road reserve and street trees*.
- 0294 *Gabion walls and rock filled mattresses*.
- 0319 *Auxiliary concrete works*.
- 1101 *Traffic management*.
- 1102 *Control of erosion and sedimentation (Construction)*.
- 1111 *Clearing and grubbing*.
- 1112 *Earthworks (Road reserve)*.
- 1351 *Stormwater Drainage (Construction)*
- 1353 *Precast box culverts*

Definitions

General: For the purposes of this worksection the following definitions apply:

- Open drains: All drains other than pipe and box culverts and include catch drains, channels (gutters) and kerbs and channels (gutters).

1.3 SUBMISSIONS

Authority approvals

Road opening permit: Submit an application to the relevant Council for approval for works to road or footpath, including the following:

- Location of services.
- Opening and compaction specifications: To 1151 *Road openings and restoration*.

Execution details

Survey: Submit set-out survey of drainage system.

Set-out of open drains: Submit details of any proposed changes to the location, length and design levels to suit construction procedures.

Temporary drainage: Submit details of procedures/devices to maintain effective drainage of the works area during construction.

Trees and rock outcrops: Submit a diversion proposal, if trees marked for preservation or rock outcrops occur in the line of the open drain.

Products and materials

Proprietary products: Submit the manufacturer's technical data.

Samples

Joint fillers and sealants: Submit a sample of the proposed preformed joint filler.

Wire mattresses: Submit a sample of the proposed type of mattress and a schedule of locations.

Geotextile: Submit a sample of the proposed geotextile material and the manufacturer's recommendations for installation.

Tests

Results: Submit results of testing to **ANNEXURE – MAXIMUM LOT SIZE AND MINIMUM TEST FREQUENCIES.**

1.4 INSPECTIONS

Notice

General: Give notice so that inspection may be made of the following:

- Set-out of open drains: Set-out.
- Salinity prevention: Location of open drains after set-out.
- Excavation:
 - . Grade to open drains.
 - . Backfill of excavation below the level of the natural channel.
 - . Surplus material disposal.
- Catch drains: Location of drains.
- Table drains: Location of drains, swales and depressed medians after completing earthworks.
- Concrete lining: Location of weepholes.
- Stone pitching: Bedding material.
- Wire mattresses: Completed installation.

2 MATERIALS

2.1 CONCRETE

General

Concrete properties and delivery, placing, compaction, finishing, curing and protection: To *0319 Auxiliary concrete works.*

2.2 PROPRIETARY PRODUCTS

General

Requirement: Conform to the manufacturer's recommendations.

2.3 WIRE MATTRESSES

General

Requirement: Provide wire mattresses to *0294 Gabion walls and rock filled mattresses.*

2.4 BATTER DRAINS

General

Material: Half round steel pipes or precast nestable concrete units, as documented.

2.5 GEOTEXTILE

General

Type: Non-woven geotextile conforming to Austroads AGPT04G (2009).

Geotextile strength and filtration requirements table

Application	Geotextile strength class ^a	EOS and flow rate requirements for $D_{15} \leq 75 \mu\text{m}^c$ (predominantly low permeability soils including clays and silts)	EOS and flow rate requirements for $D_{15} > 75 \mu\text{m}^c$ (predominantly pervious granular soils)	Filtration class
Drainage and separation behind retaining structures, including rock filled mattresses and joints of pipes and arches.	C	EOS $\leq 120 \mu\text{m}^b$ Q ₁₀₀ $\geq 30 \text{ L/s/m}^2$ ^c $\psi \geq 0.3 \text{ s}^{-1}$	EOS $\leq 250 \mu\text{m}^b$ Q ₁₀₀ $\geq 50 \text{ L/s/m}^2$ ^c $\psi \geq 0.5 \text{ s}^{-1}$	2
<p>a. Geotextile strength class for survivability for the given application. Geotextile survivability refers to the ability of the geotextile to withstand the installation stresses during construction. It is related to the construction method, subgrade condition, backfill material including stone size, and other factors.</p> <p>b. Equivalent opening size (EOS), defined as O₉₅, taken to be the mean value of the test results in conformance with AS 3706.1 (2012) and AS 3706.7 (2014). It is recognised that wet sieving generally results in lower EOS values than dry sieving.</p> <p>c. Q₁₀₀, the flow rate under 100 mm constant head and permittivity (ψ) determined in conformance with AS 3706.9 (2012).</p> <p>Source: TfNSW QA Spec R63 (2020).</p>				

Delivery and storage

Delivery: Deliver to site in the manufacturer's original packing, at least 14 days before commencement of installation and legibly marked to show type and batch number.

Storage: Store above ground, under protective cover or wrapped in waterproof, opaque UV protective sheeting to the manufacturer's recommendations.

2.6 TESTING**Quality**

Requirement: Test for all characteristics in conformance with **ANNEXURE - MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES**.

Quality verification: If material/product quality verification can be obtained from the supplier, documented tests need not be repeated.

3 EXECUTION**3.1 ESTABLISHMENT****General**

Survey control: Provide for the following:

- Mapping and pegging the drainage system.
- Locating components.

Survey data: Provide data for the set-out of gradients, open drains and construction to tolerances.

Set-out of open drains

Requirement: Identify and set out the location and levels of the open drains.

Temporary drainage during construction

Dams and diversions: Do not, temporarily or permanently, dam or divert existing watercourses.

Material and equipment: Locate material and equipment clear of watercourses or secure to prevent danger or damage due to large runoff flows.

Swales and buffer strips: Protect during construction or make use of the swale as a temporary measure. Provide geotextile with 50 mm topsoil and instant turf laid perpendicular to the flow path.

Stabilisation of topsoil areas: If required, stabilise the topsoil with hydroseed immediately after earthworks to *0257 Landscape - road reserve and street trees*.

Trees and rock outcrops

General: If trees marked for preservation or rock outcrops occur in the line of the drain, give notice.

3.2 OPEN DRAINS**General**

Clearing: To *1111 Clearing and grubbing*.

Removal of topsoil and unsuitable material: To *1112 Earthworks (Road reserve)*.

Salinity prevention: Locate open drains to minimise ingress of surface water into the groundwater table and to prevent salinity degradation of adjacent land.

Discharge: Extend open drains to natural drainage depressions, culverts, or pits connected to underground drainage systems. Follow existing watercourses and depressions in the natural surface.

Waterways outside the site: Do not disturb.

Excavation

Profile: V-shaped or trapezoidal with a minimum depth of 300 mm and minimum waterway area 0.2 m² or as documented.

Grade: Minimum 0.5% or as documented.

Trimming: To a uniform surface free of irregularities.

Compaction of foundation material: Not less than 95% for standard compactive effort to AS 1289.5.4.1 (2007).

Excavation below the level of the natural channel: Backfill with suitable material and compact to a density equal to and compatible with that existing naturally.

Surplus material: Place excavated material to form embankments to lower side of drains or remove to spoil stockpiles as documented.

Construction

Embankments: Form in layers maximum 200 mm in depth and compact in layers of maximum depth of 150 mm.

Batter slope: Not steeper than 2H:1V.

Compaction of excavated material: Not less than 95% for standard compactive effort to AS 1289.5.4.1 (2007).

Revegetation: Vegetate the embankment after its completion to *0257 Landscape - road reserve and street trees*.

3.3 UNLINED OPEN DRAIN TYPES**Catch drains**

General: Provide catch drains before construction of the adjacent roadway above the tops of cuttings and along the toes of embankments, as documented.

Position: Locate as follows:

- Minimum: More than 2 m above the tops of cuttings or below the toes of embankments.
- Maximum: To maintain the fall of the drain.

Minor diversion and contour drains

General: Provide minor diversion and catch drains as documented and with the same capacity as the nearest pipe culvert on the line of the drain.

Table drains

General: Provide table drains, swales and depressed medians, as part of earthworks to the line and level, as documented.

Channels

Requirement: Excavate inlet, outlet and diversion channels to the full width of the open drain, as documented and, extend to join the existing stream bed, avoiding disturbance in stream flow.

Existing stream bed: Preserve outside the limits of the excavation.

3.4 LINED OPEN DRAIN TYPES**General**

Timing: Line within 5 days of shaping and compacting the foundation.

Organic fibre mat and vegetation lining

Requirement: Provide to lined open drains with a longitudinal grade between 1% and 5% for the completed drain.

Installation: To **OPEN DRAINS, Surface protection** in *0257 Landscape - road reserve and street trees*.

Concrete lining

Requirement: Provide to lined open drains with a longitudinal grade of less than 1% or greater than 5% for the completed drain.

Minimum compacted thickness: 100 mm, measured at right angles to the surface of the concrete lining.

Colour: To match that of the surrounding materials or as documented.

Installation: Cast in situ or sprayed concrete to *0319 Auxiliary concrete works*.

Weepholes: Provide weepholes at 2 m spacing in non-horizontal elements or as documented.

Top of finished lining: True to line and of uniform width, free from humps, sags or other irregularities.

Tolerances: Conform to the following limits:

- Finished levels of lining surface: ± 10 mm of design levels.
- Surface deviation: Not more than 5 mm from a 3 m straightedge parallel to the direction of flow.

Contraction joints: Construct as follows or as documented:

- Width: 5 mm minimum.
- Depth: Minimum 50% of cross sectional area. Tool joint to minimum 20 mm depth to form groove.
- Intervals: 3 m maximum.

Expansion joints: Construct as follows or as documented:

- Width: 15 mm.
- Depth: Full thickness of the concrete lining.
- Intervals: 15 m maximum.
- Material: Preformed jointing material of bituminous fibreboard or as documented.

Stone pitching

Material: Sound durable rock not less than 100 mm thick, bedded on loam or sand and mortared to present a uniform surface.

Exposed surface of each stone or block: Approximately flat and not less than 0.05 m² in area.

Spaces between adjacent stones or blocks: 20 mm maximum width.

Wire mattresses

Installation: To *0294 Gabion walls and rock filled mattresses*.

Batter drains

Installation: Install drains as follows:

- Backfill over-excavation and undulations in the batter line.
- Compact both sides of the drain to form a firm shoulder against the top edge of the batter drain.
- Lay the units in a template controlled excavated trench to form an even top edge to the batter drain.
- Tolerance from the batter line at the underside of topsoil: +0 mm, -50 mm.

Topsoil: Taper over a width of 1 m to zero thickness at the top edge of the drain.

Turfing: To *0257 Landscape - road reserve and street trees*.

- Extent: To both sides of the drain for a minimum width of 600 mm.

3.5 TESTING**Quality**

Requirement: Test for all characteristics in conformance with **ANNEXURE - MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES**.

4 ANNEXURE A

4.1 ANNEXURE - SUMMARY OF HOLD AND WITNESS POINTS

For private developments, certain Hold and Witness Points where specifically noted below require representatives of both the Superintendent and the Principal Certifier (e.g. Council) to authorise release.

Clause and description	Type	Submission/Inspection details	Submission/Notice times	Process held
SUBMISSIONS Authority approvals Road opening permit	H	Approval of application	10 days before site commencement	Site commencement
SUBMISSIONS Execution details Set-out of open drains	H – Superintendent and Principal Certifier	Details of any proposed changes to designed system	5 days before proceeding	Site set-out of drainage
SUBMISSIONS Execution details Temporary drainage	H – Superintendent and Principal Certifier	Details of procedures/devices	10 days before site commencement	Temporary drainage
SUBMISSIONS Execution details Tree and rock outcrops	H	Proposal for diversion	1 day before set-out	Site set-out of drainage
INSPECTION Notice Set-out of open drains	W	Set-out	3 days	-
INSPECTION Notice Salinity prevention	W	Location of open drains for salinity prevention	1 day before set-out	-
INSPECTION Notice Excavation	W	Grade of open drains	Progressive	-
INSPECTION Notice Excavation	W	Backfill of excavation below the level of the natural channel	Progressive	-
INSPECTION Notice Excavation	W	Surplus material disposal	Progressive	-
INSPECTION Notice	W	Location of catch drains	Progressive	-

Clause and description	Type	Submission/Inspection details	Submission/Notice times	Process held
Catch drains				
INSPECTION Notice Table drains	W	Location of table drains, swales and depressed medians	Progressive	-
INSPECTION Notice Concrete lining	W	Location of weepholes	1 day before concreting	-
INSPECTION Notice Stone pitching	W	Bedding material	1 day before placing	-
INSPECTION Notice Wire mattresses	W – Superintendent and Principal Certifier	Completed installation	3 days	-

Note: H = Hold point, W = Witness point

4.2 ANNEXURE - MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES

Activity	Key quality verification requirements	Maximum lot size	Minimum test frequency	Test method
Siting and excavation	Geometry	1 drainage line	1 per drainage line	Survey
Foundation	Compaction	1 drainage line	1 per 20 Lin. m ^a	AS 1289.5.4.1 (2007)
Bedding	Material quality: Particle size distribution	1 contract	1 per 200 m ³ a	AS 1141.11.1 (2020)
	Material quality: Compaction/moisture content	1 drainage line	1 per layer, per 20 Lin. m	AS 1289.5.4.1 (2007) AS 1289.5.7.1 (2006)
Concrete lining	Geometry		1 cross section per 25 m	Survey and 3 m straightedge
Selected backfill	Material quality: Maximum particle size Plasticity index Compaction/moisture content	1 contract 1 contract 1 drainage line	1 per 100 m ³ a 1 per 100 m ³ a 1 per 2 layers per 50 m ²	AS 1289.3.3.1 (2009) AS 1289.5.4.1 (2007) AS 1289.5.7.1 (2006)

a. or part thereof, per lot

4.3 ANNEXURE - PAY ITEMS

This Annexure applies to Council projects. For private development works use of this schedule is optional, at the Superintendent's discretion.

Pay items	Unit of measurement	Schedule rate inclusions
1121.1 Excavation—catch, contour and minor diversion drains	Lin. m measured along the invert of the drain	All costs associated with: - Excavation of all material types. - Do not include separate rates for earth and rock. - Placement and compaction of material excavated from the drains on the lower sides of the drains to form banks in the excavation rates. - Temporary measures for the control

Pay items	Unit of measurement	Schedule rate inclusions
		of stormwater runoff.
1121.2 Excavation— inlet, outlet and diversion channels	m ³ measured from cross sections on the drawings using the end area method, or as 'each' where minor work is involved	All costs associated with: - Excavation of all material types. - Do not include separate rates for earth and rock. - Disposal of surplus materia.l - Temporary measures for the control of stormwater runoff.
1121.3 Concrete lining of open drains	m ² of concrete in place	All costs associated with: - Surface preparation, supply and placing of concrete, jointing and curing.
1121.4 Stone pitching of open drains	m ² of stone pitching in place	All costs associated with: - Surface preparation, supply of stone, placing, final trimming and mortar jointing.
1121.5 Batter drains	Lin. m along the length of the drain formed by batter drain units	All costs associated with: - Supply of the units, excavation, installation, backfilling and compaction
Traffic management	Lump sum	To 1101 <i>Traffic management</i>
Erosion and sedimentation control		To 1102 <i>Control of erosion and sedimentation (Construction)</i>
Vegetation of open drains		To 0257 <i>Landscape - road reserve and street trees</i>
Concrete lining		To 0319 <i>Auxiliary concrete works</i>

4.4 ANNEXURE - REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:

AS 1289		Methods of testing soils for engineering purposes
AS 1289.3.3.1	2009	Soil classification tests - Calculation of the plasticity index of a soil
AS 1289.5.4.1	2007	Soil compaction and density tests - Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1289.5.7.1	2006	Soil compaction and density tests - Compaction control test - Hilf density ratio and Hilf moisture variation (rapid method)
AS 3706		Geotextiles - Methods of test
AS 3706.1	2012	General requirements, sampling, conditioning, basic physical properties and statistical analysis
AS 3706.7	2014	Determination of pore-size distribution - Dry sieving method
AS 3706.9	2012	Determination of permittivity, permeability and flow rate
Austrroads AGPT		Guide to pavement technology
Austrroads AGPT04G	2009	Geotextiles and geogrids
TfNSW QA Spec R63	2020	Geotextiles (separation and filtration)
EN 15804	2012	Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
ISO 14025	2006	Environmental labels and declarations - Type III environmental declarations - Principles and procedures

ISO 21930 2017 Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services

5 ANNEXURE M – CESSNOCK CITY COUNCIL SPECIFIC CLAUSES

M1.	Variations to or non-conformances with Council's AUS-SPEC are to be evaluated with reference to the procedure in Council's <i>Development Engineering Handbook</i> . Acceptance is to be obtained in writing from: an authorised representative of Council's Director of Infrastructure and Engineering Services.	Variation procedure
M2.	This specification applies in addition to any development consent (DA) conditions. If there is any inconsistency, the conditions of consent shall prevail.	DA Conditions
M3.	Refer to the Cessnock City Council <i>Development Engineering Handbook</i> for final inspection, works-as-executed and handover requirements.	Completion

6 AMENDMENT HISTORY

0	15/01/2024	First Published
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