Muswellbrook Shire Council

CONSTRUCTION SPECIFICATION

AUS-SPEC (Cot 09)

1121 Open Drains Including Kerb and Channel (Gutter)

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
0	No amendment has been made	all	Nil		14 June 2012

Contents

1121 OPEN DRAINS INCLUDING KERB AND CHANNEL (GUTTER)

1 GENERAL

1.1 RESPONSIBILITIES

Objectives

General: Provide all types of open drains including unlined and lined open drains, kerb and/or channel (gutter) and rock filled wire mattresses and gabions.

Performance

Requirements: Construct open drains to the specification and dimensions shown on the drawings.

Selections: As documented.

Design

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0152 Schedule of rates – supply projects.*
- *0161 Quality (Construction) or 0167 Integrated management.*
- *0179 General requirements (Construction).*
- *0257 Landscape – roadways and street trees.*
- *0319 Minor concrete works.*
- *1101 Control of traffic.*
- *1102 Control of erosion and sedimentation.*
- *1352 Pipe drainage.*

1.3 REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:

Standards

AS 1289	Methods of testing soils for engineering purposes
AS 1289.5.4.1-2007	Soil compaction and density tests—Compaction control test—Dry density ratio, moisture variation and moisture ratio
AS 1289.5.5.1-1998	Soil compaction and density tests—Determination of the minimum and maximum dry density of a cohesionless material—Standard method
AS 1289.5.7.1-2006	Soil compaction and density tests—Compaction control test—Hilf density ratio and Hilf moisture variation (rapid method)
AS 2758	Aggregates and rock for engineering purposes
AS 2758.4-2000	Aggregate for gabion baskets and wire mattresses
AS 2876-2000	Concrete kerbs and channels (gutters)—Manually or machine placed
AS 3704 – 2005	Geosynthetics – Glossary of terms
AS 3705 – 2003	Geotextiles: Identification, marking and general data
AS/NZS 4534: 2006	Zinc and zinc/aluminium-alloy coatings on steel wire

Other publications

AUSTROADS 2008	Glossary of Austroads terms
AGPT04G/09-2009	Guide to Pavement Technology Part4G- Geotextiles and geogrids
ASTM A975 – 97	Double-twisted hexagonal mesh gabions and revet mattresses (Metallic coated steel wire or metallic coated steel wire and PVC coatings)

1.4 INTERPRETATIONS

Definitions

General: For the purposes of this worksection the definition given below applies:

- Kerb and channel (gutter): Includes all forms of concrete channels (gutters), dish drains, grated drains, and mountable median and barrier kerbing.

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

1.5 SUBMISSIONS

Acceptance criteria

General: All submissions will be subject to the approval of the Superintendent.

Documents

General: Submit the following documents for approval:

- Calculations:
  - . Proposals for temporary drainage and changed hydraulic capacity.
- Design:
  - . Temporary works details.
  - . Traffic guidance scheme.
  - . Temporary drainage plan.
  - . Road opening permit.
- Drawings:
  - . Locations of driveways and laybacks.
  - . Gully pit hydraulic capacity.
- Execution:
  - . Trial section.
- Technical data:
  - . Components for concrete materials and drainage structures, material for backfill, rock filled gabions, pipe work and precast products.
  - . Compaction data on earth materials as specified.
  - . Materials for gabions and mattress mesh, concrete in situ/precast, pipes.
- Calculations:
  - . Survey set-out data for gradients and table drains.
- Technical data:
  - . Compaction data on earth materials as specified.
  - . Survey data for construction to tolerances.
- Type test results.
  - . Data on extrusion / slip forming performance as required.

1.6 INSPECTION

Notice

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

Summary of HOLD POINTS

Clause title/Item	Requirement	Notice for inspection	Release by
PRE-CONSTRUCTION PLANNING			
Authority Approvals			
- **Provision for traffic**	Submit Traffic Guidance Scheme for approval	2 weeks prior to site commencement	Superintendent
- **Temporary drainage**	Submit details of procedures/devices for approval	2 weeks prior to site commencement	Superintendent
MATERIALS			
Concrete	NATA compliance certificates for concrete and constituents	7 days prior to commencement on site	Superintendent
Joint Fillers and sealants	NATA compliance certificates for proposed	7 days prior to commencement on site	Superintendent

Clause title/Item	Requirement	Notice for inspection	Release by
	joint filler		
Proprietary Products	Submit proprietary products and manufacturers instructions	7 days prior to commencement on site	Superintendent
Wire mattresses	NATA compliance certificates for proposed wire mattress	7 days prior to commencement on site	Superintendent
Gabions	NATA compliance certificates for proposed Gabions	7 days prior to commencement on site	Superintendent
Rock fill material	NATA compliance certificates for proposed rock fill material	7 days prior to commencement on site	Superintendent
Geotextile	NATA compliance certificates for proposed Geotextile material	7 days prior to commencement on site	Superintendent
EXECUTION			
Open drains			
- **Excavation**	Approval to divert drain to avoid trees and/or rocks.	1 working day before set-out.	Superintendent.
- **Excavation**	Location and construction of drains to prevent salination	1 working day before set-out.	Superintendent.
Kerb and channel (gutter)			
- **Foundation**	Approval for shape and compaction of foundation material.	1 working day before forming	Superintendent
- **Construction**	Submit details of proposed method	14 days prior to commencement on site	Superintendent
- **Trial section**	Demonstrate the capability of forming equipment	3 working days prior to commencement on site	Superintendent
Backfilling and reinstatement			
- **Gully pits**	Submit details for fixing to existing works for approval	1 working day before demolition	Superintendent
- **Gully pits**	Hydraulic capacity changes	7 days prior to commencement on site	Superintendent

Summary of WITNESS POINTS – On-site activities

Clause title/Item	Requirement	Notice for inspection
EXECUTION		
Open drains		
- **Excavation**	Unsuitable material removal and disposal	Progressive
- **Excavation**	Spoil site locations	Prior to placement
- **Embankment**	Embankment compaction and revegetation	Progressive

Clause title/Item	Requirement	Notice for inspection
- **Construction**	Grade and compaction of open drains	Progressive
- **Construction**	Proprietary items installed to manufacturers recommendations	Progressive
- **Types**	Maintain catch drains	Progressive
- **Types**	Construct minor diversion and contour drains, table drains, swales and depressed medians	Progressive
- **Types**	Channels preserving the existing stream bed	Progressive
Lining		
- **Concrete lining**	Instruction on weephole location.	1 working day before concreting.
- **Concrete lining**	Joints and tolerances	1 working day before concreting.
- **Stone pitching**	Bedding material and placement	1 working day before concreting.
Kerb and channel (gutter)		
- **Stormwater outlets**	Direction for other than flexible pipework	1 week before ordering
- **Vehicular or pedestrian access**	Laybacks confirmation	3 working days prior to works
Backfilling and reinstatement		
- **Backfill behind kerbs**	Backfilling timing, material and compaction	1 working day prior to backfilling
- **Pavement backfill**	Backfill adjacent new gutter material and location	3 working days prior to works
Rock filled wire mattresses and gabions – Completion	Inspection of rockfill material and filling method	On completion of works

2 PRE-CONSTRUCTION PLANNING

2.1 AUTHORITY APPROVALS

Provision for traffic

Documentation: Submit a Traffic Guidance Scheme for control of vehicular and pedestrian traffic to conform with *1101 Control of traffic*. Construct the works with the least possible obstruction to traffic, both vehicular and pedestrian. This is a **HOLD POINT**.

Temporary drainage

Documentation: Submit details of procedures/devices to maintain effective drainage of the works area during construction. This is a **HOLD POINT**.

Road opening permit

Application: Submit application to the relevant council for approval to undertake works to road or footpath. This application includes but is not limited to the following information:

- Ascertain the location of services.
- Opening and compaction specifications.

2.2 ESTABLISHMENT

Documentation

Survey control: Required for the following:

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

3 MATERIALS

3.1 CONCRETE

General

Standard: To AS 2876

Specification: Concrete properties and delivery, placing, compaction, finishing, curing and protection to conform with *0319 Minor concrete works*.

Documentation: Submit NATA registered Compliance Certificates for all constituents of the mix as verification of the mix suitability. This is a **HOLD POINT**.

3.2 JOINT FILLERS AND SEALANTS

General

Documentation: Submit preformed joint filler proposed for use at least 7 days prior to use in the works. Supply NATA registered compliance certificates. This is a **HOLD POINT**.

3.3 PROPRIETARY PRODUCTS

General

Approval: Use only proprietary products to conform with the manufacturers instructions. This is a **HOLD POINT**.

3.4 WIRE MATTRESSES

General

Standard: To ASTM A975-97.

Submit: For approval the type of mattress proposed and a schedule of locations. This is a **HOLD POINT**.

Dimension: Unless otherwise shown on the drawings. 6 m $\times$ 2 m $\times$ 230 mm. Cut to suit areas if required.

Diaphragms: Divide mattress into cells not exceeding 1 m centres.

Forming diaphragms: Folding the base layer of a mattress, provided that the bottom of each of the diaphragm halves is securely tied together so that the transmission of tensile forces in the mesh of the base layer is not impeded.

Mattress material: Flexible woven heavily galvanised wire to ASTM A975-97.

Mesh size: 60 x 80 mm.

Galvanizing: Coating mass for round wire Class W10 to AS/NZS 4534. 95% zinc 5% aluminium mischmetal alloy.

Body wire: 2.0 mm minimum core diameter.

PVC wire coating: 0.4 mm required as shown on the drawings.

Selvedge wire: 2.4 mm minimum core diameter for mattresses less then 350 mm thick. Mattresses between 350 mm and 550 mm minimum diameter of mesh must be 2.4 mm and minimum galvanized wire 3.0 mm.

Selvedge properties: Ensure the mesh does not unravel and that the strength of the connection between the selvedge wire and the mesh ≥ the breaking strength of the mesh.

Lacing wire: 2.2 mm minimum core diameter.

3.5 GABIONS

General

Standard: To ASTM A975-97.

Submit: For approval the type of mattress proposed and a schedule of locations. This is a **HOLD POINT**.

Dimension: As shown on the drawings.

Diaphragms: Divide gabion into cells not greater than the width of the gabion plus 100 mm.

Material: Flexible woven heavily galvanised wire to ASTM A975-97.

Mesh size: 80 x 100 mm nominal.

Galvanizing: Coating mass for round wire Class W10 to AS/NZS 4534. 95% zinc 5% aluminium mischmetal alloy.

Body wire: 2.7 mm minimum core diameter.

PVC wire coating: 0.4 mm required as shown on the drawings.

Selvedge wire: 3.4 mm minimum core diameter.

Selvedge properties: Ensure the mesh does not unravel and that the strength of the connection between the selvedge wire and the mesh ≥ the breaking strength of the mesh.

Lacing wire: 2.2 mm minimum core diameter.

3.6 LACING AND CONNECTING WIRE

General

Standard: To ASTM A975-97.

Minimum diameter: 2.2 mm

Alternative fasteners: 'C' clips conforming with ASTM A975-97 may be used if approved.

3.7 ROCK FILL MATERIAL

General

Standard: To AS 2758.4.

Rock quality: Clean, dense, durable hard rock.

Wet strength: > 100 kN to AS 1141.22.

Wet / dry strength variation: < 35% to AS 1141.22.

Submit: For approval rock material and NATA certificates of compliance of the proposed rock fill material. This is a **HOLD POINT**.

Particle sizes for wire mattresses: Between 75 mm and two-thirds of the mattress thickness, or 250 mm, whichever is the lesser.

Particle size for gabions: Between 100 mm and 250 mm and preferably not greater than 200 mm.

3.8 GEOTEXTILE

General

Submit: For approval the proposed geotextile material and NATA certificates of compliance. Submit a sample of the fabric, the manufacturer information and installation instructions. This is a **HOLD POINT**.

Type: As specified on the drawings or as directed/approved.

Properties

Classification: Properties, functions, design and construction requirements to AUSTROADS AGPT04B/09.

Specification: Material type and minimum mass requirements as shown on the drawings.

Quality: Free of any flaws, stabilised against UV radiation, rot proof, chemically stable, low water absorbency. Filaments must resist delamination and maintain their relative dimensional stability.

Geotextile strength and filtration: Require a knowledge of the site soils including gradings, plasticity and strength, protection of the layers supporting the drains.

Robustness and strength: Conform to the following:

- Conform to the classifications for robustness and strength cited in AGPT04G/09.
- Select material based on tests and subgrade conditions for the relevant location/function.

Delivery and storage

Delivery: At least 14 days prior to commencement of installation.

Storage: Under protective cover or wrapped with a waterproof, opaque UV protective sheeting to avoid any damage prior to installation. Store to conform to manufacturers recommendations.

Damage: Must not be stored directly on the ground or in any manner that adversely effect the material by heat, dirt or damage.

Label: Ensure the geotextile material is clearly labelled showing manufacturer, type and batch number.

4 EXECUTION

4.1 OPEN DRAINS

Excavation

Clear: To *1111 Clearing and grubbing*, strip topsoil and any unsuitable material.

Trees and rock outcrops: Approval to divert the drain where trees marked for preservation or rock outcrops occur. This is a **HOLD POINT**.

Control of erosion: Conform to *1102 Control of erosion and sedimentation.*

Salinity prevention: Locate and construct open drains to avoid recharging groundwater, a shallow water table and salinity degradation of adjacent land. This is a **HOLD POINT**.

Excavate: To the dimensions shown on the drawings or where not shown to minimum depth of 300 mm and minimum waterway area 0.2 m^2.

Cross section: V-shaped or trapezoidal unless otherwise shown on drawings.

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

Unsuitable material: Notify the Superintendent of any unsuitable material and seek a direction for removal. Dispose of the unsuitable material as approved or directed. Replace unsuitable material with acceptable cut or other material. This is a **WITNESS POINT**.

Surplus material: Use the excavated material in the works or remove to spoil stockpiles as directed. This is a **WITNESS POINT**.

Waterways outside the site: Do not disturb with activities associated with the work.

Embankment

Construct: In layers maximum 200 mm in depth and compact in layers of maximum depth 150 mm.

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

Revegetation: Vegetate the embankment after its completion to *0257 Landscape – roadways and street trees.*

Backfill: To excavation below the level of the natural channel with suitable material. Compact to a density equal to and compatible with that existing naturally. This is a **WITNESS POINT**.

Construction

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.

Trimming: To a uniform surface free of irregularities and compact any surface to be lined to 90% relative compaction.

Open drains: Grade to ensure free flow of water and minimum grade of 0.5%. This is a **WITNESS POINT**.

Types

Provide catch drains: Before construction of the adjacent roadway.

Location of catch drains: > 2 m above the tops of cuttings or > 2 m along the toes of embankments.

Maintain: The fall of the catch drains unless otherwise approved. This is a **WITNESS POINT**.

Minor diversion and contour drains: Provide the same capacity as the nearest pipe culvert on the line of the drain.

Table drains, swales and depressed medians: Construct as part of earthworks, with the line and level as shown on the drawings or from calculations. This is a **WITNESS POINT**.

Channels: Excavate inlet, outlet and diversion channels as shown on the drawings and, unless noted otherwise, extend to join the existing stream bed, avoiding disturbance in stream flow. Preserve the existing stream bed as far as possible outside the limits of the excavation. This is a **WITNESS POINT**.

4.2 LINING

General

Lining choice: Unless otherwise shown on the drawings use the following linings:

- Organic fibre mat and vegetation where the longitudinal grade of the completed drain lies between 1% and 5% inclusive; or
- Concrete where the longitudinal grade of the completed drain is less than 1% or greater than 5%.

Timing: Within 7 days of shaping and compacting the foundation.

Proprietary Items: Install approval proprietary items to conform to the manufacturer's instructions. This is a **WITNESS POINT**.

Organic fibre mat and vegetation

Conform to: *0257 Landscape – roadways and street trees.*

Concrete lining

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

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

Method: Cast-in-situ or sprayed concrete to conform with 0319 *Minor concrete works*.

Weepholes: Provide weepholes in locations shown on the drawings or at 2 m spacing in non-horizontal elements or as directed. This is a **WITNESS POINT**.

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: Within ± 10 mm of design levels.
- Surface deviation: Not more that 5 mm from a 3 m straight edge parallel to the direction of flow, except at kerb laybacks, grade changes or curves, or at gully pits requiring channel depression.

Contraction joints: Conform to the following:

- Width: 5 mm minimum.
- Depth: 20 mm minimum.
- Intervals: Every 3 m of lining.

Expansion joints: Conform to the following:

- Width: 15 mm.
- Depth: Full thickness of the concrete lining.
- Intervals: 15 m maximum.
- Material: Approved preformed jointing material. This is a **WITNESS POINT**.

Stone pitching

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

The exposed surface of each stone: Approximately flat and not less than 0.05 m^2 in area.

Spaces between adjacent stones or blocks: 20 mm maximum width. This is a **WITNESS POINT**.

Batter drains

Material: Half round steel pipes or precast nestable concrete units as shown on the drawings.

Install: The units in a carefully excavated and template controlled trench to form an even top edge +0 mm to –50 mm from the batter line at the underside of topsoil.

Backfill and compact: Backfill over-excavation and undulations in the batter line. Compact both sides of the drain over the full length to form a firm shoulder against the top edge of the batter drain.

Taper topsoil: Over a width of 1 m to zero thickness at the rim of the drain.

Turf: Both sides of the drain for a minimum width of 600 mm to conform with *0257 Landscape – roadways and street trees*.

4.3 KERB AND CHANNEL (GUTTER)

Foundation

Shape and compaction: Before placing any kerb and/or channel (gutter), shape and compact the foundation material to an approved firm base.

Relative compaction: To AS 2876 except where placed on pavement courses, then to the requirements of the respective pavement course. This is a **HOLD POINT**.

Construction

Construct: Kerb and/or channel (gutters) in fixed forms, by extrusion or by slip forming to AS 2876.
Submit: Details of method proposed including type of extrusion or slipform, concrete properties, equipment and finish. This is a **HOLD POINT**.

Trial section

Trial section: Provide a trial section to demonstrate the Contractors capability of forming equipment. This is a **HOLD POINT**.

Finish

Finish true to line: The top and face of the finished kerb and channel.

Top surface: Uniform width, free from humps, sags and other irregularities.

Type: Steel float finish or as otherwise shown on drawings.

Tolerances

Finished levels of channel / gutter surface: Within ± 10 mm of design levels.

Surface deviation of kerb face and channel (gutter) surface: ± 5 mm from the edge of a 3 m straight edge, except at kerb laybacks, grade changes or curves, or at gully pits requiring channel/gutter depression.

Joints

Contraction joints: Unless shown otherwise on the drawings, conform to the following:

- Width: 5 mm minimum.
- Depth: 20 mm.
- Intervals: Every 3 m of channel / gutter length for a minimum of 50% of cross sectional area of concrete.
- Tooling: 20 mm in depth to form a neat groove of 5 mm minimum width.

Expansion joints: Provide where the channel/gutter abuts against pits, retaining walls, overbridges and at both sides of kerb laybacks for vehicular or pedestrian access. Unless shown otherwise on the drawings, conform to the following:

- Width: 15 mm.
- Depth: Full depth of kerb and channel (gutter).
- Maximum intervals: 15 m.

Joints adjacent to concrete pavement: If kerbs and/or channel / gutters are cast adjacent to a concrete pavement, continue the contraction, construction and expansion joints documented for the concrete base across the kerb and/or channel (gutter).

Stormwater outlets

General: Reconnect and extend all existing house stormwater outlets through the kerb to match the existing type and size of pipe as shown on the drawings.

Pipes: Conform to the requirements for flexible pipes in *1352 Pipe drainage* or as directed for other types of pipe. This is a **WITNESS POINT**.

Vehicular or pedestrian access

Barrier kerb: Discontinue opposite all driveways as shown on the drawings or as directed.

Kerb laybacks: As shown on the drawings where the barrier kerb is discontinued.

Footpath crossovers: Meet the laybacks as shown on the drawings or reinstate to match existing materials. This is a **WITNESS POINT**.

4.4 BACKFILLING AND REINSTATEMENT

Backfill behind kerbs

Timing: Not earlier than 3 days after concreting, backfill and reinstate the spaces on both sides of the kerb and/or channel (gutter) to conform with the drawings, or as directed.

Material: Granular material, free of organic material, clay and rock in excess of 50 mm diameter, or approved material.

Layers: Compact in layers not greater than 150 mm thick.

Relative compaction: 95% when tested in conformance with AS 1289.5.4.1 for standard compactive effort.

Surface treatment: Free draining and free from undulations and trip hazards. This is a **WITNESS POINT**.

Pavement backfill

Backfill: Material adjacent to the new channel (gutter) as shown on the drawings or as directed. This is a **WITNESS POINT**.

Gully pits

Reconstruct: The top of gully pits or adjust precast units to suit new kerb and channel (gutter) profile to conform with *0319 Minor concrete works*.

Adjustment: Demolish and reconstruct gully pits to suit new line or level of the kerb and channel (gutter) to match the design standard of the existing gully pit.

Fixing to existing works: Fix new wall sections in concrete or brick securely to the retained wall section. Submit details of the proposed procedure for approval. This is a **HOLD POINT**.

Hydraulic capacity: Retain or improve the capacity of the original gully pit. Cavity shapes to be regular and oriented so as not to impede flow into and out of the pit.

Submit: Provide sketches and/or calculations relevant to such hydraulic capacity. This is a **HOLD POINT**.

4.5 ROCK FILLED WIRE MATTRESSES AND GABIONS

General

Location: As shown on the drawings.

Foundations

Finished level of excavation: Prior to installation of rock filled wire mattress or gabion excavate so the mattresses finish flush with the surrounding ground.

Shape and compaction: Not less than 95 % for standard compactive effort to AS 1289.5.4.1. to form a uniform channel cross-section prior to installation of mattresses.

Geotextile: Before laying out the wire mattresses or gabions, place geotextile between the wire cage and the material being protected as shown on the drawings.

Assembly

Prior to assembly: Open the wire mesh out flat on the ground and stretch it to remove all kinks and bends.

Gabion boxes: Individually assemble by raising the sides, ends and diaphragms, ensure all creases are in the correct position and that all four sides and the diaphragms are even.

Lace: The four corners first and then the edges of internal diaphragms to the sides.

Lacing and twisting: Commence the lacing by twisting the end of the lacing wire around the selvedge(s) then pass it around the two edges being joined using alternate single and double loops through each mesh in turn and tie it off securely at the bottom.

Ends: Turn the ends of all lacing wires to the inside of the box on completion of each lacing operation.

Erection

Conform to the following:

- Only assembled boxes, or groups of boxes must be positioned in the structure.
- Secure the end to either the completed work or by galvanised star pickets driven into the ground at 1 m spacing.
- Firmly embed the star pickets into the ground by minimum 900 mm.
- Star pickets to be at lest the height of the box.
- Place boxes in the structure lacing securely the proceeding one along all common corners and diaphragms.

Stretching for gabion boxes: Using a pull lift of at least 1 tonne capacity, firmly secured to the free end of the assembled gabion boxes. Whilst under tension, securely lace the gabion boxes along all edges and at diaphragm points to al adjacent boxes.

Mattresses: Adjust the position of the diaphragms so that the sides hinge up on the thicker wire woven in the mesh.

Filling

Gabion boxes: Conform to the following:

- Fill whilst the gabion boxes are under tension.
- Place the rocks at the front face and other exposed faces by hand to produce a neat face free of excessive bulges, depressions and voids.
- Internal bracing wires 4 per m^3 at 330 mm centres to prevent distortion.
- Face bracing wires 4 per m^2 of face.

- Mechanical filling equipment may be used with caution to protect any PVC or galvanized coatings from abrasion.
- Release the tension on the gabion boxes only when fully laced so as to prevent any slackening.

Mattresses:

- Mechanical filling equipment may be used with caution to protect any PVC or galvanized coatings from abrasion.
- Redistribute the filling materials by hand to ensure that all diaphragm compartments are fully filled to produce a neat and level top surface.
- Overfill by 25 to 50 mm to allow for subsequent settlement.

Final lacing

Close and lace lids: As soon as practicable after filling particularly if there is a storm or flood expected.

Stretch lids tightly over the filling and lace down securely.

Completion

Inspection: Inspection of rock fill material and filling method. This is a **WITNESS POINT**.

4.6 LIMITS AND TOLERANCES

The limits and tolerances applicable to this worksection are summarised in **Summary of limits and tolerances table**.

Summary of limits and tolerances table

Activity	**Limits/Tolerances**	**Worksection Clause/subclause**
Materials		
Wire mattresses	Diaphragm cells at 1m centres Mesh size 60mm x 80mm Galvanising 95% zinc, 5% aluminium	**Wire mattresses**
Gabions	Diaphragms < width plus 100mm Mesh size 80mmx100mm Galvanising 95% zinc, 5% aluminium	**Gabions**
Rock fill material	Wet strength> 10kN Wet / dry strength < 35% Particle size for mattresses between 75 mm and 150 mm Particle size for gabions > 100 mm < 250 mm	**Rock fill material**
Unlined open drains		
Design	Grade > 0.5% Depth > 300 mm Waterway Area > 0.2 m^2	**Open drains – Construction**
Catch Drain Location	> 2 m from top of cuttings or toes of embankments	**Open drains - Types**
	Compaction > 95% (standard compaction)	**Open drains - Embankment**
Lining		
	1% to 5% use organic mat or vegetation Less 1% greater than 5% use concrete lining	**Lining**
	Concrete 100mm thick measured at right angles	**Concrete lining**
Contraction joints	Width: 5 mm minimum Depth: 20 mm minimum Intervals: every 3m of lining Tooling: 20 mm in depth groove 5 mm minimum width	**Concrete lining**
Expansion joints	Width: 15 mm minimum	**Concrete lining**

Activity	**Limits/Tolerances**	**Worksection Clause/subclause**
	Depth: full thickness of the concrete lining Intervals: 15m maximum	
Stone pitching	Rock > 100mm thick Exposed surface > 0.05 m^2 Spaces < 20 mm maximum width	**Stone pitching**
Batter drains	Install 0 to 50mm below batter line Top soil: thickness 1m to 1 at rim of drain	**Batter drains**
- Compaction of Foundation	> 95% (standard compaction)	**Lined open drains**
- Level of lining surface	Level ± 10 mm of design level	**Concrete lining**
- Surface uniformity	Deviation lining surface from 3 m straight edge ≤ 5 mm	**Concrete lining**
Kerb and channel		
Kerb and channel (gutter)		**Execution**
- Relative compaction of foundation	To AS 2876	**Foundation**
- Finished levels of channel (gutter) surface	Level ± 10 mm of design level	**Kerb and channel (gutter) -Tolerances**
- Surface deviation of kerb face and channel (gutter) surface	± 5 mm from 3 m straight edge	**Kerb and channel (gutter) -Tolerances**
- Contraction joints	Width: ≥ 5 mm Depth: 20 mm Intervals every 3 m of channel/gutter length for a minimum of 50% of CS area of concrete	**Kerb and channel (gutter) - Joints**
- Expansion joint interval	≤ 15 m Width: 15 mm Depth: Full depth of kerb and channel (gutter)	**Kerb and channel (gutter) - Joints**
Backfill behind kerb		
- Layer thickness	≤ 150 mm	**Backfilling and reinstatement**
- Relative compaction	95% (standard compaction)	**Backfilling and reinstatement**
Rock filled wire mattresses and gabions		
- Star pickets for ties	Depth in ground > 900 mm Spacing < 1 m	**Rock filled wire mattresses and gabions - Erection**
Bracing wires	Internal: 4 per m^3 at 330 mm centres Face: 4 per m^2 of face	**Rock filled wire mattresses and gabions - Filling**
Wire mattress filling	Over fill mattresses by 25 to 50 mm	**Rock filled wire mattresses and gabions - Filling**

5 MEASUREMENT AND PAYMENT

5.1 MEASUREMENT

General

Payments made to the Schedule of Rates: To *0152 Schedule of rates – projects*, this worksection, the drawings and Pay items **1121.1-1121.8** inclusive.

Lump Sum prices: Not acceptable.

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

Methodology

The following methodology will be applied for measurement and payment:

- Erosion and sedimentation control measures: In conformance with *1102 Control of erosion and sedimentation*.
- Sprayed concrete lining of open drains: In conformance with *0319 Minor concrete works*.
- Cast-in-situ concrete or other lining of open drains: In conformance with this worksection and not *0319 Minor concrete works*.
- Miscellaneous minor concrete work not included in the pay items in this worksection: In conformance with *0319 Minor concrete works*.
- Topsoiling and turfing to sides of batter drains: In conformance with *0257 Landscape – roadways and street trees*.

5.2 PAY ITEMS

Pay items	Unit of measurement	Schedule rate scope
1121.1 Excavation—catch, contour and minor diversion drains	Linear metre measured along the invert of the drain.	All costs associated with: - Excavation of all types of material. - Does 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 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 types of material. - Does not include separate rates for earth and rock. - The disposal of surplus material. - 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	Linear metre along the length of the drain formed by batter drain units.	All costs associated with: - Supply of the units, excavation, installation, backfilling and compaction.
1121.6 Rock filled gabions	m^3 of rock filling.	All costs associated with: - Rock volumes taken from the drawings and adjusted for any authorised changes. - Supply and placement of geotextile material behind the gabions - Supply and assembly of the gabions - Supply and placing of the rock fill in the gabions.
1121.7 Rock filled wire mattresses	m^2 of rock filled mattress complete.	All costs associated with: - Area determined from the actual completed

Pay items	Unit of measurement	Schedule rate scope
		work including the area folded into the trench. - Supply and placement of geotextile material, star pickets and ties. - Supply and assembly of the wire mattresses. - Supply and placing of the rock fill.
1121.8 Kerb and/or channel (gutter)	Linear metre measured along the length of the kerb and/or channel including kerb laybacks and perambulator ramps.	All costs associated with: - Compaction of foundations, forming, concreting. - expansion and contraction joints. - backfilling and compaction adjacent to the completed kerb. - Separate pay items for each type of kerb and/or channel.