WESTERN AUSTRALIA

SPECIFICATION

220

STORMWATER DRAINAGE GENERAL

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
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*

SPECIFICATION 220
STORMWATER DRAINAGE - GENERAL

SPECIFICATION 220 : STORMWATER DRAINAGE - GENERAL

GENERAL

220.01 INTRODUCTION

1. Drainage works shall form a complete system carrying water through and away from the Works. ***Purpose***

2. This is the general Specification common and applicable to all types of drainage lines, open drains and drainage structures and shall be read in conjunction with drainage Specifications:

221	Pipe Drainage
222	Precast Box Culverts
223	Drainage Structures
224	Open Drains

as applicable to particular Contracts.

220.02 SCOPE

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

(a) preparation for stormwater drainage construction,

(b) temporary drainage during construction,

(c) siting of pipes, pipe arches and box culverts,

(d) all activities and quality requirements associated with excavation and backfilling,

(e) all concrete work associated with stormwater drainage,

(f) demolition and removal of existing redundant pipes and drainage structures.

2. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements. ***Quality***

220.03 EXTENT OF WORK

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

EXAMPLE (*TO BE COMPLETED BY COMPILER)*

(a) pipe culvert stormwater drainage,

(b) precast box culvert stormwater drainage,

(c) drainage pits, headwalls, wingwalls and aprons,

(d) open concrete dish drains,

(e) scour protection of open drains at outlets to drainage structures,

(f) demolition and removal of existing redundant pipe culverts, headwalls

and pits.

220.04 REFERENCE DOCUMENTS

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

Documents Standards Test Methods

(a) Council Specifications

211	-	Control of Erosion and Sedimentation
213	-	Earthworks
271	-	Minor Concrete Works

(b) Australian Standards

AS 1289.5.4.1	-	Compaction control test - Dry density ratio, moisture variation and moisture ratio.
AS 1289.5.7.1	-	Compaction control test (Rapid Method)
AS 1289.6.3.3	-	Determination of the penetration resistance of a soil - Perth sand penetrometer test.

CONSTRUCTION

220.05 TEMPORARY DRAINAGE DURING CONSTRUCTION

1. All drainage works carried out by the Contractor shall comply with the Specification for CONTROL OF EROSION AND SEDIMENTATION.

Control

2. The Contractor shall make adequate provision for runoff flows at 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.

Contractor's Responsibility

3. The Contractor shall not implement any proposals to dam up or divert existing watercourses (either temporarily or permanently) without the prior approval of the Superintendent.

Limitations

4. 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.

Location of Equipment

220.06 SITING OF CULVERTS

1. Before commencing construction of any culvert, the Contractor shall set out on site the culvert inlet and outlet positions 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.

Set-out

HP

2. The Superintendent may amend the inlet or outlet locations or designed levels or the culvert length 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 or Bill of Quantities as appropriate. Should the Superintendent require a change to the culvert strength or the conditions of installation an appropriate variation shall be ordered.

Amendments to planned work

3. Should the Contractor propose changes to the culvert location, length, designed levels, culvert strength, conditions of installation or cover to suit the construction procedures, the Contractor shall present the proposed culvert 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. All costs associated with such changes shall be borne by the Contractor.

Proposed Changes by Contractor

Contractor's Cost

220.07 EXCAVATION

1. Before undertaking stormwater drainage excavation, topsoil shall be removed in accordance with the Specification for EARTHWORKS.

Topsoil

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

Safety

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

Approval by Public Utility Authorities

4. Excavation by blasting, if permitted by the Superintendent, shall be carried out to ensure that the peak particle velocity measured on the ground adjacent to any previously installed culvert or drainage structure does not exceed 25 millimetres per second. The Contractor shall comply with other requirements concerning blasting operations in the Specification for EARTHWORKS.

Blasting Operation

5. As indicated on the Drawings, existing redundant pipes and drainage structures shall be excavated and removed. The resulting excavation shall be backfilled in accordance with Clause 220.08.

Redundant Pipes and Structures

6. Trench or foundation excavation for stormwater drainage works shall be undertaken to the planned level for the bottom of the specified bedding or foundation level or such other depth as directed by the Superintendent. All loose material shall be removed by the Contractor. This action constitutes a **HOLD POINT**. The Superintendent's approval of the trench or foundation level and foundation material condition is required prior to the release of the hold point.

Excavation Level

HP

7. Any material at the bottom of the trench or at foundation level which the Superintendent deems to be unsuitable shall be removed and disposed in accordance with the Specification for EARTHWORKS by the Contractor and replaced with backfill material in accordance with the requirements of this Specification and the Specifications for particular culvert types. 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 culvert.

Unsuitable Material

8. The excavated earth and rock material shall be used in the construction of embankments backfilling or spoiled in accordance with the Specification for EARTHWORKS.

Spoil

9. Any excavated redundant pipes and drainage structures shall be removed off site and legally disposed of by the Contractor.

220.08 BACKFILLING

1. Backfilling shall be carried out in accordance with the requirements of the relevant culverts or drainage structures Specifications and to the compaction requirements specified below.

220.09 COMPACTION

1. Foundations, bedding (other than for pipe drainage) and backfilling shall be compacted to the following requirements when tested in accordance with AS 1289.5.4.1 for standard compactive effort.

	Relative Compaction
Foundations or trench base to a depth of 150mm below foundation levels	95%
Material replacing unsuitable material	95%
Bedding material (other than for pipe drainage)	95%
Selected backfill and ordinary backfill material	
• below 1.5m of finished surface	95%
• within 1.5m of finished surface	100%
Backfill material within the selected material zone	100%

Compaction requirements adjacent to pipe drainage for concrete, steel or UPVC pipes are set out in the Specification for PIPE DRAINAGE.

Layers

2. All material shall be compacted in layers not exceeding 150mm compacted thickness. Each layer shall be compacted to the relative compaction specified before the next layer is commenced.

Moisture Content

3. At the time of compaction, the moisture content of the material shall be adjusted so as to permit the specified compaction to be attained at a moisture content which, unless otherwise approved by the Superintendent, is neither less than 60 per cent nor more than 95 per cent of the apparent optimum moisture content, as determined by AS 1289.5.7.1 (standard compaction).

Precautions

Contractor's Cost

4. When compacting adjacent to culverts or drainage structures, the Contractor shall adopt compaction methods which will not cause damage or misalignment to any culvert or drainage structure. Any damage caused shall be rectified, and all costs of such rectification shall be borne by the Contractor.

Perth Sand Penetrometer

5. When the compaction of suitable sand material is to be measured the Contractor may undertake Perth Sand Penetrometer testing in accordance with AS 1289.6.3.3.

Calibration

6. The Contractor shall arrange for a NATA registered laboratory to calibrate the Perth Sand Penetrometer against the Relative Compaction.

Testing Frequency

7. Perth Sand Penetrometer testing of sand backfill shall be carried out at a minimum frequency of one test every 30 metres of trench with additional tests at each pit plus one test every 10 metres along side property boundaries and two tests every road crossing. All tests shall be repeated for each 1.5 metres of backfill vertical depth. The testing shall be carried out by a NATA registered laboratory testing in random locations

within the sublots nominated. Test results shall be submitted to the Superintendent on a weekly basis.

8. If any tests show compaction is below that specified then the failed backfilled layers and those layers above the level of the failed test shall be removed and the backfill replaced in compacted layers and retested. This operation shall be carried out until compaction is as specified. The cost of such rework shall be borne by the Contractor.

Failed Tests

Contractor's Cost

9. The Contractor shall submit separate certification of all drainage backfill compaction from the testing authority.

Compaction Certification

220.10 CONCRETE WORK

1. For all concrete work, the Contractor shall comply with the Specification for MINOR CONCRETE WORKS in relation to the supply and placement of normal class concrete and steel reinforcement, formwork, tolerances, construction joints, curing and protection.

Specification

220.11 SPRAYED CONCRETE

1. If sprayed concrete has been specified, shown on the Drawings or directed by the Superintendent, it shall comply with requirements in the Specification for MINOR CONCRETE WORKS.

Standard

SPECIAL REQUIREMENTS

220.12 RESERVED

220.13 RESERVED

LIMITS AND TOLERANCES

220.14 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table 220.1 below:

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Excavation by Blasting**		
	peak particle velocity	≤25mm/sec	220.07
2.	**Relative Compaction (Standard)**		
	(a) Foundations or trench base to a depth of 150mm below foundation levels	95%	220.09
	(b) Material replacing unsuitable material	95%	220.09
	(c) Bedding material	95%	220.09
	(d) Selected backfill and ordinary backfill material: • below 1.5m of finished surface • within 1.5m of finished surface	 95% 100%	220.09
	(e) Backfill material within the selected material zone	100%	220.09
3.	**Backfill**		
	(a) Layers	≤ 150mm	220.09
	(b) Moisture Content	>60%, <95%	220.09

Table 220.1 - Summary of Limits and Tolerances

MEASUREMENT AND PAYMENT

220.15 PAY ITEMS

1. Payment shall be made for all the activities associated with completing the work detailed in this Specification and the associated activity specific specifications on a schedule of rates basis in accordance with Pay Item 220(a).

2. The Pay Items applicable to particular activities are listed in the Specifications for these activities.

3. Common to culverts and drainage structures is Excavation and payment for this shall be made under this Specification.

4. A lump sum price for this item shall not be accepted.

5. 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.

6. Erosion and sedimentation control measures are measured and paid in accordance with the Specification for CONTROL OF EROSION AND SEDIMENTATION.

7. Topsoil removal is measured and paid in accordance with the Specification for EARTHWORKS.

8. Concrete work is measured and paid in accordance with the Specification for the particular drainage activities and not in the Specification for MINOR CONCRETE WORKS.

9. Sprayed concrete work is measured and paid in accordance with the Specification for MINOR CONCRETE WORKS.

10. Miscellaneous minor concrete work not included in the pay items in this Specification shall be in accordance with pay items described in the Specification for MINOR CONCRETE WORKS.

11. Excavation and replacement of unsuitable material is measured and paid in accordance with this Specification and not in the Specification for EARTHWORKS.

Pay Item 220(a) EXCAVATION FOR STORMWATER DRAINAGE CULVERTS AND STRUCTURES

1. The unit of measurement shall be cubic metre measured as bank volume of excavation.

2. The schedule rate for this Pay Item shall be an average rate to cover all types of material encountered during excavation. Separate rates shall not be included for earth and rock.

3. The rate is deemed to include:

- Setting out and associated survey
- Excavation, including excavation and replacement of unsuitable material.
- Replacement for over-excavation for any reason
- Excavation, removal and disposal of redundant pipes and drainage structures, and backfilling of the resulting excavations.

4. The volumes of excavation for payment shall be computed as follows:

(i) **Reinforced Concrete and Fibre Reinforced Cement Pipes**

- Positive Projection (if excavation required)
  Width:
  - single cell: external pipe diameter + 1m.
  - multi cell: sum of external diameters + sum of spacings between pipes measured square to the line of the culvert + 1m.

  Depth:
  - in natural ground: average actual depth from topsoil stripped ground surface to underside of specified bedding.
  - in embankment: average actual depth or 500mm above top of pipe to underside of specified bedding, whichever is lesser.

  Length: actual excavation length, centre to centre of pits or centre of pit to face of headwall.

- Wide Trench
  Width:
  - single cell: external pipe diameter + 1m.
  - multi cell: sum of external diameters + sum of spacings between pipes measured square to the line of the culvert + 1m.

  Depth:
  - in natural ground: average actual depth from topsoil stripped ground surface to underside of specified bedding.
  - in embankment: maximum 500mm above top of pipe to underside of specified bedding.

  Length: actual excavation length, centre to centre of pits or centre of pit to face of headwall.

- Normal Trench
  Width: 1.4 times external pipe diameter or external pipe diameter +300mm on each side, whichever is the greater..

  Depth:
  - in natural ground: average actual depth from topsoil stripped ground surface to underside of specified bedding.
  - in embankment: maximum 500mm above top of pipe to underside of specified bedding.

  Length: actual excavation length, centre to centre of pits or centre of pit to face of headwall.

(ii) **Steel Pipes and Pipe Arches**

Width:	
- wide trench:	external pipe diameter or span + 2 x external pipe diameter or span.
- normal trench:	external pipe diameter or span + 600mm on each side.
Depth:	as for RC and FRC pipes.
Length:	actual excavation length.

(iii) **UPVC Pipes**

Width:	For pipes of:-:	
	Ext. dia at collar ≥75 ≤150	external diameter of pipe plus 200mm
	Ext. dia at collar >150 ≤300	external diameter of pipe plus 300mm
	Ext. dia at collar >300 ≤450	external diameter of pipe plus 400mm
Depth:		average actual depth excavated.
Length:		actual excavation length, centre to centre of pits or centre of pit to face of headwall.

(iv) **Box Culverts**

The plan area for payment shall be the area calculated from the outside dimensions of the base slab plus 300mm and wingwalls as shown on the Drawings. The depth for payment shall be the average actual depth below ground surface stripped of topsoil to the bottom of the specified bedding.

(v) **Other Drainage Structures**

The plan area for payment shall be the area calculated from the outside dimensions of the structure as shown on the Drawings. The depth shall be determined from the actual site measurement of the surface at the time of excavation to the underside of the bedding.

(vi) **Unsuitable Material under Culverts and Drainage Structures**

The volume for payment of material which the Superintendent deems unsuitable shall be calculated from the actual plan area of material removed and the average actual depth below the bottom of bedding. It shall be replaced with ordinary backfill material either from drainage excavations or from Earthworks.