1352 PIPE DRAINAGE

1 GENERAL

1.1 RESPONSIBILITIES

Objectives

General: Provide the pipework for the drainage system as documented.

Performance

~~Requirements: [complete/delete]~~

Selections: As documented.

Design

~~Designer: [complete/delete]~~

~~Design life of pipe drainage system: [complete/delete]~~

~~Authority requirements: [complete/delete]~~

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0136 General requirements (Construction).*
- *0152 Schedule of rates – supply projects.*
- *0161 Quality (Construction).*
- *0167 Integrated management.*
- *0319 Minor concrete works.*
- *1112 Earthworks (Roadways).*
- *1171 Subsurface drainage.*
- *1351 Stormwater drainage (Construction).*
- *1354 Drainage structures.*
- *1392 Trenchless conduit installations.*

1.3 REFERENCED DOCUMENTS

Standards

General: The following documents are incorporated into this worksection by reference:

AS/NZS 1260:2009	PVC-U pipes and fittings for drain, waste and vent application
AS/NZS 1477:2006	PVC pipes and fittings for pressure applications
AS 1646-2007	Elastomeric seals for waterworks purposes
AS/NZS 2041	Buried corrugated metal structures
AS/NZS 2041.1:2011	Design methods
AS/NZS 2041.4:2010	Helically formed sinusoidal pipes
AS/NZS 2041.6:2011	Bolted plate structures
AS/NZS 2566	Buried flexible pipelines
AS/NZS 2566.1:1998	Structural design
AS/NZS 2566.2:2002	Installation
AS 2758	Aggregates and rock for engineering purposes
AS 2758.1-1998	Concrete aggregates
AS/NZS 4058:2007	Precast concrete pipes (pressure and non-pressure)
AS/NZS 4130:2009	Polyethylene (PE)pipes for pressure applications
AS 4139-2003	Fibre reinforced concrete pipes and fittings
AS/NZS 5065:2005	Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications
AS/NZS ISO 9001:2008	Quality management systems – Requirements
AASHTO M190-2008	Standard specification for bituminous coated corrugated metal culvert pipe and pipe arches

AASHTO M196-2004	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
AASHTO M197-2006	Standard Specification for Aluminum Alloy Sheet for Corrugated Aluminum Pipe

Other publications

Concrete Pipe Association of Australasia

CPAA	Concrete pipe website and pipeclass software

Plastics Industry Pipe Association of Australia PIPA

POP001-2011	Electrofusion jointing of PE pipe and fittings for pressure applications
POP003-2011	Butt fusion jointing of PE pipes and fittings – recommended parameters
POP102-2009	Solvent cement jointing of PVC pipe

1.4 INTERPRETATIONS

Abbreviations

General: For the purposes of this worksection the abbreviations given below apply.

- FRC: Fibre-reinforced concrete.
- SRCP: Steel reinforced concrete pipes.

Definitions

General: For the purposes of this worksection the definitions given below apply.

- Effective pipe length: The centre-line length dimension specified by the manufacturer and subject to permissible tolerances.

1.5 SUBMISSIONS

Approval

Submissions: To the Superintendent's approval.

Documents

Submit the following for approval:

- Materials: Batch certification to AS/NZS ISO 9001 and AS/NZS 4058 or AS 4139 as appropriate.
- Manufacturers data and installation recommendations.

~~Calculations: [complete/delete]~~

~~Work-as-executed drawings: [complete/delete]~~

- Components: Pipes and fittings.
- Samples: Pretreat the samples if necessary so as to represent the condition and grading when compacted and in service.

~~Design: [complete/delete]~~

~~Drawings: [complete/delete]~~

- Execution details: Refer to **HOLD POINTS**.

~~Manuals: [complete/delete]~~

~~Prototypes: [complete/delete]~~

~~Technical data: [complete/delete]~~

~~Type tests: [complete/delete]~~

~~Warranties: [complete/delete]~~

1.6 HOLD POINTS AND WITNESS POINTS

Notice

General: Give notice so that the documented inspection and submissions may be made to the **HOLD POINT table** and the **WITNESS POINT table**.

HOLD POINTS table

Clause title/Item	Requirement	Notice for inspection	Release by
MATERIALS			
General			
Certification	Submit manufacturers certification	2 weeks prior to dispatch	*Principal Certifying Authority*
Corrugated aluminium pipes			
General - Durability	Submit for approval the protective treatment to achieve the expected design life	1 week before application	*Principal Certifying Authority*
Plastic Flexible pipes			
General - Proprietary product	Submit for approval prior to construction	2 weeks	*Principal Certifying Authority*
EXECUTION			
Installation			
General - Progressive inspections	Give notice for completed installation and jointed pipes for inspection	Progressive before backfilling	*Principal Certifying Authority*

WITNESS POINTS table

Clause title/Item	Requirement	Notice for inspection
EXECUTION		
Establishment		
Drainage - Handling and storage damage	Repair or replace damaged units	1 week
Installation		
Joints for concrete pipes	Submit joint test results	Progressive

2 PRE-CONSTRUCTION PLANNING

2.1 SCHEDULING

Program of works

General: Program the works as follows:

- Materials: Arrange the program for compliance and usage of components and materials.
- Authorities: Arrange approvals and confirm environmental requirements.
- Ground conditions: Identify and report on adverse ground conditions affecting selection of pipe materials.

3 MATERIALS

3.1 GENERAL

Certification

Quality: Prior to dispatch of each batch to site, submit manufacturer's certification to the relevant pipe standard code. This is a **HOLD POINT**.

Ground conditions

Ground condition: If the chemical composition for the soil is unknown or not tested use the default condition 'Aggressive' to AS/NZS 2041.1, AS/NZS 4058 or AS 4139.

3.2 CONCRETE PIPES

Precast reinforced concrete pipes

Requirement: Provide precast reinforced non-pressure concrete pipes to AS/NZS 4058 and in conformance with the following:

- Pipe class and size as shown on the drawings.
- Tolerance: ± 15 mm from manufacturer's nominated effective pipe length.

~~Pipe jacking: [complete/delete]~~

- Jointing type: Provide flexible rubber ring, spigot and socket joints to AS 1646 (use flush or butt joints only for the first pipe when extending existing pipes).
- Load classes: As shown on the drawings.
- Clear cover to reinforcement: Based on normal environments to AS/NZS 4058 Table 3.3.
- Maximum limit of water absorption: 6.0%.
- Tests required: Routine tests for cover and dimensional accuracy.

Marking: To AS/NZS 4058.

Durability: Protective treatments to AS/NZS 4058 Appendix E and the manufacturer's recommendations.

~~Protective treatment: [complete/delete]~~

Fibre reinforced concrete pipes

Requirement: Provide fibre reinforced concrete pipes to AS 4139 and in conformance with the following:

~~Strength requirement: [complete/delete]~~

- Pipe sizes: As shown on the drawings.
- Load classes and installation conditions: As shown on the drawings.
- Jointing: Provide flexible, elastomeric, double V-ring joints to AS 1646. Use flush or butt joints only for the first pipe when extending existing pipes.
- Tests required: Dimensions and tolerance test to verify conformance with AS 4139 clause 10.

Test frequency: One pipe per 50 pipes.

Aggregates: To AS 2758.1 and the following:

~~[complete/delete]~~

Manufacturer's statement: Submit manufacturer's statement of information to AS 4139 Appendix A2.

Marking: To AS 4139 clause 12.

Durability.

Durability: Protective treatments to AS 4139 Appendix B and the manufacturer's recommendations.

~~Protective treatment: [complete/delete]~~

3.3 CORRUGATED STEEL PIPES

~~[complete/delete]~~

3.4 CORRUGATED ALUMINIUM PIPES

General

Requirement: Provide corrugated aluminium pipes to AASHTO M197-06 and AASHTO M196-08, AS/NZS 2041.4 and in conformance with the following:

- Type:
  - Staked, double offset lock seam joint.
- Thickness:
  - 2.0 mm for 450 mm diameter and under.
  - 2.5 mm for 600 mm to 1500 mm diameter.
  - 3.0 mm for 1650 mm to 2400 mm diameter.

- Corrugations:
  . 68 x 13 mm for 1500 mm diameter and under.
  . 125 x 25 mm for 1650 mm to 2400 mm diameter.

Dissimilar metals: Prevent dissimilar metals from direct contact.
Durability: Submit for approval the protective treatment required to achieve the required design life to the manufacturer's recommendations. This is a **HOLD POINT**.

3.5 PLASTIC FLEXIBLE PIPES

General

Requirement: Provide flexible pipes including fitting to AS/NZS 2566.1 with pipe class and size as shown on the drawings.
Pressure polyethyelene (PE): To AS/NZS 4130.
Polyethelene (PE) and Polypropylene (PP): To AS/NZS 5065.
PVC pipes: To AS/NZS 1260.
Pressure PVC: To AS/NZS 1477.
Proprietary product: Submit proprietary product for approval prior to construction. This is a **HOLD POINT**.
~~Plastic flexible pipes: [complete/delete]~~
Store rubber rings for pipe joints: To AS 1646.
Electrofusion jointing for PE pressure pipe: Conform to POP001.
Butt fusion jointing for PE pipe: Conform to POP003.
Solvent cement jointing for PVC pipe: Conform to POP102.

4 EXECUTION

4.1 PROVISION FOR TRAFFIC

General

Control of traffic: Conform to the following:
- Worksection *1101 Control of traffic*: **Traffic Guidance Scheme**.

4.2 ESTABLISHMENT

General

Excavation drainage: Dewater the excavation to permit the compaction of the foundation, the bedding and any backfilling as documented.
Tolerances dimensions: Provide culverts within 10 mm of the grade line and within 10 mm of the horizontal alignment as shown on the drawings.
Re-install: Relay any culvert which is not within tolerance.
Subsurface drain location: At the discharge end of culverts terminating at pits and headwalls, provide a 3 m length of 100 mm diameter subsurface drain.
- Position: In the trench 100 mm above the invert level of the Pipe.
- Discharge: Through the wall of the pit or headwall.

Detail: Seal the subsurface drainage pipe at the upstream end and enclose in a seamless tubular filter fabric in conformance with *1171 Subsurface drainage*.

Construction plant movement

Loads: If the movement of construction plant in excess of 5 t gross mass over pipes is proposed, submit details including design protective measures for the crossings.

Damage

Handling and storage: Repair damaged units in conformance with manufacture's requirements. Replace units if unable to repair satisfactorily. This is a **WITNESS POINT**.

Inspection of pipeline components: Inspect all pipe line components for damage and flaws immediately before installation.

4.3 INSTALLATION

General

Stiffening of culverts: If required by the manufacturer, provide temporary stiffening struts to the interior prior to filling.
Lifting holes: Prior to backfilling seal lifting holes in all pipes with approved plastic preformed plugs or a 3:1 sand cement mortar.
Bulkhead locations: Construct bulkheads in conformance with *1354 Drainage structures* on all lines where the pipe gradient exceeds 5%.
Bulkheads for flexible pipes: If required, provide bulkheads or trenchstops if required to AS/NZS 2566.2 Table 5.7 or as shown on the drawings.
Progressive inspections: For each section of the work, give notice for inspection of the completed installation and jointed pipes before commencement of trench backfilling. This is a **HOLD POINT**.
Plastic culvert 'float' precautions: To ensure plastic pipe culverts do not 'float' during the backfilling and vibration process, take appropriate precautions such as holding down straps.

Positioning of pipes

Lay pipes: Install pipes with the socket end upstream.
Top designation: Install pipes which have marks indicating the crown or invert strictly in conformance with the markings.
Length: Provide pipe with minimum length of 1.2 m.
Laying and jointing for flexible pipes: Install pipes to AS/NZS 2566.2 Section 5 and to the manufacturer's recommendations.
Anchor blocks: Provide anchor blocks at a maximum spacing of 3 m and at bends or junctions for all stormwater pipes laid on a grade exceeding 20% and as shown on the drawings. Place in situ concrete directly against all faces of the keys in the sides and base of the trench.

Joints for concrete pipes

Rubber ring joints in reinforced concrete pipes: Complete rubber ring joints to the manufacturer's recommendations.
Joint testing: Submit joint test results. This is a **WITNESS POINT**.
Fibre reinforced concrete pipes: Test joints to AS 4139 Appendix L.
Precast concrete pipes: Test joints to AS/NZS 4058 Appendix H.
Skid rings: To the manufacturer's recommendations, including the use of lubricants if wedge shaped 'skid' rubber rings are required.
Jointing: Provide flush or butt joints only if required to extend existing culverts.
Sealing: Seal the joints with proprietary rubber sleeves in conformance with the manufacturer's recommendations.
Joints in fibre-reinforced concrete pipes: Provide flexible type joints using rubber rings to seal joints in both rebated and spigot and socket jointed pipes ~~or use a jointing compound comprising plasticised butyl rubber and inert fillers all~~ in conformance with the manufacturer's recommendations.
Other joints: Make direct side connections to other pipes as shown on the drawings.

4.4 LIMITS AND TOLERANCES

Application

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

Summary of limits and tolerances

Activity	Limits/Tolerances	Worksection clause Reference
		MATERIALS
Variation from nominated effective pipe length	± 15 mm	**Concrete pipes**
Maximum limit of water absorption	6.0%	
Fibre reinforced concrete pipes:		
Test frequency:	One pipe per 50 pipes.	
		EXECUTION
Culverts:		**Establishment**
- Grade line	± 10 mm	
- Horizontal alignment	± 10 mm	
Subsurface drain:		
-Length	3 m	
-Diameter	100 mm	
-Location	100 mm above the invert level	
Lifting plugs seal	3:1 sand cement mortar	**Installation**
Bulkhead locations	> 5% gradient in pipeline	
Minimum length	1.2 m	**Positioning of pipes**
Anchor blocks:		
-Maximum spacing	3 m	
-Location	> 20% gradient in pipeline	
Annular corrugations	68 mm pitch	**Joints for steel pipes**
Geotextile cover material:		
-Width	250 mm	
-Minimum mass	270 grams/m^2	
Invert protection sprayed concrete		**Invert protection for steel pipes**
- Over crest of corrugations over bottom third of pipe circumference	> 100 mm	
Sprayed concrete reinforcement:		
-Reinforcement	Steel wire 4 mm diameter with 200 mm square mesh	
-Laps in fabric	300 mm	
-Cover	50 mm	

5 MEASUREMENT AND PAYMENT

5.1 MEASUREMENT

General

Payments made to the Schedule of Rates: To *0152 Schedule of rates – supply projects*, this worksection, as shown on the Drawings and **Pay Item 1352.1**.
Lump Sum prices: Not acceptable.

Unpriced items: For each unpriced item listed in the Schedule of Rates, make due allowance in the prices of other items.

Methodology

The following methodology will be applied for measurement and payment:

Excavation, bedding, support and backfill material: Conform to *1351 Stormwater drainage (Construction)*.

- Miscellaneous minor concrete work not included in the pay items in this worksection: Conform to *0319 Minor concrete works*.
- Bulkheads: Conform with *1354 Drainage structures*.

5.2 PAY ITEM

Pay items	Unit of measurement	Schedule rate scope
1352.1 Supply and install pipe drainage culverts, pipes, structures.	Linear m of pipe drainage culvert: - Measured on centreline of each type, class and size of stormwater drainage pipe culvert. - The plan length between centres of gully pits or faces of headwalls.	The Schedule rate for this **Pay Item** to be a rate for each type, class and size of pipe culvert. All costs associated with all activities for supply, survey and setting out including: - Supply. - Survey and setting out. - Bedding. - Jointing (including connections). - Subsoil drains at pits and headwalls. - Temporary bracing and strutting. - Anchoring system including anchor blocks. - Bituminous painting. - Sprayed concrete lining and other protective measures. - Selected material backfilling. - Embankment material trench backfilling. - Reinforcing fabric. - Disposal of excesses of unsuitable material.