



**DUBBO
REGIONAL
COUNCIL**

TECHNICAL SCHEDULE

DRC-W105

**CONSTRUCTION OF GRAVITY TRUNK
SEWERS**

TECHNICAL SCHEDULE DRC-W105 – CONSTRUCTION OF GRAVITY TRUNK SEWERS

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DRC-W104: CONSTRUCTION OF GRAVITY TRUNK SEWERS

DRC-W105.1 SCOPE

This Specification applies to the construction of gravity trunk pipes (sewers) above DN300 mm and up to and including DN1200 mm, after being designed in accordance with the Principal's design standards and specifications. This Specification is applicable to contracts:

- a) That require construction only; with materials supplied by the Principal.
- b) That require the supply of materials and construction of the works by the Contractor.
- c) That are either Schedule of Rates or Lump Sum payment contracts.

The work required to be performed under this Contract shall comply with the referenced documents in Clause dRC-W105.2, unless specified otherwise herein.

DRC-W105.2 REFERENCED DOCUMENTS

The following documents are referred to in this Specification. The latest version of the document including any published amendments shall apply. Where the drawings or a project specific specification are in conflict, or inconsistent with these referenced documents, or this Specification, then the details on the drawings or project specific specification shall apply.

Australian Standards

AS 681	Elastomeric seals.
AS 1260	PVC-U pipes and fittings for drain, waste and vent application.
AS 1289	Methods of testing soils for engineering purposes.
AS 1379	Specification and supply of concrete.
AS 1646	Rubber joint rings for water supply, sewerage and drainage purposes.
AS 1741	Vitrified clay pipes and fittings with flexible joints – sewer quality.
AS 2032	Code of Practice for installation of UPVC pipe systems.
AS 2566	Buried flexible pipelines.
AS 2758	Aggregates and rock for engineering purposes.
AS 3571	Plastic piping systems – Glass-reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP resin) – pressure and non-pressure drainage and sewerage.
AS 3879	Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS and ASA pipes and fittings.
AS 3996	Access covers and grates.
AS 4058	Precast concrete pipes (pressure and non-pressure).
AS 4130	Polyethylene (PE) pipes for pressure applications.
AS 4198	Precast concrete access chambers for sewerage applications.
AS 5065	Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications.

Works shall also comply with the current versions all other relevant Australian Standards where not specifically listed above.

Water Services Association of Australia Standards

WSA01	Polyethylene Pipeline Code
WSA02	Gravity Sewerage Code of Australia
N/A	Water Services Association of Australian (WSAA) Product Specifications
WSA 113	Industry Standard for Reinforced Concrete Pipes with Flexible Thermoplastic Linings
WSA 114	Concrete Special Class
WSA 137	Maintenance Shafts and Maintenance Chambers for Sewerage

International Standards

EN 295	Vitrified clay pipe systems for drains and sewers. Requirements for pipes, fittings and joints.
ISO 10467	Plastics piping systems for pressure and non-pressure drainage and sewerage – glass reinforced thermosetting plastics (GRP) systems based on unsaturated polyester (UP) resin.
ATSM C990M-09	Standard specification for joints for concrete pipe, manholes and precast box sections using preformed flexible joint sealants (metric).

DRC-W105.3 STANDARDS

Construction of the Work Under Contract shall be undertaken in accordance with WSA02-2014 Gravity Sewerage Code of Australia, Part 2: Construction.

DRC-W105.4 DELIVERY, TRANSPORTATION, HANDLING AND STORAGE OF MATERIALS

Materials used shall be as specified by the Drawings or Project Specification.

Delivery, transportation, handling and storage of all products and materials shall be undertaken in accordance with the manufacturer's recommendations and clause 13.2 and 13.3 of WSA02-2014.

DRC-W105.5 GLASS REINFORCED PLASTIC (GRP) PIPE

GRP pipes shall be compliant with WSAA Product Specifications WSA PS-205S or WSA PS-237S and shall be:

- Manufactured in accordance with AS 3571 or ISO 10467.
- Minimum stiffness of SN10,000.
- Rubber ring jointed with approved couplings.

Where GRP pipes are to be installed using trenchless installation methods, pipes shall be compliance with WSAA Product Specification WSA-PS205J. Pipes shall have a minimum stiffness class as required to withstand the design jacking load as calculated by the Contractor.

DRC-W105.6 VITRIFIED CLAY (VC) PIPE

VC pipes for non-pressure applications shall be compliant with WSAA Product Specification WSA PS-231 and shall be:

- Manufactured in accordance with EN 295 or AS 1741.
- Minimum crushing strength of 34 kN/m for DN150 mm.
- Minimum class 120 for DN375 - 450 mm.
- Minimum class 95 for DN500 mm and larger.
- Rubber ring jointed complying with AS 1646 with root inhibiting compound.

DRC-W105.7 POLYPROPYLENE (PP) PIPE

PP pipes shall be compliant with WSAA Product Specification WSA PS-240 and shall be:

- Manufactured in accordance with AS 5065.
- Minimum stiffness SN10.
- Rubber ring jointed complying with AS 1646.

DRC-W105.8 POLYETHYLENE (PE) PIPE AND FITTINGS

PE pipes shall be compliant with WSAA Product Specifications WSA PS-207 and WSA PS-208 and shall be:

- PE100.
- Manufactured in accordance with AS 4130.
- Minimum pipe Standard Dimension Ratio (SDR) of 17.
- Coloured solid black for gravity sewerage.
- Electrofusion or butt welded jointed.

DRC-W105.9 REINFORCED CONCRETE (RC) PLASTIC LINED PIPE

RC pipes shall be compliant with WSAA Product Specification WSA PS-233 and WSAA Industry Standard WSA 113:2002 and shall be:

- Manufactured in accordance with AS 4058.
- Minimum pipe load class 4.
- Internally lined with factory cast-in thermoplastic liner.
- Externally coated with epoxy when installed in corrosive soils.
- Rubber ring jointed complying with AS 1646.
- Provided without lifting holes which are not permitted.

DRC-W105.10 ACCESS COVERS

Access covers shall be compliant with WSAA Product Specification WSA PS-290 and shall be:

- Manufactured in accordance with AS 3996.
- Class D unless stated otherwise on the drawings.
- Circular DN600 mm unless stated otherwise on the drawings.
- Infilled with concrete (where required) in accordance with AS 3996. Concrete infill shall be a minimum of N32 and have a cement content of 400 kg/m³. Concrete infill shall be vibrated during installation to eliminate air pockets.
- Gas and water tight.
- Greased using approved sealing grease on all metal to metal seals after installation.
- Installed with vegetation rings where access covers are not located in a paved or sealed area.

DRC-W105.11 STEP IRONS AND LADDERS

Where specified, step irons shall comply with WSAA Product Specification WSA PS-314 and shall be either plastic encapsulated or stainless steel grade 316.

Where specified, fixed ladders shall comply with WSAA Product Specification WSA PS-315 and shall be either stainless steel grade 316 or fibre reinforced plastic.

DRC-W105.12 MAINTENANCE HOLES

All maintenance holes shall be cast in-situ unless specified as pre-cast being permitted on the drawings. Where pre-cast concrete maintenance holes are permitted they shall be compliant with WSAA Product Specification WSA PS-323 and shall be:

- Manufactured in accordance with AS 4198.
- Cement type SR with minimum cement content of 450 kg/m³.
- Concrete characteristic strength of 50 MPa.
- Aggregate durability exposure condition C as per AS 2758 clause 9.
- Provided with minimum cover to reinforcement of 40 mm internally and 25 mm externally, except at joint ends where a minimum cover of 20 mm shall be provided.
- Provided with two lifting inserts on each component, each having a safe-lift rating of at least 1 tonne.
- Either EPDM elastomeric joint sealed in accordance with AS 1646, AS 681 or butyl rubber joint sealed in accordance with ASTM C990M-09.

DRC-W105.13 CONCRETE

Concrete shall be compliant with WSAA Product Specification WSA PS-357 for normal class and shall comply with AS 1379. Where 'Special Class' concrete is specified, this shall be compliant with WSAA Product Specification WSA PS-358 and WSA 114.

DRC-W105.14 TRENCH FILL MATERIAL

Trench fill in trafficable areas shall be 20 mm crushed rock in accordance with Transport for NSW (TfNSW) standard specifications for DGS20.

Trench fill in non-trafficable areas may be select excavated or imported material and shall be free of vegetation, organic matter, debris, and rocks with a dimension not greater than 75 mm in any direction. Select material shall be capable of compaction, without excessive effort, to a mean value of density ratio (R_D) of not less than 95%.

DRC-W105.15 EMBEDMENT MATERIAL

Embedment material shall be of the type and size as specified on the drawings or as otherwise approved by the Superintendent.

- Compaction sand embedment shall be Grade A and be compliant with WSAA Product Specification WSA PS-350.
- Embedment/5 mm minus fine crushed rock shall be compliance with WSAA Product Specification WSA PS-361.
- Fine crushed rock embedment shall be compliant with WSAA Product Specification WSA PS-359
- Well graded crushed rock shall be compliant with WSAA Product Specification WSA PS-362 and shall be of the nominal size specified on the drawings.
- Single size crushed rock shall be compliant with WSAA Product Specification WSA PS-351 and shall be of the nominal size specified on the drawings.

Careful selection of embedment material size is required where ribbed pipes such as PP are used. Manufacturer's recommendations should be sought and the maximum particle size shall be less than the width between pipe ribs to ensure sufficient support can be provided.

DRC-W105.16 LOCATION

The location, sizes, pipe class and other details of the sewers are shown on the drawings. The location of maintenance structures are also shown on the drawings. The pipelines and maintenance structures shall be constructed to the locations shown on the drawings unless directed otherwise by the Superintendent.

DRC-W105.17 COVER OVER PIPES

The minimum depth of cover over pipes, measured vertically from the finished surface level to the top of any pipe, flange or socket shall be as follows:

- 600 mm in non-trafficable locations.
- 750 mm in trafficable locations in private property (ie driveways).
- 900 mm under sealed roadways and footpaths.
- 1200 mm under major roadways.

DRC-W105.18 CROSSINGS

Where a pipeline crosses a main road, creek or involves features under the control of any authority, the affected work shall be carried out in accordance with the requirements of that authority. It shall be the Contractor's responsibility to complete written notification to the authority of the intention to carry out the work.

DRC-W105.19 EXCAVATION

All excavations for structures and pipes shall be to the lines, grades and forms shown on the drawings or directed by the Superintendent within the specified tolerances. Excavation shall be undertaken in accordance with Clause 14 of WSA02-2014. Minimum trench width for pipes shall be in accordance with the drawings and AS 2566. Where a trench is excavated across a paved surface, the trench width shall be kept to a minimum and bitumen and concrete surfaces saw cut in a neat straight line.

Spoil shall not be placed within 1000 mm from the zone of influence at the edge of any excavation. Excavated materials shall not be placed against the walls of any building or fence without the written permission of the owner of such building or fence. Topsoil from excavations shall be kept separate and utilised to make good the surface after backfilling.

The Contractor shall adequately support all excavations as the works proceed. When withdrawing supports, the Contractor shall exercise every precaution against slips or falls by means of intermediate shoring, planking or props. Backfilling shall be performed simultaneously with the withdrawal of supports.

At the completion of each work day, excavations should be preferably filled. Any excavations left open shall be suitably secured and left safe for the public and others in the vicinity of the site. As a minimum open excavations shall be secured with security fencing or steel road plates.

The Contractor shall undertake erosion and sediment control at the site in accordance with WS-101 General Construction.

DRC-W105.20 ROCK EXCAVATION

Unless noted otherwise, the Contract Sum is deemed to include excavation in any material including excavation in rock. Any delay due to the presence of rock shall be at the Contractor's expense and the Contractor shall not be entitled to any extension of time due to such delay.

Definition of Rock

Where rock excavation is stated to not be included in the Contract Sum, rock shall be defined as solid bedrock material than can only be efficiently excavated using a rock hammer attached to an excavator as determined by the Superintendent. Boulders and rippable material are not deemed to be considered rock and deemed to be included in the Contract Sum.

Measurement for payment of rock excavation, where provided for in the Contract, shall be measured based on the minimum trench width required. If the Contractor believes it has encountered rock, the Contractor shall notify the Superintendent within four hours. The Superintendent shall then inspect the material and determine whether the material is considered to be rock.

DRC-W105.21 BEDDING FOR PIPES

The trench floor shall be prepared and pipe bedding and support placed in accordance with Clause 15 of WSA02-2014.

DRC-W105.22 LAYING OF PIPES

Laying of pipes shall be undertaken in accordance with Clause 16 of WSA02-2014.

Before being laid, all pipeline system items shall be cleaned and examined by the Contractor. The Contractor shall ensure that the interior of the pipeline is clean and free from obstructions. Approved exclusion caps or plugs shall be used to prevent foreign matter entering sections of pipeline which are left uncompleted overnight.

Pipes shall be cut as needed, or directed by the Superintendent, to suit closing lengths, to remove damaged pipe or fittings, or to remove sockets if necessary when jointing a socketed fitting

DRC-W105.23 TRENCH STOPS

Trench stops shall be constructed on all pipes with a grade steeper than 5% (ie 1 in 20). Spacings of trench stops shall be calculated using the following formula:

Trenchstop spacing (m) = 100 / Grade (%)

DRC-W105.24 BULKHEADS

Concrete bulkheads shall be constructed on all pipes with a grade steeper than 15%.

For pipe grades between 15% and 29%, spacings of bulkheads shall be calculated using the following formula:

Bulkhead spacing (m) = L / Grade (%) where L = 80 x pipe length (m) (450 m max)
Where L > 100 m also construct intermediate trench stops at spacing < 100/grade (%)

For pipe grades between 30% and 50%, spacings of bulkheads shall be calculated using the following formula:

Bulkhead spacing (m) = 100 / Grade (%)

DRC-W105.25 MAINTENANCE HOLES

Maintenance holes shall be constructed in accordance with WSA 02-2014 clause 17.

Where specified on the drawings, the Contractor shall coat the internal surface of maintenance holes with an approved epoxy.

DRC-W105.26 TRENCH FILL

Trench fill shall be undertaken in accordance with WSA04-2014 Clause 20.1.

Trench fill in trafficable areas shall be 20 mm crushed rock as per Clause dRC-W105.14. Trench fill material shall be placed and compacted in layers not exceeding 200 mm loose thickness, and shall be moisture conditioned as required to facilitate compaction to the required density. The minimum dry density ratio (AS 1289.5.4.1) as measured using the Modified Compaction test (AS1289.5.2.1) for trafficable areas shall be 95% except for the top 100 mm under existing roads which shall be 98%. In the event that the road owner has trench fill requirements which exceed the above, the road owner's requirement shall take precedence and apply.

Trench fill in non-trafficable areas may be select excavated or imported material complying with Clause dRC-W105.14. The Contractor shall establish the optimum loose layer thickness to achieve the required compaction, however this shall not exceed 300 mm. The minimum dry density ratio of non-trafficable trench fill shall be 90% except for the top 600 mm of the trench which shall be 95%. Where the works are located in areas with cohesionless soils (eg sand or silty sands) and using cohesionless trench fill then trench fill in non-trafficable areas shall achieve a Density Index (AS 1289.5.6.1) relative density of 60% or PSP/DCP penetration resistance of seven blows per 300 mm.

DRC-W105.27 BORED PIPES UNDER ROADS, DRIVEWAYS AND ELSEWHERE

Trenchless construction of pipes shall be undertaken in accordance with WSA02-2014 Clause 16.12.

The installation of rubber ring jointed pipes (which are not specifically designed for trenchless technology applications) are not permitted within unsleeved boreholes. Trenchless installation of trunk sewers shall be undertaken using a specific jacking pipe or approved sleeve.

Where the annular void for the borehole exceeds 50 mm, then this shall be grouted with an approved grout mix.

DRC-W105.28 COMPACTION TESTING

Compaction testing shall be carried out in accordance with WSA02-2014 Clause 21.3 unless required otherwise by the road owner or modified otherwise by the Superintendent.

DRC-W105.29 AIR PRESSURE AND VACUUM TESTING OF SEWERS

All sewers shall be vacuum or air pressure tested in accordance with WSA02-2014 Clause 21.4. At no stage shall air pressure used exceed 50 kPa.

The Contractor shall provide the Superintendent with a minimum of three clear working days' written notice prior to carrying out hydrostatic pressure testing. This notice must be in writing and specify the pipeline sections to be tested, as well as the time, date and location of the test and equipment to be used (refer Appendix A for an example notification form).

Testing shall not be carried out during wet weather unless otherwise approved by the Superintendent.

DRC-W105.30 VACUUM TESTING OF MAINTENANCE HOLES

Concrete maintenance holes shall be vacuum tested in accordance with WSA02-2014 Clause 21.4.5 based on the following frequency:

Number of each type of MHs in the project	Cast in-situ concrete – minimum % tested initially	Pre-cast concrete - minimum % tested initially
Up to 5	20%	100%
6 to 10	20%	50%
11 to 20	20%	33%
More than 20	20%	25%

DRC-W105.31 DEFLECTION (OVALITY) TESTING OF FLEXIBLE SEWERS

All flexible sewers shall be deflection (ovality) tested in accordance with WSA02-2014 Clause 21.6 at least 14 days after completion of placement and compaction of trench and embankment fill.

Trunk sewers smaller than DN750 mm may be tested using either a proving tool or an approved electronic instrument. Deflection testing of sewers DN750 mm or larger shall only be undertaken using an approved electronic instrument.

DRC-W105.32 CCTV INSPECTION

All sewers shall be inspected internally by CCTV in accordance with WSA02-2014 Clause 21.8 and WSA02-2014 Appendix L.

CCTV inspection footage and report shall be submitted to the Superintendent in Wincan format.

DRC-W105.33 INSPECTION AND TESTING OF THERMOPLASTIC LINED RC SEWERS

Inspection and testing of thermoplastic lined RC sewers shall be undertaken in accordance with WSA02-2014 Clause 21.9. This shall include visual inspection and probing of all field welds with a feeler gauge followed by spark testing.

DRC-W105.34 CONNECTION TO EXISTING SEWERS

The Principal shall determine whether connections to existing live sewers may be undertaken by the Contractor or undertaken by the Water Agency. This determination will take into account the work involved in making the connection, impact on customers and impact on operation of the live water asset.

For connection works to be undertaken by the Water Agency, the Water Agency will not schedule the work until pre-payment of the full quoted cost has been made. Once payment has been made, the Water Agency will undertake the connection work. The Water Agency shall be given 10 clear working days' notice, after payment of the quoted charge, of such connections being requested by the Contractor. The Water Agency may require longer notice in a case where the pipes are greater than DN150 mm in size.

Connection to existing sewers shall comply with WSA02-2014 Clause 23 unless otherwise agreed with the Water Agency.

DRC-W105.35 CONSTRUCTION TOLERANCES

All works shall be constructed within the tolerances as specified in WSA02-2014 clause 22.

DRC-W105.36 WORK AS CONSTRUCTED DETAILS

The Contractor shall prepare a set of Work As-Executed drawings that contain a similar level of detail to the design drawings. The drawings should be clearly marked "As-Executed" with the relevant date and revision number. The Work As-Executed drawings are required to show all as-built information including coordinates (eastings and northings) of connection points, changes of direction or gradient, invert levels etc, even though the design drawings may not, in all instances, contain this information.

Work As-Executed drawings shall be submitted by the Contractor to the Superintendent in both PDF and Autocad DWG format. Drawings shall be prepared to the Map Grid of Australia (MGA) coordinate system.

If, during the Defects Liability Period, the Contractor modifies any of the Works, the modifications shall be included in amendments to the 'As Constructed' drawings and documentation.

DRC-W105.37 RESTORATION

Pavements, lawns and other improved areas shall be cleaned and left in the same order as they were at the commencement of the works. Restoration shall be undertaken in accordance with WSA02-2014 Clause 24 which outlines the requirements for pavements, lawns, grassed areas and bushland.

All restored surfaces shall be maintained in the condition to which they are restored until the expiry of the Defects Liability Period applicable to those surfaces, notwithstanding that any deterioration of the restored surfaces, and the need for their maintenance may or may not be due to defects which become apparent or arise from events which occur during the Defects Liability Period.

Surplus material shall be removed and disposed of to areas arranged by the Contractor. Any tipping or disposal fees shall be paid by the Contractor, and are deemed to be included in the Contract Sum.

In locations where, in the opinion of the Superintendent, surplus material left in the vicinity of the trench would not be objectionable, the surplus material may be disposed by spreading neatly in the vicinity of the trench to the satisfaction of the Superintendent in such a way as to minimise future erosion of the backfill and adjacent ground surfaces.

Any subsequent settlement of trench fill material after construction shall be made good by the Contractor, as required, by placing additional fill.

Should the Contractor elect to tunnel under paving, kerb and gutter or other improved surfaces in lieu of trenching, backfilling shall be so carried out as to restore full support to those surfaces, and payment shall be made for the restoration of the surfaces as though they had been removed and replaced. The Contractor shall remain responsible for the repair of the improved surfaces, if subsequently damaged due to subsidence of the backfill, until the end of the Defects Liability Period.

APPENDIX A – AIR PRESSURE/VACUUM TESTING FORMS

Part A - Notification of Sewer Air Pressure/Vacuum Testing by Contractor

CONTRACTOR

CONTRACT

Proposed Hydrostatic Testing

Section	Start MH	End MH	Size (DN)	Material	Date and Time of Test
A					
B					
C					
D					
E					
F					
G					

Contractor..... (Signature)

.....Date)

Received by - Superintendent..... (Signature)

..... (Date)

- Principal (Signature)

..... (Date)

Part B1 – Report of Low Air Pressure or Vacuum Testing – Sewer Pipes

CONTRACTOR

CONTRACT

METHOD Low air pressure / vacuum (cross out whichever is not applicable)

Low Air Pressure / Vacuum Testing Results

Section	Start MH	End MH	Length	Size (DN)	Start Time	Duration	Pass
A							
B							
C							
D							
E							
F							
G							

Start pressure shall be 24 kPa and allowable loss over the duration of the test shall be 7 kPa.

Witnessed by Superintendent (Signature)

.....Date

Contractor (Signature)

.....Date

Part B2 – Report of Maintenance Hole Testing

CONTRACTOR

CONTRACT

Results of Maintenance Hole Testing – As per WSA02-2014 Clause Section 21.4.5

MH No.	MH Diameter	MH Depth	Minimum Test Time (s)	Start Vacuum Pressure	Start Time	Duration	Pass

Witnessed by Superintendent (Signature)

.....Date

Contractor (Signature)

.....Date