# TWEED SHIRE COUNCIL

# DEVELOPMENT CONSTRUCTION SPECIFICATION

# C221

# **PIPE DRAINAGE**

**VERSION 1.6**

# SPECIFICATION C221 – PIPE DRAINAGE

**CLAUSE** **CONTENTS** **PAGE**

## CITATION

This document is named “Tweed Shire Council, Development Construction Specification C221 - Pipe Drainage”.

## ORIGIN OF DOCUMENT, COPYRIGHT

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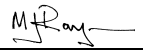
## VERSIONS, C221 PIPE DRAINAGE

| VERSION | AMENDMENT DETAILS | CLAUSES AMENDED | DATE ISSUED (The new version takes effect from this date) | Authorised by the Director of Engineering Services |
|---|---|---|---|---|
| 1.1 | Original Version | | 1 July 2003 |  |
| 1.2 | Bulkhead requirements amended<br><br>Expanded CCTV inspection criteria and reporting<br><br>Renumbered clauses, including *Summary of Limits and Tolerances* | C221.03.10 added, C221.07.04 deleted<br><br>C221.23-29<br><br>C221.30-32 | 12 January 2007 |  |
| 1.3 | Trench stops and bulkhead requirements amended<br><br>Specify CD/DVD contents and format for CCTV inspections | C221.03.10<br><br>C221.28.1 | 16 September 2013 |  |
| 1.4 | Remove all specifications related to steel pipes and pipe arches | C221.01, C221.09, C221.10, C221.11, C221.12, C221.13, C221.14, C221.15, C221.16, C221.17, C221.18. | 20 April 2015 |  |
| 1.5 | Expanded CCTV reporting requirements<br><br>Change reference to SWAC to "Certifying Engineer" | C221.28<br><br>Various | 12 June 2015 |  |
| 1.6 | Clarification of acceptable pipe materials and class and Acceptance Criteria | C221.2, , C221.4, C221.6, C221.7, C221.27, C221.28 and C221.29 | 1 July 2019 |  |
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# DEVELOPMENT CONSTRUCTION SPECIFICATION C221

# PIPE DRAINAGE

## GENERAL

### C221.01 SCOPE

1. This Specification is for the supply and installation of pipe culverts for stormwater drainage. ***Scope***

2. This Specification should be read in conjunction with the specification for STORMWATER DRAINAGE - GENERAL. ***Associated Specifications***

3. The work to be executed under this Specification consists of supply of pipes, bedding, installation and backfilling. ***Extent of Work***

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

### C221.02 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**

| | | |
|---|---|---|
| C213 | - | Earthworks |
| C220 | - | Stormwater Drainage - General |
| C223 | - | Drainage Structures |
| C230 | - | Subsurface Drainage - General |
| C271 | - | Minor Concrete Works |

**(b) Australian Standards**

| | | |
|---|---|---|
| AS 1141.11 | - | Particle size distribution by dry sieving. |
| AS 1141.51 | - | Unconfined compressive strength of compacted materials. |
| AS 1254 | - | Unplasticised PVC (PVC-U) pipes and fittings for storm or surface water applications. |
| AS 1289.3.3.1 | - | Calculation of the plasticity index of a soil. |
| 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 1289.4.3.1 | - | Determination of the pH value of a soil - Electrometric method. |
| AS 1289.4.4.1 | - | Determination of the electrical resistivity of a soil - Sands and granular materials. |
| AS 1289.E6.1 | - | Compaction control test - Density index method for a cohesionless material. |
| AS 1646 | - | Elastomeric seals for waterworks purposes. |
| AS 2032 | - | Code of practice for installation of PVC-U pipe systems. |
| AS/NZS 2566.1 | - | Buried flexible pipelines, structural design |
| AS 3725.2007 | - | Design for installation of buried concrete pipes |
| AS 4058 | - | Precast concrete pipes (pressure and non-pressure). |
| AS 4139 | - | Fibre reinforced concrete pipes and fittings. |
| AS/NZS ISO 9002 | | Quality systems - Model for quality assurance in production, installation and servicing. |

# GENERAL REQUIREMENTS

## C221.03 GENERAL

1. Pipes shall not be placed in position until the Subdivider has produced documentary evidence to the Certifying Engineer that the manufacture of the products to be used in the works has complied with the Manufacturer's Quality Plan in accordance with ISO 9002. ***Compliance with Quality Plan***

2. Documentation shall comprise a conformance certificate to AS 4058, AS 1254 or AS 4139 as appropriate for each batch of pipes to be included in the works. Conformance certificates are to be supplied at least 24 hours in advance of dispatch to site. ***Certification***

3. Each unit shall be marked at time of manufacture with: ***Marking***

   (a) Class and size.

   (b) Manufacturer's name.

   (c) Date of casting.

4. The Subdivider shall take all necessary steps to drain the excavation to allow the foundation, the bedding and any backfilling to be compacted to the specified relative compaction. ***Excavation Drainage***

5. Culverts shall be installed within 10mm of the grade line and within 10mm of the horizontal alignment specified on the design plans. The Subdivider shall relay any culvert which is not within these tolerances. ***Tolerances***

6. At the discharge end of culverts terminating at pits and headwalls, a 3m length of 100mm diameter subsurface drain shall be laid in the trench 100mm above the invert level of the culvert and discharging through the wall of the pit or headwall at 100mm above the invert level of the culvert or headwall. The subsurface drainage pipe shall be sealed at the upstream end and shall be enclosed in a seamless tubular filter fabric in accordance with the Specification C230 SUBSURFACE DRAINAGE – GENERAL. ***Subsurface Drain***

7. Excavation and backfilling for culverts shall be undertaken in a safe manner and in accordance with all Statutory requirements. ***Safety***

8. Where the Subdivider proposes to travel construction plant in excess of 5 tonnes gross mass over culverts, the Subdivider shall design and provide adequate protective measures for the crossings and shall submit the proposals to the Certifying Engineer for prior approval. Council to be provided with all information prior to implementation. ***Construction Plant Movement***

9 Backfilling of pipes shall be undertaken with equipment that does not cause cracking to the in-situ pipe. Self-compacting backfill should be used if there is any risk of compaction equipment damaging the pipe. ***Compaction of pipe backfill***

10. Trench stops and bulkheads shall be constructed in accordance with sections C402.28 & C402.29 of Specification C402 SEWERAGE SYSTEM on all lines where the pipe gradient exceeds 5 per cent. ***Trench Stops and Bulkheads***

# PRECAST REINFORCED CONCRETE AND FIBRE REINFORCED CONCRETE PIPES

## C221.04 PIPES

1. Precast reinforced concrete pipes shall comply with AS 4058 and shall be of the class and size as shown on the design plans. ***Precast Reinforced Concrete Pipes***

2. Minimum Pipe Class and Materials accepted by Council are: ***Minimum Pipe Class and Materials***
   a) Steel Reinforced Concrete Pipe (SRCP) – Class 3
   b) Fibre Reinforced Concrete Pipe (FRCP) – Class 3
   c) Unplasticised Polyvinyl Chloride (PVC-U) for roof water drainage – Sewer Class SN8
   d) When works are in marine environments, Saltwater Class SRCP shall be used.
   e) When works involve trenchless methods, reinforced Jacking SRCP shall be used.

2. Fibre reinforced concrete drainage pipes (not be accepted where the infrastructure is to be dedicated to Council) shall comply with AS 4139 and shall be of the class and size as shown on the design plans. ***Fibre Reinforced Pipes***

3. Unless specified otherwise, joints shall be of the flexible type and the pipes shall have special sockets incorporating rubber ring joints complying with AS 1646 and as recommended by the manufacturer. ***Joints***

## C221.05 EXCAVATION

1. Unless otherwise indicated on the design plans or approved by the Certifying Engineer, the formation shall be completed to subgrade level and the pipes then installed in the normal trench condition. ***Formation to Subgrade Level***

2. For normal trench conditions, the pipe shall be laid in an excavated trench with bedding as specified in Clause C221.06. The trench shall be excavated to a width 1.4 times the external diameter of the pipe, or to the external diameter of the pipe plus 300mm on each side, whichever is the greater. ***Normal Trench Conditions***

3. Care is necessary to avoid laying pipe drainage in trenches excavated to excessive width. Pipes laid in wide trench conditions will be deemed to be in embankment conditions (positive projection). Wide trench conditions apply when, for a single pipe, the width of trench, $W \geq D + 0.6$ metre where D is the pipe diameter. For multi-cell pipes, wide trench conditions apply when the width of trench, $W \geq \Sigma D + \Sigma S + 0.6$ metre where S is the square spacing between the pipelines. This definition of wide trench conditions as equivalent to embankment conditions relates to the size and geometry of the excavation utilised at construction. Pipes shown on the design plans to require trench conditions shall not be placed under embankment conditions without a design check for compliance of the pipe strength in accordance with AS3725. ***Wide Trench Conditions*** ***Design Check***

## C221.06 BEDDING

1. Bedding shall be in accordance with this Specification, AS3725.2007 for the pipe support types as shown on the design plans. Where the pipe support type is not shown on the design plans, the support type shall be HS3 within road reserves and H2 elsewhere. ***Pipe Support Type***

2. Figure C221.1 and Table C221.1 indicate the dimensions of bedding and backfilling for pipes laid in trench conditions and embankment conditions for all AS3725 pipe ***Bedding Dimensions***

support types.

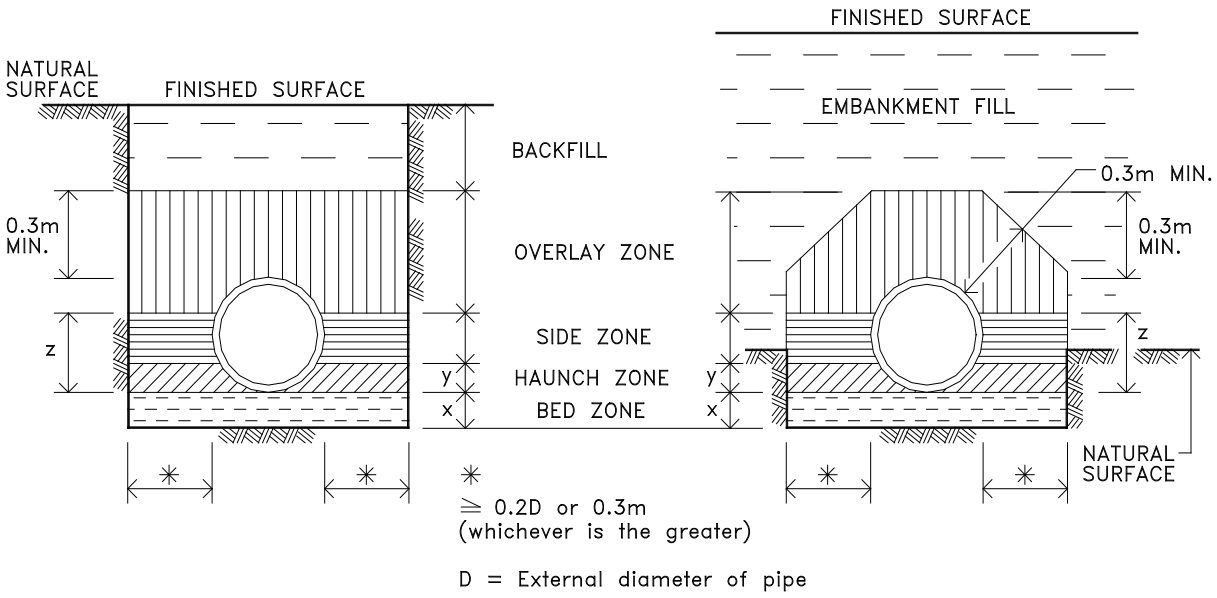


**Figure C221.1 - Pipe Installation Conditions**

| | | Pipe Support Type | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **U** | **H1** | **H2** | **H3** | **HS1** | **HS2** | **HS3** |
| Dimension (minimum) | X | 75 on rock<br>Nil on soil | 100 for D ≤ 1500<br>150 for D > 1500 | | 0.25 D<br>but >100 | 100 for D ≤ 1500<br>150 for D > 1500 | | |
| | Y | — | 0.1D | 0.3D | 0.3D | 0.1D | 0.3D | 0.3D |
| | Z | — | — | — | — | ≥ 0.7D | | |

D = External diameter of pipe

**Table C221.1 Pipe Installation Dimensions**

3. Bedding material for the bed and haunch zones shall consist of a granular material having a grading, determined by AS 1141.11, complying with Table C221.2, and a Plasticity Index, determined by AS 1289.3.3.1 of less than 6. Select fill material in the side zones, for pipe support type HS, shall also comply with Table C221.2. ***Material Requirements***

4. Construct Bedding, Haunch, Overlay and Side Zone using 10mm to 20mm aggregate. Within a sand environment, sand can be utilised. ***Aggregate Size***

| Sieve size mm | Weight passing % | |
|---|---|---|
| | Bed and Haunch Zones | Side Zones |
| 75.0 | — | 100 |
| 19.0 | 100 | — |
| 9.5 | — | 50 – 100 |
| 2.36 | 50 -100 | 30 – 100 |
| 0.60 | 20 - 90 | 15 – 50 |
| 0.30 | 10 - 60 | — |
| 0.15 | 0 - 25 | — |
| 0.075 | 0 - 10 | 0 – 25 |

**Table C221.2 Bedding Material Grading Limits**

4. The Subdivider shall advise the Certifying Engineer of the source of bedding material. ***Source***

5. All material shall be compacted in layers not exceeding 150mm compacted thickness except where explicitly approved by the Certifying Engineer (upon prior endorsement by Council), for the first placed layer above the pipe crown in the overlay zone, in order to protect the pipe from construction damage. Each layer shall be compacted to the relative compaction specified before the next layer is commenced. ***Layers***

6. 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 Certifying Engineer (upon prior endorsement by Council), 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). ***Moisture Content***

7. Compaction of select fill material in the bed and haunch zones shall be to the appropriate pipe support requirements shown in Table C221.3 when tested in accordance with AS 1289.5.4.1 for standard compactive effort. H3 Pipe Support includes concrete bedding. Concrete shall be grade N20 to AS3600. Pipe shall be suitably reinforced in accordance with AS3725 as standard elliptically reinforced pipe may not be adequate for H3 Pipe Support. Unless specifically selected pipes are nominated for use with H3 bedding, a design check shall be required to confirm the suitability of the proposed pipes. ***Compaction Requirements*** ***Design Check***

| | | Pipe Support Type | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | U | H1 | H2 | H3 | HS1 | HS2 | HS3 |
| Minimum Relative Compaction % AS1289.5.4.1 (Standard Compaction | Bed and Haunch Zones | — | 50 | 60 | Conc-rete | 50 | 60 | 70 |
| | Side Zones: Cohesionless | — | — | — | — | 50 | 60 | 70 |
| | Cohesive | — | — | — | — | 85 | 90 | 95 |

**Table C221.3 Bedding Material Compaction Requirements**

8. The top 0.1Dmm of the bedding and haunch material directly under the pipe shall be placed and shaped accurately to house the pipe after compaction is achieved in the bedding and haunch zone external to the area of direct pipe support.

9. Where the impermeability of the natural ground and the slope of the drainage line is such that erosion of bedding material is considered by the Certifying Engineer to be a likely problem, the Certifying Engineer may specify cementitious stabilisation of the bedding material used in the bedding and haunch zones. ***Cementitious Stabilisation***

## C221.07 INSTALLATION

### (a) General

1. Pipes shall be laid with the socket end placed upstream. Pipes which have marks indicating the crown or invert of the pipes shall be laid strictly in accordance with the markings. Unless specified, no individual length of pipe shall be shorter than 1.2m. ***Positioning of Pipes***

2. In the case of pipes 1200mm or more in diameter, laid in situations where embankments are to be more than 3m high, measured above the invert of the pipe, pipes shall be stiffened temporarily by the Subdivider by interior timber struts, erected before filling is placed. Struts shall be of hardwood measuring at least 100mm by 100mm or 125mm diameter. One strut shall be placed in a vertical position at each pipe joint, thence at a spacing not greater than 1200mm. Struts shall bear against a sill laid along the invert of the pipe and a cap bearing against the crown of the pipe. Both the sill and the cap shall be continuous throughout the length of the pipe and they shall be of sawn hardwood, of cross section not less than 100mm by 100mm. Struts shall be made to bear tightly by the use of wedges between the top of the struts and the cap. Struts, sills and caps shall be removed on completion of the embankment, unless removal is ordered earlier. ***Stiffening of Culverts*** ***Removal of Struts***

3. Lifting holes in all pipes shall be sealed with plastic preformed plugs approved by the Certifying Engineer, or a 3:1 sand: cement mortar before the commencement of backfilling. ***Seal Lifting Holes***

4. DELETED

5. Changes in the pipeline alignment without the prior concurrence of TSC is not permitted. The Subdivider shall provide details of any proposed changes to the pipeline alignment to the Certifying Engineer for submission to Council, and obtain written approval from TSC prior to installation of pipeline. ***Pipe alignment***

6. The Subdivider shall present the laid and jointed pipes for inspection by the Certifying Engineer prior to commencement of trench backfilling. ***Inspection by Certifying Engineer***

### (b) Joints in Reinforced Concrete Pipes

### (i) Rubber Ringed Joints

1. Before making the joint, the spigot and socket and the rubber ring shall be clean and dry except for any lubricants recommended by the manufacturer. ***Clean and Dry Material***

2. The rubber ring shall be stretched on to the spigot end of the pipe, square with the axis and as near as possible to the end, care being taken that it is not twisted. The spigot end of the pipe shall then be pushed up to contact the socket of the pipe with which it is to join, and be concentric with it. The spigot end shall then be entered into the socket of the already laid pipe and forced home by means of a bar, lever and chain, or other method approved by the Certifying Engineer. ***Procedure for Rolling Rubber Rings***

3. The joint shall be tested to ensure that the rubber ring has rolled evenly into place. ***Joint Test***

4. Where wedge shaped “skid” rubber rings are prescribed the Manufacturer’s instructions, which include the use of lubricants, shall be followed. ***“Skid” Rings***

5. Maximum gaps between joints shall be determined by manufacturer's recommendation or the Certifying Engineer. Acceptance Criteria for pipe joints is provided in Clause C221.27. ***Joint Gaps***

**(ii) Flush or Butt Joints**

1. Flush or butt joints shall be used only where required to extend existing culverts. If pipes with flush or butt joints are required, the ends of the pipes shall be butted together. ***Jointing***

2. The joints shall be sealed with proprietary rubber sleeves, supplied and installed in accordance with the manufacturer's recommendations. ***Sealing***

**(c) Joints in Fibre-Reinforced Cement Pipes (Private & Interallotment Drainage Only)**

**(i) New Pipes**

***Procedure***

1. Joints shall be of a flexible type. Rubber rings shall be used to seal joints in both rebated and spigot and socket jointed pipes in the manner specified in Clause C221.07(b). Alternatively, a jointing compound comprising plasticised butyl rubber and inert fillers may be used to seal such pipes in accordance with the manufacturer's instructions.

**C221.08 BACKFILL**

1. Select fill material to the side zones for pipe support type HS shall be compacted to the requirements shown in Table C221.3 when tested in accordance with AS 1289.5.4.1 for standard compactive effort. ***Type HS Pipe Support***

2. Ordinary fill to the side zones, for all pipe support types except type HS, and overlay zones, for all pipe support types, shall consist of Selected Backfill as defined in the Specification C213 EARTHWORKS. It shall be placed around the pipe to the dimensions shown in Figure C221.1. ***Other Pipe Support Types***

3. 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. ***Layers***

4. 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 Certifying Engineer, 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). ***Moisture Content***

5. The remainder of the trench to the underside of the subgrade, or selected material zone as specified in the Specification C213 EARTHWORKS, shall be backfilled with material satisfying the requirements for embankment material as defined in the Specification C213 EARTHWORKS. Where excavation is approved through the selected material zone, the section of trench within the select material zone shall be backfilled with selected material as defined in the Specification C213 EARTHWORKS. ***Trench Backfill***

6. When compacted adjacent to culverts or drainage structures, the Subdivider 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 Subdivider. Backfilling and compaction shall commence at the pipe or wall so as to confine remaining uncompacted material at commencement. ***Precautions***

***Subdivider's Cost***

## STEEL PIPES AND PIPE ARCHES

**C221.09 DELETED**

**C221.10 DELETED**

**C221.11 DELETED**

**C221.12 DELETED**

**C221.13 DELETED**

**C221.14 DELETED**

**C221.15 DELETED**

**C221.16 DELETED**

**C221.17 DELETED**

**C221.18 DELETED**

## PVC-U PIPES

### C221.19 CULVERT MATERIALS

1. Unplasticised PVC (PVC-U) Pipes and Fittings shall be manufactured in accordance with AS 1254 and shall be of the type and size as shown on the design plans. ***Specification***

2. Embedment material in the bedding, side support and overlay zones shall be in accordance with bed and haunch zone material in Clause C221.06.

3. Trench backfill material shall satisfy the requirements for embankment material as defined in the Specification C213 EARTHWORKS.

### C221.20 EXCAVATION AND BEDDING

1. Unless otherwise indicated on the design plans or approved by the Certifying Engineer (upon prior endorsement by Council), the formation shall be completed to subgrade level and the pipes then installed in the normal trench condition. ***Formation to Subgrade Level***

2. Figure C221.3 and Table C221.4 indicate the dimensions of bedding and backfilling for pipes laid in trench conditions and embankment conditions, unless otherwise indicated on the design plans. ***Bedding Dimensions***

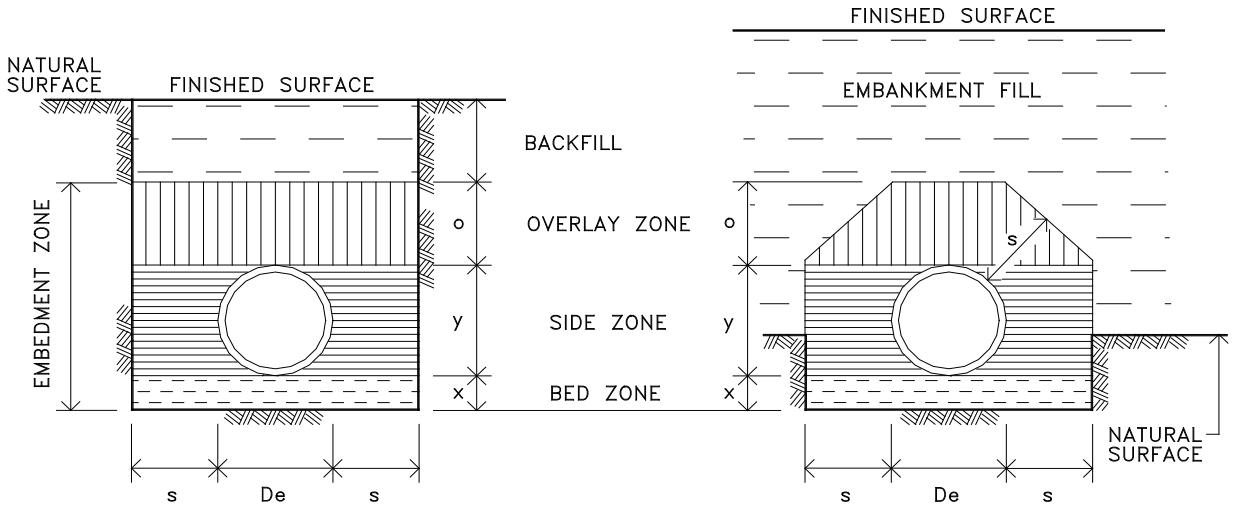


**Figure C221.3 - Pipe Installation Conditions**

| Extreme External Dia (De)mm | Minimum Dimensions (mm) | | | |
|---|---|---|---|---|
| | x | S | O | Y |
| ≥75 ≤150 | 75 | 100 | 100 | Pipe dia. |
| >150 ≤300 | 100 | 150 | 150 | Pipe dia. |
| >300 ≤450 | 100 | 200 | 150 | Pipe dia. |

NOTE: Where multiple pipes are laid side by side, the minimum distance between the pipes shall be dimension "s" for the larger of adjacent pipes.

**Table C221.4 - Trench and Embedment Dimensions**

3. Bedding zone material shall be placed and compacted in accordance with the requirements in Clause C221.06 except that the required relative compaction in the bedding zone shall be 95 per cent (AS 1289.5.4.1 Standard compaction).

## C221.21 INSTALLATION

1. Embedment of the PVC-U pipe shall be in accordance with the requirements of AS/NZS 2566.1 and to the dimensions shown in Figure C221.3.

2. Pipe laying shall be in accordance with Part 7 of AS 2032 and solvent-cement pipe jointing shall be in accordance with Part 3 of AS 2032. Jointing may be performed with the pipes either in the trench or at ground level. All pipes, or jointed pipelines, shall be lowered into the trench without being dropped. Pipelines shall be placed so that joints are not strained.

***Laying and Jointing***

3. The Subdivider shall present the laid and jointed pipes for a Holdpoint inspection by the Certifying Engineer and Council prior to commencement of trench backfilling.

***Inspection by Certifying Engineer***

### C221.22 BACKFILL

1. Compaction of the material in the side support and overlay zones shall comply with the requirements of clause C221.06 except that the required relative compaction in the side support and overlay zones shall be 95 per cent (AS 1289.5.4.1 standard compaction).

***Embedment Compaction***

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.

***Layers***

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 Certifying Engineer (upon prior endorsement by Council), 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).

***Moisture Content***

4. The remainder of the trench to the underside of the subgrade, or selected material zone as specified in the Specification C213 EARTHWORKS, shall be backfilled with material satisfying the requirements for embankment material as defined in the Specification C213 EARTHWORKS. Where excavation is approved through the selected material zone, the section of trench within the select material zone shall be backfilled with selected material as defined in the Specification C213 EARTHWORKS.

***Trench Backfill***

## SPECIAL REQUIREMENTS

### CCTV INSPECTION

### C221.23 WHEN IS A CCTV INSPECTION REQUIRED

1. A minimum of two (2) CCTV inspections will be required to be undertaken for all installed pipe drainage infrastructure, to demonstrate to the Certifying Engineer and Council that the standard of the constructed drainage infrastructure is acceptable.

**CCTV Inspections**

2. For stormwater infrastructure installed under road pavement, the first CCTV inspection shall be undertaken after the pavement AC seal has been placed and not more than two (2) weeks before the final, “on defects liability” (on Maintenance) inspection.

**First CCTV Inspection**

For stormwater infrastructure installed within the road reserve (but not under road pavement), the first CCTV inspection shall be undertaken within two (2) weeks of the final, “on defects liability” (on Maintenance) inspection.

For stormwater infrastructure installed outside the road reserve, the first CCTV inspection shall be undertaken after the final placement of topsoil and not more than two (2) weeks before the final, “on defects liability” (on Maintenance) inspection.

3. A second CCTV inspection of all pipe drainage is required to be undertaken on or immediately after the expiration of the defects liability (maintenance) period.

**Second CCTV Inspection**

4. Additional CCTV inspections are required of any remediation / repair works undertaken to the stormwater infrastructure, or as directed by the Certifying Engineer and/or Council to demonstrate that the standard of the drainage system is acceptable.

**Other CCTV Inspections (as required)**

5. The CCTV assessment shall also include any existing stormwater infrastructure that is to be utilised within the design. Council will advise if any repair / upgrades to the existing system are required.

**Use of existing infrastructure**

## C221.24 WHAT IS TO BE INSPECTED

1. All stormwater networks with pipes up to 2000mm in diameter are to be CCTV inspected.

**CCTV up to 2000mm dia**

Pipe greater than 2000mm diameter are to be assessed by visual inspection.

2. Pipes shall be inspected and reported on the following:

**Assessment Criteria**

a. Horizontal alignment
b. Vertical alignment
c. Cracks and defects
d. Pipe joints
e. Joints to manholes and other pipes
f. Ovality

## C221.25 PRE INSPECTION CRITERIA

1. All pipes are to be inspected upon delivery. A "No cracks policy" is to be adopted, giving the site supervisor the authority to reject any pipe with a crack when delivered.

**No cracks policy**

Hairline cracks or crazing cracks associated with concrete shrinkage are permitted.

2. The acceptance of pipes upon delivery to the site shall be in accordance with the following table (which has been simplified from AS4058)

**Acceptance criteria**

| Defect Description | Acceptability |
|---|---|
| **Type 1 & 2**<br>• In pipes less than 900mm in diameter<br>Cracks up to 0.10mm not extending through the wall; | • Acceptable after repair |
| **Type 1 & 2**<br>• In pipes of 900mm or more in diameter<br>Cracks up to 0.10mm not extending through the wall; | • Acceptable |
| **Type 3**<br>• Cracks over 0.10mm or cracks extending through the wall; | • Acceptable after repair and passes standard load test |
| **Type 4**<br>• Dents, bulges, chips and spalls up to 2.5mm deep/high and up to 50mm long.<br>• Surface blowholes less than 4mm deep and less than 10mm in diameter. | • Acceptable<br>• Acceptable |
| **Type 5**<br>• Dents, bulges, chips, spalls and bony patches up to 5mm deep/high and up to 50mm long.<br>• Bony patches on socket back walls less than 5mm deep:<br>• Surface blowholes less than 4mm deep and more than 10mm | • Acceptable after repair<br>• Acceptable after repair<br>• Acceptable after repair |

| | |
|---|---|
| in diameter;<br>• Visible inclusions of foreign matter less than 0.1% of either the inside or outside surface with no individual area more than 400mm$^2$ in area | • Acceptable after repair |
| **Type 6**<br>• Dents, bulges, chips, spalls and bony patches more than 5mm deep/high and up to 50mm long.<br>• Bony patches on socket back walls more than 5mm deep:<br>• Surface blowholes more than 4mm deep<br>• Defects as described above that are confined to the joints | • Not acceptable<br>• Not acceptable<br>• Not acceptable<br>• Acceptable after repair |
| **Type 7**<br>• Visible inclusions of foreign matter more than 0.1% of either the inside or outside surface or with an individual area more than 400mm$^2$ in area<br>• Defects as described above that are confined to the joints | • Not acceptable<br>• Acceptable after repair |

## C221.26 INSPECTION CRITERIA

1. The CCTV Inspection shall be carried out in accordance with the Water Services Association of Australia (WSAA) "Sewer Inspection Reporting Code of Australia" and the "Sewerage Code of Australia" (Sydney Water Edition). **CCTV Inspection Procedure**

2. CCTV surveys are to be undertaken using a camera with the ability to capture footage in colour and pan and tilt 360º.

3. CCTV Field Assessors must have NATA accreditation under the Sydney Water Field Testing Services Program for CCTV inspections. Field Assessors must also have professional indemnity insurance adequate to cover the value of the works they are inspecting. **CCTV Field Assessors**

4. All pipes must be free of debris and silt at the time of inspection.

5. The pipeline shall be assessed at the following speeds **Speed**

| Conduit Diameter | Allowable Camera Speed |
|---|---|
| Dia. < 200mm | 0.1m/s * |
| 200mm ≤ Dia. < 300mm | 0.15m/s * |
| Dia. ≥ 300mm | 0.2m/s * |
| * - Or as agreed by Council | |

6. The camera must stop perpendicular to all cracks, defects, joints and manholes and pan 360º. Particular attention should be paid to any infiltration at joints and connections. **Stop and pan 360°**

## C221.27 ACCEPTANCE CRITERIA

1. The pipe drainage will be acceptable if the Certifying Engineer and Council are satisfied that the CCTV inspection does not reveal any defects that would constitute a departure from this specification or any other relevant Tweed Shire **Acceptance of CCTV Inspection**

Council Development Specification.

2. The misalignment of the lip at the inside of a joint between two connecting pipes shall not exceed 5mm. **At Joints**

3. Gaps widths within pipe joints shall fall within the below limits: **Joint Gaps**

| Pipe Size (DN) | Nominal (mm) | Maximum (mm) |
|---|---|---|
| **375 to 675** | 5 | 12 |
| **750 to 900** | 8 | 15 |
| **> 1050** | 10 | 20 |

4. The following criteria governs whether a crack or impact damage is acceptable without repair being required. **Criteria for crack or impact damage acceptance**

   a. Minor in nature - not more than 0.2mm in width
   b. No sign of displacement across the crack
   c. The edges of the crack are not crushed
   d. No sign of entry of sand or debris to the pipeline
   e. No rupture of the pipe surface at the site of a dent or bulge

   Defects that defer from the above criteria are required to be repaired.

5. Structural Defects include; **Types of Defects**

   a. Cracks and fractures
   b. Deformed, collapsed and broken pipes
   c. Dropped inverts
   d. Displaced and open joints
   e. Surface damage
   f. Defective connections
   g. Wide gaps within pipe joints

   Serviceability Defects include;

   a. Debris and silt
   b. Obstructions
   c. Infiltrations
   d. Roots
   e. Encrustation and scale

6. All cracks / defects are to be assessed by the Certifying Engineer to determine the significance of the crack and thereby the acceptance, rejection or remedial repairs required. This assessment is to be endorsed by Council prior to any repair works being undertaken.

   Where there is a difference of opinion whether the identified defect is considered significant or not, Council's recommended course of action will prevail. Council may seek written advice from the Pipe Surveyor or the Pipe Manufacturer on this matter.

7. All manhole and gully pit pipe connections are to be mortared flush with the walls and that no pipe reinforcement is exposed.

**Acceptance criteria**

8. The acceptance of pipes during and after installation shall be in accordance with the following table (which has been simplified from AS4058).

| Construction Stage | Type of Defect | Acceptance and Remedial Action |
|---|---|---|
| **After Installation** | **Type 1 & 2 Defects**<br>Considered to be insignificant cracking and is defined as cracking that is less than or equal to 0.15mm in width | (a) Any Circumferential Crack - No remedial action required.<br>(b) Longitudinal cracks less than 300mm in length - No remedial action required.<br>(c) Longitudinal cracks exceeding 300mm in length - Must be repaired, i.e. cracks to be filled and sealed to ensure a design life of 100 years is achieved. Contractor to provide written certification by a suitably qualified engineer or Certifying Engineer that the work is acceptable and has been carried out in accordance with the manufactures specification. A complete CCTV resurvey will also be required to show the condition of the repaired pipeline. |
| **After Installation** | **Type 3 Defects**<br>Considered to be significant cracking and is defined as cracking that is more than 0.15mm in width | (a) The pipe is to be either replaced<br>or<br>(b) Structurally Reline (liner and grout) a section of the pipeline for a minimum of 200mm each side of the crack or from manhole to manhole. The relined section must conform to the original hydraulic design criteria. Upon completion of any required repair work, the Contractor shall provide certification by a suitably qualified engineer or Certifying Engineer on the acceptability of any remedial works undertaken.<br>(b) Resurvey will be required after the repair or replacement has been completed and all works reinstated. |
| **During and After Installation** | **Type 3 Defects**<br>(i) Significant damage to collar or ends of pipe during installation or<br>(ii) Significantly gouged or damaged through other construction activities | Pipe to be replaced, preferably at time of installation<br>Pipe to be replaced, preferably at time of installation |

9. Sections of the pipeline that fail the ovality test are to be excavated and the trench and embedment replaced.

10. Pipes that are crushed or creased are to be replaced.

## C221.28 SUBMISSION

1. The Applicant must submit both a hardcopy report and an electronic report (submitted on USB portable medium in a format suitable to Council - as outlined below) of the CCTV inspection. The CCTV Inspection Report is a pre-requisite for issue of a *Subdivision Certificate* and an *Off Defects Liability Compliance Certificate*.

**USB Portable drive contents and format:**

a. Individual video files representing each section of pipe from node to node. (e.g. from MH 5A to MH 6A)

b. Each video file is to be named appropriately to enable easy identification, utilising names as shown on the as-constructed or approved design drawings. (e.g. *MH5A-MH6A*)

c. Video file format is to be MPG/MPEG format (Motion Picture Experts Group).

d. Copy of pipe survey report in PDF format.

2. The reports must include

a. Name of asset owner.
b. Name of the company performing the inspection and name of the operator.
c. Operator's job reference.
d. Coding system employed (i.e. WSA 2013)
e. Method of inspection.
f. Details of equipment used.
g. Specify the date of the inspection
h. Time of commencement of inspection.
i. Specify location (including Street Name and number)
j. Specify details of the reach being inspected( including line and structure numbers)
k. Provide footage in colour
l. Whether the maintenance structure was pre-cleaned.
m. Precipitation at the time of inspection.
n. Description of any measures taken to control flow during the inspection.
o. Cover details.
p. Details of steps and ladders.
q. Type of node.
r. The vertical reference point, if recording vertical location.
s. The circumferential reference point.
t. Video or digital image storage details.
u. Identify all faults, features and connections in the pipeline.
v. Clearly show chainage along the pipeline
w. Suggest appropriate remediation measures, as required.

**For pipes greater than 2000mm dia**

3. For pipes greater than 2000mm diameter a written report shall be submitted including;

a. Certification of the pipeline by the Certifying Engineer,
b. Digital photographs of any identified defects,
c. Digital photographs of any remediation works undertaken.

## C221.29 IF REMEDIATION WORKS ARE REQUIRED

1. Any defects identified by the inspection must be repaired or replaced in accordance with the provisions of this Specification, or as directed by the Certifying Engineer (with prior Council endorsement), or Council.

**Costs**

2. All costs associated with the CCTV inspection and rectification works shall be borne by the Applicant.

**Acceptable repair methods**

3. Defects identified by the inspection requiring repair may be repaired using one of the following repair techniques;

a. Tiger patch liner
b. Econoliner
c. PL Quick Sleeve System
d. Flexi-Bond method
e. Other such technique as approved by the Certifying Engineer (with prior Council endorsement) or Council

**Circumferential cracks**

4. Circumferential cracks are to be repaired by installation of either a bandage for cracks on the outside or by Relining and Grouting for cracks on the inside or

alternatively as approved by Council.

5. Longitudinal cracks are to be repaired by filling with an approved epoxy resin. The epoxy resin shall not be less than 1mm thick and extended at least 100mm from the crack in all directions. The repair is to be reinspected after curing is complete. **Longitudinal cracks**

6. A follow-up CCTV assessment is required of any repaired or replaced infrastructure, to demonstrate that the remediation measures undertaken are satisfactory to Council.

**C221.30 RESERVED**

**C221.31 RESERVED**

# LIMITS AND TOLERANCES

## C221.32 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances for materials and product performance related to the various clauses in this Specification are summarised in Table C221.5 below.

| Item | Activity | Limits/Tolerances | Spec Clause |
|---|---|---|---|
| 1. | **Culvert Position** | | |
| | (a) Grade Line | ± 10mm | C221.03 |
| | (b) Horizontal Alignment | ± 10mm | C221.03 |
| 2. | **Bedding** | | |
| | (a) Bed and Haunch Zone Compaction | Table C221.3 | C221.06 |
| 3. | **Backfill - Concrete Pipes** | | |
| | (a) Side and Overlay Zone Compaction | Table C221.3 | C221.08 |
| 5. | **Sprayed Concrete** | | |
| | (a) Over crest of corrugations over bottom third of pipe circumference | > 100mm | C221.18 |
| 6. | **Bedding Zone Compaction** | ≥95% | C221.20 |
| 7. | **Backfill – PVC-U Pipes** | | |
| | (a) Side and Overlay Zone Compaction | ≥95% | C221.21 |

**Table C221.5 - Summary of Limits and Tolerances**