

DEVELOPMENT  
CONSTRUCTION  
SPECIFICATION

C401

**WATER RETICULATION**

## 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.

<b>Amendment Sequence No.</b>	<b>Key Topic addressed in amendment</b>	<b>Clause No.</b>	<b>Amendment Code</b>	<b>Author Initials</b>	<b>Amendment Date</b>
<i>0</i>	<i>Complete review to comply with D11</i>	<i>Var</i>	<i>Various</i>	<i>JNH</i>	<i>30 Sep 08</i>

## SPECIFICATION C401: WATER RETICULATION

### GENERAL

#### C401.01 SCOPE

1. This Specification applies to the construction of mains up to DN600 nominal size.

#### C401.02 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.
2. Council specifications and standard drawings as listed below form part of this specification.

**Documents  
Standards Test  
Methods**

##### (a) Council Specifications

- D11 - Development Design Specification – Water reticulation
- C271 - Minor Concrete Works
- Aus-Spec Standard Drawings in the range **ASD 400** to **ASD 499** and **ASD 105**

##### (b) Australian Standards

- AS 1152 - SIEVE??
- AS 1214 - Hot-dip galvanized coatings on threaded fasteners
- AS 1281 - Cement mortar lining of steel pipes and fittings
- AS 1289.5.4.1 - Compaction control test (Rapid method) - COHESIONLESS
- AS 1289.5.7.1 - Compaction control test (Rapid method) - COHESIVE
- AS 1432 - Copper tubes for plumbing, gasfitting and drainage applications
- AS 1460 - Fittings for use with polyethylene pipes
- AS/NZS 1477 - PVC - U Pipes and fittings for pressure applications
- AS 1565 - Copper and copper alloys - Ingots and castings
- AS 1627 - Metal finishing - Preparation and pre-treatment of surfaces
- AS 1646 - Elastomeric seals for waterworks purposes
- AS 1650 - Hot-dipped galvanized coatings on ferrous articles
- AS 1830 - Iron castings - Grey cast iron
- AS 1831 - Iron castings - Spheroidal or nodular graphite cast iron
- AS 1939 - Degrees of protection provided by enclosures for electrical equipment
- AS 2032 - Code of practice for installation of PVC pipe systems
- AS 2129 - Flanges for pipes, valves & fittings
- AS/NZS 2280 - Ductile iron pressure pipes and fittings
- AS/NZS 2544 - Grey iron pressure fittings.
- AS 2638 - Sluice valves for waterworks purposes
- AS 2831 - STAINLESS STEEL BOLTS??
- AS 2977 - Unplasticised PVC –U pipes for pressure applications - Compatible with cast iron pipe outside diameters
- AS 3500.1 - National plumbing and drainage code
- AS 3578 - Cast iron non-return valves for general purposes
- AS 3680 - Polyethylene sleeving for ductile iron pipelines
- AS 3681 - Guidelines for the application of polyethylene sleeving for ductile iron pipes & fittings
- AS 3688 - Water supply - Copper and copper alloy body compression and capillary fittings and threaded-end connectors.
- AS 3862 - External fusion bonded epoxy coatings for steel pipes
- AS 3952 - Water supply - DN80 spring hydrant valve for general

	purposes.
AS 4020	- Products for use in contact with drinking water
AS 4087	- Flanges for pipes, valves and fittings
AS 4129	- Fittings for polyethylene pipes for pressure
AS /NZS4130	- Polyethylene pipes for pressure applications
AS 4131	- Polyethylene compounds for pressure pipes & fittings
AS 4158	- Thermal bonded polymeric coatings on valves & fittings for water industry purposes.
AS 4321	- Fusion bonded medium-density polyethylene coating and lining for pipes & fittings
AS 4441	- Oriented (PVC – O) Pipes and fittings for pressure applications
AS 4592	- NRV??
AS 4765	- Modified (PVC – M) Pipes and fittings for pressure applications

**(c) Other**

PWD-B	General Requirements for Water Supply, Section B
AWSSA	Australian Water Supply and Sewerage Authorities Specification of Technical Requirement
WS-SPEC	- Technical Requirements (TRs) and Strategic products Specifications (WSAA)
WSA 03 1999	- Water Reticulation Code of Australia WSA 03 1999

Building Code of Australia - PART E1, Fire Fighting Equipment

## MATERIALS

### C401.03 PVC PIPES – REFER TO ASD 402

- |  |                     |
|--|---------------------|
| 1. Unplasticised PVC (PVC-U) pipe, minimum class 12, shall be manufactured in accordance with AS/NZS 4020, AS/NZS 1477 Series 2. Modified PVC (PVC-M) pipes and fittings shall be manufactured in accordance with AS/NZS 4020, AS/NZS 4765. Orientated PVC (PVC-O) pipes and fittings shall be manufactured in accordance with AS/NZS 4020, AS/NZS 4441 All PVC pipes shall be blue in colour and with rubber ring (elastomeric) spigot and socket joints. | <b>Standard</b>     |
| 2. Rubber rings shall comply with AS 1646.   | <b>Rubber Rings</b> |
| 3. Minimum Class 12 pipe (Class 16 in the Transit Hill Reservoir Zone) shall be used unless pipe of a higher Class is specified on the drawings.   | <b>Pipe Class</b>   |
| 3. PVC pipes shall be pre-curved to suit the radius of any cul-de-sac road pavement in which they are to be installed. An alternative cul-de-sac arrangement with ductile iron fittings may be used as shown on <b>ASD 410</b> . Field bending of pipes will not be permitted.   | <b>Pre-curved</b>   |
| 4. Ductile iron fittings only are to be used with PVC pipe and shall be elastomeric seal jointed.  | <b>Fittings</b>     |

### C401.04 DUCTILE IRON PIPES AND FITTINGS – REFER TO ASD 401

- |   |                 |
|---|-----------------|
| 1. Ductile iron (DI) pipes shall be manufactured and cement mortar lined in accordance with AS/NZS 2280 and AS 1281. Minimum PN 35 or Class K9 for rubber ring (elastomeric) joints. Where pipes are to be flanged, Class K12 shall be specified. | <b>Standard</b> |
| 2. Fittings shall be ductile iron in accordance with AS 2280 and coated internally and externally with an approved thermal-bonded coating to AS 4158.   | <b>Fittings</b> |

- |    |   |                             |
|----|---|-----------------------------|
| 3. | Generally, pipe and fitting joints shall be specified to be spigot and socket type ductile iron to AS 2280 using a rubber ring (elastomeric) push in seal made of natural rubber, ethylene propylene rubber or nitrile rubber with compounds complying with AS 1646. The seal shall be a single jointing component shaped to provide both groove lock and seal mechanisms.  | <b>Joints</b>               |
| 4. | Flanges shall comply with AS 4087 Table D. Bolts and nuts for flanged joints shall be in accordance with AS 2129 and be 316 stainless steel.  | <b>Flanges</b>              |
| 5. | Fittings shall be coated internally and externally with an approved thermal-bonded coating to AS 4158. Pipes shall be either cement mortar lined in accordance with AS 1281, or coated internally with an approved thermal-bonded coating to AS 4158. Externally pipes are to be wrapped with polyethylene sleeving over a bitumen coating protection, unless an approved thermal-bonded coating to AS 4158 is specified. | <b>Corrosion Protection</b> |

#### **C401.05 COPPER PIPE**

- |    |   |                 |
|----|---|-----------------|
| 1. | Copper tube shall be manufactured in accordance with AS 1432 Type A & B.  | <b>Standard</b> |
| 2. | Capillary fittings shall comply with AS 3688 and de-zincification resistant. Capillary fittings shall have silver brazed joints. Soft solder joints and compression fittings are not permitted. | <b>Fittings</b> |

#### **C401.06 POLYETHYLENE PIPE**

- |    |   |                 |
|----|---|-----------------|
| 1. | Polyethylene pipe will no longer be permitted for use in water services or for water mains around cul-de-sacs, unless specifically approved by the Water Manager. The use as an encasement shield is still acceptable as its use as water main where installation by boring is essential. |                 |
| 2. | Polyethylene pipe shall be manufactured in accordance with AS 4130 type PE 80B material, pressure class PN 16 and blue stripe black pipe.   | <b>Standard</b> |
| 3. | Where permitted to be used, polyethylene pipe fittings up to DN63 shall be blue or black coloured compression or electrofusion fittings and comply with AS 4129   | <b>Fittings</b> |
| 4. | Larger sizes of polyethylene pipes may be used for encasements in accordance with <b>ASD 420</b>  |                 |
| 5. | Fittings from DN75 to 315 mm shall be ductile iron in accordance with AS 2280 and coated internally and externally with an approved thermal-bonded coating to AS 4158   |                 |

#### **C401.07 STOP VALVES**

- |    |   |                             |
|----|---|-----------------------------|
| 1. | Stop valves shall be resilient seated and manufactured in accordance with AS 2638.                          | <b>Standard</b>             |
| 2. | Flanges shall comply with AS 4087 Class 16.   | <b>Flanges</b>              |
| 3. | Stop valves shall be closed by rotating the spindle in a clockwise direction.                               | <b>Spindle Rotation</b>     |
| 4. | Valves shall be operated by a removable key.  | <b>Operation</b>            |
| 5. | Stop valves shall be protected internally and externally with an approved thermal-bonded coating to AS 4158 | <b>Corrosion Protection</b> |

**C401.08 NON-RETURN VALVES**

1. Non-return valves shall be full-bodied swing flap type manufactured in accordance with AS 4592 **Standard**
2. Flanges shall comply with AS 4087 Class 16. **Flanges**
3. Non-return valves shall be protected internally and externally with an approved thermal-bonded coating to AS 4158 **Corrosion Protection**

**C401.09 SPRING HYDRANTS**

1. Spring hydrant bodies shall be manufactured in accordance with AS 3952. **Standard**
2. Spring hydrants shall be protected internally and externally with an approved thermal-bonded coating to AS 4158 **Corrosion Protection**
3. 316 stainless steel bolts to AS 2837 are to be used.

**C401.10 PRESSURE REDUCING VALVES**

1. Pressure reducing valves shall be as specified on the drawings. **Type**
2. Pressure reducing valves shall be installed in accordance with the manufacturer's written instructions. **Installation**

**C401.11 STEELWORK**

1. Structural steelwork, ladders, brackets, covers etc shall be 316 stainless steel. **Corrosion Protection**

**PIPELINE CONSTRUCTION****C401.12 LOCATION**

1. The location of the mains sizes of mains, types of chambers and covers and the classes of pipes are shown on the Drawings.

**C401.13 COVER OVER PIPELINES**

1. The standard minimum depth of cover to be provided for mains shall be as follows (preferred minimum depth is 600 to 750mm): **Minimum Cover**

LOCATION OF PIPE	PVC	DI
a) In footpath areas	450mm	450mm
b) In sealed roadway	NA	600mm
c) In unsealed roadway	NA	600mm
d) Cross country & elsewhere	750mm	750mm

2. Lesser covers may be permitted where special protection of the pipelines has been **Special**

specified or directed by the Water Manager.

**Protection**

3. Refer to standard drawing **ASD 405** for special conditions in regard to water main cover adjacent to road pavements. The use of bends to change vertical alignment is not acceptable.

#### **C401.14 CROSSINGS**

1. 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. The Developer shall obtain approval from the Authority concerned for the work, but it shall be the Contractor's responsibility to complete written notification to the Authority of the intention to carry out the work. Reference is to be made to Standard drawings **ASD 420, ASD 421, ASD 422 and ASD 423**

**Contractor's  
Responsibility  
and  
ASD  
references**

2. Acute angle water main crossings refers to any utility crossing over or under a water main with an intersection angle less than 45°. The acute angle crossing should not be an issue if all of the footway service allocations are complied with. The footway service allocations are shown in Standard Drawing **ASD 105**.

**Acute angle  
water main  
crossings**

3. Acute angle crossings will not be permitted

- Under road pavements.
- Where the water main is deeper than a stormwater pipe or other utility service.

**Acute angle  
crossings not  
permitted**

4. Alternatives to acute angle crossings for stormwater pipes

- Stormwater pipes can be laid on curves to follow the kerb radius with a lower radius limit in accordance with manufacturers recommendations.
- Manufacturers are able to supply stormwater pipes with additional collar length, specifically designed for curved pipelines. These have an even lower radius limit than standard stormwater pipes.
- Provide additional turning junction or kerb inlet pits.

**Alternatives to  
acute angle  
crossings**

5. Where acute angle crossings of stormwater pipes are permitted.

- Stormwater trench sand embedment material is to be carried up to 150mm over the top of the water main.
- All trench filling (sand embedment material) below the water main is to be compacted to road trench standards.
- The minimum vertical clearance between the water main and the stormwater pipe is not to be less than 150mm wherever the water main is within one stormwater pipe diameter of the stormwater pipe edge.

**Where acute  
angle  
crossings are  
permitted**

#### **C401.15 EARTHWORKS**

1. All excavations for structures and pipelines shall be to the lines, grades and forms shown on the Drawings or as directed by the Superintendent within the specified tolerances.

2. The Contractor shall leave a clear space of 600mm minimum between the edge of any excavation and the inner toe of spoil banks. No excavated materials shall be stacked 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.

**Excavated  
Material**

3. At completion of work each day, the pipeline is to be temporarily plugged with a watertight seal and safety fencing shall be installed along edges of open excavations to isolate them from the public. Where necessary, fenced walkways and vehicular crossways shall be provided across trenches to maintain access from carriageway to individual properties or within individual properties. All such installations shall be of adequate size and strength and satisfactorily illuminated.

**Public Safety**

4. In the event of any trenching being left open for longer than one day, the Developer shall provide erosion control measures to ensure minimal soil disturbance and material loss off the site. Some or all of these measures shall be provided immediately upon the onset of rain with an open trench.

**Erosion Control**

Control measures shall include:

- (a) Provision of trench stops every 30 metres along a trench with provision for overtopping to be directed to the kerb.
- (b) Placement of blue metal bags along kerb and gutter at maximum 30 metre spacings.
- (c) Placement of blue metal bags around downstream drainage pits.
- (d) Construction of diversion banks to divert the uphill catchment water from entering the trench.

**C401.16 MINIMUM TRENCH WIDTH FOR PIPELINES – REFER TO ASD 430**

1. The minimum clear width of trench (inside internal faces of timbering or sheet piling, if used) to a height of 150mm above the top of the pipe shall be as shown in Table C401.1.

NOMINAL SIZE OF PIPE (DN)	MINIMUM CLEAR WIDTH OF TRENCH (mm) (Inside timbering or sheet piling, if any)	
	PIPE OTHER THAN PVC	PVC PIPE
100	300	300
150	350	350
200	500	450
250	550	500
300	600	550
375	675	
400	700	
450	750	
500	850	
600	950	

**TABLE C401.1**

2. Where a trench is excavated across a paved surface, the width of the trench shall be kept to a minimum. Bitumen and concrete surfaces shall be carefully cut 150mm wider than the trench by sawcutting, or other approved means, so as to provide a neat straight line free from broken ragged edges.

**Minimum Disturbances**

**C401.17 EXCAVATION DEPTH– REFER TO ASD 430**

1. Unless directed otherwise by the Water Manager, excavation for ductile iron pipes to be laid in other than impermeable material shall be carried out such as to ensure solid

**Ductile Iron Pipes in**



and uniform support for each pipe over the whole length of barrel. Chases shall be excavated beneath joints to enable jointing and inspection of the joints to be carried out and to ensure that each pipe is supported on the barrel and not on the joint.

***Permeable Material***

2. For pipes to be laid in impermeable material, such as rock or clay, excavation shall be carried out to a depth of not less than 100mm for rock (and 75mm for clay) below the underside of the pipe barrel and socket or coupling.

***Impermeable Material***

3. Preferred maximum depth of cover is 900mm and maximum depth to invert is 1,400mm

***Maximum Depth***

**C401.18 SUPPORT OF EXCAVATION**

1. 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.

***Precautions Against Slips or Falls***

2. The Council may order timber shoring to be left in place where in Council's opinion its removal may endanger structures in the vicinity of the excavation.

***Timber Left in Place***

**C401.19 PIPE BEDDING – REFER TO ASD 430**

1. When excavation of trench has been completed the Contractor shall obtain the Superintendent's approval prior to commencing pipe bedding.

***Approval***

2. The pipe bedding is to be placed in the trench and compacted prior to the laying of pipes.

3. The material to be used within the embedment zone (bedding, side support and overlay) shall be free draining sand. A non-cohesive granular material with a grading falling within the limits shown in Table C401.2 and a Plasticity Index less than 6. The bedding shall have a thickness of at least 75mm below the underside of the barrel and socket of the pipe (minimum 100mm depth of bedding is required for trenches excavated in rock). The overlay shall have a minimum depth of 150mm above the top of the pipe. The Contractor shall ensure solid and uniform support for the whole length of the barrel with chases provided for joints.

***Material Quality within the embedment zone / foundation***

Sieve Size mm	Weight passing %
9.5	100
4.75	90 - 100
2.36	50 - 100
0.6	10 - 90
0.3	5 - 60
0.1	0-25
0.075	0 -5

**Table C401.2 Bedding Material Grading Limits**

4. For pipes laid in impermeable material, such as rock and clay, the material used for pipe embedment (bedding to a minimum thickness of 100mm below the underside of the barrel and socket of the pipe, side support and overlay to a depth of 300mm over the top of the pipe) shall be graded aggregate, either crushed rock or gravel, with no sharp corners or edges and its grading shall fall within the limits shown in Table C401.3:

***Impermeable material***

<b>Sieve Size Aperture Width (AS 1152)</b>	<b>Percentage Passing</b>
19.0 mm	100
16.0 mm	50 - 80
13.2 mm	30 - 65
8.0 mm	15 - 50
4.75 mm	0 - 10

**Table C401.3**

5. All material within the embedment zone shall be compacted to a Density Index of 70 (AS 1289.5.4.1 standard compaction) in footpath areas and 80 under road pavements.

**Bedding  
Compaction**

6. The pipe side support backfilling is to be in place and compacted before the overlay is placed (to avoid ovality in the pipe).

**C401.20 LAYING AND JOINTING OF PIPES**

1. Before being laid, all pipes, fittings, valves, etc shall be cleaned and examined by the Contractor and, if required by the Superintendent, the Contractor shall suspend each one in a sling to enable the Superintendent to inspect it. Damaged pipes are to be set aside and not used. If directed by the Superintendent, the Contractor shall oil valves and repack valve glands.

**Examination**

2. The contractor shall ensure that no foreign matter is left in the pipe, and approved plugs shall be used to prevent foreign matter entering sections of pipeline, which are left uncompleted overnight.

**Cleaning**

3. The Contractor shall take all necessary precautions to prevent flotation of pipes during laying, backfilling and initial testing. Any temporary supports shall be removed prior to completion of backfilling.

**Flotation**

4. Joints in pipelines shall be flexible rubber ring joints or mechanical joints (either fixed flange or bolted gland type). The joint type shall be as shown on the Drawings.

**Joint Type**

5. For pipes with rubber ring joints, spigots and sockets shall be clean and dry. Only the lubricant specified in writing by the manufacturer shall be applied in making the joint. When the joint is made, the witness mark shall at no point be more than 1mm from the end of the socket. After making the joint, a feeler gauge shall be used to check that the rubber ring has rolled in evenly, and if not, the pipe shall be withdrawn and the joint remade.

**Rubber Ring**

6. 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 joining to a socketed fitting.

**Cut Pipes**

7. For field cuts, only an approved mechanical pipe cutter shall be used, except that PVC pipes may be cut using a power saw or a fine toothed handsaw and mitre box. Ductile iron pipes may be cut using a power driven abrasive wheel cutter.

**Pipe Cutting**

8. Any pipes cut in the field shall have their ends prepared in accordance with the manufacturer's written instructions, or as directed by the Superintendent.

**End  
Preparation**

9. Where pipes are cut in the field, a witness mark shall be made on the pipe at the length specified by the manufacturer from the end of the pipe. Scoring of PVC pipes shall not be permitted. Where spigots and sockets are not made by the same manufacturer, reference shall be made to the socket manufacturer for the correct marking depth.

**Witness Mark**

10. Where PVC pipes are to be joined to ductile iron pipes, the joints shall be made by

**Jointing**

inserting a PVC Spigot into a ductile iron socket. Ductile iron spigots must not be joined to PVC sockets.

***Different Material***

11. Flexibly jointed pipelines with gradual changes in alignment or grade shall be laid with the joint being deflected after it has been made. Maximum Deflections are indicated in Aus-Spec standard drawings **ASD 401** and **ASD 402**. The manufacturer's written recommendations in respect of maximum deflection for each joint shall not be exceeded, provided that no joint shall be deflected to such an extent as to impair its effectiveness.

***Joint Deflection***

12. Bending of pipes will not be permitted. Refer to ASD 410 for details to assist in the use of pre-curved pipes or calculation of straight lengths and fitting requirements.

13. Unless otherwise directed by the Water Manager, pipes shall be laid on continuously rising grades between hydrants or from scour valve to air release valve, notwithstanding any minor irregularities in the ground surface. Minimum cover requirements are to be maintained at all times.

***Grade***

14. Unless otherwise shown on the Drawings, all valves and hydrants shall be installed at a depth such that the top of the hydrant lugs is between 100mm and 300mm below the top of the lid and the top of the valve spindle is 150mm to 450mm below the top of the pit lid. Hydrant units shall not be installed, but hydrant tees with hydrant risers (if required) and spring hydrants shall be used. Each valve shall be installed with its axis vertical. Refer to standard drawing **ASD 440** and **ASD 441**

***Hydrants and Stop Valves***

15. All pipelines are to be laid with a continuous metal detectable tape, or a 200mm wide plastic tape incorporating a stainless steel or copper wire, placed in a position suitable for pipe location by radiolocation equipment. The tape is to be placed on the bedding material prior to backfilling and not directly on the pipeline

***Metal Detectable Tape***

#### **C401.21 TRENCH STOPS**

1. Where a main is laid on bedding at a grade of 10 percent or steeper, trench stops are to be provided in accordance with standard drawing **ASD 431**. These will consist of polyethylene bags of minimum thickness 0.25mm filled with sand or other approved material and sealed in an approved manner. Hessian bags filled with cement-stabilised sand may be used as an alternative. Trench stops shall be constructed as follows:

***Grade 10% or Steeper***

(a) At the socket side of the joint nearest to the position of a stop required in accordance with the formula hereinafter, a recess 100mm deep to suit the width of bag shall be excavated into the bottom of the trench across its full width and into both sidewalls to a level of 300mm above the top of the pipe.

(b) The polyethylene bags shall be placed around and to 300mm above the pipe so as to give close contact with the pipe and to fill the entire space between the excavated recess and the pipe. Bags shall not be placed onto sand bedding.

2. The distance between trench stops shall be determined by the following formula:

***Spacing***

$$D = \frac{100}{G}, \text{ whereby}$$

D = Distance between stops in m,  
G = Grade of pipe expressed in percent.

3. Note that trench stops may be required by the Water Supply Manager for grades less than 10% in some circumstances or soil types

**C401.22 CONCRETE BULKHEADS**

1. Where a main is installed at a grade of 15% or greater, concrete bulkheads are to be provided in accordance with standard drawing **ASD 431** and constructed of Grade 20 concrete complying with the Specification for MINOR CONCRETE WORKS, 150mm minimum thickness shall be constructed as follows:

**Grade 15% or Steeper**

(a) Where concrete bedding or encasement to pipe is required, the 150mm thick bulkhead shall be cast integral with the concrete bedding or encasement across the width of trench and shall be keyed into both sidewalls a minimum of 150mm in other than rock and 75mm in rock. The bulkhead shall extend to within 150mm of the surface level or such lower level as directed by the Water Manager.

(b) Where other bedding, or no bedding, is applicable, the bulkhead shall also be keyed into the bottom of the trench 150mm in other than rock and 75mm in rock for the full width of trench.

(c) Two 75mm nominal diameter drain holes shall be provided in the concrete bulkhead immediately above the top of the encasement bedding or foundation and crushed rock or gravel shall be placed in and at the upstream end of the drain hole to act as a filter. The gravel shall be 10 to 20mm in size within 150mm in all directions upstream and above the invert of the drain hole beyond which another 150mm thick surround of gravel 2 to 10mm in size shall be placed.

2. The distance between concrete bulkheads shall be determined in accordance with the table in standard drawing **ASD 431**.

**Spacing**

**C401.23 CORROSION PROTECTION OF STEEL BOLTS AND NUTS**

1. 316 Stainless steel bolts complying with AS 2837 are to be used wherever possible.

**Stainless Steel**

2. All galvanised steel bolts and nuts where permitted to be used for installation below ground for flanges, bolted gland joints, Gibault joints, tapping bands, etc, shall be denso wrapped then sealed and taped by the polyethylene sleeving after the nuts have been tightened.

**Galvanized Steel Bolts**

**C401.24 VALVE and HYDRANT CHAMBERS - REFER TO ASD 440 and ASD 441**

1. The Contractor shall construct around each valve and hydrant a chamber of the type and to the details shown on the Drawings.

**Type**

2. Each chamber in a roadway shall be covered by a concrete surround and cast iron lid as shown in standard drawing **ASD 440 and ASD 441**. The surround shall be coloured yellow for Hydrants and white for stop valves.

**Surround**

3. The top of each cover shall finish flush with the surface in roadways and paved surfaces

**Finish**

4. In areas other than roadways, hydrant and valve pits and covers are to be as shown in standard drawing **ASD 440 and ASD 441** or an equivalent approved by the Water Manager.

**C401.25 Reserved****C401.26 SERVICE CONNECTIONS – REFER TO ASD 450, ASD 451 and ASD 452**

1. The Contractor shall provide service connections, to suit the requirements of the individual premises, as indicated on the Drawings or as directed by the Water Manager. **Requirements**
2. The whole of the plumbing pipework including placement of tapping bands, main cocks and path boxes as required shall be carried out by a trained and competent person in accordance with Aus-Spec specifications and standard drawings and the New South Wales Plumbing Code of Practice and AS 3500.1. **Code**
3. Except where otherwise approved or directed by the Water Manager, service connections under paved carriageways and footpaths and under private concrete driveways shall be installed without disturbing the pavement other than as a result of excavating access pits and trenches if such are necessary. The pipes may be placed under the pavement either by boring and jacking or by inserting the pipes through bored holes. In either case, the equipment used shall be acceptable to the Water Manager. **Pavement**
4. Approved, tapping saddles are to be used for all service connections with a minimum spacing between tappings and from a spigot end of a pipe in accordance with standard drawings **ASD 401** and **ASD 402**. Tapping saddles are to use 316 stainless steel bolts & nuts. **Tapping**
5. A single water service is to be provided for each separate lot from the water main during construction. The water service is generally to be at 90-degrees to the road centreline. For multiple dwelling sites where separate meters are required and single water service connections could become unwieldy, the Water Manager may permit the use of a single larger service with a manifold at the metering site. Single larger services may also be considered where retrofitting of services is required with subsequent water main construction work. **Single Water Services**

**C401.27 THRUST AND ANCHOR BLOCKS – REFER TO ASD 432**

1. Thrust and anchor blocks shall be constructed at valves, flexibly jointed bends, tees, enlargers and reducers or any other point where unbalanced forces resulting from internal pressures will occur. **Location**
2. The Contractor shall provide permanent thrust blocks of N20 concrete complying with the Specification for MINOR CONCRETE WORKS such that the thrust blocks bear against undisturbed material normal to the direction of thrust resulting from internal pressures over a bearing area not less than that calculated from standard drawing **ASD 432** or as directed by the Water Manager. **Thrust Blocks**
3. The Contractor shall provide permanent anchor blocks of N20 concrete complying with the Specification for MINOR CONCRETE WORKS of a volume sufficient to prevent movement of the pipeline when a pressure load is applied **Anchor Blocks**

**C401.28 Reserved****PIPELINE TESTING AND RESTORATION****C401.29 TESTING OF PIPELINES**

1. Mains shall be pressure tested to detect excessive leakage and defects in the pipeline including joints, thrust and anchor blocks.

2. Pipelines shall be tested in sections approved by the Superintendent as soon as practicable after each section has been laid, jointed and backfilled, provided that:
- Timing**
- (a) If so specified or if the Contractor so desires, some or all of the pipe joints shall be left uncovered until the whole of the section has been successfully pressure tested to the satisfaction of the Superintendent; and
- (b) The pressure testing shall not be commenced earlier than seven days after the last concrete thrust or anchor block in the section has been cast.
3. For the purpose of this sub-clause, a section shall be defined as a length of pipeline which can be effectively isolated for testing, eg by means of main stop valves.
- Section Definition**
4. Pressure testing shall not be carried out during wet weather unless otherwise approved by the Water Manager.
- Wet Weather**
5. During pressure testing, all field joints, which have not been backfilled, shall be clean, dry and accessible for inspection.
- Field Joints**
6. During the pressure testing of a pipeline, each stop valve shall sustain at least once, the full test pressure on one side of the valve in closed position with no pressure on the other side for at least 15 minutes.
- Stop Valves**
7. Before testing a pipeline section, it shall be cleaned to the satisfaction of the Superintendent and filled slowly with water, taking care that all air is expelled. Purging of air from rising mains shall be promoted by opening air valves. In order to achieve conditions as stable as possible for testing by allowing for absorption, movement of the pipeline and escape of entrapped air, the section shall be kept full of water for a period of not less than 24 hours prior to the commencement of the pressure testing.
- Filling with Water**
8. The hydrostatic test pressure which shall be applied to each section of the pipeline shall be such that at each point of the section the test head shall be equal to or greater than the design head specified or shown on the Drawings, but shall not exceed same by more than 20 per cent.
- Test Pressure**
9. The specified test pressure shall be equal to the class of pipe (1,200 kPa for Class 12) and maintained as long as required by the Superintendent, while the whole section is examined, and in any case not less than 1 hour. For the purpose of determining the actual leakage losses, the quantity of water added in order to maintain the pressure during the period of testing shall be carefully measured and recorded.
- Duration of Test**
10. The pressure testing of a section shall be considered to be satisfactory if:
- (a) There is no failure of any thrust block, anchor block, pipe, fitting, valve, joint or any other pipeline component;
- (b) There is no visible leakage; and
- (c) There is no measurable leakage.
11. Any failure, defect, visible leakage and/or excessive leakage rate, which is detected during the pressure testing of the pipeline or during the Defects Liability Period, including any failure of thrust blocks or anchor blocks constructed to a Contractor's design, notwithstanding any approval that may have been given to such design, shall be made good by the Contractor at his own expense.
- Rectification**

12. As an alternative to water testing the Water Manager may allow compressed air testing as a method of acceptance testing. **Compressed Air**
13. The method of testing shall be submitted to the Water Manager for approval 14 days prior to testing **Approval**
14. Notwithstanding that acceptance testing, by any method may produce satisfactory results, the Superintendent may reject any pipeline in which there is visible or detectable leakage. **Acceptance**

#### **C401.30 CONNECTION TO EXISTING**

1. Connections to existing pipes carrying water shall be made at such times as will cause the least interference with the supply. The Contractor shall make arrangements with Port Macquarie-Hastings Council for isolation of the existing mains where required to permit interconnection. The Council shall be given seven (7) working days notice of such arrangements. **Time of Least Interference**
2. Immediately following connection to the existing mains and successful pressure testing, the mains shall be flushed and disinfected in accordance with Department of Commerce and Services standard procedures. The Contractor shall notify Council of the intention to disinfect mains and pay any necessary fees. **Disinfection**
3. Should either pressure testing or disinfection be unsuccessful, the new mains shall be isolated from the existing mains prior to repeating these operations. The additional costs are to be borne by the contractor. **Isolation**

#### **C401.31 BACKFILL AND COMPACTION – REFER TO ASD 430**

1. When laying and jointing of a pipeline has been completed and before backfilling is commenced, the Contractor shall notify the Superintendent. **Notification**
2. Backfill shall not be placed until the Superintendent has given approval. **Approval**
3. Material for the embedment zone (bedding, side support and overlay of the pipe) shall be as specified in Clause C401.19. The material shall be compacted in layers of not more than 150mm and shall be compacted to a Density Index of 70 (AS 1289.5.4.1 standard compaction) in footpath areas and 80 under road pavements. **Side Support and Overlay**
- Compaction**
4. Materials used for backfilling shall be placed generally as follows, unless directed otherwise by the Water Manager.

(a) In Roadways

(i) For pipes located under roadways or kerbs, the remainder of the trench (between the overlay and the capping layer) shall be backfilled with a non-cohesive granular material with a grading falling within the limits shown in Table C401.2 and a Plasticity Index less than 6 in accordance with standard drawing **ASD 430**

(ii) The material shall be compacted in layers of not more than 150mm and shall be compacted to a Density Index of 80 (AS 1289.5.4.1 standard compaction)

(iii) The final 300mm (minimum) of fill below the underside of Sub base shall be backfilled with DGB 20 material satisfying the requirements of Sub base material as per Specification C242 - Flexible Pavements, and shall have a minimum relative compaction of

100 per cent AS 1289.5.4.1 standard compaction

(b) Trafficable Footpath Areas

i) For pipes located under footpath areas, the remainder of the trench (between the overlay and the surface treatment layer shall be backfilled with an inorganic fill material with maximum stone size of 75mm in accordance with standard drawing **ASD 430**

(ii) The material shall be compacted in layers of not more than 150mm and shall be compacted to a Density Index of 70 (AS 1289.5.4.1 standard compaction

(iii) The finishing is to match the existing surface or be finished with a minimum of 150mm of topsoil if the surface is to be grassed.

(c) Elsewhere

Unless stated otherwise, the remainder of the trench (above the overlay) shall be backfilled with ordinary excavated inorganic fill material. Where suitable material is not available, the Superintendent may direct the use of an approved granular material for the full depth of backfilling. The material shall be compacted in layers of not more than 150mm and shall be compacted to a Density Index of 70 (AS 1289.5.4.1 standard compaction) for cohesionless materials and .95 per cent of the standard maximum dry density of the material used when determined in accordance with AS 1289.5.7.1 for cohesive materials

5. Backfilling and compaction shall be carried out without damaging the pipe or its external coating or wrapping or producing any movement of the pipe.

**Care**

**C401.32 MARKING PLATES – REFER TO ASD 460, ASD 461 and ASD 462**

1. In rural or undeveloped areas, each stop valve, scour valve, air valve, hydrant and bend shall be identified by fixing an approved marking plate to an approved post directly opposite the fixture/pipe. The fixture, pipe type, size, depth and off-set are to be shown on the marking plate

**Information**

2. In urban areas, unless otherwise specified in the drawings or directed by the Superintendent, in lieu of marking plates the kerb adjacent to each valve and hydrant is to be painted with two (2) coats of an approved nonslip paint (white for valves, yellow for hydrants and red for closed valves).

**Location**

3. Marker posts shall conform to the following requirements as illustrated on **ASD 461**:

**Post**

(a) The post shall be a galvanised spike with a blue triangular prism attached at the top. The marking plate shall be fixed to the top of this. The post shall be 1,900mm long.

(b) When installed, the post shall project 1,300mm above the ground.

4. The post shall be spiked to a depth of 600mm in ground and be offset at least one metre from the water main.

**Installation**

5. Marking plates shall be fixed, and kerbs painted, as soon as practicable after each valve, hydrant or pipe bend is installed. However, marking plates for hydrants shall be temporarily covered using masking tape or other approved cover, which shall be removed by the Contractor on satisfactory completion of the pressure testing of the pipeline.

**Fixed After Installation**

6. Retroflective Raised Pavement Markers (RRPM) are to be installed in accordance with **ASD 462**.

**RRPM**



**C401.33 RESTORATION OF SURFACES**

1. Pavements, lawns and other improved areas shall be cleaned and left in the same order as they were at the commencement of the works. Lawns shall be restored with turf cut and set aside from the original surface or with turf imported from a source approved by the Superintendent. **Original Condition**
2. 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. Pavements shall be maintained with crushed metal, gravel or other suitable material allowing for consolidation and shall then be restored to a condition equivalent to that of the original pavement. **Maintenance**
3. Immediately the backfilling of a trench excavated through a pavement has been completed, the pavement shall be temporarily restored. Where the trench crosses bitumen or concrete pavement, a pre-mixed asphaltic material shall be used for such temporary restoration. Temporary restoration shall be maintained by the Contractor until final restoration is carried out. Final restoration of the pavement shall be carried out to restore the pavement and its sub-base to no less than the original condition. Final restoration may include, if required by the Superintendent, the removal of temporary restoration. **Temporary Pavement Restoration**
4. Backfill shall be placed sufficiently high to compensate for expected settlement and further backfilling shall be carried out or the original backfill trimmed at the end of the Defects Liability Period in order that the surface of the completed trench may then conform with the adjacent surface. Surplus material shall be removed and disposed of to areas arranged by the Contractor. **Backfill**
5. 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. The Contractor shall maintain the backfill and adjacent ground until the expiry of the Defects Liability Period. **Disposal of Surplus Material**
6. Where, within public or private property, the reasonable convenience of persons will require such, the Superintendent may order trenches to be levelled off at the time of backfilling. Any subsequent settlement shall be made good by the Contractor, as required by placing additional fill. **Settlement**
7. 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. **Tunnelling**

**PUMPING STATIONS****C401.34 PUMPS**

The specification for construction of Pumping Stations has been deleted from this set of specifications **Deleted**

## MEASUREMENT AND PAYMENT

### C401.45 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed in this Specification in accordance with Pay Items C401(a) to C401(k) inclusive.
2. 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.
3. Concrete for valve chambers, bulkheads, thrust and anchor blocks, concrete encasement and pumping stations is measured and paid in accordance with this Specification and not the Specification for MINOR CONCRETE WORKS.
4. 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.

#### Pay Item C401(a) EXCAVATION FOR WATER RETICULATION

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.
  - Backfilling, other than selected backfill, of pipes
  - Restoration of surface
  - Replacement for over-excavation for any reason
  - Control of stormwater runoff, temporary drainage and erosion and sedimentation control.
4. The volumes of excavation for payment shall be computed as follows:
  - Trench Width: Minimum width in Table C401.1 + 200mm.
  - Trench Depth: Average actual depth to underside of specified bedding.
  - Trench Length: Actual excavation length.

#### Pay Item C401(b) SUPPLY AND LAY PIPE AND FITTINGS

1. The unit of measurement shall be the linear metre measured along the centreline of each particular type of pipe installed.
2. The schedule rate shall include:
  - Supply of pipe and fittings
  - Wrapping pipeline
  - Survey and setting out
  - Bedding
  - Bulkheads
  - Thrust and anchor blocks

- Jointing (including connections)
- Temporary bracing and strutting of excavation
- Selected backfilling
- Quality testing
- Detectable tape
- Trenchstops
- Concrete bulkheads
- Fittings

**Pay Item C401(c)      SUPPLY AND INSTALL VALVES**

1. The unit of measurement shall be per "each" stop, air or scour valve and associated chamber or box installed.
2. The schedule of rate for supply and install valves shall include for setting out, excavation, formwork, supply and placing concrete, supply and installation of valves, supply and installation of covers and frames, supply and installation of marker plates, backfilling and disposal of spoil off site. It shall also include for temporary stockpiling prior to backfilling, control of stormwater run off and erosion and sedimentation control.
3. A separate unit rate shall be included in the Schedule of Rates for each type and size of valve.

**Pay Item C401(d)      SUPPLY AND INSTALL HYDRANTS**

1. The unit of measurement shall be per "each" hydrant and associated box installed.
2. The schedule of rate for supply and install hydrants shall include for setting out, excavation, formwork, supply and placing concrete, supply and installation of hydrants, supply and installation of covers and frames, supply and installation of marker plates, backfilling and disposal of spoil off site. It shall also include for temporary stockpiling prior to backfilling, control of stormwater run off and erosion and sedimentation control.
3. A separate unit rate shall be included in the Schedule of Rates for each type and size of hydrant.

**Pay Item C401(e)      CONNECTION TO EXISTING**

1. The unit of measurement shall be per "each" connection to existing pipe.
2. The schedule rate for connection to existing shall include for all the necessary works to arrange and liaise with the appropriate Authority, cut into or otherwise modify and finish the system as shown on the Drawings.

**Pay Item C401(f)      TRENCH TIMBERING LEFT IN PLACE**

1. The unit of measurement shall be the cubic metre of timber directed to be left in place by the Superintendent.
2. No extra payment shall be made where the timber used exceeds the size of timber required as determined by the Superintendent.
3. The schedule rate shall include the supply of timber only.

**Pay Item C401(g)      Reserved**

**Pay Item C401(l)      SERVICE CONNECTIONS**

1. The unit of measurement shall be the lineal metre measured along the centreline of the service installed.
2. The scheduled rate shall include supply of pipe and fittings, survey and setting out, joining, placing tapping bands, maincocks and path boxes as required backfill and testing.
3. A separate rate shall be included for each type and size of pipe.

## SPECIFICATION C401 - WATER RETICULATION

CLAUSE	CONTENTS	PAGE
<b>GENERAL.....</b>		<b>1</b>
C401.01	SCOPE.....	1
C401.02	REFERENCE DOCUMENTS.....	1
<b>MATERIALS.....</b>		<b>2</b>
C401.03	PVC PIPES – REFER TO ASD 402 .....	2
C401.04	DUCTILE IRON PIPES AND FITTINGS – REFER TO ASD 401 .....	2
C401.05	COPPER PIPE.....	3
C401.06	POLYETHYLENE PIPE.....	3
C401.07	STOP VALVES .....	3
C401.08	NON-RETURN VALVES .....	4
C401.09	SPRING HYDRANTS .....	4
C401.10	PRESSURE REDUCING VALVES.....	4
C401.11	STEELWORK .....	4
<b>PIPELINE CONSTRUCTION.....</b>		<b>4</b>
C401.12	LOCATION.....	4
C401.13	COVER OVER PIPELINES.....	4
C401.14	CROSSINGS .....	5
C401.15	EARTHWORKS .....	5
C401.16	MINIMUM TRENCH WIDTH FOR PIPELINES – REFER TO ASD 430 .....	6
C401.17	EXCAVATION DEPTH– REFER TO ASD 430 .....	6
C401.18	SUPPORT OF EXCAVATION.....	7
C401.19	PIPE BEDDING – REFER TO ASD 430 .....	7
C401.20	LAYING AND JOINTING OF PIPES.....	8
C401.21	TRENCH STOPS.....	9
C401.22	CONCRETE BULKHEADS .....	10
C401.23	CORROSION PROTECTION OF STEEL BOLTS AND NUTS.....	10
C401.24	VALVE and HYDRANT CHAMBERS - REFER TO ASD 440 and ASD 441 .....	10
C401.25	Reserved.....	11
C401.26	SERVICE CONNECTIONS – REFER to ASD 450, ASD 451 and ASD 452 .....	11
C401.27	THRUST AND ANCHOR BLOCKS – REFER TO ASD 432.....	11
C401.28	Reserved.....	11
<b>PIPELINE TESTING AND RESTORATION.....</b>		<b>11</b>
C401.29	TESTING OF PIPELINES .....	11
C401.30	CONNECTION TO EXISTING .....	13
C401.31	BACKFILL AND COMPACTION – REFER TO ASD 430 .....	13

C401.32	MARKING PLATES – REFER TO ASD 460, ASD 461 and ASD 462 .....	14
C401.33	RESTORATION OF SURFACES .....	15
<b>PUMPING STATIONS .....</b>		<b>15</b>
C401.34	PUMPS.....	15
<b>MEASUREMENT AND PAYMENT .....</b>		<b>16</b>
C401.45	PAY ITEMS.....	16