1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide sewerage reticulation as documented.

Precedence
Precedence: The technical requirements of any standard drawing provided by the Water Authority, used in conjunction with and in conflict with this worksection, take precedence.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following worksection(s):
- 0136 General requirements (Construction).
- 0152 Schedule of rates – supply projects.
- 0161 Quality (Construction).
- 0257 Landscape road reserve and street trees.
- 0319 Minor concrete works.
- 1101 Control of traffic.
- 1102 Control of erosion and sedimentation (Construction).
- 1112 Earthworks (Roadways).
- 1152 Road openings and restoration (Utilities).
- 1392 Trenchless conduit installations.
- 1859 CCTV inspection of drainage conduits

1.3 REFERENCED DOCUMENTS

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

Australian standards
AS 1141 Methods for sampling and testing aggregates
AS 1141.22-2008 Wet/dry strength variation
AS 1141.32-2008 Weak particles (including clay lumps, soft and friable particles) in coarse aggregates
AS 1210-2010 Pressure vessels
AS 1214-1983 Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series)
AS/NZS 1260:2009 PVC-U pipes and fittings for drain, waste and vent application
AS 1281-2001 Cement mortar lining of steel pipes and fittings
AS 1289 Methods for testing soils for engineering purposes
AS 1289.4.3.1-1997 Soil chemical tests - Determination of the pH value of a soil - Electrometric method
AS 1289.4.4.1-1997 Soil chemical tests - Determination of the electrical resistivity of a soil - Method for sands and granular materials
AS 1289.5.4.1-2007 Soil compaction and density tests—Compaction control test—Dry density ratio, moisture variation and moisture ratio
AS 1289.5.6.1-1998 Soil compaction and density tests - Compaction control test - Density index method for a cohesionless material
AS 1289.5.7.1-2006 Soil compaction and density tests—Compaction control test—Hilf density ratio and Hilf moisture variation (rapid method)
AS/NZS 1477:2006 PVC pipes and fittings for pressure applications
AS/NZS 1554 Structural steel welding
AS/NZS 1554.1:2011  Welding of steel structures
AS 1579-2001  Arc-welded steel pipes and fittings for water and waste-water
AS 1627  Metal finishing - Preparation and pretreatment of surfaces
AS 1627.4-2005  Abrasive blast cleaning of steel
AS 1646-2007  Elastomeric seals for waterworks purposes
AS 1657-1992  Fixed platforms, walkways, stairways and ladders—Design, construction and installation
AS 1741-1991  Vitrified clay pipes and fittings with flexible joints—Sewer quality
AS/NZS 2032:2006  Installation of PVC pipe systems
AS/NZS 2033:2008  Installation of polyethylene pipe systems
AS 2129-2000  Flanges for pipes, valves and fittings
AS 2187-Various  Explosives - Storage, transport and use
AS/NZS 2280:2012  Ductile iron pipes and fittings
AS/NZS 2566  Buried flexible pipelines
AS/NZS 2566.1:1998  Structural Design
AS/NZS 2566.2:2002  Installation
AS 2638  Sluice valves for water works purposes
AS 2638.1-2011  Metal seated
AS 2638.2-2011  Resilient seated
AS/NZS 2648  Underground marking tapes
AS/NZS 2648.1:1995  Non-detectable tape
AS 2832  Cathodic protection of metals
AS 2832.1-2004  Pipes and cables
AS 2832.2-2003  Compact buried structures
AS/NZS 3500  Plumbing and drainage
AS/NAS 3500.2:2003  Sanitary plumbing and drainage
AS/NZS 3518:2013  Acrylonitrile butadiene styrene (ABS) compounds, pipes and fittings for pressure applications
AS 3571  Plastics piping systems - Glass reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin
AS 3571.1-2009  Pressure and non-pressure drainage and sewerage (ISO 10467:2004, MOD)
AS 3572.2-2002  Determination of chemical resistance of glass filament reinforced plastics
AS 3600-2009  Concrete structures
AS 3681-2008  Application of polyethylene sleeving for ductile iron piping
AS/NZS 3690-2009  Installation of ABS pipe systems
AS 3705-2012  Geotextiles - Identification, marking, and general data
AS 3735-2001  Concrete structures retaining liquids
AS/NZS 3750  Paints for steel structures
AS/NZS 3750.4:1994  Bitumen paint
AS/ZNS 3750.19:2008  Metal primer - General purpose
AS/NZS 3862:2002  External fusion-bonded epoxy coating for steel pipes
AS/NZS 3879:2011  Solvent cements and priming fluids for use with unplasticized PVC (PVC-U and PVC-M), ABS and ASA pipes and fittings
AS 3894  Site testing of protective coatings
AS 3894.1-2002  Non-conductive coatings - Continuity testing - High voltage ('brush') method
AS 3996-2006  Access covers and grates
AS/NZS 4020:2005  Testing of products for use in contact with drinking water
AS/NZS 4058:2007  Precast concrete pipes (pressure and non-pressure)
AS 4060-1992  Loads on buried vitrified clay pipes
AS/NZS 4087:2011  Metallic flanges for waterworks purposes
AS/NZS 4129:2008  Fittings for polyethylene (PE) pipes for pressure applications
AS/NZS 4130:2009  Polyethylene (PE) pipes for pressure applications
AS/NZS 4158:2003  Thermal-bonded polymeric coatings on valves and fittings for water industry purposes
AS 4198-1994  Precast concrete access chambers for sewerage applications
AS 4310-2004  DN80 piston type vacuum interface valves for municipal sewer systems
AS 4321-2001  Fusion-bonded medium density polyethylene coating and lining for pipes and fittings
AS/NZS 4331  Metallic flanges
1.4 STANDARDS

General
Sewerage construction: To WSA 02 Part 2 and Part 3.
Buried flexible pipes design and installation: AS/NZS 2566.1 and AS/NZS 2566.2.
PVC-U installation: To AS/NZS 2032.
PE installation: To AS/NZS 2033.
ABS installation: To AS 3690.

1.5 INTERPRETATION

Abbreviations
General: For the purposes of this worksection the following abbreviations apply:
- ABS: Acrylonitrile butadiene styrene.
- DAV: Double air valve.
- DI: Ductile iron.
Definitions

General: For the purposes of this worksection the definitions given in WSA 02 and the following apply:

- Commissioning: Running of the plant and equipment to make sure there is flow through the pumping system, carrying out any necessary testing and making adjustments until it is ready and suitable for normal starting and running under service conditions.
- Inadequate foundation material: Material beneath or adjacent to the proposed drainage structures which the Superintendent deems to be of insufficient strength to support the structure and loads on the structure, or material whose characteristics the Superintendent deems would adversely affect the performance or construction of the drainage structure.
- Nominal size (DN): Dimensionless whole number, which is indirectly related to the physical size, in mm, of the bore or outside diameter of the end connections.
- Pre-commissioning: Preparation of plant or equipment for commissioning and operation. It includes all aspects of plant operation such as safety, electrical, mechanical and instrumentation.
- Section: A length of pipeline which can be effectively isolated for testing, e.g. by means of main stop valves.
- Selected material zone: The top part of the upper zone of formation in which material of a specified higher quality is required.
- Water Agency: An Authority, board, business, corporation, Council or local government body with the responsibility for planning or defining, design, construction and maintenance requirements for a water supply and/or sewerage systems. This includes Local Water Utilities (LWU).

1.6 SUBMISSIONS

Approvals

Submissions: To the Superintendent’s approval. Submit the following for approval:

- Materials: Off-site certificates of components.
- Calculations: Survey set out of sewerage works and quantity calculations.
- Work-as-executed drawings: Include sewerage system information sheets and works.
- Components: Pipes and fittings.
- Samples: For conformity testing to relevant referenced documents.
- Technical data: Product information.
- Execution details: Refer to HOLD POINTS.
### 1.7 HOLD POINTS AND WITNESS POINTS

**Notice**

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

#### HOLD POINT table

<table>
<thead>
<tr>
<th>Clause title/Item</th>
<th>Requirement</th>
<th>Notice for inspection</th>
<th>Release by</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MATERIALS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Authorised products and materials</td>
<td>Submit for approval alternative products and materials</td>
<td>2 weeks before ordering</td>
<td>Superintendent</td>
</tr>
<tr>
<td><strong>EXECUTION</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Establishment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excavation near underground services – Public utilities within the excavation for sewerage system</td>
<td>Approval from relevant Authority for the method of excavation</td>
<td>1 week</td>
<td>Superintendent</td>
</tr>
<tr>
<td>Excavation near underground services – Marking</td>
<td>Locate and mark existing underground services affected.</td>
<td>3 working days</td>
<td>Superintendent</td>
</tr>
<tr>
<td>Excavation near underground services – Protection of other services</td>
<td>Submit for approval Give notice of any interference to the works caused by an existing service and submit a proposed work method statement</td>
<td>1 week</td>
<td>Superintendent</td>
</tr>
<tr>
<td><strong>Excavation for sewerage systems</strong></td>
<td></td>
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</tr>
<tr>
<td>General – Soil type</td>
<td>Confirm surrounding soil type, give notice if different to design</td>
<td>1 week</td>
<td>Superintendent</td>
</tr>
<tr>
<td>General – Excavation across improved surfaces</td>
<td>Approval from the land owner before excavating across improved surfaces</td>
<td>1 week</td>
<td>Superintendent</td>
</tr>
<tr>
<td>Support of excavation - Trench instability</td>
<td>Submit for approval the proposal to provide adequate permanent stability of the ground affected by trenching</td>
<td>1 week before relevant action</td>
<td>Superintendent</td>
</tr>
<tr>
<td><strong>Bedding for pipes</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Trench floor preparation - Foundation</td>
<td>Where bearing capacity &lt; 50 kPa</td>
<td>3 working days</td>
<td>Superintendent</td>
</tr>
<tr>
<td><strong>Pipe laying, jointing and connecting</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Wrapping of ductile iron pipelines – Damage to sleeving</td>
<td>Rectify any damage to sleeving before backfilling trench</td>
<td>2 working days</td>
<td>Superintendent</td>
</tr>
<tr>
<td><strong>Maintenance holes, shafts and inspection openings</strong></td>
<td></td>
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</tr>
<tr>
<td>Precast concrete MH/MS/IS systems</td>
<td>Submit proposed proprietary items, if not sealed</td>
<td>2 weeks before ordering</td>
<td>Superintendent</td>
</tr>
<tr>
<td><strong>Embedment and backfill</strong></td>
<td></td>
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</tr>
<tr>
<td>Clause title/Item</td>
<td>Requirement</td>
<td>Notice for inspection</td>
<td>Release by</td>
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<tr>
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<td>------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td><strong>Pipe embedment support</strong> – Notification of pipeline laid and jointed.</td>
<td>Present the laid and jointed pipes for approval before the trench backfilling</td>
<td>2 working days</td>
<td>Superintendent</td>
</tr>
<tr>
<td><strong>Embankment fill - Embankment</strong></td>
<td>Submit proposal for construction of embankments</td>
<td>1 week</td>
<td>Superintendent</td>
</tr>
<tr>
<td><strong>Acceptance testing</strong></td>
<td>General - Unsatisfactory test results Rectify any defects even when results are in conformance</td>
<td>1 week</td>
<td>Superintendent</td>
</tr>
<tr>
<td><strong>Connections to existing sewers</strong></td>
<td>General - Notice Submit request to connect to the existing sewer and give notice of works including any affected occupants</td>
<td>2 weeks before connection</td>
<td>Water Agency - Superintendent</td>
</tr>
<tr>
<td><strong>Restoration of surfaces</strong></td>
<td>General – Original condition requirement Restore progressively and as soon as possible after the section of works is completed</td>
<td>2 working days</td>
<td>Superintendent</td>
</tr>
</tbody>
</table>

**WITNESS POINT table**

<table>
<thead>
<tr>
<th>Clause title/Item</th>
<th>Requirement</th>
<th>Notice for inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MATERIALS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>General</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conformance with manufacturer’s recommendations - Requirement</td>
<td>Inspect material and products at time of delivery</td>
<td>2 working days</td>
</tr>
<tr>
<td><strong>Pipes and fittings</strong></td>
<td>General - Certification Provide product or material certification before delivery to the works</td>
<td>3 working days</td>
</tr>
<tr>
<td><strong>Valves, holes/shafts and access covers</strong></td>
<td>Valves - Certification Provide product or material certification before delivery to the works</td>
<td>1 week</td>
</tr>
<tr>
<td><strong>EXECUTION</strong></td>
<td></td>
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<tr>
<td>Establishment</td>
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</tr>
<tr>
<td>General – Set out</td>
<td>Confirm the set out locations immediately before construction</td>
<td>3 working days</td>
</tr>
<tr>
<td>General – Crossings Authority approvals</td>
<td>Approval from relevant Authority and payment of fees</td>
<td>2 weeks</td>
</tr>
<tr>
<td>Temporary drainage during construction- Discharge</td>
<td>Approval from appropriate Authority for any discharge to sewers, stormwater drains or watercourses</td>
<td>2 weeks</td>
</tr>
<tr>
<td>Excavation for sewerage systems</td>
<td>Inadequate foundation material - Notice Give notice of any area of the foundation that may contain</td>
<td>1 week</td>
</tr>
<tr>
<td>Clause title/Item</td>
<td>Requirement</td>
<td>Notice for inspection</td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td><strong>Inadequate foundation material</strong></td>
<td><strong>Inadequate foundation material</strong></td>
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<tr>
<td><strong>Trench excavation</strong></td>
<td><strong>Trench excavation</strong></td>
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<tr>
<td><strong>Pipe laying, jointing and connecting</strong></td>
<td><strong>Pipe laying, jointing and connecting</strong></td>
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<tr>
<td><strong>Maintenance holes, shafts and inspection shafts</strong></td>
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<tr>
<td><strong>Embedment and backfill</strong></td>
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<tr>
<td><strong>Acceptance testing</strong></td>
<td><strong>Acceptance testing</strong></td>
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<tr>
<td><strong>Infiltration testing</strong></td>
<td><strong>Infiltration testing</strong></td>
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<tr>
<td><strong>Deflection (ovality) testing of flexible sewers</strong></td>
<td><strong>Deflection (ovality) testing of flexible sewers</strong></td>
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<tr>
<td><strong>CCTV inspection</strong></td>
<td><strong>CCTV inspection</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Pressure testing of inverted syphons</strong></td>
<td><strong>Pressure testing of inverted syphons</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Inadequate foundation material - Rock foundation**

Notice for inspection

- Excavate for an additional depth as directed. Backfill and compact the additional excavation
- 1 week

**Trench excavation – Trench size for pipelines**

Conformance with documentation

- 1 week

**Trench excavation – Trench widths**

Present trench width within permitted over-excavation

- 1 week

**Thrust and anchor blocks and restrained joints - Notice**

Give notice if the allowable bearing pressure of the ground and the design pressure of the pipeline differ from actual pressures on site

- 1 week

**Welding for steel pipelines – Field welding of flanges**

Submit proposal for approval

- 1 week

**Maintenance holes (MH) – MH location**

Submit any proposal to change positions of maintenance holes before commencing the works

- 2 weeks

**Covers and frames - Delivery**

Submit conformance certification of the covers and/or frames before delivery to the works

- 3 working days

**Concrete bedding and encasement to pipe**

Concrete bulkhead in conformance with documentation

- 2 working days

**Embankment fill**

Geotechnical assessment and supervision of work, if required.

- Progressive

**Trench stops and concrete bulkheads**

Concrete bulkhead in conformance with documentation

- 2 working days

**General – NATA**

Provide NATA certified test results for all testing

- 2 working days progressive

**General – Notice**

Give notice for compaction testing, hydrostatic pressure testing, block testing and water quality testing

- 3 working days progressive

**Visual inspection - Requirement**

Inspect system component markers for conformance with the documents

- 2 working days

**Visual inspection - Verify**

Submit purchasing records for products and materials

- 2 working days

**Air pressure and vacuum testing of sewers - Testing of concrete MH**

Test concrete MH

- 2 working days

**Infiltration testing - Infiltration testing requirement**

Submit method of infiltration testing

- 1 week

**Deflection (ovality) testing of flexible sewers - Deflection testing**

Submit proposal for deflection testing

- 1 week

**CCTV inspection - Verification**

Carry out a CCTV verification inspection

- 2 working days

**Pressure testing of inverted syphons - Requirement**

Submit proposed method of pressure testing

- 2 weeks
Clause title/Item | Requirement | Notice for inspection
---|---|---
Connections to existing sewers | | |
**General** - Connecting to existing sewers | Submit proposal for connection to existing sewers including work method, timing, equipment | 2 weeks |
Restoration of surfaces | | |
**Backfill** - Disposal of surplus material | Submit for approval proposal for spreading surplus material. | 2 working days progressive |

## 2 PRE-CONSTRUCTION PLANNING

### 2.1 SCHEDULING

**Program of works**
- **General**: Program the works as follows:
  - **Materials**: Arrange the program so that it conforms to the approved products and materials.
  - **Authorities**: Arrange approvals and conform to the local environmental requirements e.g. protection of the environment and heritage areas.
  - **Control of erosion and sedimentation**: Prepare an erosion and sediment control plan before starting the works.

### 3 MATERIALS

#### 3.1 GENERAL

**Authorised products and materials**
- **Products and materials**: Provide only products and materials authorised by the Water Agency, the drawings and this specification. Submit for approval any alternative or not authorised products and materials. This is a **HOLD POINT**.
- **Unauthorised material**: Remove unauthorised or non-conforming materials from the site within 24 hours.

**Conformance with manufacturer’s recommendations**
- **Requirement**: Conform to the requirements of the manufacturer’s recommendations for handling, transport and storage of materials and in a manner to prevent damage or deterioration or excessive distortion. Inspect all products and materials at the time of delivery and reject products and materials not in conformance with this specification and the manufacturer’s recommendations. This is a **WITNESS POINT**.

- **On site storage**: Store pipe fittings, valves, seals and other components as follows:
  - Maintain protective crating or packaging until immediately before use.
  - Stack piping to avoid ovalisation.
  - Support all fittings and pipes off the ground.
- **Damaged or defective materials**: Do not use damaged or defective materials, including coatings and linings, outside the manufacturer’s recommended limits and the following:
  - Faded/discoloured plastics, plastic coated pipes, fittings and appurtenances.
  - PVC-U pipes and fittings scored deeper than 10% of wall thickness to a maximum of 1 mm.
  - PE pipes and fittings scored deeper than 10% of wall thickness.
  - GRP pipes and fittings scored deeper than 1 mm or with impact damage.
  - DI and steel pipes and fittings with damage to linings in excess of 20% of the lining thickness.
  - Plastics coated pipes, fittings and appurtenances with damage to coating in excess of 20% of the coating thickness.
3.2 PIPES AND FITTINGS

General
Requirement: Provide pipes and fittings in conformance with the drawings, the schedules and the specification.
Certification: Submit product or material certification before delivery to the works. This is a WITNESS POINT.
Products and materials: Conform to the Material properties schedule.

Material properties schedule

<table>
<thead>
<tr>
<th>Material properties</th>
<th>Mat 1</th>
<th>Mat 2</th>
<th>Mat 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material type</td>
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<tr>
<td>Nominal size (DN)</td>
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<tr>
<td>Pipe series</td>
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<tr>
<td>Pressure classification (PN)</td>
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<tr>
<td>Material classification number (as necessary)</td>
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<tr>
<td>Joint type</td>
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<tr>
<td>Length and form of pipes</td>
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<tr>
<td>Type, materials and classes of fittings</td>
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<tr>
<td>Internal and external corrosion protection:</td>
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<tr>
<td>- Fittings</td>
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<tr>
<td>- Pipes</td>
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<tr>
<td>Proof stress tests:</td>
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<tr>
<td>- Fittings</td>
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<tr>
<td>- Pipes</td>
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<tr>
<td>Classification of flanges</td>
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<tr>
<td>Means of tapping</td>
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<tr>
<td>Identification of drinking and non-drinking pipe systems</td>
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<tr>
<td>Gasket types and tightening sequence</td>
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</tbody>
</table>

Ductile iron (DI)
Standard pipe: Provide DI pipe cement mortar lined to AS/NZS 2280.
Epoxy coating: To AS/NZS 3862 (or thermal-bonded polyethylene to AS/NZS 4158).
Elastomeric seals: To AS 1646.
Flanges: To AS/NZS 4087 and AS 2129.
Bolts and nuts for flanged joints: To AS 2129, galvanized to AS 1214 or stainless steel to ASTM A276.
Corrosion protection of fittings: Conform to the following or as shown on the drawings:
- Thermal-bonded coated: To AS/NZS 4158.
- Sleeved: To AS 3681. Do not allow exposure to sunlight > 7 days.
- Wrap all unprotected joints in the trench with an approved petrolatum tape system or an approved alternative.
Fitting without flanges: Pressure class ≤ Class 35.

Steel pipeline systems
Standard pipe: To AS 1579, WSA 02 Table 10.1 and the following:
- Steel pipe rated pressure: Hydrostatically tested.
- Fittings rated pressure: May be non-hydrostatically tested.
- Size, minimum wall thickness, lining and coating to Material properties schedule.
Pipe and fittings: Cement mortar lined to AS 1281.
Buried steel pipe and fittings: External coat with fusion bonded polyethylene (medium density): To AS 4321.

Pipe jointing: Conform to the following or as shown on the drawings:
- Elastomeric seal: To AS 1646, or
- Butt welded, welded spigot and socket, or welded using a welding collar and with the application of a polyethylene heat shrunk sleeve over the weld, or wrapped, or
- Flanges: To AS/NZS 4087.

Bolts and nuts for flanged joints: To AS/NZS 4087 clause 3.2.

Corrosion protection: Wrap all unprotected joints in the trench with an approved petrolatum tape system or an approved alternative.

**PVC-U non-pressure**
Standard: To AS/NZS 1260 and WSA 02 Table 10.1.

**PVC-U pressure/vacuum**
Standard: Conform to WSA 02 Table 10.3 and the following:
- PVC-U: To AS/NZS 1477 clause 2.4.2.
- PVC-M: To AS/NZS 4765.
- PVC-O: To AS/NZS 4441, Appendix ZZ clause 9.3.2.
- Vacuum pipes and fittings: To WSA 06 clause 9.5.2.

Elastomeric seals: To AS 1646.
Handling and storage: To AS/NZS 2032. Record time in storage and type of shelter protection from UV damage.

PVC-U pipe sockets: Do not use spigots of ductile iron fittings.

DI fittings: If used in conjunction with ductile iron fittings:
- Series 1 PVC-U pipe: To AS/NZS 1477.
- Series 1 PVC-M pipe: To AS/NZS 4765.

**Polyethylene (PE)**
Standard pipe: To AS/NZS 4130, WSA 01 and WSA 02 Table 10.1.
Fittings: To AS/NZS 4129.
Mechanical couplings: Self-restraining.
Stub flanges and backing rings: To POP007.
Flanges: To AS 2129, AS/NZS 4331.1 and AS/NZS 4087.
Property service pipe: PE 100, PN 16, series 1.
Jointing: Provide butt thermal fusion or electrofusion couplings or mechanical fittings.
Bending: To AS 2033.
Vacuum pipes and fittings: Conform to WSA 06 clause 9.5.3.
Internal diameter and wall thickness: Provide pipe and fittings with minimum wall thickness and minimum internal diameter to [Material properties schedule](#).

**Polypropylene (PP) non-pressure**
Standard: To AS/NZS 5065 Type B ID series and to WSA 02 Table 10.2.
Pipe stiffness class: SN 10.
Elastomeric joint seals: To AS 1646.

**Glass reinforced plastic (GRP)**
Standard pipe: To AS 3571.1 and WSA 02 Table 10.1.
Surge cycles: Refer to the manufacturer if the temperatures are likely to exceed 35 °C.
GRP fittings: To AS 3572.2.
Handling and storage: Provide protection from ultra violet light and damage if storing for longer than 7 days.
Vitrified clay pipe and fittings (VC)
Standard: To AS 1741, BS EN 295-1 and WSA 02 Table 10.1.
Class of pipe: To the loading requirements of AS 4060.
Elastomeric joints: To BS EN 681-1.

Acrylonitrile butadiene styrene (ABS)
Standard: To AS/NZS 3518 and WSA 02 Table 10.1.
Joints: Conform to manufacturer’s recommendations using solvent cement to AS/NZS 3879.
Pipe class: Provide for cyclic loading.

Reinforced concrete (PVC-U lined)
Standard: To AS/NZS 4058 and WSA 113.
Testing: To AS 4058 Appendix A including crack load, ultimate load, hydrostatic pressure, dimensional accuracy, cover, joint assembly.

3.3 VALVES, HOLES/SHAFTS AND ACCESS COVERS

Valves
Requirement: Provide valves, hydrants, holes/shafts, surface fittings and access covers as documented.
Certification: Submit product or material certification before delivery to the works. This is a WITNESS POINT.
Extended spindle: To AS/NZS 2638.1 Test J and AS/NZS 2638.2 Test M and the following:
- Welding: To AS/NZS 1554.1 Category GP. Do not weld cast iron (including grey and ductile iron) components.
- Coating: Provide the following:
  - Bitumen coat: To AS/NZS 3750.4, or
  - Synthetic resin base coat: To AS/NZS 3750.19, or
  - Thermal bonded polymeric coatings: To AS/NZS 4158.
Valves: Conform to the Valves schedule.

<table>
<thead>
<tr>
<th>Valves schedule</th>
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<tbody>
<tr>
<td><strong>Valves and hydrants properties</strong></td>
</tr>
<tr>
<td>Location</td>
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<tr>
<td>Spacing</td>
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<td>Type</td>
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<td>Class</td>
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<td>Sizing</td>
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<td>End connections</td>
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<td>Gearing</td>
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<td>Valve chamber</td>
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<tr>
<td>Installation requirements</td>
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<tr>
<td>Identification, colour and marking</td>
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<tr>
<td>Operation (e.g. electric etc)</td>
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<tr>
<td>Supports required</td>
</tr>
</tbody>
</table>

Flanges: To AS 2129 and AS/NZS 4087.
Socket joint configurations: Elastomeric joint seal to AS 1646.
Vacuum interface valves: To AS 4310 and the following:
- [complete/delete]

Stop valves
Resilient seated ball valves for property services: To AS 4796.
Metal seated valves: To AS/NZS 2638.1.
Scour valves: Connect to pipelines with a flanged joint.
Gaskets: 3 mm thick insertion rubber.
Gate valves: Conform to the following:
- Anti-clockwise rotation of the input spindle for closure.
- Provide spindle cap.
Knife gate valves: To AS 6401 and the following:
Butterfly valves: To AS 4795.1, AS 4795.2 and the following:
- Do not use in reticulation mains.
- Direction for closing: Anti-clockwise.
- Do not use if throttle of flow is required.
- Installed with trunnions horizontal and gearing operated from the surface.
- Provide chamber where gearbox is not sealed.

**Control valves**

Air valves for DN 50 to DN 200 sewerage: To AS 4883.
Non-return valves: To AS 4794 and the following:
- Pressure class: PN 16.
- Provide lifting lugs: ≥ DN 250.
- Swing check type of ductile cast iron or steel body, cover and disc or bronze body and disc seat rings.
- Clear swinging leaf to provide an unobstructed waterway.
- Do not use wafer style non-return valves.
- Maintenance: Provide body cover of sufficient size and in a location that allows removal of the valve flap and the seat for inspection without removal of the valve body.
- No flow switch: Extended spindle of minimum grade 316 stainless steel to ASTM A240/A240M and fitted with an adjustable counterweight together with a proximity switch to indicate a no-flow condition and with the following features:
  - Eccentric cam operated limit switch type.
  - Minimum rating of 10 amps, 240 V AC, 50 Hz.
  - Oil tight and dust proof to IP 65.
  - Suitable for 25 mm conduit entry.
  - Mounted on rigid adjustable brackets of stainless steel in conformance with ASTM A240/A240M and free of sharp edges and exposed corners.

**Surface fittings**

Access covers: To AS 3996 and the following:
- Coating to AS/NZS 3750.4 or BS 3416 for all cast iron solid-top covers and frames other than recessed parts. Do not apply to sealing and threaded surfaces. Make sure coating is dry to touch when handled.
- Single part round covers ≥ DN 375: 0.3 ± 0.03 mm gap between the edge of the cover and the inside edge of the frame.
- Multi-part covers: Each part snugly against the frame with no gap greater than 4 mm between either part and the frame.

**Access covers and frames schedule**

<table>
<thead>
<tr>
<th>Requirements</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
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<tbody>
<tr>
<td>Cover number</td>
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<tr>
<td>Load class</td>
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<td>Size</td>
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<td>Aesthetics</td>
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<td>Security</td>
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<td>Seals</td>
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<tr>
<td>Cover orientation</td>
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<tr>
<td>Handling</td>
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</tbody>
</table>
Jointing components
Jointing lubricant: To AS/NZS 4020.
Joint seals: To AS 1646.

Maintenance holes and shafts
Maintenance holes (MH): Conform to the following:
- ABS: To AS 3518.
- Concrete: To AS 4198.
- GRP: To AS 3571.1.
- PE: To AS/NZS 2033.
- PVC-U: AS/NZS 1477, AS/NZS 4441 or AS/NZS 4765.

Maintenance shafts (MS), inspection shafts (IS) and terminal maintenance shafts (TMS) including cover: Conform to the following:
- ABS: To AS 3518.
- Concrete: AS 4198.
- GRP: AS 3571.1.
- PE: To AS/NZS 4130.
- PVC-U: To AS/NZS 1477, AS/NZS 4441 or AS/NZS 4765.

Maintenance hole covers, frames and installation: To AS 3996.
Concrete covers and frames: To AS 4198 and AS 3996.
Covers capable of being bolted down: For areas below the 1 in 100 flood level.

3.4 STEEL AND CONCRETE

Steelwork
Ancillary steelwork, including ladders, brackets, and covers: To AS 1657.
Abrasive blast cleaning: To AS 1627.4 Class 2.5.
Protection: Hot-dip galvanize to AS/NZS 4680.
Step irons: Provide step irons as shown on the drawings or encapsulated in plastic.

Concrete
Premixed, normal class concrete: To 0319 Minor concrete works.

3.5 PROTECTION AGAINST DEGRADATION

General
Detail: Protect pipeline system items (e.g. pipes, fittings, appurtenances, elastomeric seals) including the following:
- Eliminate contact between dissimilar metals to prevent galvanic corrosion.
- Fully seal conduits for plastic pipes and fittings in contaminated ground.
- Fully seal conduits for all elastomeric seal jointed pipes and fittings in contaminated ground.
- Control trench fill and pipe embedment materials.
- Mitigate stray current or telluric effects on buried steel pipelines in conformance with WSA 03 clause 4.8.6.
- Cathodic protection for buried steel pipelines to AS 2832.1 and AS 2832.2 and in conformance with WSA 03 clause 4.8.5.

3.6 BEDDING, EMBEDMENT AND FILL MATERIAL

General
Bedding and embedment material: To AS/NZS 2566.2, WSA 02 clause 20.2 and the following:
- Free of noxious weeds and dangerous chemicals.

Bedding, embedment and fill material schedule

<table>
<thead>
<tr>
<th>Material</th>
<th>Mat1</th>
<th>Mat2</th>
<th>Mat3</th>
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<tbody>
<tr>
<td>Grading</td>
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</table>
### Material

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<tr>
<th>Material</th>
<th>Mat1</th>
<th>Mat2</th>
<th>Mat3</th>
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<tbody>
<tr>
<td>Resistivity (AS 1289.4.4.1)</td>
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<tr>
<td>pH (AS 1289.4.3.1)</td>
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<tr>
<td>Wet strength (AS 1141.22)</td>
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<tr>
<td>Wet strength/dry strength variation (AS 1141.22)</td>
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<tr>
<td>Weak particles (AS 1141.32)</td>
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<tr>
<td>Aggregate type</td>
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<tr>
<td>Nominal size of aggregate (mm)</td>
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<tr>
<td>Mix proportions</td>
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<tr>
<td>Size for stabilisation (mm)</td>
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<tr>
<td>28 day compressive strength (MPa)</td>
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<tr>
<td>Maximum moisture content at delivery</td>
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<tr>
<td>Trafficable or non trafficable areas</td>
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</table>

Recycled material: Submit for approval any recycled material proposed. This is a **HOLD POINT**.

### Geotextile


## 4 EXECUTION

### 4.1 PROVISION FOR TRAFFIC

**General**

Requirement: Conform to **1101 Control of traffic**.

### 4.2 ESTABLISHMENT

**General**

Requirement: If using trenchless technology conform to **1392 Trenchless conduit installations**.

Set out: Confirm the locations immediately before construction. This is a **WITNESS POINT**.

Space allocations: Conform to any space allocation agreements, local agreements with road owners or other utility service provider.

Sewer mains in easements: Conform to WSA 02 clause 4.2.5, WSA 02 drawing SEW-1105 and the documented requirements.

Supply of water for the works: To WSA 02 clause 14.6.

Protection: Provide protection from external factors such as external loading, third party intrusion as documented including:
- Precast reinforced concrete removable slabs.
- Concrete encasement to WSA 02 clause 14.5.
- Service duct.
- Security fencing.
- Protection barriers.

Overhead power lines and transmission towers: Provide protection as documented and as follows:
- If welded steel pipelines simultaneously run parallel (for more than 1 km) and within 500 m of powerlines > 50 kV
- Where metal pipelines are located within 5 m of a transmission tower
- Where metal pipeline access is within 50 m of a transmission tower.

Above ground water mains: Provide above ground water main components as documented including pipeline items, supports, restraints, loading protection, maintenance and access requirements, protection from exposure conditions.

Document: Record contact details with all affected customers. Resolve enquiries and complaints promptly.

Road opening permits: Obtain a road opening permit before starting of any works within a road or road reserve.

Crossings Authority approvals: If a pipeline crosses a main or state road, creek or involves features shown on the drawings under the control of any Authority, carry out the work in conformance with the requirements of that Authority including obtaining any approvals and paying any fees as appropriate. This is a WITNESS POINT.

Tolerances
Sewer horizontal: ± 100 mm lateral displacement from the design alignment.
Structures horizontal: ± 100 mm lateral displacement from the design alignment and ± 200 mm along the water main axis.
Junctions horizontal: ± 100 mm displacement along the sewer axis.
Property connection sewers: ± 100 mm displacement along the sewer axis.
Property connection risers, inspection openings and surface fittings: ± 100 mm displacement along the sewer axis and ± 100 mm displacement along the property connection sewer axis.
Sewers, property connection sewers and structures invert level: + 10 mm, – 50 mm, no reverse grades.
Property connection risers and inspection openings invert: + 10 mm, – 150 mm.

Sewer grade tolerance: To WSA 02 Table 23.1.
Property connection sewer grade tolerance: To WSA 02 Table 23.2.
Verticality of MH, MS, TM, inspection shafts, vertical risers and vents: 10 mm/m rise in any direction.
Structures higher than 5 m verticality: 50 mm cumulative deviation in any one particular direction.
Cast in situ concrete structures internal dimensions (diameter, length, width, depth etc): + 5%, - 2%.
Cast in situ concrete slabs external dimensions: + 5%, - 2%.
Cast in situ concrete thickness: + 50 mm, – 0 mm.

Temporary drainage during construction
General: For each part of the system, complete the erosion and sedimentation control measures before commencing the works.
Control of erosion and sedimentation: Conform to 1102 Control of erosion and sedimentation. Make adequate provision for runoff flows at drainage works under construction or surrounding areas/structure. Submit plan to WSA 02 clause 13.5.6.4.
Dams and diversions: Do not dam up or divert existing watercourses (either temporarily or permanently). Submit for approval if required.
Dewatering: Keep all excavations free of water. Provide dewatering including any equipment required. Make sure no damage is caused to adjacent structures and services.
Discharge: Obtain approval by the appropriate Authority for any discharge to sewers, stormwater drains or watercourses. This is a WITNESS POINT.
Material and equipment: Locate material and equipment clear of watercourses or secure to prevent danger or damage in the event of large runoff flows.
Stabilisation of topsoil areas: Immediately following earthworks where required or as directed, stabilise the topsoil with hydroseed to 0257 Landscape – road reserve and street trees, Hydroseeding.

Excavation near underground services
Public utilities within the excavation for sewerage systems: Obtain approval of the relevant Authority to the method of excavation before commencing excavation. This is a HOLD POINT.
Location: Obtain locations of water, sewer, stormwater, gas, electricity and telephone services from DIAL BEFORE YOU DIG and the Contacts schedule in 0136 General Requirements (Construction) to verify the location of services.

Marking: Before commencing earthworks, locate and mark existing underground services in the areas which will be affected by the earthworks operations including clearing, excavating and trenching. This is a HOLD POINT.

Protection of property and environment: To WSA 02 clause 13.5.2 and the following:
- Protection of other services: Give notice of any interference to the works caused by an existing service and submit a proposed work method statement. This is a HOLD POINT.
- Disused or redundant sewer mains: Carry out works as documented and to WSA 02 clause 13.5.3.

4.3 EXCAVATION FOR SEWERAGE SYSTEMS

General
Topsoil: Remove topsoil in conformance with 1112 Earthworks (Roadways) before undertaking sewerage system excavation.

Excavation level: Excavate trench or foundation for sewerage works to the designed level of the bottom of the bedding or foundation. Remove all loose material.

Soil type: Confirm surrounding soil type with design. Give notice if not consistent with the design. This is a HOLD POINT.

Location: Carry out all excavations for structures and pipelines to the lines, grades and forms shown on the drawings.

Authority requirements: Conform to the requirements of the appropriate Authority including drainage, dewatering, silt control, noise abatement, proximity to existing buildings and generally for the amenity of adjacent owners.

Safety fencing: At the completion of work each day, provide safety fencing along the edges of open excavations to statutory requirements. Plug any open pipelines to prevent ingress of soil or other material and backfill to prevent flotation of any laid pipelines.

Access to properties: Provide fenced walkways and vehicular crossings across trenches to maintain access at all times from the carriageway to individual properties or within individual properties and give prior notice to all affected occupiers.

Existing services: Locate, protect and repair, as necessary, all services within the extent of the works.

Protection of trees: Conform to the following:
- Obtain approval from the tree owner and Council for tree removal or working within allowed distances.
- Do not store materials or products against trees, under tree canopies or root zones.
- Fence off trees to keep machinery away as required or use boring or hand excavation.
- Protect roots:
  - Cleanly cut tree roots ≤ 60 mm diameter. Obtain approval before for cutting larger roots
  - Damaged roots: Treat as documented in the environmental management plan or as directed.

No blasting: Submit blasting plan to AS 2187 for approval for any blasting if required.

Excavation across improved surfaces: To 1152 Road openings and restoration (Utilities) and the following:
- Obtain approval from the land owner before commencing any excavation across improved surfaces. This is a HOLD POINT.
- Saw cut neat straight lines ≥ 150 mm beyond the outer limits.

Cover over pipelines
Minimum cover: Provide mains pipelines with the minimum depth of cover as documented and in conformance with WSA 02 Table 4.8, measured vertically from the finished ground level to the top of any socket.

Less than minimum cover: Provide lesser cover where special protection of the pipelines is documented.

Greater than minimum cover: Provide greater cover where special situations occur, where there is conflict with other services or to meet grading requirements.
Inadequate foundation material
Notice: Give notice of any area of the foundation including the sides of the trenches that may contain material that is inadequate to support the proposed drainage structure. This is a WITNESS POINT.
Confirmation of inadequate foundation material: If directed, remove and dispose of inadequate foundation material to 1112 Earthworks (Roadways) and replace the material to Bedding, embedment and fill material.
Rock foundation: If rock is encountered at the foundation level, excavate for an additional depth as directed. Backfill and compact the additional excavation with material conforming to the Bedding, embedment and fill material. This is a WITNESS POINT.

Support of excavation
Trench support stabilising: Provide any shoring, sheet piling or other stabilisation of the sides of trench excavations necessary to conform to statutory requirements.
Support: All trenches of depth > 1.5 m or in unstable ground strata.
Trench support system: Do not disturb adjacent structures and services.
Compaction of pipe embedment and trench fill material: Below any trench support and against native ground.
Permanent trench support system: Cut off the support system below ground surface.
Precaution against slips or falls: Support all excavations as the works proceed.
Trench instability: Submit, for approval, the proposal to provide adequate permanent stability of the ground affected by trenching. This is a HOLD POINT.

Excavation for under pressure cut-in connection to pressure pipes ≥ DN 80
Requirements: Excavate below and behind the host pipe ≥ 100 mm.
Host pipe: Support during excavation and drilling.
Excavation sides: Keep sides of excavation vertical ≥ 150 mm above the pipe.
Minimum cover: Satisfy minimum cover requirements at all times.

Trench excavation
Requirements: Conform to the following requirements for trench excavation:
- Minimum cover requirements as documented.
- Maintain trench excavation in a stable condition.
- Minimise the length of the open trench at any one time.
- Align the trench centreline with the design pipeline centreline.

Trench size for pipelines: Excavate the trench to WSA 02 clause 8.9 and the following:
- Buried flexible pipelines or embankment method in general: To AS/NZS 2566.2.
- PVC-U: AS/NZS 2032.
- PE: AS/NZS 2033.
- ABS: AS/NZS 3690.
This is a WITNESS POINT.
Minimum trench width: 300mm
Embankment installation condition: To AS 2566.2. Before placement of bedding and laying pipes, place and compact embankment fill to a height above the top of the bed zone of at least 0.7 times the external diameter of the pipe and for a minimum lateral distance outside each trench wall of 2.5 times the external diameter of the pipe. Place earthworks to 1112 Earthworks (Roadways).
Trench installation condition: Complete the embankment to the underside of the selected material zone before starting the excavation.
Trench width: Do not excavate > 500 mm over the minimum trench width. This is a WITNESS POINT.
Bitumen and concrete surfaces: Carefully cut, by sawcutting or other means approved by the Superintendent, to provide a neat straight line free from broken ragged edges.
Widen for fittings: Widen the trench where necessary for the installation of valves and fittings and protective coating systems.
Maximum trench depth: Excavate no more than 50 mm below the invert of the pipe.
Rock foundations: Excavate trenches to 75 mm below the underside of the pipe barrel and socket or coupling, or as otherwise shown on the drawings.
Pipe support: Provide solid and uniform support for each pipe over the whole length of the barrel with chases provided for joints and wrapping.

Minimum clearance requirements: Clearances between sewers and other underground services to WSA 02 Table 4.2.

Easement: Do not excavate outside the easement.

Clearance for on-site works: Provide over 500 mm clear space in all directions from the workface where works such as welding or corrosion protection are required.

Stockpile: Provide stockpiles as follows:
- Do not stockpile excavated materials against the walls of any building or fence.
- 600 mm minimum between the edge of any excavation and the inner toe of stockpiles.
- Stockpile excavated topsoil separately and use for surface restoration after backfilling.
- Remove any surplus excavated material not required for re-use for topsoil or backfill.

**Trenchless technology**

General: If using trenchless technology conform to 1392 Trenchless conduit installation. Submit proposal for trenchless installation. Include documentation for the following:
- General description of method and sequence of operation.
- Use of specialist subcontractors.
- Use of specialist equipment.
- Grout type and method of injection.

Existing road crossings: If shown on the drawings, use trenchless methods for the installation of the mains.

Encasement pipe: As shown on the drawings. Extend the encasement pipe 1.0 m behind the back of the kerb on either side of the carriageway.

Support cradles: Position the carrier pipe on support cradles centrally located within the encasement pipe.

Ductile iron cement lined (DICL) carrier pipe: Polyethylene sleeving is not required for any length of ductile iron cement lined carrier enclosed within the encasement pipe.

Grouting: After installation and pressure testing of the carrier pipe, fill the annular space between the carrier pipe and the encasement pipe with suitable grout or cementitious grout filler.

### 4.4 BEDDING FOR PIPES

**Trench floor preparation**

Foundation: Before placing embedment, test the proposed foundation in conformance with WSA 02 clause 15.8 and the following:

Bearing capacity: > 50 kPa at the minimum trench depth – 50 mm. If not achieved give notice for directions. This is a **HOLD POINT**.

Compaction: Compact all fill and disturbed areas to the density of the natural ground. Refill areas of excessive excavation.

Preparation: Remove all debris and water before placing bedding.

**Bedding and pipe support**

Pipes other than PVC/PE: Provide non-cohesive granular bedding with minimum thickness of 75 mm below the barrel and socket of the pipe.

PVC-U pipes: To AS/NZS 2032 Figure 5.1.

PE pipes: To AS/NZS 2033 Figure 5.1.

Concrete support: Do not place bedding material until concrete has obtained its initial set.

Compaction of beddings: Provide compaction of bedding conforming to the following:
- Flexible pipes: To WSA 02 Table 22.1.
- Rigid pipes: To WSA 02 Table 22.2.
- Pressure pipes: To WSA 07 Table 21.1.
Protect: Do not walk on the centreline of the compacted bedding.
Bedding for maintenance holes: To WSA 02 clause 16.6.

4.5 PIPE LAYING, JOINTING AND CONNECTING

Installation of pipes
Pipeline: Maintain the cleanliness and dryness of all items during construction by using exclusion caps, plugs or blank flanges. Remove any dirt and foreign matter if pipes flood at any time.
Examine: Clean and examine all pipeline system items before installation. Inspect each joint seal for fit and flaws. Do not use damaged, dirty or incorrect seals.
Cut pipes: Chamfer where required and provide witness marks on the unmarked length of any cut pipes. Do not score pipes when providing the witness mark. Treat cut pipes in conformance with the manufacturer’s recommendations.
For field cuts of ductile iron or steel: Make sure that working fire fighting equipment is on the site before making the field cuts.
Petrol engine pipe cutter: If using a petrol engine pipe cutter in an excavation, maintain a safe atmosphere in the excavation at all times.
Witness mark on cut pipes: Except for PE pipes to be butt welded, if pipes are cut in the field, make a clearly identifiable witness mark on the pipe at the length specified by the manufacturer from the end of the pipe.
Witness marks on PVC/PE pipes: Do not use PVC/PE pipes with scored witness marks.
Witness marking depth: If the same manufacturer does not make spigots and sockets, refer to the socket manufacturer for the correct marking depth.
Laying: To WSA 02 clause 17.1.4.
Laying method: Start laying pipes from the downstream end with sockets at the upstream end and barrels firm and evenly embedded on the bedding material.
Laying sequence: Lay pipes on continuously rising grades from scour valve to air release valve, despite any minor irregularities in the ground surface.
Lift and re-lay construction: Supply affected properties with a temporary water service including a ball valve.
Horizontal and vertical separation of crossing pipelines: Maintain minimum horizontal and vertical separation of crossing pipelines as documented. Fill with embedment material and compact.
Maintenance: Install valves and other appurtenances for easy access for maintenance and repair.
Prevent flotation: Conform to WSA 02 clause 17.4.
Existing asbestos cement pipe cutting and disposal: Submit method statement for approval.
Aqueducts: Install in conformance with the drawings including protection grills and corrosion protection.

Horizontal and vertical deflections of pipes
Limits of deflection: To the pipe manufacturer’s recommendations.
Remove temporary pegs and stakes: Do not point load pipes.
Curving of pipe: If documented, cold bend pipes with a uniform radius along the length of the pipe in conformance with the manufacturer’s recommendations. Join pipes directly before making the curve. Do not use temporary pegs or stakes to restrain the pipe during curving.
Methods of deflection for horizontal and vertical curves: To WSA 02 clause 17.2 and Table 17.1 or WSA 06 clause 34.2 and Table 34.1.

Thrust and anchor blocks
Requirement: Provide thrust or anchor blocks in conformance with the drawings and the following:
- Position thrust and anchor blocks to bear against undisturbed material in the direction of the thrust and over the specified bearing area. Do not encase any part of adjacent joints.
- Provide a membrane between the fitting and the concrete to prevent damage to the coating of the fitting.
- To WSA 02 clause 5.10 and Table 5.1, as shown on the drawings.
- Make sure that thrust and anchor blocks are central to the fitting and do not interfere with any other services.
Notice: Give notice if the allowable bearing pressure of the ground and the design pressure of the pipeline are different to the actual pressures on site. This is a WITNESS POINT.

Concrete: 20 MPa.

Cast in situ concrete structures and slabs: Tolerance ± 0.5% or 5 mm, which ever is greater.

Concrete thrust, anchor blocks and bulkheads: Tolerance + 5%, - 2%.

**Restained joints**

Requirement: For DI pipes, follow manufacturer’s recommendations.

Pressure and vacuum sewer: To WSA 07 clause 18.7 and WSA 06 clause 34.7.

**Marking**

Non-detectable marking tape: Lay on top of the pipe embedment material before trench filling and to AS/NZS 2648.1.

Detectable marking tape: Lay tape on top of the pipe embedment to form a continuous connection between valves. Connect bare wires to a nut or bolt of a valve or hydrant.

Requirement: Lay detectable identification tape along the line of the rising main within 150 mm of the finished surface or as otherwise directed by the Superintendent.

Tracer wire: Provide 2 mm diameter 316 stainless steel in trenchless installations.

Appurtenance location marking: Provide location marker posts, plates or other as shown on the drawings.

Time: Fix marking as soon as practicable after each valve or hydrant is installed.

Temporary cover: Temporarily cover marking plates for hydrants using masking tape or other approved cover and remove on satisfactory completion of the pressure testing of the pipeline.

Distance: Permanently mark the plate with the distance to the valve or hydrant in metres, to an accuracy of 0.1 m, with legible numbers a minimum 80 mm high.

Wooden posts: If there is evidence, by rotting or termite activity, that the integrity of the posts will be affected, do not use.

Post length: Sufficient length to be set firmly in place under saturated ground conditions.

Post projection: When installed, in conformance with the following:
- Generally: 1000 mm above the ground.
- If tall grass or crops are likely to obscure the post: 1500 mm above the ground.

Finish: Paint posts with 2 coats of white enamel for exterior use.

Pavement markers: Two-way reflective raised pavement markers to the road pavement and kerb.

**Bored pipes under roads, driveways etc.**

Plastic slippers: Place plastic slippers between the sewer and the bored hole in conformance with the manufacturer’s recommendations.

Buffer rings: Place buffer rings between vertical clay (VC) and reinforced concrete pipes pushed into bores.

Joints: Provide a continuous pipe under the road carriageway or limit to a single joint.

Grouting: Provide gravity or pressure grouting commencing from the downhill end of the bore. Achieve full penetration and complete filling of the void.

Insulators: Insert plastic slippers between the sewer and the bored hole in conformance with the manufacturer’s recommendations.

Unsupported bore: Complete all pipework and grouting within 24 hours.

**Plastics-lined reinforced concrete (RC) pipe**

Protection: Protect protruding plastic lining flaps of precast pipes from sharp changes in flap direction.

Plastic-lined < 360° of internal pipe: Provide unlined pipe inverts aligned continuously along the invert of the installed sewer.

Field jointing: Following installation of precast plastics-lined concrete products, join the plastics flap at the spigot end to the plastic lining of the previously laid pipe by welding.

Plastics lining ancillary work: Conform to the following:
- Vertically align plastics-lining keys.
- Provide vertical seepage channels between plastics-lining and precast or in situ concrete components.
- Jointing accessories and adhesives in conformance with manufacturer’s recommendations.

### Flanged joints

**Support:** Fully support matching pipe and valve/fitting during installation.

**Sequence:** Tighten bolts in the specified sequence using a torque wrench.

**PE pipe:** Provide a butt welded PE stub flange adaptor with a stainless steel backing ring in conformance with POP007.

### Welding of steel pipelines

Welding: To AS/NZS 1554.1 Category SP and WSA 02 clause 17.16.

Reinstate cement mortar linings for pipes as documented: Use an approved primer and mortar mix of sand and cement 2:1. Apply in conformance with WSA 03 Figures 15.1, 15.2, 15.3, 15.4.

Field welding of flanges: Do not field weld MS flanges. Submit proposal for approval in conformance with WSA 02 clause 17.16.2. This is a **WITNESS POINT**.

### Wrapping of ductile iron pipelines

Polyethylene sleeving: Enclose a pipeline or a section of pipeline, in layflat polyethylene sleeving and plastic tape adhesive in locations as shown on the drawings and in conformance with manufacturer’s recommendations.

**Material:** High impact resistance polyethylene sleeving in conformance with the following

- To AS 3681.
- 50 mm wide plastic adhesive tape.
- The width of the sleeving when flat: To the manufacturer’s recommendations for the size and type of the pipeline being encased.
- Do not exceed 48 hours exposure to direct sunlight.

**Protection:** Protect the sleeve from damage during application and the backfilling of the trench.

**Field joints:** Provide 250 mm minimum overlap of sleeving at each field joint.

Sleeving ends: Hold in position with at least three circumferential turns of adhesive tape.

Excess material: Neatly draw up loose, excess polyethylene sleeving material around the pipe barrel, fold into an overlap on top of the pipe and hold in place with strips of plastic tape at approximately one-metre intervals.

Bends, tapers and similar fittings: Cover with polyethylene sleeving as specified for the pipes.

Valves and irregular shaped fittings and joints: Hand wrap using flat polyethylene sheets secured with plastic adhesive tape, or other suitable material, to provide an adequate seal.

Damage to sleeving: Rectify any damage done to the polyethylene sleeving before proceeding to backfill of the trench. This is a **HOLD POINT**.

### Steel bolts and nuts corrosion protection

**General:** Wrap all galvanized steel bolts and nuts, used for below ground installation of flanges, bolted gland joints, mechanical joints and tapping bands in conformance with the manufacturer’s recommendations.

**Requirement:** Dry, clean and free from rust, immediately before wrapping.

**Tape:** Synthetic fibre open weave cloth impregnated with saturated hydrocarbons approved by the Superintendent.

### Joints

**General:** Except where solvent cement joints are needed to make up or install fittings, conform to the following:

- **Location:** As shown on the drawings.
- **Elastomeric seal joints:**
  - Either roll-on or skid type.
  - Apply only lubricant to manufacturer’s recommendation in making the joint.
- **Mechanical joints:** Fixed flange, bolted gland type, or a PE pipe system specific joint type.
- **Roll-on rubber ring joints:** Make sure spigots and sockets are clean and dry.
- **Skid rubber ring joints:** Use lubricant recommended by the manufacturer. Make the joint so that the witness mark is no more than 3 mm from the end of the socket.
- **Weld PE pipe:** To WSA 01.
PE weld pre-qualification: Submit pre-qualification for PE electrofusion and butt fusion for approval in conformance with WSA 07 clause 18.3.

Electrofusion: PE pipes ≤ 90 DN and for pipes of different SDRs.

Butt welding: PE pipes > 90 DN with the same SDR.

Solvent cement joints: To AS/NZS 3879 and manufacturer’s recommendations.

**Jointing pipes of different materials**

Gravity sewer: If jointing PVC/PE pipes to DI pipes, make joints by inserting a PVC/PE spigot into a DI socket. Do not insert DI spigots into PVC/PE sockets.

Compatibility: Confirm the compatibility of the PVC/PE pipe, joint seal and DI socket.

PVC-U pipes: If jointing pipes to pipes of another material, make the joints as follows:
- PVC/PE spigot or PVC/PE socket to VC socket: Provide a PVC/PE adaptor. Make joints using a ring conforming to AS 1646.
- PVC-U to DI: Provide a rubber ring (elastomeric) joint with an adaptor coupling.
- PE to DI: Provide a restrained joint (flange or coupler).

Alternative: Multi-fit mechanical couplings or flanged adaptor couplings, but not stainless steel leak/repair clamps, may be used to join pipes of different materials. If jointing PE with mechanical couplings, provide joint restraint.

**Appurtenances**

Compatibility with pipework: Provide proper sealing between the pipe flanges and the valve.

Concrete lining in pipework: Do not chip away or reduce to provide clearance from the working parts of valves.

Installation: Make sure that valves are installed to facilitate maintenance.

**Rising main fittings**

Location: Install rising mains, air release valves and inspection pipes as shown on the drawings.

Identification tape: Top all rising mains with an appropriate identification tape.

Marking plates: At changes of direction and, at such chainages that the location of the main is marked, at least once each 100 m. Provide marking plates bearing letters as follows:
- For double air valves: DAV.
- For scour pipes: SCOUR.
- For sewage rising main: SRM.

Urban areas: Paint the kerb adjacent to each fitting with two (2) coats of non-slip paint coloured black.

Distance: Mark the distance to the fitting in m, to an accuracy of 0.1 m, permanently on the plate with legible numbers a minimum 80 mm high.

Wooden posts: If there is evidence, by rotting or termite activity, that the integrity of the posts will be affected, do not use.

Post length: Sufficient length to be set firmly in place under saturated ground conditions.

Post projection: When installed in conformance with the following:
- Generally: 1000 mm above the ground.
- If tall grass or crops are likely to obscure the post: 1500 mm above the ground.

Post finish: Paint posts with 2 coats of white enamel for exterior use.

**4.6 JUNCTIONS AND PROPERTY CONNECTION SEWERS**

Location

Property connection sewers: Provide to WSA 02 clause 17.7 and the following:
- Where concrete surround or encasement is required, allow more than 16 hours for the concrete to set before connecting sewer.
- Locate vertical drops or risers to prevent sewer damage and provide support to maintain their position during encasement or backfilling.
- Mark property connection locations.
- Provide junctions for dead ends and property connection sewers or risers to properties to serve existing and future dwellings.
- Depth of service connection: < 2.5 m, provided the property still has service to the sewer.
- Existing dwellings: Inside the property boundary to facilitate the connection with existing sewage outlets.
- Dual occupancies: Provide separate connections.
- Vacant blocks: Inside the property boundary to facilitate the connection with topography and future likely positioning of sewage outlets.
- Long property connection sewers: Extend property connections so that sewer lines < 75 m from premises.

Squeeze-off on PE pipework: Use specially designed squeeze-off tools, avoid over compression and minimise damage. On release of the squeeze inspect and re-round the pipe as necessary, cut-out and renew the pipe if there is any indication of damage or weld an electrofusion repair saddle. Do not squeeze-off PE pipe within 5 pipe diameters from a previous point of squeeze-off isolation.

Valves, valve chambers, scours and surface fittings: Install in conformance with the drawings and WSA 07 WAT-1307.

Valves, fittings and junctions:
- Horizontal: ± 100 mm displacement from the design position along the sewer axis.

Valves, valve chambers:
- Horizontal: ± 100 mm displacement from the design sewer alignment and ± 200 mm displacement from the design position along the sewer axis.
- Vertical: ± 250 mm provided design covers, grades, finished surface levels are within tolerance.

Concrete or backfill requirements
Concrete encasement for junctions: Encase junctions for risers in 20 MPa concrete to conform to WSA 02 clause 17.7 and clause 20.6.

Backfill: Compact backfill around risers to the top of the socket or coupling on the highest branch off the riser, for the full width of trench and for a minimum distance of 500 mm upstream and downstream of the riser.

Marking
Location: Clearly mark the position of each riser, junction or end of a property connection sewer on completion of backfilling.

Adjacent to fence or boundary structure: Stencil the letter ‘J’ 50 mm high on the fence or structure. Finish marking tape flush with the existing ground surface as close to the boundary fence or structure as possible.

Peg: Drive a 75 mm × 50 mm × 600 mm long peg into the ground and leave flush with the surface of the surrounding ground. Connect the peg to an underground identification tape.

Tape position: Tie the identification tape to the junction or end of the property connection sewer and hold the tape in a vertical position during backfilling. Spike the top end of the tape by the junction peg immediately upon completion of backfilling.

Identification tape type: 75 mm red coloured polyethylene.

Inscription: ‘CAUTION – BURIED SEWER LINE’, printed in heavy black letters every 200 mm.

On-property items
Collection/pump units: Install the collection/pump units in conformance with the drawings and the manufacturer’s recommended instructions. Slope finished surface level away from the units gradually.

Tolerance on collection tanks:
- Horizontal: ± 100 mm lateral displacement from the design boundary offsets and ± 200 mm from any other design position.
- Vertical: ± 250 mm provided design covers, grades, finished surface levels are within tolerance.

Customer sanitary drains: Install new sanitary drains to AS/NZS 3500.2 and PSS-1101.

Property discharge lines: Conform to WSA 07 clause 18.9.3.

4.7 MAINTENANCE HOLES, SHAFTS AND INSPECTION SHAFTS

General
Installation: Provide MH, MS, TM, IO in conformance with the drawings and the manufacturer’s recommendations.
Maintenance shafts and inspection openings: To WSA 02 clause 19.

**Step irons:** Provide step irons in conformance with SEW-1307.

**Maintenance holes (MH)**

MH base: Construct the MH base to WSA 02 clause 18.2 and the following:
- Set out and support the MH base pipe connections to suit the diameter and offset centreline.
- In situ concrete base: Provide secure formwork and place concrete directly onto firm foundation.
- Precast base: Form the channels after the base has been placed.

MH location: Position a maintenance hole to conform to occupational health and safety requirements for access by maintenance staff, providing a proper working area around the top and access into the hole. Submit any proposal to change positions of MH before commencing the works. This is a **WITNESS POINT**.

Trench drainage around MH: Provide trench stops and drainage as shown on the drawings and to WSA 02 SEW-1207.

Connections to MHs: Provide a hydrophilic seal around the fitting in at least 2 positions for polyethylene, polypropylene or similar materials used in connections.

Core drill holes: Use a diamond hole saw.

Connections: Connect pipelines to maintenance holes, structures or embedded concrete with 600 mm long pipes. Provide 2 flexible joints, first joint < 150 mm of the face of the structure.

Flexible joints: If flexible joints cannot be made with cut pipes, select pipes from the various lengths provided to make the second joint within 300 mm of the position shown on the drawings (WSA 02 Part 3, Section 18.10, and drawings SEW-1302, 1303, 1313).

**Precast concrete MH/MS/IS systems**

Standard: To WSA 02 clause 18.4, SEW-1300, SEW-1301 to SEW-1306 and AS 4198 and the following:
- Submit proposed proprietary items if not selected. This is a **HOLD POINT**.
- Provide certification of quality before delivery to the works.
- Watertight components: Provide components that make a watertight system and satisfactory surface finish.
- Shaft sections: Section lengths to minimise the number of joints required.
- Maintenance holes: Conform to the following:
  - Make-up rings: Provide between cone sections and frames to make up height differentials.
  - Minimum wall thickness of any reinforced component below the frame: 84 mm
  - Vertical distance: 600 mm to 900 mm range from the top of the surround and the first step.

Installation: Install all preformed components in conformance with the manufacturers’ recommended procedures and requirements.

Backfill: Place backfill for preformed maintenance holes and maintenance shafts and compact evenly to a level 300 mm above the top of the highest incoming pipe and for the full width of the excavation.

Import material: If necessary, import and compact non-cohesive granular material.

**Cast in situ MH/MS/IS**

Concrete cast in situ MH: To WSA 02 clause 18.5, 18.7, 18.8, SEW-1301 and 0319 Minor concrete works.

Benching and channels: Thoroughly roughen and clean each base, brush coat of wet dry epoxy or sulphate resistant cement slurry. Render and shape benches and channels using 2:1 sand: sulphate resistant cement mix > 15 mm thick. Maintain in a damp condition for 72 hours after finishing.

Foam formwork: Construct benching and channels with off form finish.

Step irons: Fix step irons in formwork before placing concrete, ensuring step hold, alignment and spacing is positioned for safe access.

**Covers and frames**

On-site filling of recessed covers: To AS 3996, WSA 02 clause 18.9, SEW-1300, SEW-1301, SEW-1308 and any manufacturer’s instructions.

Covers and frames: Warped or twisted covers and frames are not permitted.

Uniformed surfaces: Provide a surface that is dense, uniform and free from blemishes.
Exposed edges: 4 mm radius minimum to WSA 02 Part 3, Section 18.9.

Delivery: Submit conformance certification of the covers and/or frames before delivery to the works. This is a WITNESS POINT.

Tolerances: Conform to the following tolerances:
- Cover: – 3 mm + 0 mm.
- Frame: ± 3 mm.
- Irregularities in finish: No abrupt irregularities and gradual irregularities not exceeding 3 mm.

Cover seating: Seat maintenance hole covers on a layer of bitumen impregnated fibre board with a cross-section of 25 x 25 mm or as otherwise approved.

Cover levels: Finish flush with the surface in roadways, footpaths and paved surfaces of any type.

Cover levels other than roadways, footpaths and paved surfaces: Finish 25 mm above the surface of the ground.

Tripping hazard: Make sure that the access chamber cover is not a tripping hazard.

Cast iron cover and frame location: Install a cast iron cover and frame instead of the standard concrete maintenance hole cover.

Bolt down frames: Install bolt down frames and covers in areas subjected to 1 in 100 year flooding.

4.8 EMBEDMENT AND BACKFILL

Pipe embedment and support

Notification of pipeline laid and jointed: Present the laid and jointed pipes for approval before starting trench backfilling. This is a HOLD POINT.

Material for embedment: Conform to Bedding, embedment and fill material.

Uniform placement: Place embedment material uniformly along and around the whole length of the pipe barrel, couplings and other appurtenances with no distortion, dislodgement or damage to the water main. Maintain more than 50% of the specified bedding depth under all projections.

Compaction: Compact in layers no more than 150 mm for minimum compaction of embedment conform to AS 2566.2 and WSA 02 clause 20.3, Table 22.3.

Compaction techniques: Do not use equipment or methods that would produce horizontal or vertical earth pressures that would cause damage or distortion of the water main.

Flooding compaction: Do not use unless otherwise approved in conformance with WSA 02 clause 20.3.1 and AS 2566.2.

Removal of trench supports: Lift temporary trench support systems progressively above each layer of embedment. Compact layers against undisturbed native soil.

Concrete embedment and encasement

Requirement: Embed and encase pipes in concrete as shown on the drawings.

Encasement: Set pipes to line and level on bags of natural fibre filled with sand and cement mix or on concrete blocks or saddles. Make sure pipes do not move or deform while placing concrete.

Contraction joint: Provide at the junction of encased pipeline and the concrete encased section.

Concrete: 20 MPa.

Cast in situ concrete structures and slabs: Tolerance ± 0.5% or 5 mm which ever is greater.

Concrete thrust, anchor blocks and bulkheads: Tolerance + 5%, - 2%.

Reinforced concrete: Tolerances to AS 3600.

Drainage: Provide a 75 mm diameter drain hole in concrete bulkhead above the top of the encasement bedding or foundation. Place crushed gravel or rock in the upstream end of the drain hole as follows:
- 10 to 20 mm size within 150 mm in all directions upstream.
- Above the invert of the drain hole.
- 2 to 10 mm size for a further 150 mm surround.

Grouting: After installation and pressure testing of the carrier pipe, fill the annular space between the gravity carrier pipe and the encasement pipe with suitable grout or cementitious grout filler.

Ductile iron cement lined (DICL) carrier pipe: Polyethylene sleeving is not required for any length of ductile iron cement lined carrier enclosed within the encasement pipe.
Mechanical protection of pressure pipeline: Conform to WSA 07 clause 18.11, PSS-1001, PSS-1002, PSS-1003 and AS/NZS 2566.2 Figure 5.6.

**Trench fill**

Material: To **Bedding, embedment and fill material**.

Fill: Place and compact trench fill material. Avoid subsidence over or near the trench and damage to adjacent pavements and structures.

Non-trafficable areas: Provide excavated material as trench fill as follows:
- Excavated material: Free of organic material, containing no rock or hard clay > 75 mm and compatible in conformance with WSA 02 Table 22.3.
- Cohesionless soil excavated material: Do not use in cohesive soil locations.

Placement: Conform to the following:
- Damage: Make good any damage caused by subsidence.
- Do not impact load water main.
- Do not place fill within 24 hours of placing concrete embedment or encasement.
- Fill voids behind timber ground support in close-timbered tunnels, drives and shafts by pressure grouting.
- Do not displace any valve or hydrant access cover assembly or supports.
- Correct any deficiencies caused by settlement.

Compaction of trench fill: Compact in layers to conform to WSA 02 Table 22.3.

Mechanical compaction: Do not start mechanical compaction of fill material directly above the pipe until the total depth of cover above the pipe is adequate to prevent damage to the main.

Prevention of damage to pipes, coating and wrapping: Backfill and compact all materials without damaging the pipe or its external coating or wrapping or producing any movement of the pipe.

**Embankment fill**

Embankments: Submit proposal for construction of embankments in conformance with the drawings, including the method of placement and compaction and any limitations to the placement/compaction over the top of the pipeline. This is a **HOLD POINT**.

If geotechnical assessment is required. This is a **WITNESS POINT**.

**Trench stops and concrete bulkheads**

Location and spacing: Provide trench stops and concrete bulkheads in conformance with WSA 02 clause 8.10, Table 8.1, SEW-1206, SEW-1207 and as shown on the drawings.

Concrete strength: 20 MPa.

Bedding: Conform to the following:
- Concrete bedding or encasement to pipe: Cast the 150 mm thick bulkhead integral with the concrete bedding or encasement across the width of trench and key into both sidewalls for a minimum of 150 mm. Extend the bulkhead 150 mm below finished surface level or as directed by the Superintendent. This is a **WITNESS POINT**.
- Other bedding or no bedding: Key the bulkhead into the bottom of the trench 150 mm for the full width of trench.

Drain hole: Provide a 75 mm nominal diameter drain hole in the concrete bulkhead immediately above the top of the encasement bedding or foundation. Place crushed rock or gravel in and at the upstream end of the drain hole to act as a filter as follows:
- 10 to 20 mm in size within 150 mm in all directions upstream and above the invert of the drain hole.
- 2 to 10 mm in size for another 150 mm surround.

**Work on live maintenance holes**

General: Unless shown otherwise on the drawings, complete all necessary works on live maintenance holes (that is, access ways to sewer system that is currently in service).

Work by others on live maintenance holes: Co-ordinate the works with any simultaneous and/or adjacent work by others and liaise with these Contractors and Authorities to avoid disruption, delays and possible conflict.
4.9 ACCEPTANCE TESTING

General
NATA: Provide NATA certified test results for all testing. This is a WITNESS POINT.
Unsatisfactory tests: Detect and rectify any faults that provide unsatisfactory tests until testing provide compliant test results. Rectify any visible leaks, blockage, malfunction or other defect even when results conform. This is a HOLD POINT.
Notice: Give notice for compaction testing, hydrostatic pressure testing, block testing and water quality testing. This is a WITNESS POINT.
Acceptance test: Carry out before the issue of the Certificate of Practical Completion and not earlier than one month after completion of construction of all sewers and maintenance holes in a section.

Visual inspection
Requirement: Inspect all system component markers for conformance with the documents. This is a WITNESS POINT.
Verify: Submit purchasing records for products and materials. This is a WITNESS POINT.

Compaction testing
Minimum compaction of embedment, trench fill and embankments: To WSA 02 Table 22.1, Table 22.2 and Table 22.3 tested to AS 1289.5.6.1 for cohesionless materials and AS 1289.5.7.1 or AS 1289.5.4.1 for cohesive materials.
- Pressure pipes: To WSA 07 Table 21.1.
Compaction testing requirements: Conform to the following:
- Drives and tunnel fill do not require testing.
- Trafficable areas test zone: 300 m² area with test at the centre, depth from the surface to the native ground or foundation level. Test each 300 mm of depth of fill and each test zone.
- Non-trafficable areas: 1200 m² area with test at the centre, depth from the surface to the native ground or foundation level. Test each 900 mm of depth of fill and each test zone.
- Retesting: Recompact and retest for any result that does not conform to WSA 02 Table 22.1, Table 22.2 and Table 22.3.
Embedment compaction testing for sewers > DN 300: In conformance with WSA 02 clause 22.3.3, test at the spring line ± 100 mm for each 50 m of pipeline.
Embedment compaction testing for sewers ≤ DN 300: In conformance with SEW-1200 allowable bearing pressure of the ground ≥ 50 kPa and the pre qualification method in conformance with WSA 02 clause 20.3.2.
Trench fill compaction testing: In conformance with WSA 02 clause 22.3.4, test as follows:
- Trenches in trafficable zone: 1 test in each 300 mm layer of fill for each 50 m of pipeline.
- Trenches in non-trafficable zone: 1 test in each 900 mm of fill for each 100 m of pipeline.
- MS, MH: 1 test within each 1 m depth at each location within 300 mm of each MS, MH riser.

Air pressure and vacuum testing of sewers
Pressure pipe: Do not use compressed air testing for pressure pipe.
Requirement: Pressure test all sewers ≤ DN 1500 including external MH drops, property connection sewers, vertical risers, MS and inspection shafts and fittings.
Sewers ≥ DN 750: Test during construction before MH construction.
Calibration certificates: Submit calibration certificates for testing equipment.
Low pressure air testing: Submit proposed method for testing in conformance with WSA 02 clause 22.4.2.
Vacuum testing: Submit proposed method for testing in conformance with WSA 02 clause 22.4.2.
Joints: Test every joint of sewers > DN 1500. Include proposed method with the testing submission. Testing of concrete MH: Test after placement and compaction of embedment surround in conformance with WSA 02 clause 22.4.4, Table 22.5, Table 22.6 and ASTM C1244. Note precast and cast in situ concrete are viewed separately in WSA 02 Table 22.5. This is a WITNESS POINT.

Hydrostatic pressure testing
Pressure test the sewer system: Submit proposed method for testing to AS/NZS 2566.2 clause 6.3 and the following:
- Use calibrated gauges under quality control.
- Trenchless mains carry out pressure testing before connection to the existing water main or the new section of water main installed using open trench construction.
- Test length < 100 m.
- Pressure test each property service.
- Pressure pipework: Pressure testing to WSA 07 clause 21.4 and 21.6.
- Pressure PE pipework: Pressure testing to WSA 07 clause 21.5.
- Do not use hydrostatic testing on vacuum sewers.

Sections: Test pipelines in sections as soon as practicable after each section has been laid, jointed and backfilled. Leave some or all pipe joints uncovered until the whole of the section has been successfully pressure tested. Start testing 7 days after the last placement of concrete thrust or anchor block

Wet weather: Do not perform pressure testing during wet weather.

Field joints: During pressure testing, make sure all field joints, which have not been backfilled, are clean, dry and accessible for inspection.

Stable testing conditions: To allow for absorption, movement of the pipeline and escape of entrapped air, keep the section full of water for a period of minimum 24 hours before starting the pressure testing.

Test pressure: Do not exceed the manufacturer’s recommended test pressure for the lowest rated component taking into account the components location in the pipeline.

Duration of test: Maintain the specified test pressure as directed for a minimum 6 hours.

Infiltration testing

Infiltration testing requirement: Carry out infiltration testing where a free standing water table exists at a level 1.5 m or more above a sewer or 150 mm or more above any side connections along the sewer. Submit method of infiltration testing. This is a WITNESS POINT.

Acceptable infiltration: < 5 L/mm diameter/km/day over a 24 hour period.

Deflection (ovality) testing of flexible sewers

Deflection testing: Carry out deflection testing in conformance with WSA 02 clause 22.6 at least 14 days after completion of placement and compaction of trench and embankment fill. Submit proposal for deflection testing. This is a WITNESS POINT.

Ovality proving tools: Conform to WSA 02 clause 22.6.2.

Maximum allowable short term pipe deflections: In conformance with WSA 02 Table 22.7.

CCTV inspection

Verification: Carry out a CCTV inspection of the sewer system and maintenance structures to 1859 CCTV inspection of drainage conduits. This is a WITNESS POINT.

Inspection and testing of plastic lined concrete sewers and MHs

Visual inspection: Visually inspect all plastics lined concrete sewers and MHs for cuts, tears or cracks and open or incompletely fused thermoplastic lining welds.

Spark testing: Carry out spark testing to AS 3894.1 and WSA 02 clause 22.8.

Locking key pull-out tests: Carry out locking key pull-out test for each 5 m² of plastics lined work in conformance with WSA 02 clause 22.8.3.

Pressure testing of inverted syphons

Requirement: Pressure test all inverted syphons at least 7 days after completion but before grouting in conformance with WSA 02 clause 22.9. Submit proposed method of pressure testing. This is a WITNESS POINT.

Testing of vacuum sewers and service connections

Acceptance vacuum testing: Carry out vacuum testings both daily and complete to conform to WSA 06 clause 41.4. Provide all certificates and test results.

Vacuum and moisture removal vessels: Conform to WSA 06 clause 24.8.

Vacuum vessels: Test vacuum vessels and submit certificate in conformance with AS 1210 and WSA 06 clause 24.10.5.

Moisture removal vessels: Test moisture removal vessels and submit certificate in conformance with WSA 06 clause 24.10.6.
Collection chamber and vacuum vessel: Install level sensors to conform to the manufacturer’s recommendations and WSA 06 clause 25.10.

4.10 CONNECTIONS TO EXISTING SEWERS

General
Connecting to existing sewers: Submit proposal for connection to existing sewers including work method, timing, equipment. This is a WITNESS POINT.

Notice: Submit request to connect to the existing sewer and give notice of works including any affected occupants. This is a HOLD POINT.

Completed works: Do not start any connections to existing sewers until all works are completed.

Spillage: Give notice to the environmental regulator and the Water Agency immediately following any spillage.

4.11 COMMISSIONING

General
Procedure: Test and commission the sewerage reticulation system in conformance with the commissioning procedure, schedules and record sheets in conformance with WSA 02 clause 13.2.

Supervision: Provide continuous supervision by personnel experienced in the operation of the equipment and have qualified personnel in attendance to carry out all necessary adjustments and/or remedial work during the commissioning tests.

4.12 RESTORATION OF SURFACES

General
Original condition requirement: Restore carriageway pavements, pathways, lawns, fencing and other improved areas in a continuous manner to a condition equivalent to that existing at the commencement of the works. Restore progressively and as soon as possible after the section of works is completed. This is a HOLD POINT.

Maintenance requirement: Maintain all restored surfaces in the restored condition until the expiry of the applicable Defects Liability Period, whether or not any deterioration of the restored surfaces is due to defects which become apparent or arise during the Defects Liability Period.

Restoration of surfaces: Conform to 1152 Road openings and restoration (Utilities) and WSA 02 clause 25.

Property owner advice: Provide notice to affected property owners of any pending works.

Vertical tolerance: Structures and fittings on finished surface levels as follows:
- ± 5 mm in road reserves and trafficable areas.
- + 50 mm, – 20 mm in private property non-trafficable or occasional traffic areas.

Backfill
Requirement: In other than roadways, place the backfill sufficiently high to compensate for expected settlement and carry out further backfilling or trim the original backfill at the end of the Defects Liability Period so that the surface of the completed trench conforms to the adjacent surface.

Dry weather conditions: If dry weather conditions have persisted after the original backfilling, including during the Defects Liability Period, consolidate the trench before removing surplus materials from the site.

Disposal of surplus material: Submit for approval proposal for spreading the surplus material neatly in the vicinity of the trench to avoid future erosion of the backfill and adjacent ground surfaces. This is a WITNESS POINT.

Tunnelling: If tunnelling under paving, kerb and gutter or other improved surfaces in lieu of trenching, backfill to restore full support to those surfaces.

Bushland
Environmental: Carry out bushland restoration works in conformance with the Environmental Regulator.

Promote rapid re-growth: Restore the works area to as near as practicable to the pre-existing condition and leave the site in a condition that will promote rapid re-growth of native bush plant species.

Topsoil: Return stockpiled topsoil to its pre-construction location and place to minimise erosion.
Pre-existing vegetation: Use pre-existing vegetation as a seed source and place branches and/or logs across the slope to intercept runoff.

4.13 CONSTRUCTION CONFORMANCE

Work-as-executed details
Operation and maintenance: Submit work-as-executed details and operation and maintenance information as follows:

- Work-as-executed drawings in the same format as the design drawings and certified by a Registered Surveyor.
- Show the actual location and alignment of pipelines. Include the size, type, levels of pipelines, valve and hydrant chamber types and cover details and easement requirements for maintenance.
- Asset register data as directed.

Video record of internal condition: Provide a video recording of the internal condition of all mains at the time for Practical Completion of the Contract.