TECHNICAL SPECIFICATION
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1.0 DEFINITIONS

Rigid Pipes

Pipes manufactured from Fibre Reinforced Cement (FRC), Vitrified Clay (VC), Ductile Iron (DI) and Cast Iron (CI).

Flexible Pipes

Pipes manufactured from unplasticised Polyvinyl Chloride (UPVC), High Density Polyethylene (HDPE) and Glass Reinforced Plastic (GRP).

Superintendents Representative

The Superintendents Representative will be Councils representative on site during the construction phase of the project. The Superintendents Representative will be the Contractors primary contact point for technical and construction matters, notwithstanding the Contractors responsibility to report to the Superintendent.

2.0 SAMPLES

If directed by the Superintendent, the Contractor must submit samples of all pipes, bedding, backfill and pavement materials at least 28 days prior to the proposed date of installation.

The samples shall be clearly marked, as follows:

(i) Contractor's name
(ii) Contractor's address
(iii) Source of supply
(iv) Contract number or name

The Superintendent may, at their discretion, conduct tests on the supplied samples and reject them where they do not comply with the Contract.

3.0 CONNECTION TO AND WORK ON REDLAND CITY COUNCIL SEWER OR WATER MAIN

Prior to commencing work on the construction of the sewers or water mains, verify that the location and level of the intended connection to the existing pipe is as stated on the Drawings and that a connection to the existing pipe can be made.

Advise the Superintendent, in writing, prior to commencement of construction of the sewer or water main if the connection to the existing pipe cannot be made at the location and level shown on the Drawings.

Arrange for connection to and any work on live sewers or water mains under the control of the Redland City Council to be carried out by Redland City Council.

Live works and connections will be carried out by Redland City Council or a Redland City Council approved contractor engaged by Redland City Council in accordance.

For water mains, arrange for sterilisation of all of the mains for commissioning including bacteriological sampling and testing in accordance with the SEQ Design and Construction Code.

The Contractor shall program time and resources and attend the live connections with Redland City Council resources

Redland City Council will not impose costs for live works. Live works connections are to be scheduled during normal Redland City Council working hours and in accordance with barge times. Minimum notice time for live works connections is 10 days.
All materials / excavation / safety / Traffic Control / Management etc., including bolting the valves together in preparation for a water main cut-in, are to be supplied by the contractor. RCC will cut and place the water main connection. For existing sewer manhole connections, the contractor is to lay up to the sewer manhole – with the break in being conducted by RCC. For new manholes, the contractor is to construct the new manhole over the existing sewer pipe with RCC doing the break in of the existing pipe.

4.0 MATERIALS

Pipes and fittings for sewers and water mains shall be as specified in the Contract Documents.

Pipe fittings shall be compatible with the class of pipe laid.

4.1 Unplasticised PVC (UPVC) Sewer Pipes and Fittings

UPVC pipes and fittings shall comply with AS/NZS 1260 Parts 1 - 5 for Unplasticised PVC (UPVC) Pipes and Fittings for Sewerage Applications.

Pipe Class shall be as shown on the Drawings. Sewer pipes shall be DN150-SN8 and DN225-SN10.

Pipes shall be cream in colour and identified in accordance with Section 4 AS/NZS 1260 Part 1.

Jointing shall be rubber ring joints unless:

(a) Adaptor couplings and single couplings for jointing cut pipes require solvent welding at the Site.

(b) Couplings and fittings are solvent welded to pipes at the Manufacturer's works.

(c) The joint is to be encased in concrete.

Use cleaning fluids and solvent cement in accordance with the Manufacturer's recommendations.

Maximum effective length of pipes shall be 6.0m.

Provide a Certificate of Compliance by the Manufacturer showing the results of tests carried out to determine compliance of the pipes and fittings with AS/NZS 1260.

For construction purposes, UPVC pipes shall be considered as flexible pipes.

4.2 Modified PVC (MPVC) Water Pipes and Fittings

MPVC pipes and fittings shall comply with AS/NZS 1477.

Pipe Class in non-traffic areas shall be Series 2 PN16.

Pipes shall be blue in colour and identified in accordance with Section 4 AS/NZS 1477 Part 1.

Jointing shall be rubber ring joints unless:

(a) Adaptor couplings and single couplings for jointing cut pipes require solvent welding at the Site.

(b) Couplings and fittings are solvent welded to pipes at the Manufacturer's works.

(c) The joint is to be encased in concrete.

Use cleaning fluids and solvent cement in accordance with the Manufacturer's recommendations.
Maximum effective length of pipes shall be 6.0m.

Provide a Certificate of Compliance by the Manufacturer showing the results of tests carried out to determine compliance of the pipes and fittings with AS/NZS 1477.

4.3 **Ductile and Cast-Iron Pipes and Fittings**

Ductile Iron and Cast-Iron pipes and fittings shall comply with AS 2280 and AS 2544 respectively.

Ductile Iron pipes shall be Class K9 or K12, where specified.

Jointing shall be rubber ring joints unless flanges are specified.

Flanges for cast iron pipes and fittings shall be Table D to AS 2129.

All Ductile Iron and Cast-Iron pipes and fittings shall be bitumen coated externally, sleeved in a polyethylene sleeving and shall be cement mortar lined (Class heavy, as defined in AS 2544 - Grey Iron Pressure Pipes and Fittings - Table 9.1).

4.4 **Glass Reinforced Plastic (GRP) Pipes and Fittings**

GRP pipe is not approved for general use.

4.5 **Mild Steel Pipe**

Mild steel pipe is approved for use in trunk mains of 300mm diameter and larger.

Steel pipe shall be manufactured in accordance with AS 1579.

All pipe shall be rubber ring jointed.

Pipes shall be pressure rated to withstand a system pressure of 2.00 MPa.

Pipes shall be internally coated with a thick cement lining.

Pipes shall be externally coated with a low-density polyethylene fusion bonded to the heated pipe.

4.6 **High Density Polythene (HDPE) Pipes and Fittings**

HDPE pipe and fittings are only to be used in special circumstances as approved by the Superintendent.

HDPE Pipe shall be Type 50 manufactured and tested in accordance with AS 1159.

HDPE pipe shall be of minimum Class 12, 50-year design life.

4.7 **Rubber Rings**

Rubber rings shall comply with AS 1646 - Rubber Joint Rings for Water Supply, Sewerage and Drainage Purposes.

Rubber rings used for gravity sewers or house connections shall contain between 1.2 per cent and 1.5 per cent by mass of compound of Bayer Preventol B2 root inhibitor.

Rubber rings incorporating root inhibitor shall be identified by one or more of the following methods as specified in AS 1646, Section 5.

(a) By embossing or indelibly marking by other suitable means the letters "RI"
Rubber rings used for water mains shall not contain any root inhibitor.

4.8 Geotextile

Geotextile shall be a non-woven fabric made from continuous filament and synthetic fibres.

Minimum properties of geotextile shall be:

- Nominal weight: 180 g/m²
- Load (as per AS 3706): 750 N
- Trapezoidal Tear Strength (as per AS 3706): 0.350 kN
- CBR Burst Strength: 2.5 kN
- Permittivity (under 1.0 metre head): 340 l/m²/second

The minimum lap of adjoining sheets shall be 300mm.

The method of installing the geotextile shall be in accordance with the Manufacturer's recommendation, or as may be approved in writing by the Superintendent.

4.9 Cast Iron Manhole Lids and Frames

Cast Iron manhole lids and frames shall be manufactured in accordance with AS 1830 - Grey Iron Castings.

4.10 Sluice Valves

Valves shall comply with AS 2638, Class 14 with O-ring spindle seals for valves less than 450mm dia. and gland packed seals for valves 450mm dia. and greater.

Valves shall be coated internally and externally with fusion bonded epoxy or Nulon 11 coating. Coating may be in any colour except black.

Valves shall be counter clockwise closing and fitted with a spindle cap unless otherwise specified. Valves over 300mm dia. shall be flanged. All valves shall be Authority approved.

4.11 Air Valves

Air valves shall be manufactured from gunmetal or an alternative non-corrosive material.

Sealing of the air bleed hole shall be by a float made of a non-corrosive non-flexible material sealing against a flexible seat.

25mm diameter air valves shall have a BSP threaded fitting while 100mm diameter air valves shall have flanged fitting drilled to AS 2129 to Table D.

Air valves shall be installed with a suitable isolating valve to allow removal of air valve for maintenance.

4.12 Scour Valve Arrangement

Scour valve arrangements shall consist of a scour tee fitting and a flanged sluice valve to the sizes specified below:

<table>
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<tr>
<th>Main</th>
<th>Scour Size</th>
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<tr>
<td>300 - 450mm</td>
<td>100mm</td>
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4.13 Fire Hydrants

Spring hydrants shall be manufactured of ductile or cast iron to the requirements of the SEQ Design and Construction Code and SEQ-WAT-1302-1 and SEQ accepted products.

Spring hydrants shall be treated and coated with an approved fusion bonded coating as per sluice valves. The spring hydrant manufacturer must be an approved supplier acceptable to the Redland City Council.

The hydrant mushroom shall be formed from either gunmetal or phosphorous bronze.

The spring shall be manufactured of a suitable grade of stainless steel.

All bolts used in the assembly of the spring hydrants shall be of stainless steel to AS 1449, Grade 316.

Flanges shall be drilled to the pattern specified by the Redland City Council.

4.14 Nuts and Bolts

All nuts and bolts (including assembly nuts and bolts) shall be stainless steel to AS 1449, Grade 316, with an anti-seizing paste used in assembly.

Stainless steel bolts and nuts shall comply with the metric standards AS 1111 and AS 1112 with dimensions as set out below:

<table>
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<tr>
<th>Bolt Size</th>
<th>Dimensions Across Hexagonal Flats</th>
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<tr>
<td></td>
<td>Maximum</td>
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<tr>
<td>M16</td>
<td>24mm</td>
</tr>
<tr>
<td>M20</td>
<td>30mm</td>
</tr>
<tr>
<td>M24</td>
<td>36mm</td>
</tr>
<tr>
<td>M30</td>
<td>46mm</td>
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These dimensions do not apply to bolts which form an integral part of an article.

Bolts lengths shall be equal to the sum of the thickness of the flanges, gasket and nut, and rounded up to the nearest standard size.

Bolts shall exhibit a clean cut thread with no burrs or torn peaks on the threads. Nuts must turn freely on the threads without binding.

4.15 Valve and Hydrant Cover Boxes

Hydrant and valve boxes shall conform with Redland City Council Standard requirement.

Hydrant and valve boxes shall be manufactured in ductile or cast iron, with a maximum all up weight of 50 kg.

The boxes and covers shall be coated in an approved bitumen based coating.

Hydrant and valve box lids shall be marked FH and V respectively.

Road Markers shall be placed in accordance with the SEQ Design and Construct Code.
4.16 Galvanised Steel

Galvanised mild steel shall be in accordance with AS 1650. Hot Dipped Galvanised Coatings on Ferrous Articles.

4.17 Polyethylene Sleeving

Polyethylene sleeving film shall be manufactured in accordance with AS 3680 - Polyethylene Sleeving for Ductile Iron Pipes and installed in accordance with AS 3681 - Guidelines for the Application of Polyethylene Sleeving to Ductile Iron Pipes and Fittings.

4.18 Concrete

Concrete works shall conform to the SEQ Design and Construction Code.

5.0 SURVEY SETOUT

Survey marks and set out information supplied by the Principal’s Surveyor or shown on the Drawings is to the centreline of the pipe.

6.0 INSPECTION OF SEWERS AND WATER MAINS

6.1 Witness Points - During Construction

The Contractor must arrange for the Superintendent to inspect the pipe construction at the following stages:

(a) Excavation of trench and trench foundation.
(b) Placement of bedding and laying of pipe.
(c) Immediately prior to the placement of backfill material.
(d) At completion of backfill and restoration of surface and pavements.

6.2 Completion of Construction of a Sewer

 Immediately prior to Practical Completion and also immediately prior to the issue of the Final Certificate, arrange for the Superintendent to undertake a visual inspection of sewers, manholes and fixtures. The Contractor shall undertake an RPEQ endorsed and certified CCTV survey in accordance with the WSAA CCTV specification including inclination report assessment at no cost to the Principal.

The Contractor must ensure all work on the sewer is complete at these inspections and that all tests have been completed, and that prior to the Practical Completion inspection, all sediment has been removed from manholes and sewer pipes and the system has been flushed with clean water.

7.0 EARTHWORKS FOR SEWER AND WATER MAINS

7.1 General

Carry out localised excavations where necessary to permit construction of the works specified. The Geotechnical Investigation and Acid Sulphate Soil Assessment Report for Proposed Sewerage Scheme Point Lookout North Stradbroke Island, 2 June 2005, is included as part of this specification. Several boreholes were taken along the route of the sewer and water lines, these are marked on the applicable drawings.

Borehole 13A showed a positive test result for acid-Sulphate soil, however, this borehole is located in the south-west corner of the intersection of East Coast Road and George Nothling Drive, approximately 840m east
of SPS072. Notwithstanding the results of the Geotech Report, it is the Contractors responsibility to test the acidity of soils excavated from the work site and treat in accordance with their endorsed Environmental Management Plan.

7.2 Clearing and Grubbing

Clearing and grubbing includes:

(a) Removal of trees, shrubs and overhanging branches.

(b) Demolition and removal of buildings, foundations, concrete slabs and other artificial obstructions.

(c) Removal of other vegetation matter from the ground surface (including any subsequent regrowth).

Comply with all Acts, Local Laws or Regulations having reference to clearing, and disposal of timber and debris. No burning is permitted.

Clear along the line of any trench and such other minimum area necessary to allow the excavation required to permit construction.

Do not remove or damage trees other than those specified for removal.

Grub out all stumps and vegetation to a minimum depth of 300mm below the ground surface finished profiles or subgrades.

Dispose of cleared and grubbed vegetation and debris by removal from the site and fill all grub holes with approved fill material compacted to the density of the surrounding material.

Reinstate to the approval of the Superintendent by seeding, planting or other measures, any clearing in excess of that required for the work under the Contract.

7.3 Dewatering

The Geotechnical Investigation and Acid Sulphate Soil Assessment Report for Proposed Sewerage Scheme Point Lookout North Stradbroke Island, 2 June 2005, identified the presence of a ground water table in the area of the Point Lookout Area A1 Sewerage extension. This water table data has been transferred to the longitudinal drawings for the Contractors reference but is only an indication of the likely presence of a water table and the Contractor is to make their own determination of the presence of groundwater.

The Contractor is responsible for determining the requirement and extent to dewater any or all portions of the sewerage and water line works under this contract and to manage the dewatering in line with the applicable principles and standards for this work including any treatment, sedimentation control and discharge.

7.4 Topsoil

The Contractor must strip all topsoil containing humus material from the whole of the area which is to be excavated and stockpile for re-use. Ensure the volume of topsoil stockpiled is sufficient to meet the specified topsoil replacement requirements.

Should the volume of topsoil containing humus material be in excess of requirements, the Contractor must increase the depth requirements for re-topsoiling uniformly to eliminate the surplus.

Should the volume of stockpiled topsoil be insufficient to meet the replacement requirements, strip additional topsoil if available.
Should insufficient topsoil be available from the site, the Contractor must notify the Superintendent in writing of the shortfall prior to commencement of any earthwork’s operations.

Incorporate any additional unstripped topsoil, surplus to requirements, within the earthwork’s operations.

Stockpile stripped topsoil material at sites approved by the Superintendent.

Take care in the stripping operations and in the maintenance of stockpile areas to avoid contamination of topsoil by other materials.

At completion of the works and prior to practical completion, spread topsoil material to a minimum depth of 100mm on all unpaved work areas.

Remove excess topsoil material from the site, only with the approval of the Superintendent.

Remove sticks and stones over 30mm diameter from all topsoil. Ensure completed topsoiled areas are not compacted by machinery.

**7.5 Rock Excavation (Provisional Item)**

All material not classified as rock shall be classified as soil.

"Rock" shall be deemed to be material which cannot be excavated by a hydraulic tracked excavator with engine gross power output of 148 kW at maximum RPM and a rated breakout force on the bucket of 148 kN with standard bucket at the rate of 15m³/hr. It shall be the responsibility of the Contractor to provide the excavator and bucket for this purpose at his cost. The Superintendent shall have the right to nominate an operator for this machine.

Proving the material to be rock shall be the Contractor's responsibility. The excavator employed shall be in good working condition and to the satisfaction of the Superintendent, who shall have the right to nominate the excavator operator (whether a Contractor’s employee or not) and to direct the operations of the excavator during the proving operation.

Irrespective of whether material is soil or rock the Contractor may carry out excavations using any equipment and any safe techniques.

Excavation in rock is measured as the actual solid volume of rock in cubic metres as determined by the Superintendent based on the minimum trench dimensions specified.

**7.6 Excavation Work**

Excavate in accordance with the requirements of the Workplace Health and Safety Act and Regulations and this Specification.

All excavation shall be in trench unless otherwise shown on the drawings or approved or directed by the Superintendent.

Commence excavation only when sufficient labour, materials, plant and equipment are on site to ensure uninterrupted progress of the works.

Minimise the length of open trench and excavated area and maintain safe conditions.

Excavate trenches to lines and grades specified. Where excavation is carried out in sealed pavements cut the sealed surface prior to excavation with saws or other approved tools to straight lines to facilitate restoration of the pavement to as close as possible to its original condition.

Trench depths shown on the Drawings are the depths to invert of the pipe.
Excavate to the required depth for the specified depth of bedding material below the pipe.

Widen and deepen excavation at manholes and other structures, valves, hydrants or fittings to accommodate manholes, other structures, valves, hydrants or fittings.

Advise the Superintendent where a trench is excavated to widths and to depths greater than the minimum for the pipes and fittings specified. At the direction of the Superintendent supply and lay an appropriate higher class of pipes and higher quality bedding.

Variations will not be approved for the supply of stronger pipes or for supply and placement of additional or higher quality bedding where over excavation has occurred.

Stockpile excavated material adjacent to the excavation if sufficient area is available, or at a location adjacent to the site approved by the Superintendent.

Maintain a minimum of one metre clearance between the edge of the excavation and the toe of any stockpile heap.

Ensure that excavated material stockpiled adjacent to the excavation does not affect the stability of the wall of the excavation.

Take care to prevent contamination of excavated material which could be used for bedding, backfill and replace any such material which or becomes contaminated.

Dispose of excavated material not required or unsuitable for use as bedding or backfill as approved by the Superintendent. The contractor is responsible for removing soil from site, including disposal of all materials on the project.

For the purposes of any measurement the depth of a section of a pipe shall be taken as the average depth from the finished surface level to the invert of the pipe at the point of connection to a manhole structure or end cap. The maximum cover on any water main shall be limited to 1.0 metre unless otherwise specified.

Where development work entails filling over an existing water main, prior approval must be obtained from the Superintendent where the final cover over the water main is greater than 1.0 metres.

Excavate to the required depth to allow for the specified depth of bedding material below the pipe.

7.7 Shoring of Excavations

Supply, install and maintain timbering, shoring and bracing as may be required to support the wall of the excavation and to prevent any movement which may injure or endanger persons, cause damage to any adjacent pavements, buildings, conduits or other structures.

Remove timbering, shoring and bracing from the excavation in a manner which does not affect the work or adjacent pavements, buildings, conduits or other structures. Timbering, shoring or bracing shall be left in place only at the direction of the Superintendent.

7.8 Unsuitable Foundation

Unsuitable foundation is material below the bottom of the excavation which the Superintendent directs to be excavated and replaced with an alternative type pipe bedding material.

At the direction of the Superintendent:

(i) Excavate unsuitable foundation to the line, depth, grades and widths directed.
(ii) Upon completion of the excavation arrange for the Superintendent to re-inspect.
(iii) Place bedding material of the type specified and to the depth directed.
(iv) Install an approved geotextile.

Material below the bottom of the excavation shall not be classed as unsuitable foundation solely due to excess water which may be removed by dewatering or other means.

7.9 Boring and Jacking of Pipes

Where boring is nominated on the contract drawings, pipelines may be constructed by progressively boring and then jacking an approved enveloping pipe underneath the existing ground surface. Undertake all such boring and jacking work without disturbance to the existing surface, and without impact on adjacent trees.

Employ specialist personnel experienced with the equipment and methods proposed to be used when undertaking all boring, jacking and pressure grouting work.

Neither oversize boring nor water-assisted nor lubricant-assisted nor wet boring methods shall be used unless such methods are approved by the Superintendent.

Assessing of ground conditions, determining boring and thrusting conditions and dewatering requirements, and all design work required shall be the Contractor's responsibility, and requires certification by an RPEQ Engineer.

Insert the enveloping pipe into the hole simultaneously as boring advances. Do not withdraw the enveloping pipe after the completion of boring and jacking. Do not allow excavation to proceed more than 600mm ahead of the lead pipe.

Ensure that the boring and jacking operation is continuous from each starting pit to the next adjacent pit. The Superintendent may require the Contractor to provide full stand-by capacity for the Contractor's plant and equipment to ensure such continuous operation, at the Contractor's cost.

Provide a shield or cutting edge to protect the leading edge of the front pipe, for the purpose of jacking. Such a shield shall not exceed the outer diameter of the pipe by more than 14mm.

Ensure that all inserted pipe, or any wrapping thereon, is not damaged during, or as a result of insertion in the enveloping pipe.

Unless otherwise specified, pressure grout the annular void between the enveloping pipe and the gravity sewer, or house connection or water main using an approved Portland cement grout. Ensure that the Manufacturer's recommended allowable external pressure for the type of pipe used is not exceeded and that excessive deflection, distortion or damage of such pipe is prevented during or as a result of pressure grouting. At each of the grouted section for gravity sewers or house connections provide short pipes of minimum 300mm and maximum 600mm length. Provide a flexible joint at each end of the grouted section of water main.

Construction tolerances in grade and alignment for pipeline construction by a boring and jacking method must be maintained as for construction by conventional trenching methods.

Maintain a minimum clearance between the sewer or house connection or water main and the enveloping pipe of 75mm.

Ensure that an excavated pit is constructed at both ends of the enveloping pipe, to enable line and level of the pipeline to be checked by the Superintendent prior to final inspection and acceptance of the bored and jacked pipeline. On completion take all steps necessary to prevent ingress of foreign materials to the pipeline and the enveloping pipe.

Notwithstanding the above, an alternative method of trenchless pipeline construction may be accepted providing such a method is recommended by an RPEQ Engineer in writing prior to its use.
7.10 Vegetation Protection

Existing trees, vegetation and natural features which are noted on Contract Drawings or designated by the Superintendent as protected items are to be marked and left undisturbed.

Allow for the supply of labour, plant and materials by the Contractor, to assist the Superintendent, from time to time during the course of the work under the Contract, to mark protected items.

Access to landscaped, restored or preserved areas shall not be permitted without the written approval of the Superintendent.

8.0 PIPE BEDDING AND LAYING AND JOINTING

8.1 Trench Construction

The trench construction type is to be as nominated in the design drawings and SEQ Code and drawings SEQ-SEW-1200-1 to SEQ-SEW-1205-1 for sewerage pipes and SEQ-WAT-1200-1 to 1204-1 for water pipes.

8.2 Bedding

Placement of bedding in trenches shall not be commenced until the trench bottom has been inspected and approved and the bedding type confirmed by the Superintendent.

Unless otherwise noted in the design drawings the granular embedment material shall be single-sized 7mm aggregate, in accordance with SEQ Code.

8.3 Laying and Jointing Sewer Pipes

The Contractor must lay pipes to the lines and grades specified in the Contract Documents.

Check sewers for line and grade by visual inspection of the bore and in addition by level checks as follows:

- Sewer less than 225mm diameter levels checked at each manhole
- Sewer 225mm - 375mm diameter levels checked at each manhole and at maximum 20m intervals.

Jointing of pipes and fittings is to be in accordance with the manufacturer’s recommendation.

Ensure that the seal at joints is adequate to withstand the test pressures to be applied to the sewer.

Remove any material which may enter the pipe during jointing and ensure pipe bores are kept clean.

Cap the ends of dead-end sewers, junctions, house drains and manhole inlets for future connections using caps approved by the Superintendent, and in accordance with the material standard.

Construct oblique junctions, house connection branches and risers for connection of sewers to house drains where shown on the Drawings or directed by the Superintendent.

Take care in constructing house connection risers to support the pipes firmly in position and to protect the pipes from damage or movement during construction of the concrete surround and during the placement and compaction of backfill material.

Detectable pipe and identification tape colour to be in accordance with SEQ Design and Construction Code. Detectable marker tape to be located 300mm above the pipe.

8.4 Laying and Jointing Water Mains
Lay pipes in straight lines, or where changes in direction are required, in smooth curves. The deflection at each joint shall not exceed the Manufacturer's recommendation for the pipe being laid.

Lay pipes in accordance with trenching requirements of Contract Drawings and SEQ Design and Construction Code.

Pipe and identification tape colour to be in accordance with SEQ Design and Construction Code. Marker tape is to be located 300mm above the pipe.

All DICL pipes must be polyethylene sleeved. Tape sleeving to form an integral sleeve over the full length of the pipeline and fittings. Ensure that the sleeving is not punctured during handling. Should punctures occur, repair in accordance with the Manufacturer's recommendations.

Check water mains for line and grade by visual inspection of the pipe and by level checks where necessary.

Joint pipes and fittings in accordance with the Manufacturer's recommendation using rubber rings, unless otherwise specified.

Remove any material which may enter the pipe during jointing and ensure pipe bores are kept clean. Flush all mains thoroughly prior to connection to a Redland City Council main.

8.5 Bridging Over Pipelines

Where required, install concrete bridging over the sewer main as specified. This shall be designed by an RPEQ Engineer.

8.6 Thrust and Anchor Blocks

Construct concrete thrust and anchor blocks as specified at all bends, tees and dead ends of a water main. Ensure blocks are founded against sound material in accordance with SEQ Design and Construction Code standards and material is capable of withstanding hydrostatic forces without movement.

Do not pressure test water mains until the concrete in the thrust and anchor blocks has developed sufficient strength to withstand the forces exerted during the pressure test.

Thrust and anchor blocks are to be exposed for visual inspection during the pressure test.

Refer to SEQ Design and Construction Code and SEQ standard drawings SEQ-WAT-1200-1 and 1205-1 for construction of thrust blocks in different subgrade material types.

8.7 Backfilling

Backfill, or trench fill, is that material placed in the excavation above the embedment material to 150mm below finished surface level in unpaved areas and to the underside of pavement material in roads and paved areas.

Compact backfill material in layers not greater than 200mm thick to the standard specified in clause 8.8 pf this Specification, unless otherwise specified.

Backfill material shall be a material available on site or imported to the site which complies with the requirements of 8.1 or the following requirements and is approved by the Superintendent.

<table>
<thead>
<tr>
<th>Location</th>
<th>Approved Backfill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under paved areas, Road Pavements and</td>
<td>A sand complying with AS 2758.1 for fine aggregate or a selected fill material as</td>
</tr>
<tr>
<td>Department of Main Roads Road Shoulders:</td>
<td>specified hereunder.</td>
</tr>
</tbody>
</table>
Cement stabilised sand is to be 25:1 sand:cement placed dry and compacted in 100mm layers.

Excavate and relay any pipework damaged during backfilling.

**Selected Fill**

(a) A gravel, decomposed rock or broken rock, free from organic matter and lumps of clay having the following grading and properties:

<table>
<thead>
<tr>
<th>AS Sieve (mm)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.50</td>
<td>100</td>
</tr>
<tr>
<td>9.50</td>
<td>60 - 85</td>
</tr>
<tr>
<td>2.36</td>
<td>25 - 70</td>
</tr>
<tr>
<td>0.075</td>
<td>3 - 30</td>
</tr>
</tbody>
</table>

(b) Sand, Clayey Sand, Sandy Clay or loam having the following grading and properties may be used as an alternative selected fill only with the approval of the Superintendent:

<table>
<thead>
<tr>
<th>AS Sieve (mm)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.50</td>
<td>100</td>
</tr>
<tr>
<td>2.36</td>
<td>70 - 100</td>
</tr>
<tr>
<td>0.075</td>
<td>3 - 30</td>
</tr>
</tbody>
</table>

Completely refill all tunnels to the roof of the tunnel with cement stabilised sand filling, placed in layers not more than 200mm thick, with each layer compacted before the succeeding layer is placed. Backfill tunnel shafts similarly to trenches.

**8.8 Compaction Requirements**
Approved bedding, surround, select fill and trench backfill shall comply with the following compaction requirements:

- Cohesionless materials shall be compacted to 60% Density Index determined in accordance with AS1289.5.6.1 in non-trafficable areas. The Density Index shall be increased to 70% in trafficable areas.
- Cohesive materials shall be compacted to 90% Standard Dry Density Ratio determined in accordance with AS1289.5.4.1 based on the Field Dry Density as per AS1289.5.3.2 or AS1289.5.8.1 and Maximum Dry Density as per AS1289.5.1.1 in non-trafficable areas. The Dry Density Ratio shall be increased to 95% in trafficable areas.

8.9 Testing for Compaction

Determine Density Indices and Dry Density Ratios at randomly selected locations progressively during the compaction operations in accordance with the “Acceptance Testing” requirements of this contract.

Carry out compaction testing of all bedding and backfill under roads, paved areas and within road reserves, development areas and non-trafficable areas in accordance with the SEQ Design and Construction Code at the following minimum rates:

Conduct a compaction test at the completed embedment zone for each 100 lineal metres of pipeline or part thereof unless the embedment compaction method is prequalified in accordance with Section 19.3 of the SEQ Sewerage Code. For trenches located in a trafficable zone, conduct one test in each 300 mm of trench fill for each 50 lineal metres of sewer or part thereof. For trenches located in a non-trafficable zone, conduct one test in each 900 mm of trench fill for each 100 lineal metres of sewer or part thereof. For maintenance and inspection structures conduct one test within each 1 metre depth at one location within 300 mm of each riser or shaft. Increase the number of tests if directed by the Superintendent.

Compaction requirements specified are minimum requirements. Results falling below the required value will not be accepted. Backfill all test holes with approved material and compact to the standard specified.

9.0 SYSTEM FEATURES

9.1 Water Services

Water service connections are to be singular and copper pipe in accordance with SEQ Water Code and Drawings SEQ-WAT-1107-2 and SEQ-WAT-1109-2. The Contractor is to tap into the existing 200 DICL water main and connect to the existing water meter for each affected property. No disturbance or reduction in water pressure is to be caused to any properties other than a minimal disturbance to the property being connected. The Contractor is to notify the Service Manager Network Operations 24 hours prior to the commencement of each service connection. The replaced service pipe is to remain pressurised until all properties are disconnected to the 150 AC water main that is to be abandoned.

9.2 Cover Boxes, Margin and Valve Boxes

Fix cast iron cover boxes over valves and hydrants and cast concrete margin around valve and hydrant cover boxes as specified.

Construct walls of brickwork or concrete blocks on which the cover boxes are to be founded on a sand cushion as specified, so that as little as possible weight or shock, is transmitted to the pipe.

Provide round reinforced concrete margin or surround with a rectangular hole to fit the cast iron cover box.

All valves over 300mm diameter shall be flanged and housed in suitably sized concrete valve boxes. Install valves by use of a connector and Gibault to facilitate easy removal for maintenance purposes. Install the connector and Gibault within the valve box.

9.3 Marker Plates - Hydrant and Valve
Install hydrant and valve marker posts to mark the location of all hydrants and valves. Position hydrant and valve marker posts against the front property boundary directly behind the fitting. Marker posts must conform with the Redland City Council requirements.

9.4 Scour Outlets

Construct scour outlet and protection as specified.

9.5 Manholes

Survey marks and set out information supplied by the Principal's Surveyor or shown on the Drawings is to the intersection point of the centreline of the largest upstream and downstream sewers and is not necessarily the true centre of the manhole. Prior to excavating the manhole establish the true position of the centre of the manhole to ensure that benching within the manhole conforms to the requirements specified or in the absence of any specific requirements that the change in direction of sewer flow occurs over the maximum radius possible in the manhole.

Construct manholes as specified. Unless cast-insitu manholes are specified precast manholes may be used where the particular manhole system has been approved by the Superintendent.

Concrete in manholes shall be S32 with all characteristics as per Normal-Class concrete.

Pour cast-insitu concrete walls against formwork and not against ground, sandbags or similar.

Use Type 2 bedding as a foundation for manholes where the adjacent sewer pipes are bedded on Type 2 Bedding.

Increase the manhole base slab thickness to 300mm for all manholes greater than 2 metres in depth to sewer invert. (Thickness is measured at the invert level of the outflow pipe.)

Cast the concrete surrounding the spillway pipes and external drops monolithically with the manhole wall concrete. Wash manhole couplings with a neat cement or other approved treatment to ensure a good bond and freedom from leaks and cast into the walls as concrete is placed.

When constructing Type C inlets (external manhole drops) scabble the external surface of the manhole to ensure a good bond between the manhole wall concrete and the drop surround concrete.

Cement render benches and channels with two (2) layers of cement sand mortar, comprised of one-part cement and two parts approved fine sand, to give a total thickness of 12mm. Apply cement render to 'green' concrete unless otherwise approved by the Superintendent. Wet, scabble and score dry concrete and the first layer of cement mortar to ensure a sound bond. Finish cement mortar with a steel trowel true to the shape and dimensions specified.

Top slabs shall preferably be poured in-situ. Alternatively, a precast top slab may be used with the approval of the Superintendent, provided that the joint between the slab and wall can be made watertight.

Unless otherwise specified, cast iron manhole covers and frames for manholes shall be manufactured to Department of Local Government standards. The cover shall give an even and true seating in the frame.

Prior to finishing the manhole ensure that the finished level is verified on site and adjusted as necessary to correspond to the actual finished surface level and grade of the surrounding surface.

Set precast concrete rings in 12mm thick cement mortar placed on a clean scabbled surface.

Finish concrete rings to the grades and levels specified in Clause 3.19 of this Specification.

Construct manhole inlet Types as specified in the Contract Documents.
Provide non-slip step irons (steel with full plastic encapsulations) being Aymroo or approved equivalent and comply with AS1657.

Seal all manhole lids using a strip of bitumen impregnated foam plastic. Ensure that the seal is intact at the end of the maintenance period.

10.0 TESTING OF SEWERS AND MANHOLES

10.1 Construction Testing

At completion of the construction of a section of the sewer, the section is to be air tested to ensure that the completed sewer will comply with the "Acceptance Testing" requirements of this contract.

A section of sewer shall mean the length of sewer between constructed manholes including drops, house connection branches and risers, oblique junctions and with 300mm of backfill placed over the sewer pipe, unless otherwise notified by the Superintendent.

10.2 Acceptance Testing of Sewers

At completion of the Works the Contractor must arrange for the sewer to be air tested in the presence of the Superintendent.

Provide all labour and equipment necessary to conduct the test, including a pressure test gauge of 150mm minimum diameter, calibrated and certified by an approved Testing Authority to accurately measure pressures within the range 0 to 50 kPa.

Adopt the following general procedure for conducting the test unless otherwise directed by the Superintendent:

(a) Test a complete sewer length including all connections, risers and drops.

(b) Plug all open sewer pipes and make the sewer airtight.

(c) Connect an airline from an air compressor and raise the pressure in the sewer to the initial pressures shown in the Table hereunder and hold the air pressure at the initial pressure for a minimum of three minutes to stabilise temperatures.

\[
\begin{array}{|c|c|c|c|c|c|}
\hline
\text{Initial Pressure} & 0-1.5 & 1.5-3.0 & 3.0-4.5 & 4.5-6.0 & \text{Over 6.0} \\
\hline
\text{Depth Range (metres)} & & & & & \\
\hline
\text{Initial Pressure (kPa)} & 30 & 35 & 40 & 45 & 50 \\
\hline
\text{Test Start Pressure (kPa)} & 25 & 30 & 35 & 40 & 45 \\
\hline
\end{array}
\]

(d) Close off the air supply to the sewer and measure the time taken for the pressure to drop by 5 kPa from the test start pressure.

(e) If the time in (d) above is less than the times shown in the Table hereunder, the sewer has failed the test.

\[
\begin{array}{|c|c|c|c|c|c|}
\hline
\text{Time To Drop 5 kPa} & 150 & 225 & 300 & 375 & 450 & 525 & 600 \\
\hline
\text{Main Sewer Diameter (mm)} & & & & & & & \\
\hline
\text{Minimum Time} & 1.5 & 1.5 & 3.0 & 3.0 & 4.0 & 5.0 & 6.0 \\
\hline
\text{(Minutes)} & & & & & & & \\
\hline
\end{array}
\]
(f) Undertake remedial works to the sewer and on completion of the remedial work arrange for retesting of the sewer in accordance with this clause.

For flexible pipelines, once restoration is substantially completed and the dewatering removed, in the presence of the Superintendent pass a sphere of diameter 5% less than the average internal diameter of the sewer pipe down the sewer for the full sewer length between manholes, to check for any deflection. If the sphere will not pass freely down the sewer, the deflections in the pipe will be considered excessive and require rectification.

10.3 Acceptance Testing of Manholes

25% of manholes, as selected by the Superintendent are to be water tested as follows:

(a) Plug off all sewers entering or leaving the manhole.

(b) Fill the manhole with water to the level directed by the Superintendent and maintain the water surface at this level for a minimum period of four hours.

(c) After the initial four hour period in paragraph (b) above, determine the leakage of water from the manhole by measuring the drop in water surface level in the manhole.

The manhole shall be satisfactory if the level of the water surface in the manhole does not drop by a rate exceeding 25mm in a period of twenty-four hours.

Reconstruct any manhole which does not pass the water test unless an alternative form of remedial work to make the manhole watertight is approved by the Superintendent.

If any manhole does not pass the water test the Superintendent may direct the testing of any or all other manholes constructed. Such test will be done at the Contractor's expense.

11.0 TESTING OF WATER MAINS

11.1 Construction Testing

At completion of the construction of a section of the water main, pressure test the section to ensure that the completed main will comply with the "Acceptance Testing" requirements of this contract.

11.2 Acceptance Testing of Water Mains

At completion of the Works arrange for the water main to be hydraulically tested in the presence of the Superintendent and a Redland City Council representative.

Provide all labour and equipment necessary to conduct the test, including a pressure test gauge of 150mm minimum diameter, calibrated and certified by an approved Testing Authority to accurately measure the test pressures. Place the test gauge as close as practicable to the lowest point in the water main being tested.

Where cement lined pipes and fittings are installed, prior to hydraulic testing, fill the main with water and allow the system to stand full for a minimum period of 4 hours to allow for absorption by the pipe lining.

If the pipeline fails, the tests undertake remedial work and arrange for retesting of the pipeline in accordance with this clause.

11.3 Testing Procedures

All water mains constructed are to be tested to a pressure of 1300 KPa measured at the lowest point within the pipeline section being tested.
Pump water into the mains, ensuring all air is extruded, to a pressure of 1300 KPa. Maintain this pressure for a one (1) hour period with volume losses not greater than nominated below:

<table>
<thead>
<tr>
<th>Main Size</th>
<th>Allowable Volume Drop (Litres) Per 1,000 Metres Pipeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>10.0</td>
</tr>
<tr>
<td>150</td>
<td>15.0</td>
</tr>
<tr>
<td>225</td>
<td>22.5</td>
</tr>
<tr>
<td>300</td>
<td>30.0</td>
</tr>
<tr>
<td>375</td>
<td>37.5</td>
</tr>
<tr>
<td>450</td>
<td>45.0</td>
</tr>
<tr>
<td>525</td>
<td>52.5</td>
</tr>
<tr>
<td>600</td>
<td>60.0</td>
</tr>
</tbody>
</table>

11.4 Chlorination of water mains

All new mains are to be flushed and chlorinated.

12.0 TOLERANCES

12.1 Pipes and Associated Features

Tolerances are to be in accordance with SEQ Code WSA 02 Section 22.1 and 22.2, and Section 21 WSA 03.

12.2 Manholes

(a) Horizontal Tolerances

The locations of manholes shall not vary from those specified by more than +/- 50mm.

(b) Vertical Tolerances

The invert levels of manholes shall not vary from those specified by more than +/- 6mm, provided that the manholes join neatly to existing structures and are at levels compatible with other structures that are to be constructed in the works.

The levels of the tops of frames, surrounds and covers in paved areas shall match the finished surfaces. The levels of the tops of frames, surrounds and covers in unpaved areas shall match the finished surface grade and be 50mm +/- 10mm above the finished surface.

13.0 QUALITY MANAGEMENT PLAN

13.1 Inspection & Test Plans

The Contractor is to include Inspection & Test Plans (ITP’s) in their Quality Management Plan and submit these to Council prior to the commencement of construction for Council’s approval. The critical witness points include:

- Implementation of the Contractors Traffic Management Plan
- Implementation of the Contractors Environmental Management Plan
- Implementation of the Contractors Site Safety Management Plan
- Confirmation of notification to residents/owners 7 days in advance of construction
- Confirmation of notification to residents/owners 4 days in advance water service interruption
- Pre-construction reinstatement survey
- Grout filling of steel-cased bores
14.0 MEASUREMENT OF PROVISIONAL ITEMS

Bedding is measured in compacted cubic metres of material and is calculated as the product of the minimum trench width and minimum depth of the bedding material shown on the Drawings, the length of pipe laid on the bedding less the volume of the pipe encased by the bedding material. This measurement includes additional trench excavation and placement of bedding other than the type specified, where permitted.

Excavation in rock is measured as the solid volume of rock in cubic metres as determined by the Superintendent, based on the specified minimum trench width required for the sewer pipe.

15.0 SEQ DRAWINGS

The following drawings are provided for reference only.

15.1 Sewerage

SEQ-SEW-1103-1 RIGSS PIPELAYING TYPICAL ARRANGEMENTS
SEQ-SEW-1104-1 SEWERAGE HOUSE CONNECTION TYPICAL CONSTRUCTION DETAILS 1
SEQ-SEW-1105-1 SEWERAGE HOUSE CONNECTION TYPICAL CONSTRUCTION DETAILS 2
SEQ-SEW-1200-1 SOIL CLASSIFICATION GUIDELINES AND ALLOWABLE BEARING PRESSURES
SEQ-SEW-1200-2 EMBEDMENT & TRENCHFILL TYPICAL ARRANGEMENT
SEQ-SEW-1201-1 TYPICAL STANDARD EMBEDMENT FLEXIBLE & RIGID PIPES
SEQ-SEW-1202-1 TYPICAL SPECIAL EMBEDMENT INADEQUATE FOUNDATIONS REQUIRING OVER EXCAVATION AND REPLACEMENT
SEQ-SEW-1203-1 TYPICAL SPECIAL EMBEDMENT CONCRETE AND STABILISED SUPPORTS
SEQ-SEW-1204-1 TYPICAL SPECIAL EMBEDMENT SUPPORT UTILISING PILES
SEQ-SEW-1205-1 TYPICAL TRENCH AND BEDDING DETAILS WITHIN EXISTING ROADS
SEQ-SEW-1206-1 TYPICAL BULKHEADS AND TRENCH STOPS
SEQ-SEW-1207-1 TRENCH DRAINAGE TYPICAL SYSTEMS
SEQ-SEW-1207-2 TYPICAL DRAINAGE OF SEWER TRENCHES AND DIVERSION DRAINS
SEQ-SEW-1300-1 MAINTENANCE HOLES ≤ DN300 SEWER TYPES P1, P2 & P3 TYPICAL PRE-CAST
SEQ-SEW-1301-1 CAST IN-SITU MAINTENANCE HOLE TYPICAL COPING & ANCHOR BRACKET DETAILS
SEQ-SEW-1302-1 MAINTENANCE HOLES CAST IN-SITU AND PRECAST TYPICAL PIPE CONNECTION DETAILS
SEQ-SEW-1303-1 MAINTENANCE HOLES SEWERS ≤ DN300 TYPICAL CHANGES IN LEVEL DETAILS
SEQ-SEW-1307-1 DN1000 TO DN1500 CAST IN-SITU MAINTENANCE HOLES TYPICAL DETAILS
SEQ-SEW-1308-1 TYPICAL MAINTENANCE HOLE COVER AND SURROUND DETAIL
SEQ-SEW-1308-8 MAINTENANCE HOLE COVER SEWER - CLASS D - BOLT DOWN TYPICAL BASE FRAME DETAILS
SEQ-SEW-1308-9 MAINTENANCE HOLE COVER SEWER - CLASS D - BOLT DOWN TYPICAL RISER RING DETAILS
SEQ-SEW-1308-10 MAINTENANCE HOLE COVER SEWER - CLASS D - BOLT DOWN TYPICAL COVER DETAILS
SEQ-SEW-1308-11 MAINTENANCE HOLE COVER SEWER - CLASS D - BOLT DOWN TYPICAL COVER DETAILS
SEQ-SEW-1402-1 TYPICAL BURIED CROSSINGS MAJOR ROADWAYS
SEQ-SEW-1403-1 TYPICAL BURIED CROSSINGS BORED AND JACKED ENCASING PIPE DETAILS

15.2 Water Supply
SEQ-WAT-1102-1 TYPICAL MAINS CONSTRUCTION RETICULATION MAIN ARRANGEMENTS
SEQ-WAT-1103-1 TYPICAL MAINS CONSTRUCTION DISTRIBUTION AND TRANSFER MAIN ARRANGEMENTS
SEQ-WAT-1105-2 TYPICAL CONNECTION TO EXISTING MAINS
SEQ-WAT-1107-2 TYPICAL COPPER PROPERTY SERVICES MAIN TO METER AND CONDUIT DETAILS
SEQ-WAT-1200-1 TYPICAL SOIL CLASSIFICATION GUIDELINES AND ALLOWABLE BEARING PRESSURES
SEQ-WAT-1200-2 EMBEDMENT & TRENCHFILL TYPICAL ARRANGEMENT
SEQ-WAT-1201-1 STANDARD EMBEDMENT TYPICAL FLEXIBLE & RIGID PIPES
SEQ-WAT-1202-1 TYPICAL SPECIAL EMBEDMENT INADEQUATE FOUNDATIONS REQUIRING OVER EXCAVATION & REPLACEMENT
SEQ-WAT-1203-1 TYPICAL SPECIAL EMBEDMENT CONCRETE & STABILISED EMBEDMENT AND FLEXIBLE JOINT DETAILS
SEQ-WAT-1204-1 TYPICAL TRENCH AND BEDDING DETAILS WITHIN EXISTING ROADS TYPE K-N
SEQ-WAT-1205-1 TYPICAL THRUST BLOCK DETAILS MASS CONCRETE
SEQ-WAT-1206-1 TYPICAL THRUST AND ANCHOR BLOCKS FOR VALVES
SEQ-WAT-1207-1 TYPICAL THRUST AND ANCHOR BLOCKS FOR VERTICAL BENDS
SEQ-WAT-1208-1 TYPICAL RESTRAINED JOINT SYSTEM DN 100 TO DN 375 DI MAINS
SEQ-WAT-1209-1 TYPICAL TRENCH DRAINAGE BULKHEADS AND TRENCHSTOP
SEQ-WAT-1210-1 TYPICAL TRENCH DRAINAGE TRENCH SYSTEMS
SEQ-WAT-1211-1 TYPICAL BURIED CROSSINGS UNDER OBSTRUCTIONS
SEQ-WAT-1212-1 TYPICAL BURIED CROSSINGS MAJOR ROADWAYS
SEQ-WAT-1214-1 TYPICAL BURIED CROSSINGS BORED AND JACKED ENCASING PIPE DETAILS
SEQ-WAT-1300-1 TYPICAL VALVE AND HYDRANT IDENTIFICATION MARKERS
SEQ-WAT-1300-2 TYPICAL VALVE AND HYDRANT IDENTIFICATION MARKER POSTS
SEQ-WAT-1301-1 TYPICAL VALVE AND HYDRANT INSTALLATION VALVE ARRANGEMENT
SEQ-WAT-1302-1 TYPICAL HYDRANT INSTALLATION
SEQ-WAT-1305-1 TYPICAL SURFACE FITTING INSTALLATION VALVE AND HYDRANT SURFACE BOXES TRAFFICABLE AND NON-TRAFFICABLE
SEQ-WAT-1306-1 TYPICAL SURFACE FITTING INSTALLATION VALVE AND HYDRANT SURFACE BOXES SUPPORT AND SURROUND DETAILS
SEQ-WAT-1307-3 TYPICAL APPURTENANCE INSTALLATION SCOUR ARRANGEMENTS
SEQ-WAT-1313-1 FLANGED JOINTS TYPICAL BOLTING DETAILS
SEQ-WAT-1407-1 DI INSTALLATION VALVE BYPASS ARRANGEMENT TYPICAL DI PIPE FITTINGS