PINE RIVERS SHIRE COUNCIL

DESIGN MANUAL

CIVIL INFRASTRUCTURE DESIGN

SPECIFICATIONS

AusSpec	Asset Owner Specifications (Roadworks & Drainage)
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PINE RIVERS SHIRE COUNCIL

SPECIFICATIONS

PRSC 400

WATER SUPPLY SPECIFICATIONS

401	Water Main Pressure Pipeline Construction
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403	**Plain and Reinforced Concrete Works for Water Supply**

PRSC 403
PLAIN AND REINFORCED CONCRETE WORKS FOR WATER SUPPLY

1.0.0 PURPOSE

1.1.0 The purpose of this specification is to set down requirements for the construction of reinforced concrete pits and chambers for valves and pipework etc. associated with water supply works.

1.2.0 This specification does not apply to reservoirs, tanks or holding vessels, or pre-stressed members.

2.0.0 SCOPE

2.1.0 This specification shall apply to works to be constructed by contract, subcontract, or direct labour.

2.2.0 This specification shall apply to works being constructed directly by the Pine Rivers Shire Council or other authority or for a principal who will hand over the ownership of the constructed works to the Pine Rivers Shire Council or who will retain ownership.

3.0.0 REFERENCES

3.1.0 The following shall apply:-

Sewerage and Water Supply Act 1949-1982 with Amendments

Standard Water Supply Law

Water Resources' Guidelines for Planning and Design of Urban Water Supply Schemes

Workplace Health and Safety Act 1995 and Regulations with Amendments.

The Manual of Uniform Traffic Control Devices

AS 1657-1992	Fixed Platforms, Walkways, Stairways and Ladders - Design, Construction and Installation
AS 2124-1992	General Conditions of Contract
AS 3600-2001	Concrete Structures
AS 3610-1995	Formwork for Concrete
AS 3900	Quality Management and Quality Assurance Standards
AS 4373-1996	Pruning of Amenity Trees
ISO 9000	Quality Management and Quality Assurance Standards

3.2.0 The following shall apply when the respective materials have been specified or approved for use. Where the editions listed have been superseded or replaced, then any later copy of the standards shall apply in their place:-

AS 1012	Methods of Testing Concrete
1012.1-1993	Sampling of Fresh Concrete
1012.3-1983	Methods for the Determination of Properties Related to the Consistence of Concrete
1012.4-1983	Methods for the Determination of Air Content of Freshly Mixed Concrete
1012.8-1986	Method for Making and Curing Concrete Compression, Indirect Tensile and Flexure Test Specimens, in the Laboratory or in the Field
1012.9-1999	Method for the Determination of the Compressive Strength of Concrete Specimens
1012.13-1992	Determination of the Drying Shrinkage of Concrete for Samples Prepared in the Field or in the Laboratory
AS 1141-1999	Methods for Sampling and Testing Aggregates (Set)
AS 1289-2000	Methods of Testing Soils for Engineering Purposes (Set)
AS 1345-1995	Identification of the Contents of Pipes, Conduits and Ducts
AS 1379-1997	Specification and Supply of Concrete

AS 1449-1994	Wrought Alloy Steels - Stainless and Heat Resisting Steel Plate, Sheet and Strip
AS 1478-2000	Chemical Admixtures for Concrete, Mortar and Grout – Admixtures for Concrete
AS 1554	Structural Steel Welding
1554.3-2002	Structural Steel Welding - Welding of Reinforcing Steel
AS 1627-1997	Metal Finishing - Preparation and Pre-treatment of Surfaces
1627.1-2003	Cleaning Using Liquid Solvents and Alkaline Solutions
1627.2-2002	Power Tool Cleaning
1627.4-2002	Abrasive Blast Cleaning
1627.7-1988	Hand Tool Cleaning of Metal Surfaces
1627.9-2002	Pictorial Surface Preparation Standards for Painting Steel Surfaces
AS 1665-2004	Welding of Aluminium Structures
AS 1726-1993	Geotechnical Site Investigations
AS 1796-1993	Certification of Welders and Welding Supervisors
AS/NZS 2280-2004	Ductile Iron Pipes and Fittings
AS/NZS 2312-2002	Guide to the Protection of Iron and Steel against Exterior Atmospheric Corrosion
AS 2518-1992	Fusion-bonded Low-density Polyethylene Coating for Pipes and Fittings
AS/NZS 2544-1995	Grey Iron Pressure Fittings
AS/NZS 2566	Buried Flexible Pipelines
AS/NZS 2566.1-1998	Structural Design
AS/NZS 2566.2-2002	Installation
AS 2758	Aggregates and Rock for Engineering Purposes
2758.1-1998	Concrete Aggregates
AS 2848	Aluminium and Aluminium Alloys - Compositions and Designations
2848.1-1998	Wrought Products
AS 3582	Supplementary Cementitious Materials for use with Portland and Blended Cement (Set)
AS 3583	Methods of Test for Supplementary Cementitious Materials for use with Portland and Blended Cement (Set)
AS 3972-1997	Portland and Blended Cements
AS 3996-1992	Metal Access Covers, Road Grates and Frames

AS/NZS 4158-1996	Thermal-bonded Polymeric Coatings on Valves and Fittings for Water Industry Purposes
AS/NZS 4671-2001	Steel Reinforcing Materials
AS/NZS 4680-1999	Hot-dip Galvanised (Zinc) Coatings on Fabricated Ferrous Articles

3.3.0 The document "Installation of Utility Services within the Boundaries of State Controlled Roads" issued by the Department of Main Roads (latest issue) shall apply to work within the boundaries of state controlled roads.

3.4.0 Where materials, not covered by this specification, are specified or approved for use as part of water supply works, the relevant Pine Rivers Shire Council specifications shall apply. Where no Pine Rivers Shire Council specification is available, an appropriate Pine Rivers Shire Council approved product, or other specification approved by the General Manager Pine Water shall apply.

4.0.0 DEFINITIONS

4.1.0 For the purpose of this specification the following definitions shall apply:-

- **Construction** - any work necessary for the construction of pits, chambers or other concrete structures (excluding reservoirs and holding vessels) required in commissioning of a water supply pressure pipeline. The term shall include such operations as establishment, clearing, excavation, forming, erection of reinforcement, concrete pouring, vibrating, stripping, and backfilling and restoration etc.

- **Premises** - any parcel of land improved or unimproved, for which there is a property description

- **Water Main** - any conduit used for carrying, distribution, or reticulation of potable water, which is not a property service, water service or private fire service

- **Rigid Pipe** - pipe manufactured from mild steel, ductile iron or cast iron

- **Flexible Pipe** - pipe manufactured from the family of polyvinyl chloride (PVC), polyethylene (PE), glass filament reinforced thermosetting plastics (GRP), or acrylonitrile butadiene styrene (ABS)

- **PVC Pipe / Fittings** - The family of PVC pipes including PVC-M (Modified PVC), OPVC (Optimised PVC) and uPVC (unplasticised PVC) pipes approved for use in water supply pipelines.

- **Developer** - the company, organisation or person to whom, under the provisions of the Planning Scheme, approval has been given to carry out the works and who acts as principal for the purpose of works executed by contract

- **Consulting Engineer** - the registered professional engineering company or registered professional engineer engaged by the principal to carry out the investigation and design of the water supply works to be constructed by the principal. When engaged for the construction phase, the company or engineer shall act as superintendent for the purpose of works carried out by contract

- **Contract, Contractor, Principal and superintendent** - as defined in AS 2124

- **General Manager Pine Water** - the person occupying that position within the Pine Rivers Shire Council, or their nominated representative

- **Pine Rivers Shire Council engineer** - the engineer employed by the Pine Rivers Shire Council to approve, supervise or inspect the works, or their nominated representative

5.0.0 SPECIFICATION

5.1.0 WORK ON PINE RIVERS SHIRE COUNCIL CONTROLLED PREMISES

5.1.1 Before entering these premises in order to carry out approved work, the contractor shall give the superintendent and / or a Pine Rivers Shire Council engineer at least two working days notice of his or her intention to do so.

5.1.2 The contractor shall exercise due care to prevent interference or damage to improvements existing on the premises or to their satisfactory operation. These improvements may be located above or below ground.

5.1.3 The contractor shall preserve all pegs indicating the real property boundaries of the premises in the path of construction and adjacent to the works site. Should such pegs become dislodged or removed during construction, the contractor shall, at his or her own expense, employ a licensed surveyor to restore the pegs to their original positions. The surveyor shall provide a plan of the restored pegs to the Titles Office, with a copy to a Pine Rivers Shire Council engineer.

5.1.4 The works site shall be restored to the satisfaction of a Pine Rivers Shire Council engineer.

5.2.0 WORK ON OTHER PREMISES

5.2.1 The designer shall have obtained the written approval of the owner and occupier of the premises on which works are to be carried out. Before entering these premises, the contractor shall notify the owner and occupier of the premises at least two working days in advance of his or her intention to do so.

5.2.2 The contractor and their employees shall not trespass on any premises adjoining the site of the works. A list of owners of vacant land within the site of works will be made available by a Pine Rivers Shire Council engineer at the request of the contractor.

5.2.3 The contractor shall exercise due care to prevent interference or damage to improvements existing on the premises or to their satisfactory operation. These improvements may be located above or below ground.

5.2.4 The contractor shall preserve all pegs indicating the real property boundaries of the premises in the path of construction and adjacent to the works site. Should such pegs become dislodged or removed during construction, the contractor shall, at his or her own expense, employ a licensed surveyor to restore the pegs to their original positions. The surveyor shall provide a plan of the restored pegs to the Titles Office, with a copy to a Pine Rivers Shire Council engineer.

5.2.5 The premises shall be restored to the reasonable satisfaction of the owner and/or occupier of the premises. At the completion of construction and prior to the constructed works being declared practically complete, the contractor shall obtain a clearance certificate from the owner of each premise. This certificate shall indicate satisfaction at the standard of restoration.

5.2.6 Notwithstanding such clearance being obtained, the superintendent and / or a Pine Rivers Shire Council engineer may instruct the contractor to carry out further restoration work on the premises if the superintendent and/or a Pine Rivers Shire Council engineer consider that the restoration work has not been completed to a reasonable standard. Further, the contractor shall be required to return to the premises to undertake placing further backfill material or other restoration of trenches which may have settled during the defects liability period.

5.3.0 WORKS WITHIN RAILWAY LAND

5.3.1 The consulting engineer shall be responsible for arranging written approval from Queensland Rail to construct works under or adjacent to any railway.

5.3.2 The contractor shall submit drawings and specifications to Queensland Rail to support the application and shall comply with any conditions imposed on the works.

5.3.3 Before constructing any work under or adjacent to any railway, the contractor shall give the required notice in writing to Queensland Rail of his or her intention to commence operations. The contractor shall not commence any such work until he or she has received the written permission of the Queensland Rail, and shall conduct the whole of the works under such conditions and supervision, and with such precautions against interruption or danger to traffic as Queensland Rail may direct.

5.3.4 The contractor shall be solely responsible for any stoppages, delays or accidents arising out of or in any way attributable to his or her operations. Should Queensland Rail consider it advisable, flagmen or other personnel shall be placed on any work to be executed under, over, or near any railway or any railway land for the purpose of seeing that no danger occurs to the traffic or railway property. Such action shall not relieve the contractor of any of the responsibilities.

5.3.5 The contractor shall obtain any necessary permits and pay all fees and charges in connection with the works carried out under this section, including the cost of the flagmen or other personnel referred to above.

5.3.6 The attention of the contractor is drawn to the "Code for the Installation of Other Parties' Services and Pipelines within Railway Boundaries" or similar document issued by the Railways of Australia.

5.4.0 WORKS WITHIN ELECTRICITY EASEMENTS

5.4.1 Where construction works are proposed in high voltage electricity easements, the consulting engineer shall be responsible for arranging written approval from the controlling authority.

5.4.2 The consulting engineer or designer or contractor shall submit drawings and specifications to the authority controlling the easement in support of the application.

5.4.3 The contractor shall comply with any conditions imposed upon the works.

5.5.0 WORKS WITHIN STATE CONTROLLED ROADS

5.5.1 The consulting engineer or designer shall be responsible for arranging written approval from the Department of Main Roads to construct works under or adjacent to any state controlled road.

5.5.2 The contractor shall submit drawings and specifications to the Department of Main Roads to support the application and shall comply with any conditions imposed on the works.

5.5.3 Work within the boundaries of state controlled roads shall be carried out in accordance with the current issue of the document "Installation of Utility Services within the Boundaries of State Controlled Roads" or any other documents prepared by the Queensland Department of Main Roads.

5.5.4 The contractor shall be responsible for giving the Department of Main Roads the required notice prior to the commencement of construction.

5.6.0 WORKS WITHIN OTHER ROADS

5.6.1 Work under road surfaces carrying vehicular traffic shall be carried out in accordance with the details shown on the Pine Rivers Shire Council standard drawings and to the requirements of a Pine Rivers Shire Council engineer.

5.6.2 The contractor shall be responsible for giving a Pine Rivers Shire Council engineer one weeks notice prior to the commencement of construction.

5.6.3 Where the works are on or beside existing roads, they shall be carried out in such a manner which causes the least interruption to traffic. Access to properties shall be maintained at all times. Where traffic shall cross open trenches, suitable bridging shall be provided.

5.6.4 The sides to trenches through roads and hard surfaced areas, including concrete, asphalt and chip sealed roads, shall be saw cut to provide a clean edge. Should the edges of saw cut surfaces crumble, the surfaces shall be saw cut again clear of the damaged area, prior to restoration.

5.6.5 Existing roads shall not be closed for more than half their width, except for short durations during placement of materials, unless approved by a Pine Rivers Shire Council engineer.

5.7.0 WORKING HOURS

5.7.1 Construction works shall be limited to between the hours of 7am and 6pm, Monday to Friday and on Saturday between 7am and 12 noon. The contractor shall not be permitted to carry out construction on Sundays and Public Holidays.

5.7.2 Where the contractor wishes to carry out construction works outside of the above hours, they shall seek approval of the superintendent and / or a Pine Rivers Shire Council engineer in writing. The request shall include the following information:-

i. the hours the contractor wishes to work
ii. the duration or period the contractor wishes to work those hours
iii. the reason why the contractor wishes to work outside the normal hours
iv. the measures the contractor intends to put in place in order to minimise any noise or other nuisance

The request shall be considered and may be refused, accepted, or accepted subject to certain conditions.

5.7.3 Notwithstanding Clauses 5.7.1 and 5.7.2 of this specification, the contractor shall comply with the Pine Rivers Shire Council local laws regarding abatement of excessive noise in relation to residential construction sites. The contractor shall also comply with the provisions of the Environmental Protection Act (1994) and relevant Australian standards relating to noise from a construction site.

5.7.4 Should the contractor elect to carry out work outside of the normal award hours and which, in the opinion of the Manager Water Supply Services, requires the presence of a Pine Rivers Shire Council engineer, the Pine Rivers Shire Council reserves the right to recover from the contractor any cost which it incurs in making a Pine Rivers Shire Council engineer available.

5.8.0 INFORMATION SUPPLIED TO THE CONTRACTOR

5.8.1 The principal shall supply to the contractor sufficient details by way of drawings, specifications and schedules to allow the contractor to construct the works to the principal's requirements.

5.8.2 Such information will normally be in the form of key or layout plans, detail plans, longitudinal sections of adjacent pipelines, structural details, equipment details, standard drawings, results of soil investigations at the works site and any other information which may be considered relevant.

5.8.3 In the case of structures incorporating pipework, the contractor shall be supplied full details of any pipework, service penetrations or anchorages which are to be built into the structure.

5.9.0 SETTING OUT

5.9.1 The principal shall supply to the contractor sufficient information to accurately locate the works.

5.9.2 In the case of concrete structures, the principal shall supply the contractor with sufficient information to position and establish orientation of the structure. The contractor will be supplied with drawings showing full construction details for the structures and fabricated items (except as may be required to be supplied by the contractor under the contract) and the diameter, level and grade of the connecting pipework.

5.9.3 In the case of other works the principal will establish datum lines from which the contractor can locate structures and interconnecting pipework. The contractor will be supplied with detail drawings and layout plans showing structure details, alignment, diameter, level, length and grade of the pipelines.

5.9.4 In both cases the contractor will be supplied with a level datum related to conveniently placed permanent marks or temporary benchmarks. The stated origins for the level datum shall be preserved from damage or interference by the contractor. The contractor shall be responsible for any costs associated with the reinstatement of any survey mark or survey peg damaged or removed during the progress of the works.

5.9.5 It shall be fundamental to the contract that the positions of the structures in relation to the boundaries of premises and / or easements and to the improvements thereon shall be maintained unless authorised otherwise by the superintendent and / or a Pine Rivers Shire Council engineer in writing.

5.10.0 NATURE OF GROUND

5.10.1 Where the principal has undertaken a sub-soil testing programme on the site of the works, that information shall be made available to the contractor. It shall be the contractor's responsibility to interpret the information supplied.

5.10.2 In the case of water mains, the testing may be restricted to a limited number of positions which were accessible to the drilling crew. Therefore, it should not be assumed that the available information represents all the sub-soil conditions which may be encountered.

5.10.3 Trees shall not be cut down outside of the work areas without the approval of the superintendent and / or a Pine Rivers Shire Council engineer, and all trees designated by the superintendent and / or a Pine Rivers Shire Council engineer shall be protected from damage by the contractor's operations. The superintendent and/or a Pine Rivers Shire Council engineer may direct that hand excavation be carried out adjacent to selected trees in this regard.

5.10.4 The contractor shall be deemed to have satisfied themselves as to the nature of the ground at the time he or she made the offer to carry out the works including the type of material to be excavated and sub-surface conditions, and shall allow for any dewatering, timber shuttering and shoring that may be required.

5.11.0 MATERIALS AND WORK STANDARDS

5.11.1 The contractor shall supply all the materials required to complete the works in accordance with the issued drawings, specifications and schedules. The materials supplied shall comply with the relevant Australian standards and where necessary shall be approved for use by the General Manager Pine Water.

5.11.2 Pipework, fittings, valves and other items supplied for inclusion in the structure shall be in accordance with Pine Rivers Shire Council specifications.

5.11.3 All materials used shall be of new and unused material and entirely suitable for use for the purposes intended.

5.11.4 The contractor shall employ experienced workers and trades-persons on all types of work. The standard of work shall be such as to allow the works to be used for their intended purpose over their expected working life. Licensed trades-persons shall be employed on those works governed by statutory regulations.

5.11.5 Where supplier / manufacturer accredited courses are offered for use of their materials and components, and these are being used in the works, the contractor shall ensure at least one person so accredited is involved with that element of the works at all times.

5.11.6 Where they exist, construction shall be carried out to relevant Australian standards.

5.12.0 PIPES

5.12.1 The pipe materials and their structural requirements shall be as set out in the specifications and drawings. Pipes shall be provided with flexible joints in accordance with the relevant Australian Standards unless otherwise stated.

5.12.2 For the purpose of establishing construction standards, pipes shall be classified as either rigid or flexible. For details of the classifications of pipes refer to the relevant Pine Rivers Shire Council specifications.

5.12.3 In handling pipes and fittings during laying, transporting or during any other process, the greatest care shall be exercised to avoid damage to the pipe or fitting or coating. Under no circumstances shall a pipe be lifted by unprotected slings, levered or moved by implements without protecting pads. Slings shall be of a broad webbing material, selected in accordance safe lifting requirements, and be of a width so as to adequately support the pipe without damaging any protective coatings. Where special lifting devices or methods are recommended by manufacturers, these shall be adhered to. Lifting forks shall not be permitted. Fittings are to be lowered to ground and shall not to be thrown or dropped.

5.12.4 Any damage occurring to the pipe, fitting or coatings shall be made good by the contractor.

5.13.0 SERVICES

5.13.1 The contractor shall note the presence of existing underground or overhead services in public and private premises on the works site. Special care shall be taken in the vicinity of all services.

5.13.2 The locations of some services given on plans are based on the information supplied by the respective authorities where such information is available. It is to be clearly understood that the information regarding these services are tentative only with respect to both details of services shown and the existence of other services not shown. The superintendent and / or a Pine Rivers Shire Council engineer does not warrant the completeness of any information given, and the contractor is required to make enquiries to all relevant authorities regarding the presence of underground services.

5.13.3 The contractor shall verify the position of each underground service with the relevant authority before they commence excavation. The contractor shall pre-locate the services as to depth, alignment and extent or size, so as to ensure such services are not adversely affected. **Hand excavation shall be used in close proximity to such services until the exact location is determined.**

5.13.4 Trenches or excavations containing underground services shall be backfilled so that the subgrade is restored as nearly as possible to its original state of compaction. Where selected backfill has been placed by other utilities and has had to be removed, it shall be replaced by the same type of selected material. All backfill shall be carefully deposited in the trench and around the utility service in layers and adequately compacted by appropriate hand rammers and tampers, or by use of effective mechanical equipment.

5.13.5 Extra care shall be taken by the contractor to recompact excavations near existing underground pipework, so that foundations of that pipework are restored.

5.13.6 The contractor shall be responsible for any damage caused to existing underground services. In case of failure or damage, repairs shall normally be carried out immediately by the contractor. If there is any delay, the superintendent and / or a Pine Rivers Shire Council engineer will arrange for repairs to be carried out and the full cost of such repairs shall be borne by the contractor. If in the opinion of the superintendent and / or a Pine Rivers Shire Council engineer the failure or damage causes an emergency situation, then remedial action will be taken by the superintendent and/or a Pine Rivers Shire Council engineer and the full cost of such action shall be borne by the contractor.

5.13.7 Should the contractor find that any existing services require alteration, the contractor shall bring this to the attention of the superintendent. Any alterations to existing services ordered by the superintendent and / or a Pine Rivers Shire Council engineer shall be carried out by the principal at no cost to the contractor.

5.13.8 Claims for payment or extension of time as a result in delays in alterations to services will not be accepted.

5.14.0 WATER REQUIRED FOR WORKS

5.14.1 Reticulated water shall not be used for general earthworks.

5.14.2 The contractor shall make the necessary arrangements with a Pine Rivers Shire Council engineer to obtain water.

5.14.3 The contractor shall not use a standpipe on a hydrant until such time that an application has been made to the Pine Rivers Shire Council and a permit issued for the use of a hydrant. Any fees or charges imposed for the use of a standpipe or for the water used shall be paid by the contractor.

5.14.4 The contractor shall abide by any restrictions imposed on the use of water by a Pine Rivers Shire Council engineer. The Pine Rivers Shire Council may impose a charge for water used if the contractor is deemed to be wasting water.

5.15.0 EXCAVATION

5.15.1 Before commencing work the contractor shall establish the centre of the pipeline, and locate any underground services which may be present. The contractor shall make provision for the safe passage of foot and vehicular traffic during construction, and install appropriate signs as required by the superintendent and / or a Pine Rivers Shire Council engineer, and the Manual of Uniform Traffic Control Devices.

5.15.2 Excavation may be carried out using either the open cut or caisson method of construction. The contractor shall ensure that the work site is maintained as a safe working area and that the requirements of the Workplace Health and Safety Act and Regulations are complied with at all times.

The contractor shall indemnify the principal and / or the Pine Rivers Shire Council against any costs arising out of any events occurring on the work site.

5.15.3 All excavations shall be taken out accurately to the lines and levels shown on the drawings. All surfaces to receive concrete foundations, floors or walls shall be neatly trimmed and cleaned of all loose materials. All excavations taken beyond the levels shown on the drawings shall be refilled with materials furnished and placed by the contractor by a method approved by the superintendent and / or a Pine Rivers Shire Council engineer. The material shall be blinding concrete where the adjacent structure is concrete. Elsewhere the material shall be selected material from the excavations compacted to not less than 95% of the maximum dry density using standard compaction in accordance with by AS 1289.5.1.1.

5.15.4 The contractor shall leave a clear space of not less than 600 mm between the edge of the excavation and the inner toe of the spoil bank. Materials shall not be stacked within 1 m of the edge of any excavation. Excavated materials shall not be placed against the walls of any building or fence without the written permission of the owner of such building or fence.

5.15.5 The contractor shall do all work necessary to divert any water likely to interfere with the progress of the works, to keep the excavations free from water while the works are in progress and prevent any damage to the works by water due to floods or other causes. Any work or material damaged by water shall, if ordered, be taken up and replaced with fresh material by the contractor at his or her own cost.

5.15.6 Dewatering shall be carried out by methods which cause no damage to the works or to adjacent property. The contractor shall provide, where considered necessary in the opinion of a Pine Rivers Shire Council engineer, erosion protection measures and sediment traps on the discharge line of each dewatering pump, to prevent the deposit of sediment in channels and stormwater drains or shall pipe the water to an approved discharge point.

5.15.7 Following completion of the structure and associated works, the excavated material shall be spread and compacted to the line and level indicated on the design drawings, ensuring that the filling levels brought to the final levels as indicated on the design plans in accordance with Section 5.55.0 of this specification.

5.15.8 All surplus spoil shall be removed from the site and stacked or spread as directed, or as specified in the job specification and shall not be disposed of in any other manner. Any material which is removed or falls beyond the limits of the excavation shown shall be removed by the contractor at his or her own expense.

5.15.9 Spoil shall not be placed on any property in Pine Rivers Shire that is external to the site of the works without prior written application and approval from the Pine Rivers Shire Council under the Pine Rivers Shire Council local laws and / or planning scheme requirements.

5.16.0 CONCRETE MATERIALS

5.16.1 Unless otherwise stated, all concrete shall be Portland cement concrete and shall be composed of Portland cement, fine aggregate, coarse aggregate, additives if approved, and water proportioned and mixed as specified herein. All materials for use in concrete shall conform to the requirements of this specification and shall be approved by the superintendent and / or a Pine Rivers Shire Council engineer. Any materials which do not conform shall be immediately removed from the site at the contractor's expense.

5.16.2 All cement used shall be Portland cement of approved brand and Australian manufacture and shall comply with AS 3972. The type of cement used shall be Type GP - General Purpose Cement - unless otherwise designated. Documentary or other acceptable evidence of the quality of the cement shall be furnished by the contractor if required.

Fly ash and blended cements shall not be used without the written approval of the superintendent and / or a Pine Rivers Shire Council engineer. If approved, fly ash shall comply with AS 3582.1 and blended cement with AS 3972.

5.16.3 Water used in the manufacture of concrete shall comply with the requirements of AS 1379.

5.16.4 Fine aggregate shall consist of natural sands, or a combination of natural and manufactured sands containing not less than 50 percent natural sands. Particles shall be clean, hard and durable and shall conform to AS 2758.1 - Concrete Aggregates.

5.16.5 Coarse aggregate shall consist of uncrushed gravel, crushed gravel, crushed stone, or combinations thereof. Particles shall be clean, hard and durable and shall conform to AS 2758.1 - Concrete Aggregates.

Unless noted otherwise on the drawings the nominal size of aggregate which may be used in all classes of concrete shall be 20 mm except in mass concrete where the nominal size shall be 4 mm.

5.16.6 Aggregates shall be tested to the requirements of AS 2758.1 in accordance with the methods of AS 1141, except as qualified below:-

i. The water absorption of the aggregates shall be determined and shall not exceed 2.5%.

ii. Durability of fine and coarse aggregates shall be determined and shall satisfy the requirements of AS 2758.1 for the severe exposure classification. For coarse aggregates, durability shall be assessed using the method set out in Clause 10.2.1 of AS 2578.1.

iii. The aggregates shall be tested for weak particles, light particles, impurities and reactive materials in accordance with Clauses 11, 12 and 14 respectively of AS 2758.1. It is a requirement of this specification that all aggregates be tested for alkali-reactive materials in accordance with Clause 14.3.1 of AS 2758.1.

iv. Where the total quantity of concrete in the contract is less than 300 cubic metres the contractor shall provide a certificate of compliance for the aggregate in accordance with Clause A4.1 of AS 2758.1.

v. The contractor shall submit a referee sample of 50 kg of each type of coarse aggregate and 25 kg of each type of fine aggregate to be used in the works. The contractor, at his or her own expense, shall deliver the samples to the superintendent and/or a Pine Rivers Shire Council engineer site office. Samples shall be collected in accordance with AS 1141.

vi. Concrete shall not be delivered to the site until the compliance or test certificate has been provided, the referee samples delivered and the material approved in writing by the superintendent and / or a Pine Rivers Shire Council engineer.

5.16.7 Materials are to be stored in accordance with the requirements of AS 1379.

Cement shall be stored in dry, weatherproof enclosures. Cement shall not be stored in contact with the ground, walls or floors where dampness can permeate the bag. Cement which exhibits lumps which cannot be broken into the original fine consistency by finger pressure shall not be used in the works, and shall immediately be removed from the works site.

Aggregates shall be stored in a manner which will prevent mixing of materials, contamination by foreign matter, or segregation of the aggregate. Aggregates shall not be stored in direct contact with the ground.

5.17.0 CONCRETE ADMIXTURES

5.17.1 Admixtures shall not be used in concrete without the written approval of the superintendent and / or a Pine Rivers Shire Council engineer. Should the contractor desire to use an admixture he or she shall give the superintendent and / or a Pine Rivers Shire Council engineer notice in writing of:-

i. type and brand of admixture to be used
ii. rate of application
iii. type and location of metering device
iv. the part of the structure where admixture is proposed to be used
v. reasons for use
vi. manufacturer's data sheet giving chemical constituents of the admixture, recommended dose rates and method of dosing

5.17.2 If more than one admixture is proposed, the contractor shall provide test evidence as to the compatibility of the admixtures.

5.17.3 Generally, admixtures approved will be restricted to air entraining admixtures, and for certain approved applications, water reducing set-controlling admixtures, Type WRRe or WRAc.

5.17.4 Despite the use of admixtures, the quantity of cement shall in no case be reduced below the value specified for the particular class of concrete.

5.17.5 Calcium chloride shall not be used as an admixture in reinforced concrete.

5.17.6 Any admixtures if approved shall comply with the requirements of AS 1478. A test report in accordance with Clause 5.7 of AS 1478 shall be provided for each admixture prior to its use.

5.17.7 Admixtures shall not be used in concrete containing fly ash or blended cement unless test results are available to show that the concrete properties will not be affected by use of the admixture.

5.17.8 Where air entrainment is allowed, the air content shall be within the range 3-5% except where otherwise specified.

5.17.9 The contractor shall have a suitable air content gauging device on the job so that the air content of the freshly mixed concrete may be accurately determined in accordance with AS 1012.4.

5.17.10 Admixture metering shall be by an approved and well maintained dispenser.

5.18.0 CLASS OF CONCRETE

5.18.1 Unless nominated otherwise in the hob drawings or job specification, all concrete shall be of the normal class, specified as "Class N-X" where “X” is the characteristic 28 day compressive strength in mega Pascals.

5.18.2 Where lean mix concrete is ordered, this shall be of a no slump 20:1 sand-aggregate : cement mix in accordance with AS 1379.

5.18.3 The compressive strength shall be determined in accordance with AS 1012.9, and the target slump values as indicated in the Table 5.0.

Table 5.0

CLASS OF CONCRETE	CHARACTERISTIC28 DAY COMPRESSIVE STRENGTH	TARGET SLUMP (mm)
N-20	20 MPa	40-80
N-25	25 MPa	40-80
N-32	32 MPa	40-80
Blinding concrete	-	-
Lean Mix concrete	-	Nil

5.19.0 CONCRETE MIX DESIGN AND ACCEPTANCE

5.19.1 The contractor shall be solely responsible for the design and production of concrete to comply with this specification.

5.19.2 The contractor shall submit for approval, details of the concrete mix he or she proposes to use for each particular class of concrete. The following information on the concrete mix shall be forwarded to the superintendent and / or a Pine Rivers Shire Council engineer:-

i. mix designation mark

ii. concrete class

iii. proportion by weight of individual ingredients

iv. admixtures and quantity of admixtures incorporated (if approved)

v. target slump

vi. design characteristic 28 day compressive strength (target strength)

5.19.3 Concrete shall not be placed until the mixes have been approved in writing by the superintendent and/or a Pine Rivers Shire Council engineer. Notwithstanding any approval given, the concrete shall meet the specified strength at 28 days. Once approved, the mix shall not be altered without the written approval of the superintendent and/or a Pine Rivers Shire Council engineer.

5.20.0 CONCRETE FOR CORE FILLING

5.20.1 All reinforced concrete blockwork shall be core filled. Where unreinforced concrete blockwork is required to be core filled, this shall be indicated on the job drawings and/or specification.

5.20.2 Concrete used for core filling of reinforced or unreinforced blockwork shall have a maximum nominal aggregate size of 5 mm or 7 mm. The minimum cement content shall be 300 kg/m³. The target slump shall be 180 mm unless approved otherwise by the superintendent and / or a Pine Rivers Shire Council engineer. Concrete used for core filling shall be Class N-25 unless nominated otherwise on the job drawings or job specification.

5.21.0 CONCRETE FOR THRUST BLOCKS

5.21.1 The contractor may use Type HE - High Early Strength Cement in the construction of thrust blocks.

5.21.2 As an alternative, a heating agent additive may be added to the mix in an effort to achieve earlier set.

5.21.3 Should the contractor wish to use a High Early Strength Cement, or mix additive in the construction of thrust blocks, he or she shall seek the approval of the superintendent and/or a Pine Rivers Shire Council engineer before using such a concrete. Where additives are used, the contractor shall supply the superintendent and/or a Pine Rivers Shire Council engineer with information on the type of additive, dosage, and effect of the additive on the properties of the concrete.

5.21.4 The use of the alternatives mentioned in 5.21.1 and 5.21.2 of this specification shall only be permitted where the main is required to be put into operation and the thrust blocks are required to withstand a load before they would reach a satisfactory compressive strength if Type GP general purpose cement and ordinary mix were used.

5.22.0 CONTROL OF CONCRETE QUALITY

5.22.1 Concrete quality shall be assessed by determining the compressive strength of the concrete. The method of testing and assessment of the concrete compressive strength shall be in accordance with Appendix B of AS 1379. Project assessment of strength grade in accordance with Clause B7 of AS 1379 is required.

5.22.2 The superintendent and/or a Pine Rivers Shire Council engineer shall be provided with the monthly production assessment reports for the plant supplying the concrete to site. The reports shall be provided for the full duration of the contract period.

5.22.3 For concrete manufacturing plants which do not produce controlled strength grades, the production assessment shall be supervised by an independent person, who shall be a registered professional engineer, Queensland or equivalent. Such person shall be approved by a Pine Rivers Shire Council engineer.

5.22.4 Unless otherwise directed by the superintendent and / or a Pine Rivers Shire Council engineer, all test cylinders produced as a result of the project assessment provisions of Clause 5.22.1 of this specification shall be manufactured, handled and cured by the contractor in accordance with AS 1012.1, 1012.3 and 1012.8 and delivered to the superintendent and / or a Pine Rivers Shire Council engineer site office, in sufficient time for testing at 28 days. The cylinders shall be marked for identification purposes. The cost of manufacture, handling and curing the cylinders and delivery to the site office shall be borne by the contractor. The cost of capping and testing shall be borne by the principal.

5.22.5 If during the course of the job the proposed degree of concrete control is not maintained as evidenced by either the batch mixing methods employed, slump test results, or strength results of test cylinders taken from the works, a new mix design shall be prepared and submitted to the superintendent and / or a Pine Rivers Shire Council engineer for approval.

5.22.6 Subject to approval by the superintendent and / or a Pine Rivers Shire Council engineer the contractor may arrange for his or her own convenience to have cylinders tested at other locations provided all such tests are carried out by a NATA certified laboratory approved by the superintendent and/or a Pine Rivers Shire Council engineer. All cylinders tested by the contractor shall be sulphur capped before test and complete cost of such testing shall be borne by the contractor.

5.23.0 READY MIXED CONCRETE

5.23.1 Only those manufacturers approved by a Pine Rivers Shire Council engineer shall supply ready mixed concrete and a Pine Rivers Shire Council engineer may withdraw approval from any supplier should performance of the ready mixed concrete be unsatisfactory in any manner.

5.23.2 The production, delivery and testing of the ready mixed concrete shall be carried out in accordance with the requirements of AS 1379. Not withstanding the provisions of AS 1379, the slump of the concrete immediately prior to placing shall comply with Clause 5.18.3 of this specification.

5.23.3 The size and type of transit mixer trucks and their method of access to the site shall be approved by the superintendent and/or a Pine Rivers Shire Council engineer.

5.23.4 Ready mixed concrete shall be mixed, delivered and discharged in accordance with AS 1379, and within the time limits specified in Table 5.1, or in sufficient time to enable the proper placement and compaction of the concrete before the concrete takes its initial set. The temperatures in the table shall be the temperatures at the time of discharge from the mixer.

Table 5.1

CONCRETE TEMPERATURE	MAXIMUM ELAPSED TIME FROM TIME OF COMMENCING MIXING
Less than 24^{o} C	90 minutes
24^{o} C - 32^{o} C	60 minutes
32^{o} C - 35^{o} C	45 minutes

Concrete shall not be accepted if more than the times stated above have elapsed since commencement of mixing, unless agreed otherwise with the superintendent.

The superintendent and / or a Pine Rivers Shire Council engineer may permit longer times than those stated if a set retarding agent is being used. In this case the contractor shall make written application to vary the maximum elapsed time and provide data, from the manufacturer of the set retarding additive, to support the proposed variation.

5.23.5 Notwithstanding the provisions of AS 1379, water shall not be added to the truck mixer on site unless the concrete manufacturer provides a certificate stating how much additional water may be added. The certificate shall state the total amount of water which has already been added to the mix, including the water content of the aggregate. Water shall be added to the mixer using a graduated container approved by the superintendent and/or a Pine Rivers Shire Council engineer.

5.23.6 Water shall not be added to a truck mixer on site once it has commenced discharging its load or if the certificate described in Clause 5.23.5 is not provided to the superintendent and/or a Pine Rivers Shire Council engineer. A sample of concrete shall be taken from every truck load of concrete to which water is added on site. This sample shall be subject to project assessment testing in accordance with Clause B7 of AS 1379.

5.24.0 HAND MIXED CONCRETE

5.24.1 Hand mixed concrete shall be limited to works of a minor nature, and where a small quantity of concrete is required. Hand mixed concrete shall not be used for construction of works of a structural or load bearing nature.

5.24.2 Hand mixed concrete shall only be used with permission from the superintendent and/or a Pine Rivers Shire Council engineer.

5.24.3 Hand mixing shall be of a mix design similar to a batched mix design for the strength grade of concrete required. Hand mixing shall be carried out on a water-tight platform, turned a minimum of three times dry and three times wet, to a uniform colour and consistency throughout the mix.

5.25.0 HOT WEATHER CONCRETING

5.25.1 Precautions shall be taken to avoid premature stiffening of the fresh mix and to reduce water absorption and evaporation losses.

5.25.2 If the temperature of the surrounding air is higher than 30^{o}C the following shall apply:-

i. the formwork shall be continuously sprayed with cold water in advance of the concreting and excess water shall be removed from the inside of the forms immediately prior to the placement of concrete

ii. the reinforcement, and the formwork if metal forms are used, shall be protected from the effects of hot winds and direct sunlight

iii. suitable barriers shall be provided to protect the freshly placed concrete from wind until the concrete has hardened sufficiently to allow it to be covered according to paragraph v below

iv. the concrete shall be held to a temperature not higher than 35^{o}C when placed by:-

a. using chilled mixing water; or
b. spraying the coarse aggregate with cold water; or
c. covering the container in which the concrete is transported to the forms; or
d. using any combination of these methods.

v. the concrete shall be mixed, transported, placed and compacted as rapidly as possible, and shall then be covered until moist curing begins, by one of the following methods:-

   a. an impervious membrane; or
   b. Hessian, kept wet;

vi. curing compounds shall not be used as an alternative to the requirements of paragraphs iv and v

5.25.3 Concrete shall not be placed when the concrete temperature is over 35^{o}C.

5.26.0 SLUMP TESTING

5.26.1 The concrete may be rejected by the superintendent and/or a Pine Rivers Shire Council engineer if the measured slump value is 15 mm higher or lower than the target slump value of the approved mix design or values given in Clause 5.18.3.

5.26.2 After completion of mixing, but prior to site handling, all concrete shall have its slump determined in accordance with AS 1012.3.

5.26.3 The contractor shall supply the necessary apparatus to conduct the slump testing and shall arrange to perform the testing in the presence of the superintendent and/or a Pine Rivers Shire Council engineer. Testing shall be performed by a NATA registered technician unless otherwise approved by a Pine Rivers Shire Council engineer.

5.26.4 Plastic concrete may be rejected by the superintendent and/or a Pine Rivers Shire Council engineer if it is significantly different in appearance or cohesiveness from previously supplied concrete of the same class.

5.27.0 FORMWORK

5.27.1 Formwork shall be designed and constructed in accordance with AS 3610.

5.27.2 Formwork shall be provided to all concrete works where surfaces and edges are visible to provide a neat, straight edge and uniform surface finish.

Exposed edges to columns, beams, landings, and top edges of walls are to be provided with a 20 mm by 20 mm chamfer unless shown otherwise in the job drawings. All edges shall be straight and true.

5.27.3 Formwork documentation, as detailed in Clause 4.7 of AS 3610, shall be submitted by the contractor to the superintendent and / or a Pine Rivers Shire Council engineer at least two weeks before such formwork is erected. The submission of this documentation shall not relieve the contractor of his or her responsibilities under the contract.

5.27.4 The permanent structure shall not be used for the restraint of formwork without the prior approval of the superintendent and/or a Pine Rivers Shire Council engineer. The contractor shall demonstrate that the permanent structure is adequate to support the applied loads and shall strengthen the structure, if required, at no cost to the principal.

5.27.5 Penetrations and inserts in formed concrete surfaces shall be located as shown on the drawings. Any alterations or additions to what is shown on the drawings shall not be permitted unless approved by the superintendent and / or a Pine Rivers Shire Council engineer.

5.27.6 All joints between adjacent forms, formwork parts, and the permanent structure shall be sealed water tight.

5.28.0 SURFACE FINISH AND COLOUR

5.28.1 All concrete surfaces which are exposed to view shall have a surface finish of Class 2C in accordance with Section 3 of AS 3610. All other surfaces shall have a Class 3 surface finish.

5.28.2 Where a Class 2C surface finish is required in the works, the contractor shall construct test panels in accordance with Clause 3.6 of AS 3610, unless approved otherwise in writing by the superintendent and / or a Pine Rivers Shire Council engineer. The same test panel may be used for both surface finish and colour control. Separate test panels shall be provided for the wall, column, and beam-slab elements which may be required in the structure, if applicable.

Test panels are not required for Class 3 finishes.

5.28.3 The test panels shall be constructed to match the dimensions of the elements they represent.

For walls, the test thickness shall be chosen to match the thinnest wall in the contract containing 2 layers of reinforcing. The minimum height shall be 1.5 m, and minimum width 1.0m.

For columns, the cross section dimensions shall correspond with the smallest column in the contract. The minimum column height shall be 1.5 m.

For beam-slab elements, the beam shall match the beam in the contract which has the largest depth to width ratio, depth being measured from the soffit of the slab. The beam-slab test panel shall be a minimum of 1.5 m long, and have a minimum width of 1.0 m.

5.28.4 The test panels shall be constructed with a base so that they will be free-standing. Lifting eyes shall be included in the panels so they can be moved around the site. Any test panel damaged during the contract shall be replaced by the contractor at the contractor's expense.

5.28.5 Colour control of the concrete surface shall be within the range specified in Table 3.6.1 of AS 3610, using the tonal scale contained in Appendix B of AS 3610.

5.29.0 FORM TIES

5.29.1 Tie rods shall not be permitted in columns and beams designated as requiring a Class 2C finish, unless authorised otherwise by the superintendent and / or a Pine Rivers Shire Council engineer.

5.29.2 In walls, tie rods shall be positioned vertically above each other for the full wall height and in the same horizontal plane. The minimum spacing, horizontally and vertically, for tie rods in walls shall be 1.2 m.

5.29.3 Metal form ties shall be of an approved type and if cast in shall be constructed so as to permit their removal to a depth of at least 30 mm from the face without injury to the concrete. Ordinary wire ties shall not be used. Cavities left when the end fittings of ties are removed shall be as small as possible and shall be subsequently filled with cement mortar and the surface left sound, smooth and uniform of colour.

5.30.0 PREPARATION AND PLACEMENT OF CONCRETE

5.30.1 Each Wednesday, during the contract period, the contractor shall submit his or her proposed programme for placing concrete for the following week. The contractor shall give the superintendent and / or a Pine Rivers Shire Council engineer 24 hours notice in writing of any change to the programme. Placing of concrete shall be performed only in the presence of the superintendent and/or a Pine Rivers Shire Council engineer.

5.30.2 The strength of a hardened concrete member shall be verified prior to placing additional concrete supported by this member. Early age strength testing may be used as a guide to the likely 28 day compressive strength of the member.

Cylinder specimens required for this testing shall be in addition to the cylinders required for the project assessment testing specified in Section 5.22.0 of this specification.

5.30.3 All concrete shall be placed in dry weather only. Concrete shall not be placed until the forms, reinforcing and foundations as applicable have been inspected and approved in writing by the superintendent and / or a Pine Rivers Shire Council engineer. The formwork shall be inspected in accordance AS 3610.

5.30.4 Water and soft foundation material shall be removed from excavations before concrete is deposited, unless otherwise directed by the superintendent and / or a Pine Rivers Shire Council engineer. Any flow of water into the excavation shall be diverted through proper side drains to a sump, or be removed by other approved methods, which will avoid washing the freshly deposited concrete.

5.30.5 Water vent pipes and drains shall be filled by grouting or otherwise, after the concrete has thoroughly hardened. Springs encountered in the foundation shall be plugged, piped or otherwise satisfactorily disposed of.

5.30.6 Before any concrete is placed, forms shall be inspected to see that they are thoroughly clean. All sawdust, shavings, nails, dirt and rubbish of any description shall be removed from within the forms.

5.30.7 For narrow walls and columns where the bottom of the form is inaccessible, the lower form panels shall be left loose so that they may be removed for cleaning out extraneous material immediately before placing the concrete, and for purposes of compaction.

5.30.8 Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable, by methods which prevent the separation, segregation or loss of ingredients. Mixing and transporting equipment shall be free from hardened concrete and foreign materials on the inner surface. The concrete shall be deposited in the forms as near as practicable in its final position, to avoid rehandling. Concrete shall not be moved to its final position by the use of vibrators. Unless otherwise required by the job specification or otherwise directed by the superintendent and/or a Pine Rivers Shire Council engineer, concrete shall be so deposited as to maintain until the completion of the unit, a plastic surface approximately horizontal.

5.30.9 Forms for walls shall be provided with openings, or other devices, that will permit the concrete to be placed in a manner that will avoid accumulation of hardened concrete on the forms or metal reinforcement. Under no circumstances shall concrete which has partly hardened be deposited in the work.

5.30.10 When concrete is conveyed by chutes, the plant shall be of such size and design as to ensure a practically continuous flow in the chute. The angle of the chute shall be such as to allow the concrete to flow without separation of the ingredients. The delivery end of the chute shall be as close as possible to the point of deposit. The chute shall be thoroughly flushed with water before and after each run. The water used for this purpose shall be discharged outside the forms in a manner approved by a Pine Rivers Shire Council engineer.

5.30.11 Pneumatic placers and concrete pumps shall be used only if authorised by the superintendent and / or a Pine Rivers Shire Council engineer. Such equipment shall be arranged so that vibrations do not damage freshly placed concrete. The delivery end of the pipe shall terminate in a fitting of approved design which shall prevent segregation of the concrete. After the completion of any concreting operations the equipment shall be thoroughly cleaned.

5.30.12 Concrete shall be placed in an essentially continuous manner between approved construction joints so as to avoid being placed against partially set concrete.

5.30.13 Concrete shall be gently placed into position, and shall not be poured from a greater height than 1.5 m into the forms unless suitable chutes or downpipes are specially provided. It shall be placed in layers not thicker than 300 mm except as otherwise provided herein, and the section of the works undertaken shall be such that the next layer of concrete will be placed on top of the first within 20 minutes of placing the first layer, or such time as to preclude any danger of disturbing the first layer once it has taken its initial set.

5.30.14 Concrete shall be well worked and consolidated around the reinforcement and embedded fixtures and into corners of forms, by means of suitable tools, in such a manner as to prevent the formation of any void spaces, and to ensure the most thorough compacting to obtain density and watertightness.

5.31.0 COMPACTION OF CONCRETE

5.31.1 The concrete shall be thoroughly compacted during and immediately after depositing. Concrete other than no fines concrete shall be compacted with high frequency internal vibrators in the manner described below. Hand compaction in lieu of mechanical vibration will be allowed only as an emergency measure when approved by the superintendent and/or a Pine Rivers Shire Council engineer.

5.31.2 Vibration shall be internal except as provided in Clause 5.31.8 of this specification.

5.31.3 Vibrators shall be of an approved type, capable of transmitting vibration to the concrete at frequencies of not less than 8000 impulses per minute at such an intensity to visibly effect a 25 mm slump in the concrete at a radius of 300 mm.

5.31.4 The contractor shall provide a sufficient number of vibrators to properly compact each batch immediately after it is placed in the forms. The minimum number of vibrators to be provided will depend on the rate of placing concrete but in no case shall be less than one vibrator for each 5 cubic metres of concrete or part thereof placed per hour, with a minimum of two vibrators. At least one vibrator in working order shall be held in reserve at all times.

5.31.5 A vibrator shall be inserted into the concrete at successive positions not more than 500 mm apart and vibration shall continue at each position until air bubbles cease to emerge. The vibration shall be of sufficient duration to thoroughly compact the concrete, but shall not be continued so as to cause segregation. The vibrators shall be inserted into and withdrawn from the concrete slowly.

5.31.6 Vibrators shall be inserted so as to thoroughly compact the concrete around the reinforcement and embedded fixtures and into the corners and angles of the forms. Vibration shall be applied at the point of deposit and in the area of freshly deposited concrete.

Where more than one layer is being placed in a continuous operation the vibrator shall be inserted through the layer into the layer below.

5.31.7 Vibration shall not be applied directly or through the reinforcement, to sections or layers of concrete which have hardened to the degree that the concrete ceases to be plastic under vibration. It shall not be used to make concrete flow in the forms over distances so great as to cause segregation, and vibrators shall not be used to transport concrete in the forms.

5.31.8 The provisions of this section shall also apply to precast members except that if approved by the superintendent and / or a Pine Rivers Shire Council engineer, the manufacturer's method of vibration may be used. For precast slab units, internal vibration shall be used in conjunction with external mould vibration.

Special care shall be taken to ensure complete compaction behind reinforcement anchorages.

5.32.0 EMBEDMENT OF METAL WORK

5.32.1 Where metal work is to be built into concrete it shall be truly placed in the position shown on the plans or as directed by the superintendent and / or a Pine Rivers Shire Council engineer and so secured that this position shall be maintained after the concrete has set. Where such built-in work is out of position, it shall be brought back to position or otherwise adjusted as directed by the superintendent and/or a Pine Rivers Shire Council engineer at the contractor's expense.

5.33.0 CONSTRUCTION JOINTS

5.33.1 The surface of set concrete to which fresh concrete is to be bonded shall be termed a construction joint. The location of the construction joints has not been strictly set. All concrete shall be placed in as large sections as possible without a break to ensure a minimum of joints. Joints shall be located so as to least impair the strength and appearance of the structure. The contractor shall complete by continuous depositing of concrete, sections of the work between such joints.

5.33.2 When placing of concrete is interrupted by some contingency long enough for the concrete to take a set, concreting operations shall cease and the surface shall be treated as a construction joint.

5.33.3 Where concrete is to be placed on other concrete which has taken its final set prior to the commencement of placing of new concrete, all laitance, porous concrete or other objectionable substance shall be removed from the surface of concrete. Joint surfaces shall be prepared by air-water jetting or by brushing with stiff wire brushes. This shall be done approximately three to six hours after placing the concrete, when the concrete is stiffened but

before it becomes too hard for effective cutting. When such area is cleansed and wetted but free from surplus water and approved by the superintendent and / or a Pine Rivers Shire Council engineer, a layer of mortar 10 mm thick, having the same proportions of water, cement and fine aggregate as the concrete to be placed, shall be thoroughly worked into all crevices and depressions, after which the new concrete may be put in position. The new concrete shall be well compacted so as to make a thoroughly bonded and watertight joint.

5.33.4 Should the concrete become set, it shall be treated as directed by the superintendent and / or a Pine Rivers Shire Council engineer to ensure satisfactory bonding of the new concrete.

5.33.5 Great care shall be taken fitting the forms at joints. Should unevenness in the surface occur at a joint, the contractor must immediately treat the surface by chipping and/or grinding so that a smooth even surface results. In addition, the contractor shall alter, where necessary, his or her method of fixing forms at joints or reshape his or her formwork or both so that the next joint is smooth and even.

5.33.6 The contractor shall not permit walking over or upon finished surfaces of concrete until these are sufficiently hardened. While setting, the concrete shall not be disturbed or subjected to vibration or interference of any kind. Should concreting be stopped for any reason, the work shall be left protected until operations are resumed.

5.34.0 REMOVAL OF FORMWORK

5.34.1 Except where otherwise provided in this section, the forms shall be removed as soon as the concrete has hardened sufficiently to prevent damage by careful form removal in order to facilitate satisfactory progress with the specified curing and to enable the earliest practicable repair of the surface imperfections.

5.34.2 The removal of formwork, including minimum stripping times, shall be in accordance with the requirements of Clauses 5.4.3 and 5.4.4 of AS 3610 and Clause 19.6.2 of AS 3600. The requirements of AS 3610 shall apply where these are more stringent than the relevant requirements of AS 3600.

5.35.0 CONCRETE SURFACES

5.35.1 Exposed surfaces such as tops of walls and floors shall be properly screeded off to correct levels shown on the plans by the use of a steel trowel or float and given a suitable finish complying with the requirements of Section 5.28.0 of this specification, or other finish as detailed on the project drawings.

5.36.0 REPAIR OF CONCRETE

5.36.1 Repairs to concrete surfaces shall be performed by skilled workers. All concrete repairs shall be carried out in the presence of the superintendent and / or a Pine Rivers Shire Council engineer. Repairs of imperfections shall be completed within 24 hours after removal of forms or in the case of unformed concrete, within 24 hours after the placing of the concrete. All fins and encrustations shall be neatly removed from surfaces.

5.36.2 Concrete that is damaged through any cause or concrete that is honeycombed, fractured or otherwise defective, must be removed and replaced with stiff 3:1 sand/cement mortar containing just sufficient water for compaction by ramming, or with concrete as hereinafter specified.

5.36.3 Holes resulting from the removal of ends of form ties shall be filled with stiff 3:1 sand / cement mortar. Where bulges or abrupt irregularities protrude on formed surfaces, the protrusions shall be reduced by grinding so that the surfaces are reasonably fair and smooth. Stiff 3:1 mortar shall be used for filling holes of small depth, for narrow slots cut for the repair of cracks and tie rod fastener holes.

5.36.4 Mortar shall not be used for filling behind reinforcement or filling holes that extend completely through a concrete section; concrete fillings shall be used for holes extending entirely through concrete sections, for holes which are greater in area than 0.01 m² and deeper than 100 mm and for holes in reinforced concrete which are greater in area than 0.005 m² and which extend beyond reinforcement.

5.36.5 All fillings shall be bonded tightly to the surfaces of the holes and shall be sound, free from shrinkage cracks and drummy areas after curing.

5.37.0 CURING OF CONCRETE

5.37.1 All concrete shall be cured either by water curing or by membrane curing. Water curing is the preferred method of curing and no membrane curing shall be used unless authorised in writing by the superintendent and / or a Pine Rivers Shire Council engineer.

Membrane curing shall not be used on surfaces with a Class 2C surface finish, surfaces to be coated or painted, or construction joints.

5.37.2 The contractor shall advise the superintendent and / or a Pine Rivers Shire Council engineer, in writing at least seven days prior to pouring any concrete of the methods proposed to cure the various concrete surfaces to be constructed during the contract. If it is proposed to use a membrane sealing compound, a sample of the compound, together with the manufacturer's data sheet, shall be submitted to the superintendent and / or a Pine Rivers Shire Council engineer for testing at least 30 days prior to use.

5.37.3 The unformed top surfaces of walls shall be moistened by covering with an approved water saturated material or by other effective means as soon as the concrete has hardened sufficiently to prevent damage by water. These surfaces and steeply sloping and vertical formed surfaces shall be kept completely and continually moist prior to and during form removal, by water applied at the unformed top surfaces and allowed to pass down between the forms and the formed concrete faces.

5.37.4 Concrete cured with water shall be kept wet for a period of not less than seven days immediately following the placement of concrete, or until covered by fresh concrete, by covering with water or by using an approved water saturated covering or by sprinkling so that the surface will be kept continuously wet.

5.37.5 On horizontal surfaces or near horizontal surfaces, covering for not less than seven days with an impervious sheet such as polythene shall be acceptable. The concrete surface under the sheet shall be saturated with water at the beginning and end of each day, during the seven day curing period.

5.37.6 If fly ash has been used in the concrete, the curing periods nominated in 5.37.4 and 5.37.5 above shall be extended to 14 days.

5.37.7 Membrane curing shall be by the application of an approved type of sealing compound which forms a water retaining membrane on the surfaces of the concrete. Generally, the only curing compound which will be approved is paraffin wax emulsion in water. The compound shall be applied at the rate recommended by the manufacturer. The use of resin and PVA based compounds shall not be permitted.

5.37.8 If necessary, to provide a continuous membrane over the whole of the surface, a second coat of sealing compound shall be applied by spraying in a direction at right angles to the direction which the first coat was applied.

5.37.9 Where sealing compound is to be used on unformed concrete surfaces, applications of the compound shall commence immediately after the finishing operations are completed and any bleed water on the surface has evaporated.

5.37.10 When sealing compound is to be used on formed concrete surfaces, the surfaces shall be moistened with a light spray of water immediately after the forms are removed to a point where they will not readily absorb more moisture. Sealing compound shall be applied to the concrete as soon as the surface film of moisture disappears, but while the surface still has a damp appearance.

5.37.11 After application of the sealing compound has been completed and the coating is dry to the touch, any required repair of concrete surfaces shall be performed. Each repair shall be moistened and coated with sealing compound in accordance with the requirements of this section.

5.37.12 Traffic and/or other operations across concrete surfaces shall be arranged and maintained by the contractor in a manner which shall avoid damage to the coatings of sealing compound for a period of not less than 28 days after the application of the compound.

5.37.13 Where it is impossible because of construction operations to avoid traffic over the surfaces coated with sealing compound, the membrane shall be protected by a covering of sand not less than 25 mm in thickness or by other effective means. This covering shall not be placed until the membrane is completely dry.

5.37.14 Before final acceptance of the work, the contractor shall remove all sand covering in a manner acceptable to the superintendent and / or a Pine Rivers Shire Council engineer. Any sealing membrane which is damaged or which peels from concrete surfaces within 28 days after application shall be repaired without delay.

5.38.0 DIMENSIONAL TOLERANCES

5.38.1 Formwork shall be erected so as the required dimensions are achieved. Unless detailed otherwise, walls shall to be straight and true, wall-to-wall and wall-to-floor joints square, and walls shall be perpendicular with one another. Formwork shall be adequately braced there is no change or distortion when the forms are loaded with concrete.

5.38.2 Where tolerances are not stated in the specifications or drawings for any individual structure or feature thereof, deviations from established lines, grades and dimensions shall not be greater than those set out in Tables 3.4.2 and 3.4.3 of AS 3610 for formed surfaces and Clause 19.5 of AS 3600 for all other surfaces.

5.39.0 STEEL REINFORCEMENT

5.39.1 All reinforcements of concrete shall be in accordance with Australian Standards Specifications:-

5.39.2 The steel shall be of the quality specified in these specifications and shall have been tested in the manner prescribed therein, and approved by the superintendent and / or a Pine Rivers Shire Council engineer. All reinforcement shall be of Grade 410Y deformed bar unless otherwise noted on the drawings.

5.40.0 BENDING OF REINFORCEMENT

5.40.1 Reinforcement shall be bent in accordance with Clause 19.2.3 of AS 3600.

5.40.2 After cutting and bending, bars shall be bundled or stacked according to their respective "marks" as shown in the bending schedule. All reinforcing shall be labelled with strong wired tags for absolute identification.

5.41.0 STORAGE OF REINFORCEMENT STEEL

5.41.1 Reinforcement when delivered on to the works shall be stored on suitable racks. These racks shall be so constructed that the steel does not come into contact with the ground.

5.41.2 On no account shall steel be left lying on the ground or exposed to the weather prior to being placed in a position in the work.

5.42.0 PLACING OF REINFORCEMENT

5.42.1 At the time concrete is placed reinforcement shall be free from mud, oil, grease and other non-metallic coatings, loose rust and scale which would reduce the bond between the concrete and the reinforcement. In this context rust shall not be deemed to be loose if on rubbing with the thumb it leaves only a stain thereon. Nevertheless, a deformed bar having millscale or rust or both shall be deemed to comply with this specification if, for a specimen which has been wire-brushed by hand:-

i the dimensions of cross-section, including height of deformations and
ii. the mass

are not less than the dimensions and mass required by the applicable Australian Standard

5.42.2 All steel reinforcement shall be accurately placed in the positions shown in the drawings and firmly held during placing and setting of the concrete.

5.42.3 Unless otherwise specified or directed by the superintendent and / or a Pine Rivers Shire Council engineer reinforcement shall be placed in its specified position, within the tolerances given in Clause 19.5.3 of AS 3600 such that the nominal cover shown on the drawings shall not be encroached upon.

5.42.4 Bars shall be held in position by wiring at all intersections with annealed wire not less than No. 18 gauge except where spacing is less than 300 mm in each direction when alternate intersections shall be tied. Distances from forms shall be maintained by precast mortar blocks, metal hangers, plastic chairs or other approved devices. Stirrups and ligatures shall

pass around the main bars and be securely wired thereto.

5.42.5 Metal supports and tie wires which extend to the surface of the concrete shall not be permitted. Plastic tipped steel bar chairs shall not be used in the works unless the distance from the metal portion of the chair, including those portions encased in plastic is equal to or greater than the minimum concrete cover to reinforcement shown on the drawings.

5.42.6 Concrete blocks shall be cured by immersion in water for at least seven days until 24 hours before the blocks are to be used. Layers of bars shall be separated by precast mortar blocks or by other equally suitable devices. The use of pebbles, pieces of broken stone or brick, metal pipe and wooden blocks will not be permitted.

5.42.7 Vertical reinforcing and starter bars to be left for any period of time longer than 24 hours shall be capped as a safety measure, or where practicable, be ordered with the top ends bent over. Caps are to be removed from the steel before attaching additional reinforcing bars and before placing of concrete.

5.43.0 WELDING OF REINFORCEMENT

5.43.1 Welding of reinforcement shall not be carried out unless shown on the drawings, specified, or otherwise approved by the superintendent and / or a Pine Rivers Shire Council engineer. Such welding shall comply with AS 1554.3 - “Welding of Reinforcing Steel”.

5.43.2 The following limitations on welding shall apply:-

i Except as provided in paragraph ii. below, welding shall not be carried out within 75 mm of a bend having an internal diameter less than 12 bar diameters, or any part of a bar that has been bent and subsequently bent in the reverse direction or straightened.

ii. With the approval of the superintendent and / or a Pine Rivers Shire Council engineer, it shall be permissible to tack weld bars sufficiently to maintain the reinforcement in its correct positions.

5.44.0 ROLLED FABRIC

5.44.1 If fabric reinforcement is shipped in rolls, it shall be straightened into flat sheets before being placed.

5.45.0 SPLICING OF REINFORCEMENT

5.45.1 All reinforcement shall be furnished in the full lengths indicated on the drawings. Splicing of bars, except where shown on the drawings, will not be permitted without the written approval of the superintendent and / or a Pine Rivers Shire Council engineer. Splices shall be staggered as far as possible. Where bars are spliced they shall be lapped the distances shown on the drawings. Where unscheduled laps are authorised the bars shall be lapped the distances approved by the superintendent and / or a Pine Rivers Shire Council engineer in writing. In lapped splices, the bars being spliced shall be placed in contact and wired together in such a manner as to maintain a clearance of not less than the minimum clear distance to other bars and the minimum distance to the surface of the concrete specified in the plans.

5.46.0 LAPPING OF REINFORCING MESH

5.46.1 Sheets of mesh reinforcement shall overlap each other by a distance equal to that given by Clause 13.2 of AS 3600.

5.47.0 SUBSTITUTIONS

5.47.1 Substitution of different size bars will not be permitted unless written application is made to the superintendent and / or a Pine Rivers Shire Council engineer for such substitution at least four weeks before the reinforcing steel is to be placed. Such permission will only be given if the structure is not adversely affected. No additional payment will be made on account of these alterations.

5.48.0 INSPECTION OF REINFORCEMENT

5.48.1 Reinforcement in any member shall be placed and then inspected and approved by the superintendent and / or a Pine Rivers Shire Council engineer before the placing of concrete begins. Concrete placed in violation of this provision may be rejected and its removal required.

5.49.0 DEFECTIVE CONCRETE

5.49.1 Concrete which is not placed and completed in accordance with this specification or which, in the opinion of the superintendent and / or a Pine Rivers Shire Council engineer, is defective shall be removed within the limits assigned by the superintendent and / or a Pine Rivers Shire Council engineer. Such concrete shall be replaced at the contractor's cost by concrete placed and completed in accordance with this specification.

5.50.0 PVC WATER STOPS

5.50.1 PVC water stops shall be placed in joints of the concrete structure where shown on the drawings or as directed by the superintendent and / or a Pine Rivers Shire Council engineer.

5.50.2 The PVC water stops shall be extruded polyvinyl chloride and shall comply with the requirements of British Standard Specification No. 2571 "Flexible Polyvinyl Chloride (PVC) 'Extrusion Compounds' Class 3, Compound Type G4".

5.50.3 The water stops for use centrally in walls and floors or other places where shown on the drawings or as directed by the superintendent and / or a Pine Rivers Shire Council engineer shall be of the flat corrugated type with a hollow centre bulb, which are characterised by numerous ribs running the length of the water stop. The waterstops shall be Expandite Supercast Hydrofoil or equivalent of a suitable section width.

5.50.4 The contractor shall take care in the storage of water stops and any part that shows signs of deterioration will be rejected. The contractor shall also support and protect the water stops during the progress of the work and shall replace and repair any part damaged before acceptance of the work.

5.50.5 The number of splices in the water stop shall be the minimum practicable. The equipment used for making splices, together with details of splicing method shall be submitted to the superintendent and / or a Pine Rivers Shire Council engineer for approval.

5.50.6 The contractor shall make the splices and ensure:-

i. that the material is not damaged by heat, sealing, or by the application of cementing material

ii. that the splices have a tensile strength not less than 80% of the unspliced material

iii. that the ribs and central bulb where applicable match up exactly and are continuous

iv. the joint provides an effective waterstop

5.50.7 Centre bulb waterstops shall be securely held in position by tying the outstand beyond the last rib to the reinforcing steel in the concrete section to be cast and/or to the formwork where the waterstop is protruding using very heavy gauge nylon fishing line or other approved non-metallic ties. Waterstops which are incorrectly located with the centre bulb not coinciding with the joint face shall not be accepted. Remedial measures may include breaking out and recasting of the waterstop in the correct location or building up the joint faces with an approved sand filled epoxy-mortar to the correct profile.

5.50.8 The minimum clear distance from the waterstop to reinforcing bars or dowels which are not stainless steel or hot dip galvanised steel shall be 50 mm unless otherwise shown on the drawings or specified in this specification.

5.51.0 COATING OF VALVES, PIPEWORK, FITTINGS AND FABRICATED ARTICLES

5.51.1 Ductile iron pipes and fittings laid underground require no additional external paint treatment, but shall be wrapped with polythene sleeving applied in accordance with AS 3681.

5.51.2 Pipes, valves, fittings and other components to be installed in pits or chambers, and which have not been supplied with a thermal bonded polymeric coating shall be painted in accordance with the relevant clauses of this and relevant Pine Rivers Shire Council specifications. An approved DENSO coating system or equivalent may be accepted by a Pine Rivers Shire Council engineer.

5.51.3 All fabricated items not manufactured of all stainless steel, or supplied with a thermally bonded polymeric coating, and which are to be located in pits or chambers shall be painted, or hot dip galvanised in accordance with the relevant clauses of this and relevant Pine Rivers Shire Council specifications. An approved DENSO coating system or equivalent may be accepted by a Pine Rivers Shire Council engineer.

5.51.4 Hot dip galvanising shall be carried out in accordance with AS 4680, after final fabrication of the component.

5.51.5 Before painting, components shall be treated externally by abrasive blast cleaning followed by painting with an approved system as detailed in AS/NZS 2312, reference LP1-A or LP2-A as appropriate to the installation location.

5.51.6 <u>ABRASIVE BLAST CLEANING</u>

i. The surfaces to be blast cleaned shall be dry abrasive blast cleaned to a metal finish in accordance with AS 1627-Part 4 and AS 1627-Part 9 using one of the following methods:-

- grit blasting using compressed air nozzles;
- grit blasting using centrifugal wheels; or
- sand blasting using compressed air nozzles.

ii. The articles shall be cleaned by abrasive blast to a surface standard at least equal to Class 2½ as defined by AS 1627 - Part 4.

iii. Metallic abrasive, where used, shall comprise cast iron, cut wire or grit and shall be hard, sharp and free from dust. The maximum particle size shall be not larger than that passing through 1.18 mm Australian standard sieve.

iv. Non-metallic, silica free and silica material shall not be reused in the blasting operation.

v. All free oil and moisture shall be effectively removed from the air supply lines of all blasting equipment using adequate filters and driers.

vi. After blasting, the surface shall be brushed or blown down with clean dry air (using driers and oil mist filters in air lines), or vacuum cleaned to remove all blast products and abrasives from the entire surface including pockets and corners.

vii. Blast cleaning operations shall not be performed on objects which have a surface temperature which is less than 3^0C above the dew point of the ambient temperature, or when the humidity is calculated using a hygrometer, the wet bulb temperature differs from the dry bulb temperature by less than 7½% of the dry bulb temperature.

viii. The cleaned surfaces shall be kept free of all contamination before painting and shall not be touched by bare hands or other bare parts of the body.

ix. Any areas which become contaminated shall be immediately solvent cleaned in accordance with AS 1627 - Part 1.

x. Any surface which has been abrasive blast cleaned shall be coated within four hours or less of blasting depending on climatic conditions.

xi. All reference to the standard surface preparation shall be to AS 1627 - Part 4 Section 1.4 and AS 1627 - Part 9.

5.51.7 PAINTING

i. Where fabricated articles are not specified or shown on the drawings to be galvanized or hot dip galvanized, they shall be painted.

ii. Proposed paint systems shall be submitted to the superintendent and/or a Pine Rivers Shire Council engineer for approval before use. Full details of the paint manufacturer's specifications, which shall include details of methods of application, dry film thickness, pot life, drying time, recoating time, thinners and compatibility between primer and top coats shall be submitted.

iii. For wetted surfaces, the paint system shall be suitable for continuous immersion and, in the case of potable water, shall be approved by the Government Paint Committee for that purpose. The metalwork shall be painted with an approved system as detailed in AS 2312, reference LP1-A i.e. primed with an inorganic zinc silicate with a minimum dry

film thickness of 65 microns and maximum of 75 microns, followed by two coats of high build catalysed epoxy paint, the two coats being different shades or colours. Total dry film thickness shall be not less than 325 microns. Micaceous iron oxide may be incorporated into the first of the two coats to assist bonding.

iv. For other surfaces, the steelwork shall be painted with an approved system as detailed in AS 2312, reference LP2-A i.e. primed with an inorganic zinc silicate with a minimum dry film thickness of 65 microns and maximum of 75 microns, followed by two coats of high build catalysed epoxy micaceous iron oxide paint, the two coats being different shades or colours. Total dry film thickness shall be not less than 325 microns.

v. The final external colour of painting on pipework and fittings shall be those called for in AS 1345, according to the use of the pipeline. The paint colour proposed for items other than pipework and fittings shall be submitted to and approved by a Pine Rivers Shire Council engineer before application.

5.52.0 FABRICATED ITEMS

5.52.1 The contractor shall supply and install fabricated items as shown on the drawings.

5.52.2 All steel items shall be hot dip galvanized after fabrication in accordance with AS 4680.

5.52.3 Ladders and miscellaneous items shall be fabricated from aluminium unless noted otherwise on the drawings or in this specification.

5.52.4 All aluminium items shall be fabricated in accordance with the provisions of AS 1665, by personnel qualified for and granted Certificate No. 8 as set out in AS 1796.

5.52.5 Unless noted otherwise on the drawings or elsewhere in this specification, all aluminium extrusions shall be alloy 6061 tempered to T6, all aluminium sheet thinner than 3 mm shall be alloy 5251 tempered to H34, and all aluminium sheet 3 mm and thicker shall be alloy 5083 tempered to H321. Aluminium and its temper treatment shall be in accordance with AS 2848.1.

5.52.6 Aluminium fabricated items shall be insulated from concrete bearing surfaces by stainless steel brackets, HDPE gaskets, painting the contact area with a heavy coat of approved alkali-resistant bituminous paint or by other means approved by a Pine Rivers Shire Council engineer. Where aluminium comes in contact with hot dip galvanized steel, a neoprene insertion or equivalent approved method shall be used to separate the materials.

5.52.7 Nylon or polyethylene washers, top hat sections and spacers shall be used to separate stainless steel or Monel metal fasteners from aluminium. Under washers and boltheads and on bolt shanks etc. where the fastener size is too small for the above insulating methods, that is less than 3 mm diameter, a heavy application of "Duralac" to the mating surfaces can be substituted.

5.52.8 Unless shown otherwise on the drawings, all butt welds shall be full penetration welds for both steel and aluminium fabrication. All joints shall be seal welded unless specifically noted to the contrary.

5.52.9 Ladders shall comply with the requirements of AS 1657, and shall be in accordance with the Pine Rivers Shire Council standard drawing.

5.52.10 The contractor shall submit detailed fabrication drawings of other fabricated items not covered by the Pine Rivers Shire Council standard drawings. Manufacture of these items shall not commence until the superintendent and / or a Pine Rivers Shire Council engineer has given approval.

5.53.0 FASTENERS AND MISCELLANEOUS ITEMS

5.53.1 All fasteners used in the work shall be stainless steel of Grades 316 or 304 to either AS 1449, or AISI 316 or 304 (American Iron and Steel Institute) or UNS S31600 or S30400. This includes bolts, nuts, washers, studs, screws, masonry anchors and threaded items used for joining flanges, mounting equipment, or in the assembly of valve bodies and other components.

5.53.2 All stainless steel bolts, nuts, studs, masonry anchors and washers shall be marked in accordance with either the ISO 3506 or the AISI marking standards as appropriate. Products not marked in accordance with either of these standards shall be accompanied with a manufacturer's certificate indicating the grade and strength, and general authenticity of the products compliance with the requirements of this section.

5.53.3 All bolts, nuts, studs and masonry anchors up to and including 24 mm dia. shall be Class 70, having a minimum tensile strength of 700 MPa. Fasteners greater than 24 mm dia. may be Class 50, with a strength of 500 MPa.

5.53.4 Threads shall generally be cut in accordance with DIN 933 or DIN 931.

5.53.5 Bolts shall be metric series, hexagonal head. Studs shall be either hexagonal head, or where used in the assembly of components, may be socket head type. Bolts and studs shall be manufactured from Grade 316 stainless steel.

5.53.6 Nuts shall be metric series normal type, hexagonal nuts. Nuts shall be manufactured from Grade 304 stainless steel.

5.53.7 Washers shall be normal series washers manufactured from Grade 316 stainless steel.

5.53.8 Bolt and stud lengths shall be chosen and supplied such that when used to assemble materials supplied in accordance with the Pine Rivers Shire Council specification for "Supply of Water Main Pressure Pipes, Valves, Fittings etc." there shall be a minimum of 10 mm thread remaining under the washer when the articles are assembled and, a minimum bolt projection of 10 mm clear beyond the external face of the nut.

5.53.9 Bolts for use with gibaults shall be selected for length and threaded length so as:-

i. There is a minimum bolt projection equivalent to 1½ x nut thickness clear beyond the external faces of the assembly when loosely assembled prior to tightening; and

ii. When gibaults are assembled and installed in accordance with accepted industry practice, there shall be a minimum of 10 mm thread remaining under the washer.

Alternatively, lengths of threaded road with an additional nut and washer may be used in place of bolts. The above minimum overall length of rod shall apply. The rod shall be of a strength grade equivalent to that required for bolts.

5.53.10 The contractor shall provide washers under all nuts, studs or bolts where rotation can occur

during tightening of the fastener. Loctite 222 or 567 or other approved nickel based anti-galling paste shall be used on all threads and between stainless steel mating surfaces as an anti-galling lubricant.

5.53.11 Hole sizes shall be drilled only sufficiently large enough to accommodate the fastener and isolator chosen. Oversized holes shall not be accepted.

5.53.12 Unless otherwise shown on the drawings or specified in the job specification, chemical anchors shall comply with Table 5.01.

Table 5.1

SIZE (min.)	LENGTH (min.)	EMBEDMENT	DISTANCE TO EDGE (min.)
M 10	130	90	45
M 12	160	110	55
M 16	190	125	65

5.53.13 Unless otherwise shown on the drawing or specified in this specification, mechanical anchors shall comply with Table 5.02

Table 5.2

SIZE (min.)	LENGTH (min.)	EMBEDMENT	DISTANCE TO EDGE (min.)
M 10	90	60	60
M 12	110	80	80
M 16	145	100	100

5.54.0 CONSTRUCTION DETAILS OF STRUCTURES, PITS AND CHAMBERS

5.54.1 Structures, pits and chambers shall be constructed as detailed on the job drawings.

5.54.2 The contractor shall supply and install cast iron or aluminium access covers and frames as detailed on the job drawings or on the Pine Rivers Shire Council standard drawings. The access cover frames may be cast into the roof slab when it is poured, or grouted into place into a rebate formed into the roof or walls specifically for that purpose. The grout used shall be a stiff 3:1 sand : cement mix containing just sufficient water for compaction by ramming.

5.54.3 Pipe joints shall not be made and cast into walls of pits or chambers without authority from the superintendent and /or a Pine Rivers Shire Council engineer, except where shown on the Pine Rivers Shire Council standard drawings. Acceptance of this practice does not relieve the contractor of any responsibilities regarding integrity and water tightness of the pipe joint, or rectification of unsatisfactory pipe joints.

5.54.4 Thrust flanges are to be positioned centrally into walls of pits. Localised thickening of walls to accommodate thrust flanges shall not be permitted unless detailed on the job drawings.

5.54.5 The dimensions of structures containing pipework, and the positions of pipework and fittings within the structure are to be checked against the actual dimensions of fittings supplied to be included in the structure before commencing work. If necessary, the final dimensions of the structure are to be varied to suit the actual dimensions of the fittings supplied. All variations to the dimensions of the structure and positions of pipework and fittings within are to be approved by the superintendent and / or a Pine Rivers Shire Council engineer.

5.55.0 BACKFILLING AND FILLING AROUND STRUCTURES

5.55.1 Following completion of the structure the contractor shall backfill the excavations to the levels shown on the drawings. The backfilling shall be placed in layers of maximum 250 mm depth using approved material and consolidated with vibrating rollers or other approved methods to achieve compaction in accordance with Clause 5.55.4 of this specification.

5.55.2 Where filling is required around structures and above the existing ground levels, the area at the works site which is to be filled shall be stripped to a depth of 150 mm.

5.55.3 Backfill and fill material shall be drawn from material excavated on site, where this material is suitable. The characteristics of a suitable material shall be that It shall compact free of cavities or voids to the standards given below. It shall be free from hard pointy stones and shall contain sufficient fines material, but not be of all fines or silt material. The material shall be generally free from vegetable mater.

5.55.4 The filling shall be placed in uniform layers and be compacted to comply with the following standards of compaction:-

i. sand - the density index measured in accordance with AS 1289 shall be not less than 65
ii. material other than sand shall be placed in layers not exceeding 300 mm thickness, and compacted in accordance with the following table using compaction as determined by AS 1289:-

BACKFILL COMPACTION		
Allotments		
- residential	95 % standard	DI - 65 minimum
- commercial	98 % standard	DI - 70 minimum
Verges and pathways	95 % standard	DI - 65 minimum
Roads		
- Base course	98 % modified	Not applicable
- Sub-base	95 % modified	Not applicable
- Blanket course	95 % modified	Not applicable
- Sub-grade - Top 300 mm	100 % standard	DI - 80 minimum
- Balance	95 % standard	DI - 65 minimum

5.55.5 Backfill and fill layering is to continue up to 150 mm below finished surface.

5.55.6 On completion of the backfilling the area is to be topsoiled and turfed.

5.55.7 Any settlement of any backfilling taking place during the defects liability period shall be refilled and regraded by the contractor to designed levels.

5.56.0 TURFING

5.56.1 The backfilled/compacted area shall be top soiled to a depth of 100 mm and raked smooth to 50 mm below the finished surface level.

5.56.2 Laying of turfs on any areas shall not commence without prior approval of the superintendent and / or a Pine Rivers Shire Council engineer.

5.56.3 Payment shall be made at the scheduled rate per square metre and shall include the supply, spreading, compaction, fertilising and watering of turfs.

5.56.4 The turfs shall be of Cynodon Dactylon (green couch). The grass shall be of good quality free from paspalum, nut grass, oxalis and other weeds. Turfs shall be cut 300 mm wide and 3 m length approximately and 50 mm - 60 mm thick. Turfs shall be cut and delivered to the site so as to minimise time between delivery and laying. If necessary, the turfs shall be stacked, well watered and protected from the sun. All rolls of turf shall have the grass facing inwards. A sample of 2 m^2 of turf shall be submitted to the superintendent and/or a Pine Rivers Shire Council engineer at least one week prior to the commencement of laying turfs. If approved, all turfs shall be of at least equal quality. If rejected, further samples from different sources shall be submitted, until an approved source is found.

5.57.0 TIDYING OF SITE

5.57.1 The contractor on completion of the works specified herein, shall tidy up the whole of the site of the works including the construction area and the area used for his or her plant, stores and amenities. This shall include the removal of all rubbish, waste and excess materials.

5.58.0 KEYS AND LOCKS

5.58.1 Where required by the job specification, the contractor shall liaise with the superintendent and / or a Pine Rivers Shire Council engineer with regard to the suitability of locks that shall be able to be converted to the master system being operated by the Pine Rivers Shire Council at the end of the maintenance period.

5.59.0 PAYMENT UNDER A SCHEDULE OF RATES CONTRACT

5.59.1 This section of the specification is intended primarily for the Pine Rivers Shire Council projects. It may also be applied to other projects as described in the job specification and schedules.

5.59.2 This section of the specification identifies the obligations of the contractor and the items in the schedule of rates under which it is expected that a competent contractor would make a cost allowance to meet these obligations. The contractor shall not be entitled to any additional payment in meeting obligations set out in this specification or to be implied from the description of works to be carried out but not specifically referred to in this section. The clause numbers listed in the clauses below are as found in this specification.

5.59.3 The construction of pits and chambers are usually listed for payment as an individual item for each installation.

Such items shall be inclusive of works associated with excavation and backfill; formwork; supply and placement of reinforcing, supply and placement and compaction of concrete, installation of covers and frames, placement of fixtures into covers, and supply and fixing fabricated articles.

5.59.4 The contractor's obligations under Sections 5.1.0 to 5.19.0 inclusive and 5.22.0 to 5.50.0 inclusive and Sections 5.53.0 to 5.58.0 inclusive shall be allowed for in the items for construction of each pit or chamber listed.

5.59.5 The contractor's obligations under Section 5.20.0 shall be allowed for in the rate for items relating to erection of blockwork.

5.59.6 The contractor's obligations under Section 5.21.0 shall be allowed for in the rate for items relating to the laying and jointing of pipes.

5.59.7 The contractor's obligations under Section 5.51.0, Clauses 5.51.2 and 5.51.5 to 5.51.7 inclusive, shall be allowed for in the rate for items relating to painting or coating of pipework and fittings etc.

5.59.8 The contractor's obligations under Section 5.51.0, Clauses 5.51.3 to 5.51.7 inclusive shall be allowed for in the items for construction of each pit or chamber listed.

5.59.9 Unless identified separately in the job specification or schedules, the contractor's obligations under Section 5.52.0 shall be allowed for in the items for construction of each pit or chamber listed.

5.59.10 Payment shall be made on the basis of completion of all of the works identified and listed for each item scheduled.