PINE RIVERS SHIRE COUNCIL

DESIGN MANUAL

CIVIL INFRASTRUCTURE DESIGN



SPECIFICATIONS

PRSC 500	Sewerage Specifications
PRSC 400	Water Supply Specifications
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PINE RIVERS SHIRE COUNCIL

SPECIFICATIONS



PRSC 500

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PINE RIVERS SHIRE COUNCIL

PRSC 503 - CONSTRUCTION OF A SUBMERSIBLE SEWAGE PUMPING STATION



PRSC 503 CONSTRUCTION OF A SUBMERSIBLE SEWAGE PUMPING STATION

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1.0.0 PURPOSE

- **1.1.0** The purpose of this specification is to set out the Pine Rivers Shire Council requirements for the construction of submersible sewage pumping stations.
- **1.2.0** This specification applies particularly to a single 2.0 m diameter well fitted with dual submersible sewage pumps. The specification may be applied to wells of different diameter or containing a single pump in a dual well configuration subject to the approval of the Pine Rivers Shire Council's General Manager Pine Water.

2.0.0 SCOPE

- **2.1.0** This specification shall apply to works constructed by contract, subcontract or direct labour.
- **2.2.0** This specification shall apply to pumping stations being constructed directly for 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:-

Workplace Health and Safety Act 1995 and Regulations with amendments.

Sewerage and Water Supply Act 1949 - 1982 with amendments

AS 2124 - 1992	General Conditions of Contract
AS 3600-2001	Concrete Structures
AS 3610-1995	Formwork for Concrete
AS 4373 - 1996	Pruning of Amenity Trees

3.2.0 The following shall apply when respective materials have been specified or approved for use:-

AS	1012 1012.1-1998 1012.3-1998	Methods of Testing Concrete Methods for Sampling Fresh Concrete Methods for the Determination of Properties Related to the Consistency of Concrete
	1012.4-1999 1012.8-2000	Methods for the Determination of Air Content of Freshly Mixed Concrete Method for Making and Curing Concrete Compression, Indirect Tensile and Elexure 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 in the field or in the laboratory
AS AS AS	1111 1111.1-2000 1111.2-2000	ISO Metric Commercial Hexagon Bolts and Screws Product Grade C – Bolts Product Grade C - Screws
AS	1112-2000	ISO Metric Hexagon Nuts (Set)
AS	1141-1999	Methods for Sampling and Testing Aggregates (Set)
AS	1289-2000	Methods of Testing Soil for Engineering Properties (Set)
AS	1379-1991	The Manufacture and Specification of Concrete
AS	1478-2000	Chemical Admixtures for Use in Concrete, Mortar and Grout – Admixtures for Concrete
AS	1554.3-1983	Structural Steel Welding - Welding of reinforcing steel
AS	1627 1627.1-2003 1627.4-2002 1627.9-2002	Metal Finishing - Preparation and Pre-treatment of Surfaces Cleaning Using Liquid Solvents and Alkaline Solutions Abrasive Blast Cleaning Pictorial Surface Preparation Standards for Painting Steel Surfaces

AS 1657-1992	Fixed Platforms, Walkways, Stairways and Ladders -Design, Construction and Installation			
AS 1665-2004	Welding of Aluminium Structures			
AS 1796-1993	Certification of Welders and Welding Supervisors			
AS 2053.1-2001	Conduits and fittings for electrical installations – General Requirements			
AS 2280-2004	Ductile Iron Pipes and Fittings			
AS 2312-2002	Guide to the Protection of Iron and Steel against Exterior Atmospheric Corrosion			
AS 2544-1995	Grey Iron Pressure Fittings			
AS 2758 2758.1-1998	Aggregates and Rock for Engineering Purposes Concrete Aggregates			
AS 3582 (Set)	Supplementary cementitious materials for use with Portland and Blended Cement			
AS 3583	Methods of test for supplementary cementitious materials for use with Portland and Blended Cement			
AS 3972-1991	Portland and Blended Cements			
AS/NZS 4671-2001	Steel Reinforcing Materials			
AS/NZS 4680-1999	Hot-dip Galvanising (Zinc) coatings on Fabricated Ferrous Articles			

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 a sewage pumping station. The term shall include such operations as establishment, clearing, excavation, bedding, forming, concrete pouring, vibrating, stripping, testing, coating, backfilling and fitting out
 - Sewer any conduit for the carrying off of sewage from any premises which is not a house drain, soil or waste pipe
 - Premises any parcel of land improved or unimproved, for which there is a property description
 - Developer the company, organisation or person to whom 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 developer to carry out the investigation and design of the sewerage works to be constructed by the developer. 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 or their nominated representative
 - Manager Electrical and Mechanical Services the person occupying that position or their nominated representative
 - Pine Rivers Shire Council engineer the engineer employed by the Pine Rivers Shire Council to approve, supervise or inspect sewerage 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 General Manager Pine Water at least two working days notice of their 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 their 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 the General Manager Pine Water.

5.2.0 WORK ON OTHER PREMISES

- 5.2.1 Before entering these premises in order to carry out approved work, the contractor shall obtain the written approval of the owner of premises to do so.
- 5.2.2 The contractor and his/her 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 their 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 premises. 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 WORKING HOURS

- 5.3.1 The contractor shall comply with the limitation on hours of work imposed by the local laws of the Pine Rivers Shire Council or as amended by any subdivisional permit or other development approval. 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.
- 5.3.2 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.

- 5.3.3 Notwithstanding Clauses 5.3.1 and 5.3.2 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.
- 5.3.4 Should the contractor elect to carry out work outside of the normal Award hours and which, in the opinion of the General Manager Pine Water, 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.

5.4.0 INFORMATION SUPPLIED TO THE CONTRACTOR

- 5.4.1 The principal shall supply to the contractor sufficient details by way of drawings and specifications to allow the contractor to construct the works to the principal's requirements.
- 5.4.2 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.
- 5.4.3 In the case of sewage pumping station construction, the contractor shall be supplied full details of any pipework, service penetrations or equipment anchorages which are to be built into the structure.

5.5.0 SETTING OUT

- 5.5.1 The principal shall supply to the contractor sufficient information to accurately locate the works.
- 5.5.2 In the case of sewerage pumping stations the principal shall supply the contractor with

sufficient information to locate the centres of each pump station well. The contractor shall be supplied with drawings showing full construction details for the pump station 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 sewers.

- 5.5.3 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 layout plans, structure details and the diameter, level, length and grade of the pipelines.
- 5.5.4 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 permanent mark damaged or removed during the progress of the works.
- 5.5.5 It shall be fundamental to the contract the positions of the pumping station in relation to the boundaries of premises and to the improvements thereon, shall be maintained unless authorised otherwise by the superintendent and / or a Pine Rivers Shire Council engineer in writing.
- 5.5.6 The contractor shall establish offset pegs clear of the immediate working area.

5.6.0 MATERIALS AND WORK STANDARDS

- 5.6.1 The contractor shall supply all the materials required to complete the works in accordance with the issued drawings and specifications, Pine Rivers Shire Council Specifications, and relevant Australian Standards.
- 5.6.2 Unless the manufacturer has an approved quality system in place, all manufactured items shall be inspected and tested at the place of manufacture by the nominated inspecting and testing authority.
- 5.6.3 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.

5.7.0 WATER REQUIRED FOR WORKS

- 5.7.1 The contractor shall make the necessary arrangements with a Pine Rivers Shire Council engineer to obtain water. Any fees or charges imposed for the use of a standpipe or for the water used shall be paid by the contractor. 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.
- 5.7.2 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.
- 5.7.3 Reticulated water shall not be used for general earthworks.

5.8.0 EXCAVATION

- 5.8.1 The contractor shall satisfy themself as to the type of material to be excavated and subsurface conditions, and shall allow for any dewatering, timber shuttering and shoring that may be required.
- 5.8.2 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.
- 5.8.3 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.
- 5.8.4 All excavations shall be taken out accurately to the lines and levels shown on the drawings. All surfaces to receive concrete foundations, floors or sloping 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.
- 5.8.5 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.
- 5.8.6 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 injury 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 their own cost.
- 5.8.7 Following completion of the structure the contractor shall backfill the excavations to the levels shown on the drawings. The backfilling shall be placed and consolidated with vibrating rollers or other approved means to not less than 95% of the maximum dry density using standard compaction in accordance with by AS 1289.5.1.1.
- 5.8.8 Following completion of the pumping station 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 are 100 mm (minimum) below final levels of any structures. Any excess excavated material shall be carted away and disposed of in a manner approved by the superintendent and / or a Pine Rivers Shire Council engineer.
- 5.8.9 Any settlement of any backfilling taking place during the defects liability period shall be refilled and regraded by the contractor to designed levels.

- 5.8.10 Where filling is required around structures and above the existing ground levels up to the finished surface levels, available excavated material shall be used. The filling shall be placed in uniform layers and be compacted.
- 5.8.11 The material shall 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 this material shall achieve a compaction of not less than 95% of the maximum dry density using standard compaction as determined by AS 1289

5.9.0 EXISTING UNDERGROUND SERVICES

- 5.9.1 The contractor under this contract shall be responsible for accurately determining the location of all underground services within and adjacent to the works area. The drawings do not necessarily show the precise location of the underground services where services are indicated on the drawings, they are provided for guidance only.
- 5.9.2 The contractor under this contract 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 by the principal or others 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 principal and / or the Pine Rivers Shire Council the full cost of such action shall be borne by the contractor.

- 5.9.3 Any alterations to existing services ordered by the superintendent and / or a Pine Rivers Shire Council engineer shall be carried out on behalf of the principal at no cost to the contractor.
- 5.9.4 No claims for payment or extension of time as a result in delays in alterations to services will be accepted.

5.10.0 CONCRETE MATERIALS

- 5.10.1 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.
- 5.10.2 All cement used shall be Portland cement of approved brand and Australian manufacture and shall comply with Australian Standard 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.

- 5.10.3 Water used in the manufacture of concrete shall comply with the requirements of AS 1379
- 5.10.4 Fine aggregate shall consist of natural sands, or a combination of natural and manufactured sands containing not less than 50% natural sands. Particles shall be clean, hard and durable. It shall conform to the Australian Standard 2758.1.
- 5.10.5 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 the Australian Standard 2758.1.

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 40 mm.

- 5.10.6 Aggregates shall be tested to the requirements of AS 2758.1 in accordance with the methods of AS 1141, except as gualified 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/her own expense shall deliver the samples to the superintendent and / or a Pine Rivers Shire Council engineer's 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 has been approved in writing by the superintendent and / or a Pine Rivers Shire Council engineer

5.11.0 CONCRETE ADMIXTURES

- 5.11.1 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/she shall give the superintendent and / or a Pine Rivers Shire Council engineer notice in writing of:-
 - (a) type and brand of admixture to be used
 - (b) rate of application

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- (c) type and location of metering device
- (d) part of the structure where admixture is proposed to be used
- (e) reasons for use
- (f) manufacturer's data sheet giving chemical constituents of the admixture, recommended dose rates and method of dosing
- 5.11.2 If more than one admixture is proposed, the contractor shall provide test evidence as to the compatibility of the admixtures.
- 5.11.3 Generally admixtures approved will be restricted to air entraining admixtures, and for certain approved applications, water reducing set-retarding admixtures, Type WRRe.
- 5.11.4 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.
- 5.11.5 Calcium chloride shall not be used as an admixture in reinforced or prestressed concrete.
- 5.11.6 Any admixtures if approved shall comply with the requirements of AS 1478 "Chemical Admixtures for use in Concrete". A test report in accordance with Clause 5.7 of AS 1478 shall be provided for each admixture prior to its use.
- 5.11.7 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.
- 5.11.8 Where air entrainment is allowed the air content shall be within the range 3-5 per cent except where otherwise specified.
- 5.11.9 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.
- 5.11.10 Admixture metering shall be by an approved and well maintained dispenser.

5.12.0 CLASS OF CONCRETE

- 5.12.1 Concrete shall be classed as "Class SSX" where X is the characteristic 28 day compressive strength in mega Pascals.
- 5.12.2 The compressive strength shall be determined in accordance with Australian Standard 1012.9. Target slump values, maximum water cement ratios, minimum and maximum cement contents shall be within the values in Table 5.0.

Ta	ble	5.	0
			-

CLASS OF CONCRETE	CHARACTERISTICS 28 DAY COMPRESSIVE	ERISTICS DAY ESSIVE MM CETH CEMENT CONTENT SLUMP MM		IENT TENT ′m ³	MAX. WATER CEMENT RATIO BY
	STRENGTH		MIN	MAX	WEIGHT
SS32	32 MPa	40-80	300	380	0.5
Blinding Concrete	-	-	170	-	-

- 5.12.3 Where fly ash or blended cement has been approved for use in Class SS32 concrete, the target mean proportion of fly ash by weight shall not exceed 30% and the target mean proportion of ground granulated blast furnace slag by weight shall not exceed 50%. These materials shall be considered as part of the cementitious content. If fly ash or blended cement is used the maximum water/cementitious ratio shall be 0.45 and the maximum cementitious content shall be 420 kg per cubic metre. A minimum cementitious content of 330 kg per cubic metre shall apply.
- 5.12.4 The drying shrinkage at 56 days, for concrete used in sewage pumping stations shall not exceed 600 microstrain as determined in accordance with AS 1012.13.

5.13.0 CONCRETE MIX DESIGN AND ACCEPTANCE

- 5.13.1 The contractor shall be solely responsible for the design and production of concrete to comply with this specification.
- 5.13.2 The contractor shall submit for approval, details of the concrete mix he/she proposes to use for each particular class of concrete. The following information shall be forwarded to the superintendent and / or a Pine Rivers Shire Council engineer.
- 5.13.3 The concrete mix details shall include the following:
 - 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)
 - vii. drying shrinkage at 56 days
- 5.13.4 Concrete shall not be placed until the mixes have been approved in writing by the superintendent and / or a Pine Rivers Shire Council engineer. Upon request of the contractor, the superintendent and / or a Pine Rivers Shire Council engineer may give provisional approval of a Class SS32 mix if the average of the 7 day strengths is not less than 28 MPa. 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.

5.14.0 CONTROL OF CONCRETE QUALITY

- 5.14.1 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.
- 5.14.2 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.
- 5.14.3 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.
- 5.14.4 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 5.14.1 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's 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.
- 5.14.5 Subject to approval by the superintendent and / or a Pine Rivers Shire Council engineer the contractor may arrange for his/her own convenience to have cylinders tested at other locations provided all such tests are carried out by a NAATA 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.

5.15.0 READY MIXED CONCRETE

- 5.15.1 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.
- 5.15.2 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 5.12.2 of this specification.
- 5.15.3 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.
- 5.15.4 Ready mixed concrete shall be placed and compacted within the time limits specified in Table 5.1. The temperatures in the table shall be the temperatures at the time of discharge from the mixer. 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.

CONCRETE TEMPERATURE	MAXIMUM ELAPSED TIME FROM TIME OF CHARGING THE MIXER
Less than 24° C	90 Minutes
24° C - 32° C	60 Minutes
32° C - 35° C	45 Minutes

- 5.15.5 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.
- 5.15.6 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 5.15.5 of this specification 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.

5.16.0 HOT WEATHER CONCRETING

- 5.16.1 Precautions shall be taken to avoid premature stiffening of the fresh mix and to reduce water absorption and evaporation losses.
- 5.16.2 If the temperature of the surrounding air is higher than 35°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°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.
- 5.16.3 Concrete shall not be placed when the concrete temperature is over 35°C.

5.17.0 SLUMP TESTING

- 5.17.1 After completion of mixing, but prior to site handling, all concrete shall have its slump determined in accordance with AS 1012.3. 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.
- 5.17.2 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.
- 5.17.3 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.

5.18.0 FORMWORK

- 5.18.1 Formwork shall be designed and constructed in accordance with AS 3610.
- 5.18.2 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/her responsibilities under the contract.
- 5.18.3 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.
- 5.18.4 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.

5.19.0 SURFACE FINISH AND COLOUR

5.19.1 All surfaces of concrete 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. The internal surfaces of the pumping station shall have a Class 3 surface finish.

5.20.0 FORM TIES

- 5.20.1 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.
- 5.20.2 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.

5.21.0 PREPARATION AND PLACEMENT OF CONCRETE

- 5.21.1 Each Wednesday, during the contract period, the contractor shall submit his/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.
- 5.21.2 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 5.14.0 of this specification.

- 5.21.3 All concrete shall be placed in the dry and no concrete shall 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 with Clause 5.4.1.7 of AS 3610.
- 5.21.4 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.
- 5.21.5 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.
- 5.21.6 Before any concrete is placed, forms shall be inspected to see if they are thoroughly clean, and all sawdust, shavings, nails, dirt and rubbish of any description shall be removed from within the forms.
- 5.21.7 For narrow walls and columns where the bottom of the form is inaccessible, the low 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.
- 5.21.8 Where concrete is to be placed on other concrete which has taken its final set prior to the commencement of placing, all laitance, porous concrete or other objectionable substance shall be removed from the surface of concrete. When such area is cleansed and wetted but
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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 concrete may be put in position and shall be well compacted so as to make a thoroughly bonded and watertight joint.

- 5.21.9 Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable, by methods which prevent the separation 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. 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.
- 5.21.10 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.
- 5.21.11 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.
- 5.21.12 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.
- 5.21.13 Concrete shall be placed in an essentially continuous manner between approved construction joints so as to avoid being placed against partially set concrete.
- 5.21.14 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.
- 5.21.15 It 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.

5.22.0 COMPACTION OF CONCRETE

5.22.1 Concrete during and immediately after depositing shall be thoroughly compacted. 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 Pine Rivers Shire Council

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- 5.22.2 Vibration shall be internal except as provided in Clause 5.22.9 of this specification.
- 5.22.3 Vibrators shall be of an approved type, capable of transmitting vibration to the concrete at frequencies of not less than 8,000 impulses per minute at such an intensity to visibly effect a 25 mm slump concrete at a radius of 300 mm.

Vibrators for Class S40 and Class S50 concrete shall be capable of transmitting vibration to the concrete at frequencies of not less than 12,000 impulses per minute at an intensity to visibly effect a zero slump concrete at a radius of 300 mm.

- 5.22.4 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).
- 5.22.5 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. It shall then be withdrawn slowly.
- 5.22.6 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 vibration shall be inserted through the layer into the layer below.
- 5.22.7 The vibrators shall be inserted into and withdrawn from the concrete slowly. The vibration shall be of sufficient duration to thoroughly compact the concrete, but shall not be continued so as to cause segregation.
- 5.22.8 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.
- 5.22.9 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.

5.23.0 EMBEDMENT OF METAL WORK

5.23.1 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.

5.24.0 CONSTRUCTION JOINTS

- 5.24.1 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 at least to impair the strength and appearance of the structure. The contractor shall complete by continuous depositing of concrete, sections of the work between such joints.
- 5.24.2 Vertical construction joints will not be allowed in the walls of water retaining structures and the placing of these structures shall be in full circle lifts. 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.
- 5.24.3 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. 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.
- 5.24.4 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/her method of fixing forms at joints or reshape his/her formwork or both so that the next joint is smooth and even.
- 5.24.5 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.

5.25.0 REMOVAL OF FORMWORK

- 5.25.1 Except where otherwise provided in this clause, 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.
- 5.25.2 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.

5.26.0 CONCRETE SURFACES

5.26.1 Exposed surfaces such as tops of walls and floors shall be properly screeded off to correct levels shown on the plans and given a suitable finish complying with the requirements of Clause 5.19.0 of this specification by the use of steel trowel or float.

5.27.0 REPAIR OF CONCRETE

- 5.27.1 Repairs to concrete surfaces shall be performed by skilled workmen. 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.
- 5.27.2 Concrete that is damaged through any cause or concrete that is honeycombed, fractured or otherwise defective, must be excavated and replaced with stiff 3 to 1 mortar containing just sufficient water for compaction by ramming or with concrete as hereinafter specified.
- 5.27.3 Holes resulting from the removal of ends of form ties shall be filled with stiff 3 to 1 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 to 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.
- 5.27.4 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 square metres and deeper than 100 mm and for holes in reinforced concrete which are greater in area than 0.005 square metres and which extend beyond reinforcement.
- 5.27.5 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.

5.28.0 CURING OF CONCRETE

- 5.28.1 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.
- 5.28.2 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.
- 5.28.3 The unformed top surfaces of walls shall be moistened by covering with 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.
- 5.28.4 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.

- 5.28.5 On horizontal surfaces or near horizontal surfaces, covering with an impervious sheet such as polythene for not less than seven days 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.
- 5.28.6 If fly ash has been used in the concrete, the curing periods nominated above shall be extended to 14 days.
- 5.28.7 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.
- 5.28.8 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.
- 5.28.9 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.
- 5.28.10 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. As soon as the surface film of moisture disappears, but while the surface still has a damp appearance, sealing compound shall be applied.
- 5.28.11 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 foregoing requirements.
- 5.28.12 Traffic or other operations by the contractor shall be such as to avoid damage to coatings of sealing compound for a period of not less than 28 days after the application of the compound.
- 5.28.13 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.
- 5.28.14 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.

5.29.0 DIMENSIONAL TOLERANCES

5.29.1 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.

5.30.0 STEEL REINFORCEMENT

- 5.30.1 All reinforcements of concrete shall be in accordance with Australian Standard Specifications:-
- 5.30.2 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.

5.31.0 BENDING OF REINFORCEMENT

- 5.31.1 Reinforcement shall be bent in accordance with Clause 19.2.3 of AS 3600.
- 5.31.2 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.

5.32.0 STORAGE OF STEEL REINFORCEMENT

- 5.32.1 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.
- 5.32.2 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.

5.33.0 PLACING OF REINFORCEMENT

- 5.33.1 At the time concrete is placed, reinforcement shall be free from mud, oil, grease and other non-metallic coatings and loose rust 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 or a welded wire fabric 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 for reinforcement.

- 5.33.2 All steel reinforcement shall be accurately placed in the positions shown in the drawings and firmly held during placing and setting of the concrete.
- 5.33.3 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.
- 5.33.4 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. Metal supports and tie wires

which extend to the surface of the concrete shall not be permitted. Stirrups and ligatures shall pass around the main bars and be securely wired thereto.

- 5.33.5 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.
- 5.33.6 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.

5.34.0 WELDING OF REINFORCEMENT

- 5.34.1 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.
- 5.34.2 The following limitations on welding shall apply:
 - i. except as provided in paragraph ii., 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.

5.35.0 ROLLED FABRIC

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

5.36.0 SPLICING OF REINFORCEMENT

5.36.1 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.

5.37.0 LAPPING OF REINFORCING MESH

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

5.38.0 SUBSTITUTIONS

5.38.1 Substitution of different size bars will not be permitted unless written application is made 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.

5.39.0 INSPECTION OF REINFORCEMENT

5.39.1 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 removal required.

5.40.0 DEFECTIVE CONCRETE

5.40.1 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.

5.41.0 PVC WATER STOPS

- 5.41.1 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.
- 5.41.2 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".
- 5.41.3 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 with a suitable section width not less than 150 mm.
- 5.41.4 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.
- 5.41.5 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.
- 5.41.6 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
- 5.41.7 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 nonmetallic 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.
- 5.41.8 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.

5.42.0 CAST IRON AND DUCTILE IRON PIPES AND FITTINGS

- 5.42.1 Grey iron pressure fittings shall be manufactured, tested and supplied in accordance with AS 2544.
- 5.42.2 Ductile iron pipes and fitting shall be manufactured, tested and supplied in accordance with AS 2280.
- 5.42.3 Ductile iron pipes shall be PN 20 or PN 35, except that flanged pipes shall be Class K12. Ductile Iron pipes Class K9 and K12 are also accepted.
- 5.42.4 All ductile iron pipes and fittings shall be cement lined with a Type SR or Calcium Aluminate sulphate resisting cement, and preferably have spigots and sockets coated with a thermal bonded polymeric coating in accordance with AS 4158.
- 5.42.5 Ductile iron pipes and fittings installed in sewage pumping stations shall be treated externally by abrasive blast cleaning followed by painting with an approved system as detailed in AS 2312, reference LP1-A or LP2-A as appropriate to the installation location. The abrasive blast cleaning, location and painting shall comply with clauses 5.44.2 and 5.44.3 of this specification.

5.43.0 KNIFE GATE VALVES

- 5.43.1 The contractor under this contract shall supply and install knife gate valves at the locations shown on the drawings.
- 5.43.2 Knife gate valves shall be flanged and drilled to suit the mating flanges. Wafer type valves shall not be installed unless specifically approved by a Pine Rivers Shire Council engineer. The body of each valve shall be made of cast iron or a non-corrosive material. Steel flanges shall not be accepted. The gate, seat and all bolts and studs shall be Grade 316 stainless steel. Nuts and washers shall be Grade 304 stainless steel. The valve stem shall be Grade 304 stainless steel or better. Washers shall be provided under all nuts and bolt heads where rotation can occur.
- 5.43.3 Knife gate valve seals shall be of synthetic rubber or Nylon 6. The seal shall not be located in the bottom of a recess in the valve body but shall be located in the side of the recess.

- 5.43.4 Each knife gate shall be tested open and to withstand 75 m head of water. The valve shall be able to operate against an unbalanced head of 10 m from the opposite direction. Driptightness is not required for the unbalanced head test. The valves shall be fitted with handwheels unless otherwise shown on the drawings.
- 5.43.5 The direction of closing shall be anti-clockwise.
- 5.43.6 Knife gate valves for installation within concrete benching and other similar places where shown on drawings shall be bonneted valves. The valves shall comply with Clauses 5.43.2 to 5.43.3 of this specification with the appropriate actuator installed as shown on the drawings or as specified.
- 5.43.7 Knife gate valves, installed above ground or in sewerage wet wells, shall generally be of all Stainless Steel manufacture unless otherwise approved by a Pine Rivers Shire Council engineer. Knife gate valves which are not of all Stainless Steel manufacture shall be coated in accordance with Section 5.44.0 of this specification.
- 5.43.8 Where shown on the drawing to have an extended spindle, the knife gate valve shall have its spindle extended upwards to finish with the top of the spindle inside a 300 mm long, 100 mm diameter aluminium sleeve or a twice locking insert box as appropriate. The top of the extension spindle shall be shaped to suit a standard valve key. The extended spindle shall be fabricated from stainless steel. The extended spindle shall be non-rising.
- 5.43.9 Brackets shall be provided at 1.5 m maximum centres to support the extended spindle. Nylon or polythene bushes shall be provided between the spindle and bracket.
- 5.43.10 Prior to fabrication, the contractor shall submit to the superintendent and / or a Pine Rivers Shire Council engineer for approval, full details of the extension spindles including details of their connection to the valves.

5.44.0 COATING OF VAVLES AND PIPEWORK

5.44.1 All knife gate valves, reflux valves and pipework not of all stainless steel manufacture, which is located above ground or in sewerage wet wells, shall be coated in accordance with Clauses 5.44.2 and 5.44.3 of this specification.

5.44.2 ABRASIVE BLAST CLEANING

- 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. 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.
- iii. Non-metallic, silica free and silica material shall not be re-used in the blasting operation.

- iv. All free oil and moisture shall be effectively removed from the air supply lines of all blasting equipment using adequate filters and driers.
- v. 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.
- vi. Blast cleaning operations shall not be performed on objects which have a surface temperature which is less than 3°C 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.
- vii. 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.
- viii. Any areas which become contaminated shall be immediately solvent cleaned in accordance with AS 1627 Part 1.
- ix. Any surface which has been abrasive blast cleaned shall be coated within four hours or less of blasting depending on climatic conditions.
- x. All reference to the standard surface preparation shall be to AS 1627 Part 4 Section 1.4 and AS 1627 Part 9.

5.44.3 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 manufacturers' specifications, which shall include details of methods of application, dry film thickness, pot life, drying time, re-coating time thinners and compatibility between primer and top coats shall be submitted.
- iii. The fabricated articles shall be cleaned by abrasive blast to a surface standard at least equal to Class 2¹/₂ as defined by AS 1627 Part 4.
- iv. 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.
- v. 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.

5.45.0 FABRICATED ITEMS

- 5.45.1 The contractor shall supply and install fabricated items as shown on the drawings.
- 5.45.2 Ladders and miscellaneous items shall be fabricated from aluminium unless noted otherwise on the drawings or in this specification.
- 5.45.3 All steel items shall be hot dip galvanized after fabrication in accordance with AS 4680.
- 5.45.4 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.
- 5.45.5 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.
- 5.45.6 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 alkaliresistant 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.
- 5.45.7 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.
- 5.45.8 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.
- 5.45.9 Ladders shall comply with the requirements of AS 1657, and shall be in accordance with the Pine Rivers Shire Council standard drawing.
- 5.45.10 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.

5.46.0 COATING TO PUMPWELLS

- 5.46.1 Various surfaces of pumpwells shall be coated with Peerless Emulsion "Epigen 1311" or Wattyl "Sigmagaurd CSF 75" (white) applied in two coats with a total dry film thickness of 600 microns minimum. The extent of the coating shall be the benching, pumpwell walls, valve pit walls and pumpwell and valve pit roof soffit.
- 5.46.2 All air holes and other defects shall be rectified by bagging with sand and cement mortar and grinding as appropriate to ensure a smooth surface for coating.

- 5.46.3 The epoxy resin coating shall not be applied until at least 28 days have elapsed from the time of placing the concrete. The receiving surfaces shall then be well cleaned of all loose material by lightly sandblasting or acid etching and coated in strict compliance with the manufacturer's recommendations.
- 5.46.4 The resultant coating shall be white in colour and shall have a smooth surface free from any irregularities or undulations. A sample of the finished coating on a piece of fibre cement sheet, or similar, shall be supplied to a Pine Rivers Shire Council engineer together with details of the method of application for approval prior to any surfaces being coated. Unless otherwise approved by a Pine Rivers Shire Council engineer, at least two coats shall be applied.
- 5.46.5 The epoxy resin coating shall be applied by specialist subcontractors approved by the supplier. The coating shall show no noticeable deterioration at the end of the defects liability period. Should deterioration be evident the coating shall be made good in accordance with the recommended procedures of the paint manufacturer.
- 5.46.6 The valve pit floor shall be coated with a 5 mm thick layer of Monier Relpatch Acrylic Modified Mortar or an equivalent approved product. The material shall be mixed and applied in accordance with the manufacturer's recommendations.

5.47.0 FASTENERS AND MISCELLANEOUS ITEMS

- 5.47.1 All fasteners used in the work excluding shackles, shall be stainless steel in accordance with AS 1444. This includes bolts, nuts, washers, studs, screws, masonry anchors and threaded items joining flanges, mounting equipment or used in the assembly of valve bodies and fabricated items. Shackles shall be fabricated from Grade 304 stainless steel in accordance with AS 1444.
- 5.47.2 Bolts shall be hexagon head bolts complying with AS 1111 **except** that the material shall be Grade 316 stainless steel. The tensile and proof loads shall comply with Table 9 of AS 1111.
- 5.47.3 Nuts shall be hexagon nuts complying with AS 1112 manufactured from Grade 304 stainless steel. The nuts shall be normal type complying with the proof loads given in Table 10 of AS 1112 for property class 5.
- 5.47.4 Washers shall be normal series washers manufactured from Grade 304 stainless steel.
- 5.47.5 All saddles, clips and clamps used in the work shall be fabricated from Grade 316 stainless steel.
- 5.47.6 All stainless steel bolts, nuts, studs or washers shall be marked either with the ISO marking "A4" or the AISI marking "316" or "304" as appropriate.
- 5.47.7 The contractor shall provide washers under all nuts, studs or bolts where rotation can occur during tightening of the fastener. Loctite 222 or 567 shall be used on all threads and between stainless steel mating surfaces as an anti-galling lubricant.
- 5.47.8 Hole sizes shall be drilled only sufficiently large enough to accommodate the fastener and isolator chosen. Oversized holes shall not be accepted.

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5.47.9

Unless otherwise shown on the drawings or specified in this specification, chemical anchors shall comply with the requirements of Table 5.2.

Table \$	5.2
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SIZE MIN	LENGTH MIN	EMBEDMENT	MIN. EDGE DISTANCE
M10	130	90	45
M12	160	110	55
M16	190	125	65

5.47.10 Unless otherwise shown on the drawing or specified in this specification, mechanical anchors shall comply with the requirements of Table 5.3.

SIZE MIN	LENGTH MIN	EMBEDMENT	MIN. EDGE DISTANCE
M10	90	60	60
M12	110	80	80
M16	145	100	100

5.48.0 PUMPING STATION CONSTRUCTION DETAILS

- 5.48.1 Pumping station shall be constructed as detailed on the drawings using either *in situ* or caisson type construction.
- 5.48.2 The contractor shall supply and install aluminium access covers and frames as detailed on the drawings. The access cover frame shall be cast into the roof slab when it is poured. The provision of a recess when the slab is poured for grouting the frame into position at a later date shall not be permitted.

5.49.0 ELECTRICAL CONDUITS

5.49.1 All conduits shall be of the nominated diameter and fabricated from heavy duty electrical grade uPVC in accordance with AS 2053.

5.50.0 FILLING AROUND PUMPING STATION SITE

- 5.50.1 The area at the station which is to be filled shall be stripped to a depth of 100 mm.
- 5.50.2 In conjunction with the construction of the pumping station the area is to be backfilled in layers of maximum 250 mm depth using approved material. This material shall be compacted to a similar standard to that specified under the pump station valve chamber floor.
- 5.50.3 The backfilling layering is to continue to 100 mm below finished surface levels.
- 5.50.4 On completion of the backfilling the area is to be topsoiled and turfed.

5.51.0 TURFING OF EMBANKMENTS AT PUMPING STATION SITES

- 5.51.1 The backfilled / compacted area shall be top soiled to a depth of 75 mm and raked smooth to 25 mm below the finished surface level.
- 5.51.2 Laying of turfs on any areas shall not commence without prior approval of the superintendent and / or a Pine Rivers Shire Council engineer.
- 5.51.3 Payment shall be made at the scheduled rate per square metre and shall include the supply, spreading, compaction, fertilising and watering of turfs.
- 5.51.4 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 two square metres 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.

5.52.0 TIDYING OF SITE

5.52.1 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 / her plant, stores and amenities.

5.53.0 REMOVAL OF TREES

5.53.1 Approval of the superintendent and / or a Pine Rivers Shire Council engineer shall be obtained prior to the removal of any tree on the site. The superintendent and / or a Pine Rivers Shire Council engineer may direct that hand excavation be carried out adjacent to selected trees.

5.54.0 KEYS AND LOCKS

5.54.1 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.