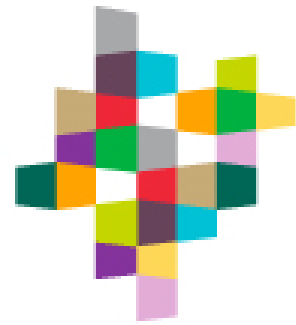


QPRC



**QUEANBEYAN PALERANG
REGIONAL COUNCIL**

**DEVELOPMENT DESIGN
SPECIFICATION**

D11

**WATER RETICULATION - SOUTH
JERRABOMBERRA**

VERSION 2 – APRIL 2018

TRIM REF: SF140543/04-01
C1849967

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
1	Provide for water supply to other areas	D11.04	A	HB	4/04
2	Pressure requirements to QCC Standards	D11.05	M	HB	4/04
3	Requirement for Network Analysis	D11.05	A	HB	4/04
4	Requirements for individual services	D11.06	AM	HB	4/04
5	Valve closing clockwise	D11.06	M	HB	4/04
6	Details of Main location	D11.07	AM	HB	4/04
7	Delete use of some pipe materials	D11.09	O	HB	4/04
8	Delete use of uPVC, ABS, GRP pipes	D11.10 D11.11 D11.15	M	HB	4/04
9	Limit use of PE pipes	D11.14	A	HB	4/04
10	Information required at PS witness point	D11.17	A	HB	4/04
11	Ambient conditions changed to -10°C	D11.19	M	HB	4/04
12	Telemetry to comply with existing	D11.21	O	HB	4/04
13	Lifting equipment to allow removal from Pump Station	D11.23	M	HB	4/04
14	Approval of design before start of construction	D11.24	AM	HB	4/04
15	Provide Longitudinal section only if required	D11.24	M	HB	4/04
16	Deemed to Comply	D11.27	A	HB	4/04

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17	Generator connection for pump stations	D11.17.6	A	KD	9/05
18	A1 plan size	D11.25.3	A	KD	9/05
19	Hold Point for water reticulation design	D11.04.1	A	BP	1/06
VERSION 1					
20	Requirement for dual water supply	D11.02.1	M	MC	04/02/13
21	Water pressures amended to WSA 03	D11.05	A	MC	04/02/13
22	Fire fighting supply to AS2419.1	D11.05	A	MC	04/02/13
23	Requirements for distribution mains added	D11.06.1	A	MC	04/02/13
24	WSA 03 requirements for dead end mains stipulated	D11.06.4	M	MC	04/02/13
25	Requirements for distribution mains	D.11.06.5	M	MC	04/02/13
26	Requirements for recycled water services added	D11.06.6	A	MC	04/02/13
27	Valve structures to WAS 03	D11.06.7	A	MC	04/02/13
28	Alignment for dual water supply ,stop valve locations, permanent dead end hydrants, pressure zone valve arrangements, major commercial two directional	D11.07.1	M	MC	04/02/13
29	Requirement for easements	D11.07.2	M	MC	04/02/13
30	Pipe types for potable water and recycled water supply stipulated, pipe colour coding to WSA 03 (NDW), fire flow on recycled water main, thrust blocks to WSA 03.	D11.09	M	MC	04/02/13
31	PVC-M pipe for potable water mains and PVC-O pipe for recycled water mains	D11.10	M	MC	04/02/13
32	DICL PN35 flange class nominated	D11.12	M	MC	04/02/13
33	Use of steel pipe limited	D11.13	M	MC	04/02/13
34	PE pipe use limited	D11.14	M	MC	04/02/13
35	GRP pipe use limited	D11.15	M	MC	04/02/13
37	Hold Point added	D11.24.1	M	MC	04/02/13
38	Pipe colours for drawings	D11.24.6	A	MC	04/02/13
39	Hold Point added	D11.25.1	M	MC	04/02/13

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40	References to WSA 03 updated to Version 3.1	Various	M	MC	04/02/13
41	Plastic identification covers required on valves	D11.06	A	MC	04/02/13
VERSION 2			A	KD	20/10/14
42	Reservoirs added	D11.01.2			
43	C401 reference updated to Version 3.3. Australian Standards and other references updated.	D11.03.2			
43	Design life added	D11.04.4			
44	Additional demand information, valve information and flow meters added	D11.05			
45	Peak daily demand requirements expanded, dead end main requirements added, appurtenance added	D11.06			
46	Non-Drinking Water mains deleted, easement s clarified	D11.07			
47	Permitted materials revised	D11.09			
48	SDR ratio added for PVC-O pipe	D11.10			
49	Cement lining to be treated	D11.12			
50	Pump stations and Reservoir details added	D11.17 – D11.68	A		
51	Annexure – Design Submissions, Approvals and HAZOP Studies for Reservoirs and Pump Stations	D11-A	A	KD	
52	Maximum pressures amended, reference to AS3500 added.	D11.05	M	CS	12/4/2018
53	Individual water service crossing requirements amended	D11.06	M		
54	Table 1 Amended to only include Residential & Commercial lot service sizes		O		
55	WSA reference omitted, valves requirement at each street added.	D11.07	M		
	Requirement for heat applied retro reflective markers added		A		
56	Working pressure amended to 1,600kPa, Class amended to Class 16	D11.09	M		
57	DICL fittings to be 450mm	D11.12			

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58	Addition of application for Construction and requirement for long sections to be submitted	D11.63	A		
59	Deemed to comply omitted	D11.72	O		

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**DEVELOPMENT DESIGN SPECIFICATION D11
WATER RETICULATION – SOUTH JERRABOMBERRA**

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AUS-SPEC #1

**DEVELOPMENT DESIGN SPECIFICATION D11
WATER RETICULATION - SOUTH JERRABOMBERRA**

GENERAL

D11.01 SCOPE

- | | |
|--|---------------------------|
| <p>1. The work to be executed under this Specification consists of the design of a water reticulation system either as a stand-alone project or part of a development.</p> | System |
| <p>2. This Specification contains procedures for the design of the following elements of a water supply system.</p> <ul style="list-style-type: none"> (a) Reticulation (b) Pump Stations (c) Reservoirs | Elements |
| <p>3. The design of reticulation and pump station components shall comply with the Water Services Association of Australia's publication WATER RETICULATION CODE OF AUSTRALIA unless specified otherwise herein and should be constructed in accordance with the DEVELOPMENT CONSTRUCTION SPECIFICATION - WATER RETICULATION – VERSION 3.3.</p> | Compliance |
| <p>4. Where the Specification forms part of a contract attracting Government Grant funds, the Principal shall identify:</p> <ul style="list-style-type: none"> (a) Items which are not of the least cost option, that <ul style="list-style-type: none"> (i) Are intended to have a much longer design life than the normal asset service life detailed in the Asset Management Guidelines of the International Infrastructure Management Manual. (ii) Do not meet the project objectives and the requirements of the various Authorities for the least Net Present Value (NPV) but may become the preferred option for construction. (b) Particular equipment which is procured without relevant competition through tendering (c) Duplication of equipment or unit processes in a system configuration | Subsidised Schemes |

D11.02 OBJECTIVE

- | | |
|--|---------------------|
| <p>1. The objective of a water supply system is to provide to the consumer a reticulated potable water supply to meet the demands imposed upon it by both the consumers and fire fighting requirements. Consumer requirements shall be met by providing a water main and allowing an appropriate point of connection for each individual property.</p> | Water Supply |
|--|---------------------|

D11.03 REFERENCE AND SOURCE DOCUMENTS

- | | |
|--|------------------|
| <p>1. Documents referenced in this Specification are listed below whilst being cited in the text in the abbreviated form or code indicated. The Designer shall possess, or have access to, the documents required to comply with this Specification.</p> | Documents |
| <p>2. References to the WATER RETICULATION CODE OF AUSTRALIA are made</p> | Water |

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where there are parallel sections or equivalent clauses to those in this Specification. Where not called up as part of this Specification, these references are identified by part and section numbers and enclosed in brackets thus (WSA Part, Section).

**Reticulation
Code**

(a) Council Specifications

- C401 - Development Construction Specification Water Reticulation – Version 3.3.

The Designer shall include the requirements of the DEVELOPMENT CONSTRUCTION SPECIFICATION - WATER RETICULATION – VERSION 3.2.

(b) Australian Standards

References in this Specification or the Drawings to Australian Standards are noted by their prefix AS or AS/NZS. (WSA 03 Part 1, section 1.4, and Part 2)

**Australian
Standards**

The Designer shall use the latest edition of the Australian Standards, including amendments and supplements, unless specified otherwise in this Specification.

- AS1101.1 - Graphic symbols for general engineering – Hydraulic and pneumatic systems

- AS1101.3 - Graphic symbols for general engineering – Welding and non-destructive examination

- AS 1102 - Graphical symbols for electrotechnical documentation (various)

- AS/NZS 1111 - ISO metric hexagon commercial bolts and screws

- AS/NZS 1112 - ISO metric hexagon nuts including thin nuts slotted nuts and castle nuts

- AS/NZS1170 - Structural design actions – General principles

- AS 1214 - Hot dipped galvanised coatings on threaded fasteners (ISO metric coarse thread series)

- AS/NZS 1260 - PVC pipes and fittings for drain, waste and vent applications

- AS 1281 - Cement mortar lining of steel pipes and fittings

- AS 1432 - Copper tubes for plumbing, gasfitting and drainage applications

- AS 1444 - Wrought alloy steels – Standard, hardenability (H) series and hardened and tempered to designated mechanical properties

- AS 1449 - Wrought alloy steels – Stainless and heat resisting steel plate, sheet and strip

- AS 1460 - Fittings for use with polyethylene pipes

- AS/NZS 1477 - PVC pipes and fittings for pressure applications

- AS 1579 - Arc welded steel pipes and fittings for water and wastewater

- AS/NZS 1594 - Hot rolled steel flat products

- AS 1646 - Elastomeric seals for waterworks purposes.

- AS 1657 - Fixed Platforms, walkways, stairways and ladders – Design, construction and installation

- AS/NZS 1891 - Industrial fall-arrest systems and devices – Harnesses and ancillary equipment

- AS 2129 - Flanges for pipes, valves and fittings

- AS 2200 - Design charts for water supply and sewerage

- AS/NZS 2280 - Ductile iron pressure pipe and fittings

- AS/NZS 2312 - Guide to the protection of structural steel against atmospheric corrosion by use of protective coatings

- AS/NZS 2566.1 - Buried flexible pipelines – Structural design

- AS 2634 - Chemical plant equipment made from glass fibre re-inforced plastics (GRP) based on thermosetting resins

- AS 2638 - Sluice Valves for waterworks purposes

- AS 2837 - Wrought alloy steels – Stainless steel bars and semi-finished products

AS/NZS 2890	-	Parking facilities
AS 3500	-	National Plumbing and Drainage Code
AS 3518.1	-	Acrylonitrile Butadiene Styrene (ABS) pipes and fittings for pressure applications – Pipes
AS 3518.2	-	Acrylonitrile Butadiene Styrene (ABS) pipes and fittings for pressure applications – Solvent cement fittings
AS 3571	-	Glass filament reinforced thermosetting plastics (GRP) pipe - Polyester based - Water supply, sewerage and drainage applications
AS 3578	-	Cast iron non-return valves for general purposes
AS 3579	-	Cast iron wedge gate valves for general purposes
AS 3680	-	Polyethylene sleeveings for ductile iron pipelines
AS 3688	-	Water supply – Copper and copper alloy body compression and capillary fittings and threaded-end connectors
AS 3691	-	Solvent cement and priming (cleaning) fluids for use with ABS pipes and fittings
AS 3735	-	Concrete structures for retaining liquid
AS 3855	-	Suitability of plumbing and water distribution systems products for contact with potable water
AS 3862	-	External fusion-bonded epoxy coating for steel pipes
AS 3952	-	Water supply- DN80 spring hydrant valve for general purposes.
AS 3996	-	Metal access covers, road grates and frames
AS 4020	-	Products for use in contact with drinking water
AS 4041	-	Pressure piping
AS 4058	-	Precast concrete pipes (pressure and non-pressure)
AS 4087	-	Metallic flanges for Waterworks purposes.
AS 4100	-	Steel structures
AS/NZS 4129(Int)	-	Fittings for polyethylene (PE) pipes for pressure applications.
AS/NZS 4130	-	Polyethylene (PE) pipes for pressure applications.
AS/NZS 4131	-	Polyethylene (PE) compounds for pressure pipes and fittings.
AS/NZS 4158	-	Thermal bonded polymeric coatings on valves and fittings for water industry purposes
AS/NZS 4321	-	Fusion-bonded medium-density polyethylene coating and lining for pipes and fittings
AS/NZS 4765(Int)	-	Modified PVC (PVC–M) pipes for pressure applications
HB 48	-	Steel structures design handbook

(c) Other

Institute of Public Works Engineering Australia (IPWEA)

- Streets Opening Conference Information Bulletin on Codes and Practices (Sections 3 and 4 detailing locations and depths of other services and preferred location for water reticulation pipes)

NSW Department of Public Works and Services (DPWS)

- MEW E101 - Electrical Services Minimum Requirements
- PWD-WSIM - Water Supply Investigation Manual
- PWD - Safety Guidelines for fixed ladders, stairways, platforms and walkways.
- WS-SPEC - Technical Requirements (TRs) and Strategic products Specifications (WSAA)

Water Services Association of Australia (WSAA)

- WSA 03 - Water Reticulation Code of Australia

Water Directorate

- Operation and Maintenance Manuals –
 - Water Pumping Stations - 2004
 - Water Supply Service Reservoirs – 2010

- Water Reticulation – 2003
 - Chlorination Installations – 2003
- Overview of the 2011 Australian Drinking Water Guidelines – 2012
 Fire Flow Design Guidelines - 2011
 Section 64 Determination of Equivalent Tenements – 2009
 Manual for Mechanical and Electrical Infrastructure – 2010
 Cutting, Handling and Disposal of AC Pipe Guidelines - 2014

Building Codes Board of Australia
 - Building Code of Australia - PART E1, Fire Fighting Equipment.

ADWG Australian Drinking Water Guidelines

AWWA
 AWWA D100-96 Welded Steel Tanks for Water Storage

ASTM
 A276

(d) Standard Drawings

Drawings

WATER RETICULATION CODE OF AUSTRALIA drawings shall be used in preference to DPWS standard drawings (WSA 03 Part 3).

DESIGN CRITERIA

D11.04 GENERAL

1. The layout and sizing of distribution and reticulation systems within a proposed development cannot be viewed in isolation, treating only the area under development. Provision shall be made for anticipated flows from and to other areas as required by the Water Authority. Except where specified otherwise, the division of responsibilities between the Water Authority and the Designer shall be in accordance with the DEVELOPMENT CONSTRUCTION SPECIFICATION-WATER RETICULATION. (WSA 03 Part 1, section 2). The approval of final design constitutes a **HOLD POINT**.

Responsibility

HP

2. The Designer shall take into account the special requirements for dual water supplies where required by the Water Authority, including but not limited to, demand, size and location for each pipe system. Dual services shall not be installed unless part of a dual supply.

Dual Supplies

3. The Designer shall take into account the location and type of valve required considering maintenance and repair requirements, the need for double air valves with integral isolating valve on mains or single air valve with isolating valve on reticulation mains, and scour points.

Valve Type and Location

4. Asset design life shall be as per Table 1.2 of WSA03, if not specified otherwise in Table D11.1 below.

Design Life

Table D11.1

Asset Useful Life

Asset	Useful Service Life (Years)
-------	-----------------------------

Protective Coatings	15
Electrical work (except Telemetry)	25
Concrete Structures	75
Metalwork / Structures	50
Steel Reservoirs	75
Rafters and Columns	40
Purlins	25
Roof Sheeting	25
Cathodic Protection	20
Stairs and Platforms	25

5.– For design purposes the air temperature range shall be as follows

Design Air Temperature

- Minimum -10°C
- Maximum +45°C

D11.05 RETICULATION PRESSURE

1. Reticulation systems shall be designed to supply peak instantaneous demand by gravity while maintaining a minimum static heads stipulated in Table 2.3 of WSA 03 Part 1, section 2.5.

Minimum Static Head

2. A peak instantaneous demand of 0.15 L/s/tenement shall be used.. The Water Authority shall be consulted when determining local average and peak demands for different end user types. If no local demands can be provided by the Water Authority, then a standard average day demand of 230kL/annum/equivalent tenement (residential) shall be used in determining peaking factors and peak demands. Water demands for other developments shall be as detailed in the DEVELOPMENT CONSTRUCTION SPECIFICATION-WATER RETICULATION – Version 3.2 (WSA 03 Part 1, section 3) and shall be endorsed by the Water Authority prior to completion of detailed design.

Water Demand

3. Under no circumstances shall the pressure be able to equal or exceed the safe working pressure of the reticulation pipe material. The effect of water hammer is to be taken into account for the maximum pressure.

Maximum Pressure

4. The maximum pressure is 800 kPa in the reticulation system. Zoning of the reticulation system by means of pressure reducing valves ('RV's) may be necessary to achieve these pressures across the development. Further reduction of pressure maybe required at property interface in accordance with AS3500.

Desirable Maximum Pressure

5. Water mains required for fire-fighting purposes in the development shall be designed in accordance with AS 2419.1-2005.

Fire Fighting

6. The Designer shall provide a network analysis of the reticulation system detailing the pressure and velocity distribution after consultation with the Water Authority. The data and model shall be supplied in an electronic format compatible with Council's water network analysis model. If compatible data is not available then the network analysis provided will include computer software sufficient for Council to investigate the proposed reticulation system. Detailed surge and fatigue analyses of the pipe network(s) and detailed water age analyses shall be included in the design submission.

Network Analysis

7. Elevations shall be in meters Australian Height Datum (AHD)

Elevations

8. Flow velocities shall be as specified in WSA 03, Part 1, Section 3.1.6.4.

Flow Velocities

9. Pressure and supply zones shall be designed in consultation and agreement of the Water Authority.

Pressure and Supply Zones

10. The selection of pressure reducing and pressure sustaining valves shall be done

Pressure

WATER RETICULATION – SOUTH JERRABOMBERRA

in consultation and agreement of the Water Authority. Consideration shall be given to pressure range, noise, surge, valve hunting, ease of maintenance and manual handling. The Water Authority prefers the use of needle type pressure reducing and pressure sustaining control valves provided with a suitably designed manifold with associated actuators, modulating equipment, isolation valves, bypass structure, controls and gauges. Gauges and controls shall be connected to the Water Authority's data management system.

Valves

11. Electromagnetic flow meters shall be installed and connected to the Water Authority's management system at each pressure and supply zone

Flow Meters

D11.06 PIPELINE

1. Trunk mains directly supplying reticulation systems shall be designed as part of the reticulation system to carry peak instantaneous demands. (WSA 03 Part 1, sections 3 and 5)

Trunk Mains

2. Gravity mains feeding service reservoirs shall be designed to carry peak daily demands over 24 hours. Pressure mains feeding service reservoirs shall be designed to carry peak daily demands over 18 hours. The Water Authority may consider in extending this timeframe to 22 hours, but is subject to detailed hydraulic and cost analyses and Asset Category as defined in Table 1.1 of WSA 03 Part 1.

Peak Daily Demand

3. Reticulation mains shall be looped to eliminate dead ends unless permitted otherwise by the Water Authority. All permitted dead ends shall terminate with a flushing point as per Water Authority's requirements. Flushing points shall be provided where zone valves cause dead ends.

Looped Mains

4. Where a dead end is permitted to provide for future extension from staged development, the end shall be fitted with a gate valve, and hydrant. (WSA 03 Part 1, section 5.10.2)

Staged Development

5. Distribution mains shall comprise twin transfer mains and/or looped distribution mains in accordance with WSA 03 Part 1, Section 2.4, Figure 2.1(c). Distribution mains >225 mm dia shall not be utilised for service connections. Where required, rider mains shall be provided in accordance with WSA 03, Part 1, Section 5.8. Duplicate mains shall be provided when required as stipulated in WSA 03, Part 1, Section 5.7.

6. Each lot shall have an individual service tapped from each main and extending 500mm inside the lot boundary. As far as practicable services should be located adjacent one common property boundary, with other utility services located at the other common property boundary. Water services in road crossings shall be individual and installed in a UPVC conduit not exceeding 50mm, potable and recycled services to each lot can share a common conduit. The water service shall be located at least 1m off the boundary. All services shall be perpendicular to the main, unless approved by the Water Authority. The maximum length of individual services shall be 10m unless otherwise approved by the Water Authority. Table 1 below summarises services which apply;

Individual Service

Table 1: Service Size for Lot Type

Lot Type	Service Size
Residential Lot	20 mm
Commercial Lot	40mm minimum

Where a future development on the lot will potentially require a fire service, consideration should be given to the installation of a 100 mm service with associated Stop Valves and on-site hydrants in accordance with AS 2419.1 – 2005 and WSA 03 – section 8.2.8

7. Valves on trunk mains are to be housed in valve chambers. The Designer shall show on the Drawings the type of cover and how the covers shall be seated. Valves on reticulation mains shall be provided with a valve surface box in accordance with WSA 03, Part 1, section 8.10.

Valve Chambers

8. Metal access covers shall be manufactured in accordance with AS 3996. The Designer shall ensure that air valve covers have adequate openings for air exchange.

Access Covers

9. Stop valves shall be clockwise closing.

Valve Closing

10. The Designer shall provide for ease of valve maintenance within valve chambers, where provided, and select valve types such that servicing of the valve can be effected without removal from service, wherever possible.

Valve Maintenance

11. Plastic identification covers shall be installed on the valve spindle cap in accordance with WSA 03, Part 1, section 8.1.5.

12. Adequate provision shall be made to include appropriate appurtenances for maintenance of the water transfer, distribution and reticulation network. This shall include, but not be limited to, connections and fittings for scouring, pigging, flushing and the like for commissioning and ongoing operational activities.

Appurtenance

D11.07 LOCATION

1. In designing the reticulation system, standard locations shall be followed, as detailed below:

Standard Location

- (a) Reticulation mains shall be laid in compliance with the Water Authority's standard footpath allocation for public utilities, or in the absence thereof, in conformity with the Streets Opening Conferences' protocols and in accordance with WSA 03, Part 1, section 5.4.5. Location in a common trench in the footway allocation shall be the preferred treatment, with the non-potable water main located closest to the property boundary (WSA 03, Part 1, section 5.4.5). Where this arrangement cannot be achieved separate trenches in the footway allocation on opposite sides of the road reserve shall be used as an alternative. Location under the road carriageway, except for road crossings, shall not be used unless prior approval of the Water Authority and Road Authority is obtained.
- (b) Valves shall be located to avoid conflict with driveways, telephone house service pits and underground electrical boxes. Stop valves shall be located to limit the number of dwellings isolated during a shutdown, each local street shall have a valve configuration to allow it to be isolated from surrounding streets. Mains in cul-de-sacs and dead end mains shall be provided with a Stop valve adjacent the tee with the through main.
- (c) Hydrants shall be located on all reticulation mains as follows
 - The interval between hydrants shall not exceed 60 metres except at locations where fire fighting coverage is not required, where the spacing may be increased to 90 metres.
 - Hydrants shall also be installed at all high and low points of the main, and at dead ends.
 - Permanent dead ends of mains shall be provided with a hydrant bend, hydrant riser and spring hydrant.
- (d) Water mains laid around the curves at the end of cul-de-sacs shall be

minimum DN 100 and be located within the verge.

- (e) Heat applied retro reflective half diamond markers and reflective road pavement markers shall be placed at all hydrant and valve locations.
- (f) Pressure zone dividing valves and hydrants shall be installed in accordance with WSA 03, Part 1, Figure 8.10 (a) as an X-O-X arrangement.
- (g) Major commercial lots shall be provided with two directional supply in accordance with WAS 03, Part 1, Figure 8.14. The Water Authority shall be consulted to determine whether a lot will be deemed to require this arrangement.

2. Water mains will not be located on private property without the prior approval of the Water Authority. If permitted, an easement for water supply over the subject private properties must be created in favour of the Water Authority. A Registered Surveyor shall survey easements and pipelines.

Easements

D11.08 MINE SUBSIDENCE AREAS AND AREAS OF SLIPPAGE

1. The Designer shall accommodate the movement associated with the ground strain for the area, as advised by the Mine Subsidence Board for water reticulation jointing systems in proclaimed Mine Subsidence Areas, or in a known or expected area of subsidence or slippage. The design ground strain for the development shall be detailed on the Drawings. (WSA 03 Part 1, section 4.3.3.3)

Ground Strain

2. The pipe jointing system selected shall be capable of accepting ground movements, without impairing the water tightness of the joint, for the ground strain as advised by the Mine Subsidence Board. For areas with high ground strains a pipe jointing system using shorter effective length pipes and/or deep socket fittings shall be used. This action constitutes a **WITNESS POINT**. The Principal shall advise at the time of notification by the Designer whether the option to confer is required.

Pipe Jointing System

(WP)

3. Where the Mines Subsidence Board does not cover an area of known, or suspected, subsidence or slippage, the above requirements shall still apply.

Areas Applicable

MATERIALS

D11.09 GENERAL (WSA 03 Part 2)

1. The working pressure of pipes, fittings, valves and hydrants shall be fit for the purpose in accordance with the relevant Australian Standard for the material and shall be at least 1600 kPa (160m).

Working Pressure

2. The Designer shall select pipe type, class and standard based on pumping design and in accordance with AS 2200 and site conditions. All pipes shall be a minimum Class 16 unless otherwise determined by the Water Authority. (WSA 03 Part 1, sections 3.3). Roughness coefficients for new and old pipes shall be used and presented in hydraulic and lifecycle cost calculations.

Class and Standard

3. Pipes and fittings for the potable water reticulation shall be of PVC-M, ductile iron, steel, or copper. The material specifications for each pipe type are provided in clauses D11.10 to D11.16 inclusive. Other pipe materials shall only be used where the Water Authority agrees to their specific use where conditions warrant.

Type

4. The Designer shall provide for the water pipes to be colour coded and shown on the Drawings accordingly. (WSA 03, Part 1, sections 4.2.2)

Colour Coding

<p>5. The Designer shall show on the Drawings the extent of external protection required to be undertaken by the Contractor. External protection shall be shown to comply with the DEVELOPMENT CONSTRUCTION SPECIFICATION-WATER RETICULATION – Version 3.2 (WSA 03 Part 1 section 4.8).</p>	<p>External Protection</p>
<p>6. Piers for any above ground water main shall be in accordance with the DEVELOPMENT CONSTRUCTION SPECIFICATION - WATER RETICULATION – version 3.1 (WSA 03 Part 1, section 7.8).</p>	<p>Piers</p>
<p>7. The Designer shall allow for adequate working area, waste removal and transport arrangements where scouring points or pipe inspection locations are nominated. (WSA 03 Part 1, section 8.6)</p>	<p>Special Allowances</p>
<p>8. The Designer shall indicate the location of connections for gauges required on mains.</p>	<p>Gauge Locations</p>
<p>9. The minimum diameter of all pipes shall be DN100 unless otherwise determined by the Water Authority. In commercial, industrial or high-rise building areas the minimum shall be DN150. In all cases pipe sizes and residual pressures shall be designed to cater for fire fighting flows. (WSA 03 Part 1, sections 2.3.1.1 and 3.7.3.1)</p>	<p>Diameter</p>
<p>10. The Designer shall take regard of the limits of use for the pipeline system materials under consideration. (WSA 03 Part 2, sections 2.5, 3.6, 4.6, 5.6, 6.6, and 7.6)</p>	<p>Limits of Use</p>
<p>11. Where valves are specified and shown on the Drawings, they shall comply with the valve details in the DEVELOPMENT CONSTRUCTION SPECIFICATION - WATER RETICULATION – Version 3.1. (WSA 03 Part 1, section 4.7.1)</p>	<p>Valves</p>
<p>12. The Designer shall design thrust blocks in accordance with WSA 03, Section 5.9.</p>	<p>Thrust Blocks</p>
<p>13. The Designer shall provide for surge control by specifying an appropriate pipe material and class selection.</p>	<p>Surge Control Method</p>
<p>D11.10 UNPLASTICISED AND MODIFIED PVC (uPVC and PVC-M) PIPE</p>	
<p>1. Series 2 PVC-M pipe (PN 16 minimum with rubber ring joints) and fittings may be specified for all potable water reticulation mains and potable water trunk mains up to 375 mm diameter.</p>	<p>Standards</p>
<p>2. Series 2 PVC-O pipe (PN 16 minimum with rubber ring joints) and fittings may be specified for all water reticulation mains and water trunk mains up to 375 mm diameter. The minimum standard dimension ratio (SDR) of PVC -O pipes shall be 37.</p>	
<p>3. Pipes and fittings and shall comply with AS/NZS 1477, AS/NZS 4441 or AS/NZS 4765 as appropriate, shall be suitable for use with elastomeric seals complying with AS 1646 and shall be of the class and size as shown on the Drawings. (WSA 03 Part 3, Section 12.1)</p>	
<p>4. Pipes and fittings shall be handled and stored in accordance with WSA 03 or AS/NZS 2032. Where storage beyond the times specified in WSA 03 and AS/NZS 2032 are required, the Contractor shall provide protection for the pipes and fittings from ultra violet light and damage as recommended in the standards for the pipes and fittings. The Contractor shall take account of the time for storage and type of shelter.</p>	<p>Protection</p>
<p>5. Pipes and fittings shall be joined in accordance with the manufacturer's instructions using solvent cement to AS/NZS 3879.</p>	<p>Joining</p>

D11.11 ACRYLONITRILE BUTADIENE STYRENE (ABS) PIPE AND FITTINGS

Not to be used

Reserved

D11.12 DUCTILE IRON (DI) PIPE AND FITTINGS

1. Ductile iron pipes and fittings shall be 450mm and manufactured in accordance with AS/NZS 2280 minimum Class PN35 Flanged Class. (WSA 03 Part 2, section 3)

Standard

2. The Designer shall specify cement mortar lining in accordance with AS 1281, or fusion-bonded medium density polyethylene to AS/NZS 4321. Cement lining shall be treated to avoid deterioration of water quality as water inside the pipe age during low or no flow conditions. External protection shall be epoxy coating to AS 3862 where not otherwise specified as sleeved or wrapped, taking into account the type of corrosion protection required.

Corrosion Protection

3. Generally, pipe and fitting joints shall be specified to be spigot and socket type using a rubber ring (elastomeric) push in seal made of natural rubber, ethylene propylene rubber or nitrile rubber with compounds complying with AS 1646. The seal shall be a single jointing component shaped to provide both groove lock and seal mechanisms.

Joints

4. The Designer shall take account of congested service corridors, poor soil conditions and the need for additional security for strategic mains with regard to the provision of restrained joints.

Restrained Joints

5. Flanges shall be specified to be manufactured in accordance with AS 4087 and AS 2129 Table C. The Designer shall specify bolts and nuts for flanged joints in accordance with AS 2129, galvanised in accordance with AS 1214, or stainless steel in accordance with AS 1449 as for pumps specified in the DEVELOPMENT CONSTRUCTION SPECIFICATION - WATER RETICULATION – Version 3.2.

Flanges

D11.13 STEEL PIPE AND FITTINGS

1. Steel pipes and fittings shall only be specified where the Water Authority has granted concurrence to their use. Where allowed, the pipes and fittings shall be specified to be manufactured in accordance with AS 1579 and AS/NZS 1594 and designed to AS/NZS 2566.1. (WSA 03 Part 2, section 4).

Standard

2. The Designer shall specify the jointing system where long-term corrosion resistance, ease of construction or special circumstances dictate the need. The pipe jointing shall be either:

- (a) Rubber ring (elastomeric) jointed to conform to AS 1646, or
- (b) Welded with butt welding or by using a welding collar with the application of a polyethylene heat shrunk sleeve over the weld, or wrapped, or
- (c) Flanged to comply with AS 4087 to the table specified on the Drawings. Bolts and nuts for flanged joints shall be in accordance with AS 2129 and galvanised in accordance with AS 1214, or stainless steel in accordance with AS 2837 as for pumps specified in the DEVELOPMENT CONSTRUCTION SPECIFICATION – WATER RETICULATION – Version 2.

3. The Designer shall avoid the positioning of continuously welded steel pipelines in parallel with high voltage power lines. (WSA 03 Part 1, section 5.4.12 and Part 2, Table 8.2)

Power Lines

D11.14 POLYETHYLENE PIPE AND FITTINGS

- | | |
|--|------------------------|
| 1. Polyethylene (PE) pipes and fittings shall not be used for water mains except where the Water Authority agrees to their specific use where conditions warrant. PE 100 pipe may be used for residential property services in accordance with WSA 03, Part 1, Section 5.11. | <i>PE Pipe</i> |
| 2. Polyethylene pipe shall be manufactured in accordance with AS/NZS 4130 and designed to AS/NZS 2566.1. | <i>Standard</i> |
| 3. Fittings shall comply with AS/NZS 4129. | <i>Fittings</i> |

D11.15 GLASS REINFORCED PLASTIC (GRP) AND FITTINGS

- | | |
|--|------------------------|
| 1. Glass Reinforced Plastic (GRP) pipes and fittings shall not be used except where the Water Authority agrees to their specific use where conditions warrant. | <i>GRP Pipe</i> |
| 2. Glass reinforced thermosetting plastics (GRP) pipes and collars shall be manufactured to AS 3571.2 and designed to AS/NZS 2566.1. | <i>Standard</i> |
| 3. Ductile iron fittings conforming to AS/NZS 2280 with appropriate elastomeric seals conforming to AS 1646 may be used. | <i>Fittings</i> |

D11.16 COPPER PIPE AND FITTINGS

- | | |
|---|------------------------|
| 1. Copper tube shall be specified to be manufactured in accordance with AS 1432 in the range of DN6 to DN200 for Type A. The Designer shall take into account the requirements of AS 3500. (WSA 03 Part 2, section 2) | <i>Standard</i> |
| 2. Capillary and compression fittings shall be specified to comply with AS 3688 and de-zincification resistant. Capillary fittings shall have silver brazed joints or solder insert capillary joints. | <i>Fittings</i> |

PUMP STATIONS AND RESERVOIRS

GENERAL

D11.17 ACCESS ROADS

1. Access roads shall be trafficable during all weather conditions.
2. All roadway pavements shall be designed for a 40 year life and 1x10⁶ ESA
3. Access roads shall be designed considering the Austroads *Waterway Design* criteria for serviceability and survivability.
4. Access roads shall be serviceable up to and including the 1:20 year ARI storm event considering worst storm intensity and duration
5. Access roads shall be survivable up to and including the 1:40 year ARI storm event considering worst storm intensity and duration
6. The geometry for all new roadways shall be designed for Articulated Vehicles (AV) in accordance with AS 2890.2, A clearance of 0.5 m shall be provided on each side of the nominal turning circles/paths to allow for the differences in vehicles and driver ability.
7. Sufficient allowance shall be made for maintenance vehicles and cranes such that access is maintained for regular plant operations.
8. Parking layout shall be acceptable for the required vehicular movements (including tanker delivery, maintenance vehicles and allowance for crane access) and shall be agreed with the Water Authority during the detailed design. Allowance for the parking of two 5t trucks shall be provided adjacent to the reservoir and pump station.
9. The following minimum requirements shall apply to the access road and parking area design –
 - Minimum pavement width 5 metres
 - Provide access road around full extent of reservoir or pump station, unless otherwise approved
 - Desirable maximum grade – 12.5%
 - Absolute maximum grade – 15% (>15% may be acceptable where concrete pavements are used)
 - Preferred crossfall – 3%
 - Maximum crossfall – 5%
 - All new roadwork pavements shall be bound granular material with asphaltic concrete surfacing
 - The roadwork drawings shall include plan views with pavement contours as well as longitudinal sections along centrelines and also kerb lines where necessary if cross falls are complex

Access Roads

Access Road Minimum Design Requirements

D11.18 STRUCTURES

1. All structures shall be designed in accordance with the principles of structural mechanics and shall be constructed to be capable of sustaining the most adverse combinations of load to which they may be subjected in accordance with Australian Standards and the relevant provisions of the Building Code of Australia
2. The design shall use dead weight and the relevant load combinations to achieve a factor of safety for stability limit stages given in AS1170.1 guarding against potential buoyancy effects.
3. Structures shall be designed for isolation and emptying. Structures shall be designed to allow for both saturated backfill and no backfill conditions.
4. The wind loading for detailed design shall be determined in accordance with AS 1170...2.
5. Walkways, platforms, stairways and other personnel access components shall be designed for a minimum live loading of 4 kPa. All other loadings shall be in accordance with AS 1170.1

Structures

Load

Wind Load

D11.19 LIFE CYCLE COSTS

1. The term “Life Cycle” refers to the life of the overall section of the plant and not the life of its component parts. Where a component is likely to be replaced one or more times during the economic life a particular section of the plant, the life cycle cost of that component is the sum of the costs of the original component and its replacements. The component having the necessary functionality and greatest life per dollar cost (acquisition cost, maintenance cost and operation cost) is therefore the preferred component
2. In selecting the materials for construction and fabrication of structures and incorporation into plant and equipment, the design shall consider the durability, expected useful service life of the plant and maintenance. AS 2312 shall be used as a guide.
3. Where the useful service life of an item of equipment is shorter than the specified economic life of a particular section of the plant, the Consultant will demonstrate that the choice of such equipment, allowing for its replacement one or more times during the life of a particular section of the plant, will support optimising the life cycle cost of a particular section of the plant.

Life Cycle Costs

D11.20 RISK MINIMISATION IN DESIGN

1. During design, the Consultant shall address and minimise operational, maintenance, workplace, health and safety and environmental risks during construction and the service life of the work by minimising risk in design. This process to ensure risk impacts are minimised, which shall include a “best for project” decision making process, shall be detailed in the Risk Analysis and Management Plan which shall be included as an appendix to the specification by the Designer.
2. All aspects of the design including structural, mechanical, electrical, instrumentation and controls shall be reviewed to ensure safety and prevention of damage to structures, equipment or environment under normal, breakdown and maintenance operation.
3. The Designer shall seek to identify all material hazards and aim to eliminate those hazards during the detailed design. Hazards shall be assessed including:
 - Physical egg. noise, radiation, light, vibration, flooding, collapse, falls;
 - Mechanical/electrical egg. slips, trips and falls, tools, electrical equipment, equipotential earthing, electrocution; and
 - Psychological egg. fatigue

Risk Analysis

Hazards

4. This risk assessment process must identify risks to the Water Authority including:
- Compliance with the Environmental Authorisation requirements;
 - Increased Capex costs;
 - Increased Opex costs;
 - Operational risks during project delivery;
 - Adopt a life cycle approach that considers construction, installation, commissioning, operation, maintenance, repair and demolition of the asset being designed;
 - Adopt a consultative approach with relevant stakeholders including operators and Maintenance staff and workplace health and safety personnel; and
 - Identify and adopt risk control measures which reflect the hierarchy of controls.

**Risk
Assessment**

D11.21 WORKING AT HEIGHTS PROVISIONS

1. Provision shall be made in the detailed design for safe access for operations and maintenance into all structures incorporating Working at Heights.
2. Ladders shall be avoided wherever possible and preference shall be given to stairs.
3. Details of the proposed access into reservoirs shall be submitted to the Water Authority for acceptance prior to incorporation into the detailed design.
4. It is envisaged that temporary access into structures will generally be provided by means of a portable aluminium access ladder with access supported by a fixing bracket with fall arrest anchor points in accordance with AS1891 and be similar to the systems installed on existing water reservoirs within Queanbeyan.
5. If a fixed ladder cannot be avoided then the maximum fall distance (height between landings) shall be not more than 4.0 metres.
6. Fixed ladders will only be permitted with the specific agreement of the Water Authority.

**Working at
Heights**

Reservoirs

**Water
Authority
Approval**

D11.22 CHOICE OF MATERIALS AND EQUIPMENT

1. Equipment and plant in general shall be specified of materials suitable for use in the environment in which they are to operate and for the useful service life and in the case of pumps, with regard to the fluid to be pumped.
2. In order to maximise equipment knowledge and to reduce spare parts holdings, the selection of plant and equipment shall consider the commonality of equipment across existing facilities. The Water Authority will advise the Consultant a list of preferred equipment when requested.
3. Structural members for stairs and walkways, grids and stair treads, handrails and kickplates shall be either hot dip galvanised after fabrication or aluminium. The choice of material shall be confirmed in consultation with the Water Authority during the detailed design.
4. Hot dip galvanised components shall be designed to be able to be dismantled so that they can be re-hot dip galvanised. Ladders shall be avoided wherever possible and preference shall be given to stairs.
5. Kickplates shall be designed and detailed to ensure that the gap between the bottom of the kickplate and the walkway does not exceed 10 mm.
6. Chain shall not be used to close openings in handrailing (guardrailing), Hinged gates

shall be used.

D11.23 OPERATION, MAINTENANCE AND ACCESS TO EQUIPMENT

- 1. Mechanical equipment shall be designed for easy and safe access for operation and maintenance. **Access**
- 2. Design shall minimise the need for confined spaces access and be fully compliant with all relevant safety legislation.
- 3. The positioning of the plant and equipment shall consider safety issues such as limits of access, the requirement for lifting equipment, safety barriers and handrails.
- 4. The design of plant and equipment must ensure that maintenance and operations personnel have sufficient access to perform their functions in a safe manner. Structures shall be designed so that convenient access may be attained by crane trucks, cranes, maintenance vehicles and the like.

5. Appropriate access and clearances shall be provided to ensure equipment can be safely lifted into and out of the relevant parts of the facility.

6. Adequate hose down facilities shall be provided for servicing of reservoir internals and pump stations. **Hose Down Facilities**

7. All electrically actuated valves and metering and monitoring equipment which is located external to buildings and below ground, shall be located in concrete pits which can be easily accessed **Valve Pits**

8. Valve pits shall be suitably covered and shall be free draining to a low point such that the pits will not fill with water. Sump pump installations will only be permitted with the specific agreement of the Water Authority. Where allowed a sump pump shall be provided in an adequately sized sump of dimensions not less than 400 mm square by 400 mm deep

D11.24 PIPEWORK

1. All pipework systems shall be designed and detailed on the drawings complete with all pipework, valves, actuators, couplings, appurtenances, controls, supports, anchors, and fittings necessary for the operation and maintenance of the system in accordance with sound engineering practice and the equipment manufacturer’s recommendations... **Pipework**

D11.25 SECURITY AND ACCESS CONTROL SYSTEMS

1, Security system shall be incorporated into the design including card readers and electromagnetic door locks where applicable.

- 2. The security system is to comprise :
 - Appropriate padlocks on access gates, hatch covers, valve pit covers and external doors on electrical switchboard cabinets; and
 - A switch-operated alarm system including proximity type switches on hatch covers, electrical switchboard doors, reservoir roof hatches, reservoir stair access gate, passive infrared and voice alarm on reservoir near access stairway landing

3. All security switches shall be individually connected to terminals in the main switchboard.

D11.26 ELECTRICAL DESIGN

1. The design must include 15A general power outlets at locations to be agreed with the Water Authority.

2. The design must include the provision of additional 3-phase connection points as

agreed with the Water Authority.

D11.27 FIRE FIGHTING SYSTEM

1. The design must be in compliance with the Building Code of Australia, NSW Fire and Rescue requirements, Rural Fire Service requirements, Water Authority’s insurer’s requirements and relevant Australian Standards.

D11.28 SIGNAGE AND LABELLING

1. The Designer shall specify all mandatory, caution, prohibition, safety and danger signage as required by current legislation at all appropriate locations. Signs shall be compliant with AS 1319.

2. Above ground pipework, conduits and ducts shall be provided with identification markers indicating contents and direction of flow in accordance with AS 1345. Markers shall be long life, UV resistant, self-adhesive labels. Marker tape shall also be specified for belowground pipework and conduits.

3. Appropriate signage and labelling shall be provided at reservoirs as per requirements of the Water Authority.

D11.29 WEIGHT LIMITS AND TRIP HAZARDS

1. Hinged covers, removable covers and any equipment required for regular access, operation and maintenance of the plant shall be designed for a maximum lifting mass of 16kg. Where this requirement cannot be satisfied, purpose made lifting equipment with appropriate safe working load capacity shall be specified subject to acceptance of the Water Authority.

Weight limit

2. All walkways and covers in accessible areas shall be designed free of trip hazards with recessed hinges, lifting handles and the like.

Trip Hazards

D11.30 DESIGN VERIFICATION

1. All items which are designed shall be design checked or verified. The design check or verification shall be undertaken by a professional engineer who has NPER-3 registration from the Institution of Engineers, Australia in the category appropriate to the item being design checked or verified.

Certifier

2. The Designer may seek the written acceptance of the Water Authority to use an engineer who is eligible for NPER-3 registration but who does not yet have NPER-3 registration to design check or verify the work.

PUMP STATIONS

D11.31 GENERAL

1. The Designer shall take into account site access, site maintenance and restoration, easement, power supply and working area when locating pump stations in road reserves or on private property. A report on the options considered and reasons for selecting the location and the results of the matters considered constitutes a **WITNESS POINT**.

Location

(WP)

2. Above ground pump units shall be secured under a purpose-designed building which may be subject to Development Approval (DA) by the Council and/or a Construction Certificate – Building. The building shall match the aesthetics of the

Pump Building

surrounding land use and shall accommodate any need for climate and/or acoustic control. Work Health and Safety requirements shall be met especially with regard to clearance for maintenance, and avoidance of trip hazards.

3. Where pumps are to be installed below ground level, the Designer shall provide for the pumps to be mounted on plinths and housed in a single pump well.

Substructure

4. The Designer shall provide for the construction of the pump well after taking into consideration the ground and site conditions.

Conditions

5. Preformed components or systems, complying with the Drawings, if any, may be used in lieu of in-situ construction provided:

Preformed Components

- (a) Preformed concrete wall units are to be manufactured to AS 4058. The Designer shall take into account the cover requirements for the reinforcing steel.
- (b) Joints shall be internal flush
- (c) The Designer shall ensure components make a watertight system and have a satisfactory surface finish.

6. Where the pump station site is exposed to possible flooding, the Designer shall provide for the floor of the pump station or top of pump well, as appropriate, to be one (1) metre above the 1 in 100 year flood level or to such other level as provided by Council's planning instruments, whichever is the higher.

Protection Against Flooding

7. The Designer shall provide for the design of pump wells against flotation both during the construction/installation stage and whilst operating under flood conditions designed as above.

Protection Against Flotation

8. Capacities of the pump unit shall be calculated from the intersection of the pump performance curve and the pipeline characteristic curve calculated at mid water level of the service reservoir involved with this duty point. The pump station shall deliver the required transfer capacity over a period of 18 hours. The Water Authority may consider extending this timeframe to 22 hours, but this is subject to detailed hydraulic and cost analyses and the Asset Category as defined in Table 1.1 of WSA 03 Part 1. Standby pumping capacity shall be provided such that if one (1) pump is out of service, the pump station will remain able to supply the required transfer capacity under peak demand conditions. The pump unit shall be capable of operating near optimal efficiency within the range of operating conditions.

Pump Capacity

Pump analyses shall be conducted for the following demand conditions:

- Average day demand
- Peak day demand
- Average week demand
- Peak week demand

.Pump and system curves along with pump and motor efficiencies shall be submitted to the Water Authority for approval.

9. All pipework and fittings shall be in accordance with this Specification. In addition, all steel bolts, nuts and washers shall comply with AS/NZS 1111 and AS/NZS 1112 and shall be galvanised in accordance with AS 1214 or stainless steel complying with AS 1449 grade 316.

Pump Pipework

10. Where there is negative suction head at the pump inlet, provision shall be made to facilitate priming of each pump.

Pump Prime

11. The Designer shall provide for alarms and signals systems with the concurrence of the Water Authority.

Alarms and Signals

D11.32 PUMP

- | | | |
|----|---|------------------------------------|
| 1. | Pumps shall comply with the WS-SPEC. The Designer shall take account of dismantling joints and valves provided in the pipework to facilitate removal of the pumps for maintenance and the need for surge control devices. | <i>Pump Type</i> |
| 2. | Pump sets are to be interchangeable within each pump station where standby pumps are installed. | <i>Inter-Changeable</i> |
| 3. | The Designer shall design structural steelwork in accordance with HB 48. | <i>Structural Steelwork</i> |

D11.33 ELECTRICAL

- | | | |
|----|---|--|
| 1. | Notwithstanding other clauses mentioned herein, the Designer shall be responsible for the design of the equipment as suitable for the purpose. Equipment design shall comply with the requirements of the relevant standard specification. | <i>Design Responsibility</i> |
| 2. | The Designer shall provide for Switchgear Control Assembly (SCA), SCA housing and electrical requirements as detailed in the DEVELOPMENT CONSTRUCTION SPECIFICATION-WATER RETICULATION – Version 3.2. | <i>SCA and Electrical</i> |
| 3. | Where more than one (1) item of equipment is designed to form a particular function, all such items of equipment shall be identical and completely interchangeable (eg pilot lights, pushbuttons, relays, etc). | <i>Inter-changeability</i> |
| 4. | The switchboard shall be installed visibly and physically accessible above all areas at risk of flooding. | <i>Switchboard</i> |
| 5. | Ambient conditions shall be within the normally accepted limits of -10°C to 45°C. | <i>Ambient Conditions</i> |
| 6. | The switchboard shall be connected to the local electricity supply system.

Nominal system parameters:

(a) 415 volt, 3-phase, 4-wire, 50 Hz, solidly earthed neutral system.

(b) Prospective Fault Current: As specified by the Local Supply Authority.

The switchboard shall provide a generator connection point to allow the pump station to be run via generator in the event of failure of the local electricity supply system. | <i>Connection to Local Supply</i> |
| 7. | The works shall be designed in accordance with and subject to the provisions of MEW E101, except where modified by this Specification. | <i>Standards</i> |
| 8. | The pump station shall be designed for fully automatic operation in the unmanned condition. | <i>Automatic Operation</i> |
| 9. | Adequate lighting shall be provided to minimise shadows inside the building or pump well. | <i>Lighting</i> |

D11.34 ELECTRICAL POWER SUPPLY

1. The consumer electrical mains shall be run underground where possible and commence at the point of attachment on a steel consumers pole (if applicable) installed near the property boundary and run in conduit to the switchboard.

**Consumer
Mains**

2. The minimum size of the consumers mains shall be sized to satisfy the following requirements:

Minimum Size

- (a) Current carrying capacity to suit the maximum demand with an excess current carrying capacity of 30 per cent minimum.
- (b) Be sized for a voltage drop less than 1.5 per cent of the maximum demand as calculated.
- (c) Be single core PVC/PVC cables. XLPE insulated cable may also be used.
- (d) Comply with the requirements of the Local Supply Authority.
- (e) Pole termination method shall be determined in consultation with the Local Supply Authority.

D11.35 TELEMETRY

1. The Designer shall provide for telemetry requirements in accordance with the schedule supplied by the Water Authority.

Schedule

2. The telemetry system is to be compatible with the existing system in use by the Water Authority.

Compatibility

D11.36 LADDERS

1. Ladders shall comply with AS 1657 and applicable Occupational Health and Safety legislation.

Standard

2. If required, the Designer shall set intermediate landings in wells to achieve the minimum head room clearance. Wherever possible, the landing shall be located adjacent to fittings and machinery requiring maintenance.

**Ladder
Landings**

3. Ladder cages shall not be used on ladders in pump station wells.

Ladder Cages

D11.37 OTHER APPURTENANCES

1. The Designer shall provide for machinery lifting equipment including pump chains and gantries as necessary to facilitate the removal of equipment from the pumping station.

**Lifting
Equipment**

2. The Designer shall provide pressure tapping and gauges for all valves, including isolation and non-return valves as detailed in the DEVELOPMENT CONSTRUCTION SPECIFICATION-WATER RETICULATION – VERSION 3.2.

Gauges

3. The Designer shall take account of the possibility of site flooding ingress and overflow, and Work Health and Safety requirements in providing for access and inspection covers.

Covers

RESERVOIRS

D11.38 WATER RETAINING STRUCTURES

1. The reservoir design objectives are to achieve the following criteria :
 - The reservoir is to be functional;
 - Ensure ease of maintenance;
 - Ensure reliable operation;
 - Ensure fitness for purpose;
 - Ensure water quality is not degraded;
 - Ensure ease of constructability;
 - Minimise adverse environmental and community impact;
 - Comply with environmental requirements;
 - Comply with WH&S requirements;
 - Minimise energy consumption by efficient operation;
 - Achieve extended service life with minimal maintenance and least whole of life cost;
 - Provide adequate weather protection and stormwater management;
 - Provide adequate ventilation to minimise corrosion; and
 - Provide sufficient vehicular and personnel access for maintenance.

D11.39 CONSTRUCTION METHODOLOGY

1. The following reservoir construction methods are acceptable :
 - Fabricated Mild Steel
 - Cast In-situ Reinforced Concrete
 - Pre-cast Post Tensioned Concrete

Construction Methods
2. Where the reservoir is founded on sound rock all of the above options are acceptable

Rock Foundation
3. For sites where the reservoir is to be founded on residual soils, or is subject to potential differential settlement or is located within a mine subsidence area, provide fabricated mild steel only. Consideration may be given to acceptability of concrete reservoirs where appropriate foundation treatment such as piling is adopted.
4. To reduce the WHS risks of confined space entry via the roof platform, there is a preference for fabricated mild steel tanks with side wall hatch access to the reservoir for cleaning and maintenance activities.
5. Panel or proprietary tanks with an internal liner or bladder shall not be used if the useful service life of the reservoir is greater than 4 years.
6. Water retaining structures shall be designed and constructed in accordance with AS 3735-2001 and for reservoirs not covered in AS3735 shall conform to AWWA D100-96 Welded Steel Tanks for Water Storage. Specifically the concrete cover to reinforcement shall be agreed with the Water Authority prior to commencing structural design.

D11.40 SITE SURVEY

1. The whole of the reservoir site is to be surveyed by a registered surveyor to identify the boundaries, surface contours and existing services

Registered Surveyor
2. This information is to be used by the designer in siting the reservoir, considering the operating levels for the reservoir, pipework routes (inlet / outlet, scour,

overflow, bypass), flowmeter, water service, power supply and drainage as well as the access roadway and turning areas

3. The site survey shall also indicate the proximity of adjoining properties, particularly those which may be impacted upon adversely by the construction and operation of the reservoir.

4. During the testing phase, accurate survey is to be undertaken and compared to baseline survey prior to filling

D11.41 GEOTECHNICAL SURVEY

1. A geotechnical investigation is required to determine ground conditions which will impose requirements on the designer. The Designer shall address:

Geotechnical Investigation

- Reservoir foundations;
- Pipework thrust restraint;
- Access road and hardstand areas; and
- Mine subsidence / settlement issues.

2. The geotechnical consultant is to prepare both a factual and interpretive report which details the investigation and findings.

Report

HYDRAULIC DESIGN

D11.42 INLET PIPEWORK

1. The inlet pipe diameter should be sized for peak instantaneous (all pumps running, no demand) flows and should be one pipe size larger than in the incoming watermain to allow for a future increase in capacity

Inlet Pipe Diameter

2. A bend / nozzle should be provided on the discharge to promote mixing. Inlet pipework is to typically be DICL however for steel reservoirs with the connection through the floor is to be mild steel welded to the floor plates.

D11.43 OUTLET PIPEWORK

1. The outlet pipe diameter should be sized for peak instantaneous (no pumps running, peak demand) flows and should be one pipe size larger than in the discharge watermain to allow for a future increase in capacity.

Outlet Pipe Diameter

2. The outlet should nominally be located close to the edge of the reservoir to minimise joints under the structure. The outlet pipe is to be positioned at a height to minimise the risk of any accumulated sediment within the reservoir being disturbed and being discharged during reservoir operation. This is typically achieved by positioning the outlet above the designed grade of the reservoir floor, normally graded to achieve a minimum 100mm fall.

3. Outlet pipework is to typically be DICL however for steel reservoirs the connection through the floor is to be mild steel welded to the floor plates.

D11.44 OVERFLOW

1. A vertical pipe located outside the reservoir (where possible) with a suitable inlet arrangement set at an appropriate invert level should form the outlet structure.

2. The overflow pipe diameter should be sized for peak instantaneous (all pumps running, no demand) flows and sized to prevent excessive velocities. The overflow pipe is normally one size larger than the inlet pipeline. Reservoir routing calculations shall be

Overflow Pipe Diameter

submitted for endorsement by the Water Authority.

3. Provide a bellmouth on the overflow, situated a minimum 200mm above TWL with minimum of 300mm freeboard between top of bellmouth and underside of roof members. Ensure that the bellmouth is free of obstruction from roof members. **Bellmouth**
4. An air gap shall be maintained as per AS3500.1 **Air Gap**
5. Undertake a risk based assessment of time for overflow due to response times, telemetry backup, asset criticality and location. Consideration is also to be given to instrumentation time delays, accuracy and sensor calibration when selecting operating levels. **Risk Based Assessment**
6. To ensure the overflow is always operational there shall not be valves installed on the overflow line.
7. The wall plates shall be mild steel welded and the overflow pipework components are to be protected using an internal solventless epoxy coating system. **Wall Plates**
8. Attachments and fixings for all internal components of the overflow pipework are to be grade 316 stainless steel
9. The overflow line shall discharge to an energy dissipation pit or other approved location
10. Provide a visual overflow level marker at the roof entry hatch.

D11.45 SCOUR / WASHOUT BULKHEAD

1. A washout bulkhead is to be installed in the wall strake of fabricated mild steel reservoirs adjacent to the overflow pipe.
2. The scour points in concrete tanks are to be located to optimise scour and cleaning activities.
3. A suitably sized scour pipe shall extend from the external side of the bulkhead or scour point to an energy dissipation pit or other approved location.
4. The scour pipeline shall be as a minimum, the same diameter as the inlet pipe and will generally connect through a valved connection to the overflow line.
5. An external pit shall be provided in the scour line to allow sludge to be trapped and pumped out.

D11.46 WASHDOWN HYDRANT

1. A spring hydrant connection for manual washdown is to be located adjacent the access road close to the main personnel access hatch. The supply for this hydrant shall be a DN100 pipeline connected to the upstream side of the inlet pipeline valve. **Manual Washdown**
2. Provide for installation of a hydrant internally on concrete tanks. Allow for valved connection of a booster for clean out.

D11.47 SITE DISCHARGE STRUCTURE

1. An energy dissipation pit is required to reduce the energy of the overflow/scour discharges due to the driving head of the reservoir water level
2. Discharge locations ARE subject to approval by the Water Authority, Suitable locations may include local stormwater reticulation, stormwater channel, and sewer manhole.

3. Assess the impacts to both upstream and downstream receiving water including flooding and contamination due to both controlled and uncontrolled discharges for the chosen option.
4. Ensure retention of sediment and sludge within a pit.
5. Pit(s) shall be designed to allow for the treatment of 1/3 of the total reservoir volume. The pit(s) shall attenuate water being discharged from the reservoir to acceptable water quality levels prior release to the environment.

WATER QUALITY ASPECTS

D11.48 MIXING OF STORAGE

1. Stagnant areas within the reservoir can lead to microbiological growths, which may be difficult to control. Based on the size of the proposed storage (<10ML), mechanical mixing is not normally required where provision of separate inlet and outlet pipework / nozzles are used. The pipework arrangement for a reservoir shall be approved by the Water Authority.
2. Pipework shall be arranged so that the inlet and exit energy maintains rotation of the water in the reservoir (i.e. a dynamic volume is created).
3. The inlet nozzle shall be directed to maximise mixing of the reservoir
4. The acceptable criteria for reservoir turnover would be at least once per day.
5. For large reservoirs (>10ML), CFD (Computational Fluid Dynamics) analysis is required to determine whether adequate mixing / contact time can be achieved.
6. Submersible mechanical mixers are not preferred. Prior concurrence from the Water Authority shall be obtained prior to their incorporation into the reservoir design.

D11.49 LIGHTING, VENTILATION, VERMIN PROOFING

1. The Australian Drinking Water Guidelines (ADWG) stress the importance of securing the distribution system and it is recommended that the following measures should be incorporated into the design:
 - While no ventilation is the ideal for water quality, it is desirable / good design practice to provide sufficient natural ventilation to limit corrosion of the roof structure and assist in minimising WHS risks during confined space entry. This can be achieved by a combination of inlet ventilation openings provided at the top of the wall strake together with ventilators located at the centre of the roof structure;
 - Ventilators shall be designed to allow for air to be discharged during reservoir filling and for 6 air changes per hour based on the air volume above TWL. Consideration shall be given to the use of fixed ventilators;
 - To guard against the entry of contaminants, for example birds and small animals, all ventilation openings shall be covered with a vermin proof mesh consisting of corrosion resistant materials (marine grade aluminium or stainless steel);
 - Provide a ventilation access hatch in bottom wall strake to enable forced ventilation for future maintenance / coating application;
 - Ventilation needs to be designed to encourage airflow across the total internal area – inlet vents shall be included as well as exit vent points;

- Inlet vents shall be orientated away from sources of contamination;
- Natural light penetration shall not exceed 1% of the total roof area; and
- The placement of safety mesh on top of purlins shall be avoided.

D11.50 INLET NOZZLES

1. Separate inlet / outlet pipework to the reservoir shall be provided.

D11.51 RE-CHLORINATION

1. Determine in conjunction with the Water Authority whether a site specific chlorination facility is required to boost disinfection levels within the system.
2. Where required ensure that adequate land area is available for operation and maintenance of the facility.

**Chlorination
Facility**

D11.52 STORMWATER MANAGEMENT

1. Design the roof structure to allow rainwater to flow off the roof to the hardstand area below and around the reservoir. Ensure all roof water drains off the reservoir.
2. Full length sheeting is to be used where practical and laps of roof sheeting to be in accordance with the manufacturer's recommendations.
3. Gutters shall not be used as the accumulation of leaves can permit the entry of contaminants into the reservoir.
4. Ensure hatches are designed to prevent the ingress of water run-off into the reservoir.

RESERVOIR DESIGN

D11.53 THERMAL EFFECTS

1. Roof sheeting designs are to incorporate sliding joints or similar to allow for thermal effects.
2. All aluminium roof structure designs are to incorporate sliding connections with slotted holes to allow for thermal effects.

D11.54 DISSIMILAR METALS

1. All points of contact between materials are to be separated by isolating mediums, with the exception of aluminium and stainless steel.

D11.55 FABRICATED MILD STEEL

1. The following parameters shall be incorporated into the wall and floor plate design:
 - Corrosion allowance of 2mm for all plate;
 - Design limiting stress for base bending up to 0.5 x Yield Stress is considered acceptable; and
 - The maximum additional horizontal deflection due to filling shall be the lesser of

**Wall and Floor
Plate Design**

height/250 and 20mm.

2. The Design Report shall include as a minimum the method of calculation of the steel shell, hoop stress in the walls, bending stress in the floor to wall joint and wall deflections.

Design Report

D11.56 REINFORCED CONCRETE TANKS (CAST IN-SITU AND PRECAST)

1. The following parameters / considerations shall be incorporated into the design:
 - Minimum steel for crack control;
 - Concrete mix design;
 - Minimise shrinkage effect by stipulating the pouring of the sections of the work between construction joints in a sequence such that there will be suitable time delays between adjacent pours;
 - Curing methodology;
 - Single reinforced concrete structural elements are not permitted;
 - Minimum wall thickness of double reinforced structural elements to be 230mm wide;
 - Concrete pour heights for vertical elements to be minimised to prevent segregation; and
 - Jointing and sealing methodology.
2. Where approved by the Water Authority, use of reinforced cast in-situ concrete construction method is acceptable where whole of life costs are considered.
3. Where approved by the Water Authority, use of pre-cast concrete post tensioned construction methods is acceptable where whole of life costs are considered.
4. Stipulate detailed design and construction requirements to ensure quality is maintained in terms of precast panel design, joint interfaces, tensioning, stitch panel, etc

D11.57 ROOF ACCESS

1. Roof access shall be provided for all reservoir types. This shall be done via a free standing fabricated stairs / platform structure in lieu of caged ladder system to reduce WHS risks to operations and maintenance personnel.
2. Provide a security enclosure around perimeter of stair access.
3. Ensure that ANY electrical switchboard is located within the security enclosure.
4. Vertical ladders are unacceptable and shall not be used.

D11.58 ROOF PLATFORM

1. The reservoir roof platform (at top of the roof for access into the reservoir) shall be located directly over the traffic accessible area in order to enable the maintenance operator to use the davit to pick up equipment from a vehicle below.
2. The roof platform is to be constructed of marine grade aluminium.
3. The roof platform shall be large enough to provide for the hatch cover and lifting davit. There shall be sufficient room on the platform when the cover is open for

adequate access to the cover and ladder with a minimum unobstructed flat area of 1,700 mm x 3,000 mm.

4. The roof platform is to have a handrail/ guardrail on its perimeter and located at least 6,000mm either side of the platform or any other section of roof edge used by personnel to operate or maintain the tank.

5. A gate shall be provided in the handrail to give access to the peak of the roof. The gate will be used for a person to access the roof, walking in a straight line to the peak, where a lanyard attachment will be located for the person to latch on to – all the while the person is protected from falling off the roof by the handrails around the roof platform

6. Platforms shall be designed to ensure that they drain effectively and prevent debris build up.

7. Platforms shall be inserted under roof sheets for effective drainage.

D11.59 MAINTENANCE VEHICLE ACCESS HATCH

1. For tanks greater than 30m diameter provide a vehicle hatch minimum dimension 4000mm x 2000mm to be installed on the roof to allow a bobcat or similar to be lowered into the tank

2. Hatch cover to be hinged operated and lockable when cover is at an open or closed position.

3. Provide mechanical means of opening, such as a hand operated winch or similar.

D11.60 ROOF ACCESS HATCH

1. Access hatch shall have a minimum opening of 900mm x 1200mm.

2. Provide a lockable hatch cover over the internal ladder.

3. Hatch cover shall be hinged operated and lockable when cover is at an open or closed position.

4. Provide mechanical means of opening, hand operated winch or similar, for heavy hatches covers or hatches covers positioned with restricted access.

5. For concrete tanks provide two means of entering the structure by access hatches

6. Hatches should have a continuous raised edge frame (75mm+ high) and a corresponding overlapped cover to prevent storm water and foreign matter from contaminating the tank. The overlapping sides also serve to stiffen the hatch cover against unauthorized entry or vandalism.

7. There should be no internal projections such as ladder stiles that prevent complete sealing of the hatch cover against debris or animal entry.

8. Hatches must be heavy duty and 100% secured against accidental opening, contamination ingress or structural damage caused by climatic events.

9. All hatch covers should be securely locked. Vertical lugs must be provided to allow a padlock to lay flat and remain easy to operate

D11.61 INTERNAL LADDER

1. Provide an internal uncaged ladder extending from the Roof Platform to floor

level. Material for the internal ladder shall be FRP (Nextep) or GRP.

2. The ladder shall allow persons to orientate when descending or ascending.
3. Provide a suitable fall arrestor system where the potential fall from height exceeds legislated limits or risk assessment justifies provision of such a system. Design the attachment point for the Lanyard (Life Line) in such a way to allow a person to be attached before entering the hatch area. The ladders and fall arrest systems must be compliant with AS1657 Fixed Platforms, Walkways, Stairways and Ladders and AS/NZS1891 Industrial Fall Arrest Systems and be clearly marked with the safe working load.

D11.62 EYEBOLTS

1. All load bearing components / attachments shall be load tested as per AS1891.
2. Eyebolts are to be properly secured on a central post to enable maintenance personnel to attach Lanyards (Life Lines) and to work around the reservoir roof and wall.
3. Provide two (2) eyebolts for each opening in the roof. Locate eyebolts approximately 1,600mm from the centre of the opening to suit 1,800 mm long lanyards / life lines and to secure the harness worn by the stand-by personnel.
4. Provide a minimum 35mm hole for eyebolts to enable attachment of lanyards / life lines.

D11.63 REMOVABLE DAVIT AND LIFTING GEAR

1. The davit and lifting gear is to be made from galvanised steel.
2. Provide for a manually operated winch that can be attached to the davit arm. The davit and lifting gear shall be hand operated and designed to comply with the following minimum requirements:
 - The centre of the lifting gear shall be above the centre of the opening for the hatch cover;
 - Ground unloading point shall be at least 600 mm away from objects (i.e. handrails, posts, roof and wall);
 - The davit shall be capable of unloading a person on the Roof Platform (i.e. within the handrails, not on the roof);
 - Lifting gear shall be sufficient to pick up load from the floor of the reservoir and unload on the ground outside the reservoir;
 - There shall be a minimum 2.4m clearance above the roof or platform level to the jib;
 - The davit shall have an eyebolt or similar device to enable easy detachment of the lifting gear;
 - The davit shall have a handle or other device to facilitate slewing by hand;
 - The davit shall have a maximum horizontal force to comply with the standard / regulations;
 - The davit shall have a minimum safe working load capacity of 1.5 Tonne; and
 - The davit shall have a maximum deflection (vertical) 10mm.
3. The ground landing area shall be an unobstructed flat horizontal area of minimum

horizontal dimensions 6000 mm x 2000 mm and shall be so positioned in relation to the reservoir wall in order to enable unloading at the approximate centre of the area.

D11.64 RESCUE SYSTEMS

1. Any rescue anchor system should have the ability to fold down onto the platform area when not in use, to reduce bird activity and the resulting contamination potentials incurred.
2. The anchor system should allow rescue rigging equipment to be fitted whilst in a lowered position, before being raised to its full working height.
3. The anchor system should be capable of sustaining sideways loadings for complex rescue situations down to 'safe ground'. Lifting an injured person out of the tank is only half of the rescue solution – lowering safely down to the ground is the final part of the operation, and this will generally involve multiple ropes and an abseiling type scenario with at least two persons being supported off the anchor system.
4. A single point of base fixing (as used in most pivoting davits) offers no back up if the material it is attached to (the wall concrete in most cases) or the fixing bolts themselves become defective - a multiple type base design offers more security against failure.

D11.65 VENTILATION HATCH

1. A 600mm diameter ventilation hatch shall be provided to provide allow forced ventilation. This is primarily required when painting the internal surfaces.

D11.66 SAMPLING POINT

1. Water quality sampling points shall be provided at the flowing locations:
 - Flameproof tap located at the outlet; AND
 - Sampling points at different elevations and locations as required by the Water Authority.

D11.66 SITE PERIMETER FENCING

1. Reservoir site boundaries are typically fenced with a manproof/ chainwire fence
2. Provide a lockable 6m wide access gate and an additional personnel access gate. Other site security may be required for some locations and the Water Authority shall be consulted as to their requirements for each site

D11.68 LANDSCAPING

1. Ensure that the aesthetics of the area are maintained and prepare a landscape plan that addresses this issue as part of the design drawings and specification.
2. The landscape plan shall be designed to blend into the local area and be determined on lowest cost for ongoing maintenance
3. Choices of flora shall be suitable to the area. Trees and shrubs are to be Australian natives
4. No planting over services or under powerlines is allowed and special attention shall be paid to the type of trees and shrubs planted in the vicinity of pipework. Consideration shall also be given to the location of plants.

DOCUMENTATION

D11.69 GENERAL

1. The Principal shall submit, to the Water Authority an Application for Certification of Design Drawings under Part 3 Division 2 Section 307 of the Water Management Act 2000, together with four (4) copies of the proposed water main design, including long section, calculations and network analysis, if required (WSA 03 Part 1, section 2). The principal must obtain approval for Construction from the Water Authority under Section 68 of Local Government Act 1993, at the lodgement of design. This action constitutes a **HOLD POINT**. Approval of the design by the Water Authority will be made by the issue of a compliance certificate under Part 3 Division 2 Section 307 of the Water Management Act 2000.

*Review***(HP)**

2. The Drawings shall show to scale:

(a) Plan showing:

- (1) Lot boundaries and lot numbers
- (2) Location and size of all mains, appurtenances and pump stations
- (3) Existing mains
- (4) Existing and proposed features and services
- (5) North point and scale bar
- (6) Easement locations
- (7) Arrangement of other utilities.

Plan

(b) Longitudinal section showing:

- (1) Reduced levels for natural surface and design surfaces at all changes in grade
- (2) Mains, appurtenances and pump stations
- (3) Appurtenances numbered in accordance with Water Authority's Asset Register
- (4) Invert levels where necessary
- (5) Size, type, class and grade of pipe
- (6) Pipe Support type
- (7) Location, invert level and size of all drainage lines, sewer mains, and other utility services crossing the main
- (8) Notation regarding all joining lines
- (9) Property ownership
- (10) Note "In road" trench conditions

Longitudinal Section

(c) The drawings and specifications must be sufficiently detailed to cover all aspects of the facility. Basic details of all services, fittings, fixtures

Reservoirs and Pump Stations

and finishes as well as architectural, civil, structural, hydraulic, mechanical, pipework, instrumentation and electrical requirements must be included. Refer to Annexure D11-A for details in regard to Design Submissions, Approvals and HAZOP studies.

(d) Details of corrosion protection required for pipes and fittings. **Pipe Protection**

(e) Areas designated for trenchless pipe installation. **Trenchless Installation**

3. Detail plans shall be drawn to a scale of 1:500 and longitudinal sections to a horizontal scale of 1:1000 and a vertical scale of 1:100. The Designer shall show locations of hydrants, stop valves, non-return valves, air valves and scour valves, tees, tapers, creek crossings, trench dimensions and backfill, thrust blocks, and other existing and proposed services and installations including chambers and covers and items of construction which are project specific. **Drawing Scale**

4. Drawings shall be 'A1' size for approval with 'A3' size copies to be forwarded to the Water Authority once the plans have been approved **Drawing Size**

5. Drawings shall also be provided in electronic form after consultation with the Water Authority. **Electronic Form**

6. Potable water supply mains and fittings shall be indicated in blue colouring (WSA 03, Part 1, section 4, Table 4.1). **Drawing Colour**

D11.70 PUMP STATION

1. The Principal shall submit, to the Water Authority for approval, prior to commencement of the manufacture of any pumps and control equipment, four (4) copies of the following: **Review**

(a) Switch and Control Gear Assemblies (SCA) - Proposed fully dimensioned manufacturing details, general arrangement (showing internal/external details) and foundation/gland plate details.

(b) Common Control - Complete circuit diagram and description of operation.

(c) Schedule of Equipment - Completed as to the equipment to be provided.

(d) Other Engineering drawings as required fully describing the proposed equipment.

The submission of the documents constitutes a **HOLD POINT**.

(HP)

2. The Designer shall take into consideration the technical requirements to minimise all risks associated with chlorination, and entry into confined space. **Risk**

3. Drawings shall be on 'A1' size for approval with 'A3' size copies to be forwarded to the Water Authority once the plans have been approved. All symbols used shall conform to AS 1102 and all wires and terminals shall be numbered. **Drawings**

4. Drawings shall also be provided in electronic form after consultation with the Water Authority. **Electronic Form**

D11.71 ASSET REGISTER

1. The Designer shall provide asset schedules and Drawings in a form consistent with the existing or proposed Asset Register after consultation with the Water Authority. (WSA 03 Part 1, section 5.6)

Consistency

SPECIAL REQUIREMENTS

D11.72 RESERVED

D11.73 RESERVED

D11.74 RESERVED

ANNEXURE D11-A

DESIGN SUBMISSIONS, APPROVALS AND HAZOP STUDIES FOR RESERVOIRS AND PUMP STATIONS.

D11-A.1. GENERAL

1. The drawings and specifications must be sufficiently detailed to cover all aspects of the facility. Basic details of all services, fittings, fixtures and finishes as well as architectural, civil, structural, hydraulic, mechanical, pipework, instrumentation and electrical requirements must be included. The information to be provided shall include :

i) **Hydraulics**

- (a) Hydraulic Profile
- (b) Hydraulic calculations.

ii) **Mechanical**

- (a) Above ground pipework plans, sections and details;
- (b) Painting schedules;
- (c) Mechanical equipment schedules;
- (d) Valve schedules;
- (e) Piping schedules; and
- Mechanical equipment basic specifications and drawings;

iii) **Electrical**

- (a) Single line diagrams;
- (b) Electrical schematic drawings;
- (c) Switchboard and panel layout drawings;
- (d) Area layout drawings;
- (e) Earthing and lightning protection system designs;
- (f) Maximum demand calculations;
- (g) Electrical equipment and instrumentation schedules;
- (h) Security system schedules and drawings;
- (i) Lighting designs and drawings;
- (j) In slab conduit layouts;
- (k) Cable block diagrams;
- (l) VSD THD review
- (m) Cable schedules
- (n) Cable installation details;

iv) **Civil**

- (a) Site layouts showing roads, pipes, drainage, etc;
- (b) Basic earthworks drawings and schedules;
- (c) Basic foundation drawings;
- (d) Structural plans and elevation drawings;
- (e) Reinforced concrete drawings;
- (f) Pipework plan and longitudinal section drawings;
- (g) Metalwork drawings; and
- (h) Civil specification and drawings;

<p>v) Other Deliverables</p> <ul style="list-style-type: none"> ▪ (a) Design Report including the basis of all design criteria and capacity (or capacities); ▪ (b) Copies of design calculations; ▪ (c) Estimates of Cost; and (d) Bills of Quantities and/or Items. 	
<p>2. Draft drawings/schematics/schedules/reports/plans for each section of the design shall be submitted to the Water Authority for review at 50% and 95 % complete</p>	
<p>3. The Designer shall carry out sufficient level of detailed design and prepare sufficiently detailed drawings for the mechanical equipment and pipework, and the electrical equipment and instrumentation so that the Mechanical Equipment and Electrical Equipment Contractors can complete the detailed design and drawing as part of their Contract works. The preliminary design details shall be followed in the detailed design.</p>	
<p>4. Where requested by the Water Authority, the Designer shall provide a copy of the Consultant's verified design calculations for any part of the work for overview by the Water Authority. The Designer shall incorporate the Water Authority's comments on draft drawings/ schematics/ schedules as required and submit the final drawings/ schematics/ schedules to the Water Authority for acceptance.</p>	
<p>D11-A.2. PROCESS AND INSTRUMENTATION DIAGRAMS</p>	
<p>1. Process and Instrumentation Diagrams (P&IDs) shall be prepared for the pumping systems showing all controls and interlocks. Layout drawings and P&IDs shall be submitted to the Water Authority for review. The Water Authority shall provide a preferred Equipment List to the consultant for assignment of Equipment Numbers which shall be used on the final P&ID and in the tender documents and drawings. Assets and equipment number labelling shall be allocated according to the Water Authority's requirement as early in the detailed design process as is practicable to ensure that they are referenced in all detailed design drawings including general arrangements, schematics, cable schedules, connection diagrams and subsequently in operational software, in equipment labelling and in the operations and maintenance manuals</p>	
<p>D11-A.3 CIVIL, STRUCTURAL & ARCHITECTURAL DESIGN AND DRAWINGS</p>	
<p>1. The Designer shall carry out the site investigation and detailed design including the architectural, civil and structural design and shall prepare drawings for the civil, structural and architectural works components for the reservoir, pipeline, pump station, valve pits and all associated works</p>	
<p>2. Landscaping shall be consistent with the other similar sites adopted by the Water Authority</p>	
<p>3. Site layout drawings shall also show footpaths, roadways, drains, fences, landscaping and all finished levels.</p>	
<p>4. The general arrangement drawings of each structure shall be drawn at a scale with a ratio of 1:100 or less. Details shall be drawn at a scale with a ratio of 1:20 or less</p>	
<p>5. The Designer shall prepare a report detailing the existing geotechnical site information (including a review and design of batter stability measures).</p>	
<p>D11-A.4 MECHANICAL DESIGN AND DRAWINGS</p>	
<p>1. Mechanical work shall include the design and drafting (other than where noted as high level detail only) the following items as a minimum:</p> <ul style="list-style-type: none"> ▪ Pump installations and associated pipework including provision for maintenance; ▪ Reservoir inlet, outlet , overflow and drainage including provision for maintenance; ▪ Reservoir washdown arrangement; ▪ Reservoir structural and roof; ▪ Pump station structural and roof; and <ul style="list-style-type: none"> • The Designer shall investigate the options for isolation valves (such as butterfly, sluice valve or pinch valves) and submit to the Water Authority for acceptance. 	

WATER RETICULATION – SOUTH JERRABOMBERRA

2.	The layout, elevation and section drawings for all mechanical equipment shall be drawn to scale and shall show all relevant structures, equipment, valves and pipework together with the outline of electrical control devices, instruments and electrical cable routes (conduits, cable ducts and cable trays). Equipment numbers shall be shown on every item of equipment (valves, pumps etc)	
3.	All components that are submerged and within one metre of the water surface shall be designed as ASTM A276 Grade 316 stainless steel except for chemical systems.	
4.	Hot dip galvanised components will be accepted for general structural steel work.	
5.	Where plastics are used they shall be suitable for the chemicals and UV stabilised to achieve the required life. Plastics shall be protected from potential damage in traffic areas.	
6.	Design criteria for mechanical equipment shall be stated in the Basis of Design Report.	
D11-A.5 HAZOP AND CHAIR STUDIES		
1.	Hazard and Operability (HAZOP) and Construction Hazard Assessment Implication Review (CHAIR) studies shall be held in accordance with NSW WorkCover requirements.	
2.	The Designer shall provide input to and participate in a HAZOP Study of the proposed P&IDs and preliminary facility layout which will be held at a location in consultation with the Water Authority and, involving representatives from Operations & Maintenance personnel and also the project group.	
3.	The HAZOP Study facilitator shall be provided at no cost to the Water Authority. The CV of the proposed facilitator shall be submitted to the Water Authority for approval at least 2 weeks prior to the HAZOP. The HAZOP Study is scheduled to occur when preliminary issue of all P&IDs at 90 % complete and the facility layout is 70% complete. The Designer shall resubmit the revised P&IDs and facility layout drawings to the Water Authority following this HAZOP Study. The duration of HAZOP study is expected to be a maximum of two (2) days.	
D11-A.6 DESIGN REPORT		
1.	The Designer shall prepare and submit a draft detailed Design Report to the Water Authority for review	
2.	The detailed Design Report should cover all aspects of the design. The Designer shall receive comments from the Water Authority on the draft detailed Design Report and shall incorporate the Water Authority's comments and submit a final detailed Design Report for acceptance	
3.	Bills of quantities (BOQ) as and cost estimates shall be included in all versions of the Design Report. Estimates for all remaining packages (electrical & SCADA) shall be updated prior to inviting tenders for the detailed design and construction works	
4.	The detailed Design Report shall include: <ul style="list-style-type: none"> • Table of Contents; • Introduction; • Definitions; • Legislative requirements; • Basis of design; • Description of design approach; • Design criteria, parameters and methods used; • Design constraints; • Operation and control philosophy; • Drawing and specification lists; 	

<ul style="list-style-type: none"> • Implementation program; • Definitive estimates of cost including a BOQ; • Design calculations (Hydraulic, Structural, Civil, Electrical & Mechanical design) and schedules; • References including codes, standards and manuals used in the design; • Risk Analysis and Management Plan; and • Any other relevant information. 	
D11-A.7 DRAWINGS, DIAGRAMS AND SCHEMATICS	
<p>1. All drawings shall be clearly drawn to scale by competent draftspersons in accordance with the requirements of the relevant SAA codes and good engineering drawing practice. They shall be produced at A1 size but will be required to be used and fully legible at A3. All drawings, diagrams and schematics shall be prepared using a computer aided drafting (CAD) package</p>	
<p>2. Autodesk’s AutoCAD 2012 is the version of AutoCAD currently in use by the Water Authority. Symbols on Process and Instrumentation Diagrams shall be in accordance with AS 1101.5, AS 1101.6. Symbols on all electrical drawings, diagrams and schematics shall be in accordance with AS 1101 and AS 1102 as applicable. A logical set of drawing numbers shall be developed in consultation with the Water Authority. The final list shall be subject to the Water Authority’s approval</p>	
<p>3. Diagrams and schematics shall be full sized on A1 paper. Drawings, diagrams and schematics included in reports and in tender documents shall be reduced to A3 size</p>	
<p>4. If it is determined by the Water Authority that the drawings do not meet all of the required standards, then the Water Authority may refuse to review or approve drawings</p>	
D11-A.8 WORD PROCESSING AND SPREADSHEETS	
<p>1. All reports and drawings shall be submitted in both paper and electronic form. The electronic form of the reports will comply with the MS Office 2007 suite of programs (Microsoft Word, Excel & Project).</p>	
<p>2. Arial 11 point font shall be used as the normal font in all Word documents, Excel spreadsheets and project schedules</p>	
D11-A.9 DOCUMENT SUBMISSIONS	
<p>1. Reports shall have headers and footers with the exception of the cover and the title pages which do not have headers and footers. All reports shall include a document control (revision history) inside the front cover and the version and date of issue shall be noted in the footer.</p>	
<p>2. Project reports shall be bound’</p>	
<p>3. Contract documents and drawings shall be bound.</p>	
<p>4. The following number of bound paper copies of documents shall be provided:</p> <ul style="list-style-type: none"> • Three (3) copies of all draft specifications/plans/reports/manuals and drawings; • One (1) full size (A1) set and one (1) A3 set of (signed) tender drawings and tender document; AND • Three (3) copies of all final reports. 	
<p>5. All documents shall be provided in electronic as well as hardcopy format. All electronic copies shall be saved into the applications and versions given above and be provided on CD disks</p>	
<p>6. Complete water model (pumps, network and reservoirs) shall be provided in a format that is compatible with WaterGEMS.</p>	
<p>7. Electronic files shall contain all formulas and macros and shall not have any</p>	

security setting	
D11-A.10 OPERATIONS AND MAINTENANCE MANUALS	
1. Operations and Maintenance Manuals shall comply with the latest Water Directorate guidelines	
2. The format of the manuals shall be agreed with the Water Authority	
D11-A.11 OPERATOR TRAINING	
1. Sufficient operator training shall be provided at no cost to the Water Authority prior to asset handover.	