TITLE:

DEVELOPMENT CONSTRUCTION GUIDELINE

WATER SUPPLY SYSTEM

July 2008

MACKAY REGIONAL COUNCIL

PLANNING SCHEME POLICY NO. 15.11

DEVELOPMENT CONSTRUCTION SPECIFICATION - WATER SUPPLY

REVISION RECORD

VERSION	AMENDMENT DETAILS	CLAUSES AMENDED	DATE ISSUED	AUTHORISED SIGNATURE
1	Original Version	-	15/03/2006	
2	Generally revised version with major upgrades	All	02/02/2008	

DEVELOPMENT CONSTRUCTION SPECIFICATION - WATER SUPPLY

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APPENDICES

ABBREVIATIONS

ABBREVIATION	INTERPRETATION
ABS	Acrylonitrile Butadiene Styrene
AHD	Australian Height Datum
AOP	Allowable Operating Pressure
AS/NZS	Australian / New Zealand Standard
DA	Development Approval
DICL	Ductile Iron Cement Lined
DIEL	Ductile Iron Epoxy Lined
DN	Nominal Diameter
EN	European Standard
EMP	Environmental Management Plan
FBPE	Fusion Bonded Polyethylene (“Sintakote”)
GRP	Glass Reinforced Plastic
IDAS	Integrated Development Assessment System
IPA	Integrated Planning Act
ITP	Inspection and Test Plan
KL	kilolitre
KPA	kilopascal
KW	kilowatt
L/S	Litres per second
MA	milliamps
MAOP	Maximum Allowable Operating Pressure
MEN	Multiple Earthed Neutral
MGA	Map Grid of Australia
MH	Maintenance Hole
MPA	megapascal
NPSHA	Net Positive Suction Head Available
NPSHR	Net Positive Suction Head Required
P&ID	Process and Instrumentation Diagram
PLC	Programmable Logic Controller
PN	Nominal Pressure Class
PVC	Polyvinylchloride
PVC-M	Polyvinylchloride modified
PVC-O	Polyvinylchloride orientated
PVC-U	Polyvinylchloride unplasticised
RPEQ	Registered Professional Engineer Queensland

RPZD	Reduced Pressure Zone Device
RRJ	Rubber Ring Joint
SCA	Switchgear and Control gear Assembly
SCADA	Supervisory Control and Data Acquisition
SCL	Steel Cement Lined
SEL	Steel Epoxy Lined
WSAA	Water Services Association of Australia
WS-SPEC	Water Services Specification

DEVELOPMENT CONSTRUCTION SPECIFICATION
WATER SUPPLY

C401.01 APPLICATION OF THE POLICY

Application

This Planning Scheme Specification functions as part of the Integrated Development Assessment System (IDAS) under the Integrated Planning Act (IPA) and is applicable to the design of new water supply infrastructure and/or upgrades of existing water supply infrastructure within the Mackay Local Government Area.

C401.02 PURPOSE

Purpose

This Specification, has the following functions:

(a) To nominate the Water Services Association of Australia (WSAA) Codes and associated documents as the general requirements to be met for the Asset Creation process within the Mackay Regional Council Area of jurisdiction.
(b) To specify parameters, requirements and functions contained within the Codes that the Council is to nominate or to amend.
(c) To specify additional technical and/or administrative matters (that are not otherwise specified within Australian Codes or Standards) pertaining to Operational Works applications made in accordance with the Queensland Integrated Planning Act (IPA).
(d) To specify any technical requirements not covered by the Codes.
(e) To identify materials, solutions and methods permitted by the Codes that are not acceptable to Council.
(f) To specify preferred options where the Codes provide for several methods to deal with a particular issue.

C401.03 STRUCTURE

Structure

This Planning Scheme Specification, is based upon compliance with the national Water Supply Code of Australia (WSA-03) and is complimented by the strategic product specifications and technical requirements contained within WS-SPEC.

WSA-03 is available from the Water Supply Association of Australia (WSAA), email: info@wsaa.asn.au. WS-SPEC is available from the Saiglobal Webshop at www.saiglobal.com/shop.

C401.04 SUMMARY OF THE ASSET CREATION AND APPROVALS PROCESS

Approvals Process

For the Asset Creation process within the Mackay Regional Council Local Government Area the essential process is as follows:

(a) Pre-lodgement discussions and concept development
(b) Lodgement of an Operational Works Application with Council
(c) Scrutiny of conceptual design / development plan by Council
(d) Information request by Council if required
(e) Planning Approval by Council
(f) Submission of detailed design to Council
(g) Scrutiny of detailed design by Council
(h) Information request by Council if required
(i) Approval of the Operational Works Application by Council (as determined)
(j) Construction and commissioning work
(k) Final connection.
(l) Sealing of Plan of Survey, if applicable.
(m) Submission to Council of request for release of Maintenance Bond
(n) Remedial work as required
(o) Completion and handover
(p) Release of Maintenance Bond by Council

C401.05 ENVIRONMENTAL MANAGEMENT

Environmental Management

Construction of infrastructure shall be planned and executed to minimise impact on the environment. Where a choice of alternative solutions is possible, an objective environmental risk assessment shall be undertaken to give due weight to reducing the risks to the environment resulting from the construction and operation of the infrastructure.

The Contractor shall prepare and submit an Environmental Management Plan (EMP) for the site of the works. This EMP shall be submitted to Council 14 days prior to the commencement of construction. Construction work shall not be permitted to commence until Council has advised the Contractor that the EMP is accepted by Council in regard to the proposed measures for environment protection. As a minimum, the EMP shall include:

(a) Stormwater management and erosion control
(b) Vegetation removal
(c) Stockpiling and reuse of materials on site
(d) Removal of excess material from the site
(e) Protection of existing flora and fauna
(f) Noise and dust control
(g) Management of Excavation in Acid Sulphate and Contaminated Soils
(h) Management of excavation in tidal areas
(i) Management of excavation in environmentally sensitive areas

C401.06 CONNECTIONS TO COUNCIL'S

Connections to Council's

INFRASTRUCTURE The connection of new water supply infrastructure to Council's existing system forms part of the infrastructure realisation to be carried out at the Developer's expense. Normally, Council staff will undertake all connections to Council's water supply infrastructure. The Contractor shall not carry out the connection unless Council gives special approval in exceptional circumstances. When Council makes the connection, an estimate of cost will be provided to the Developer and the connection will not be made until the payment is received. Where the Contractor is to make a connection, the Designer is to co-ordinate the work and the processes for inspection and payment. Council shall be given 5 working days notice of the work to enable Council to provide staff to operate valves and isolate pumping stations as necessary and to monitor the Contractor's work. An estimated cost of the monitoring shall be agreed prior to notice being given. The estimated cost and a signed undertaking to pay the actual costs of the work when completed shall accompany the notice. Contractors are not permitted to operate Council's infrastructure unless written approval has been obtained from Council. Council reserves the right, on advice of its authorised representative to stop, or take over a connection being undertaken by a Contractor, if in the representative's opinion the Contractor is incapable of completing the connection work in a reasonable time without causing damage to Council's infrastructure or undue inconvenience to the public. Consumer requirements shall be met by providing a water main and allowing an appropriate point of connection for each individual property.	***Infrastructure***
SERVICE CONNECTIONS For new sub divisions the developer is to provide a service pipe a minimum of 300mm into each allotment but exclude the provision of an isolating valve and meter within the allotment. The building developer of an individual allotment is to subsequently provide an isolating valve, meter etc as required for the building project. The size of the service extended into each allotment shall be determined taking into consideration the normal flow requirements plus provision for any likely flow requirements to service fire hose reels and internal fire hydrants. Water service connections to individual allotments shall generally be provided in pairs at the common boundary. Services should generally be located staggered from electricity/ telephone services which are also generally provided in pairs at alternate common boundaries. Where services less than 100mm cross existing or new streets they shall be provided with an enveloper pipe. Diagonal road crossings shall be provided where property boundaries are staggered as shown on standard drawing no. WA3-840	***General***

The location of the service crossings are to be marked into the kerb and channel as shown on the standard Drawing.	
Services to Residential Dwellings	***Residential***
Services to residential dwellings and buildings of similar water demand shall be MDPE Class 16 polyethylene pipe coloured blue and terminating with a capped end 300mm within the allotment generally in accordance with standard Plan No. WA3-840	
The location of the service crossings are to be marked into the kerb and channel as shown on the Standard Drawing.	
Services to Residential Dwellings	
Services to residential dwellings and buildings of similar water demand shall be MDPE Class 16 polyethylene pipe coloured blue and terminating with a capped end 300mm within the allotment generally in accordance with Standard Plan WA3-840	
The minimum diameter of enveloper pipes across street services shall be 50mm internal diameter.	
Services to Commercial, Industrial, Community Title Development. Sites	***Commercial/ Industrial***
Services to commercial, industrial etc sites shall be sized to provide for all likely flows including flows to service fire hose reels and internal fire hydrants.	
The minimum service diameter to service a single fire hose reel is nominal 32mm ID (40mm OD). However each development should be individually assessed.	
The minimum service diameter to service an internal hydrant is to be 100mm.	
Services to Reserves for public Open Space, Landscaping etc	***Other***
Where reserves for public open space are provided as part of a subdivision development, then a service it to be extended to such reserves terminating in a hose cock to Council requirements.	
Landscaped areas provided as part of a subdivision are to be provided with irrigation systems including a backflow prevention device. Irrigation is not required for single tree planting's in footpaths and traffic islands.	
Where communal open space (common areas in BCCM development) and landscaping areas are provided, then appropriate provision should be made for internal services for irrigation systems including backflow prevention device.	
Separation From Other Services	***Separation***
The minimum separation between the water main and other services that cross the mains path is 150mm. No other services shall share a trench with the water main unless prior approval has been obtained from all authorities, including Council. Water mains are to be located above any adjacent sewer line.	

C401.07 DEFINITIONS

Definitions

Asset Creation means any or all aspects of the planning, design, construction, supervision of construction, testing and commissioning and eventual handover of water supply infrastructure

Contractor means a private contractor approved by Council to construct water supply infrastructure on behalf of a Developer.

Council means Mackay Regional Council and the Mackay Water & Waste business unit of Council

Designer means a Professional Engineer who is qualified in Queensland (currently met by a person being registered as a Registered Professional Engineer Queensland (RPEQ)) and is competent to perform the engineering works required for the Asset Creation process on behalf of a Developer.

Developer means the person who has submitted a planning application for the provision of infrastructure under the Asset Creation process or for the utilisation of existing water supply infrastructure.

IDAS means the Integrated Development Application System under the IPA

IPA means the Queensland State Integrated Planning Act 1997.

Service Reticulation means pipework less than DN300 and for which direct service connections are permissible.

Switchgear and Control Gear Assembly means main switchboard, main distribution board, distribution board, control board, electrical kiosk, electrical panel, control panel or similar enclosure

Surveyor means a licensed surveyor, endorsed in the Register of Surveying Associates, Surveying Graduates, Surveyors (Body Corporate) and Surveyors (Individual), who is competent to perform the surveying work required for the Asset Creation process on behalf of a Developer.

The Code means the Water Supply Code of Australia (WSA-03) published by the Water Supply Association of Australia (WSAA).

Trunk Mains means pipework equal to or greater than DN 300, and for which no direct service connections are permissible

WS-SPEC means the national standard water industry specifications.

C401.08 SCOPE

The work to be executed under this Specification consists of the construction, commissioning and handover to the Council of a constructed water supply system, as either a stand-alone project or part of a development and its integration into the existing water supply system.

The work shall be undertaken under Council's Asset Creation process which shall comply in all respects with relevant Statutory Legislation, Codes of Practice, Australian Standards and with Councils local laws, policies and guidelines.

The Contractor shall ensure that all works procured in the Asset Creation process shall comply in all respects with the requirements of and/or intent of this specification and referenced documentation.

This Specification contains procedures for the construction of the following elements of a water supply system.

(a) Service Reticulation

(b) Trunk Mains

(c) Pump stations, complete with all ancillary plant and equipment to effect a fully operational pump station.

The Contractor shall provide all necessary plant, equipment, labour, and materials that are required to meet the intent and / or the requirements of this specification and referenced documentation.

C401.09 ORDER OF PRECEDENCE

Where discrepancy or contradiction in documentation may occur, the order of precedence for documents specifying the works to be undertaken (from highest to lowest order of precedence) shall be as follows:

(a) This specification

(b) Mackay Regional Council Standard Policies, Specifications and Drawings

(c) Water Supply Code of Australia (WSA-03)

C401.10 REFERENCE DOCUMENTS

Reference and Source Documents

Documents referenced in this Specification are listed below. The Contractor shall possess, or have access to, the latest edition of all documents required to comply with this Specification, including all current amendments and supplements of those documents. The Contractor shall include all relevant specifications and requirements of these documents into the construction of the works.

(a) Council Planning Scheme Policies

Council Planning Scheme Policies

15.12 Development Design Specification - Water Supply (D11)

(b) Council Policy Documents

Council Policies

Mackay Regional Council Policy - MW16 Clearance to Water and Sewerage Assets

Mackay Regional Council Policy – D20 Drawings and Documentation Guidelines

(c) WSA 03 - Water Supply Code of Australia

WSA-03Code of Practice

(d) WS-SPEC National Water Specifications (WSAA)

WS-SPEC

(e) Australian Standards

Australian Standards

References in this Specification or the Drawings to Australian Standards are noted by their prefix AS or AS/NZS.

The Designer shall use the latest edition of the Australian Standards, including amendments, supplements and replacement applicable thereto.

Australian Standards are listed within WSA-03.

Council Standard Specifications

(f) Council Standard Specifications

Council Standard Specification for Electrical Assets

(g) Other Documents

Other Documents

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).

ISO 5199- Technical Specifications for Centrifugal Pumps

(h) Council Drawings

C401.11 COMPLIANCE AND AMENDMENTS

Compliance with and Amendments to WSA-03

The construction of the works shall comply with the Water Services Association of Australia's publication WATER SUPPLY CODE OF AUSTRALIA (WSA-03) unless specified otherwise herein. Amendments

made by MACKAY REGIONAL COUNCIL to WSA 03 are included below. Where conflict occurs between the requirements of this table and other documents, the requirements of this table shall prevail.	
Amendments to WSA 03-2002 **Note:** The clause numbers and table numbers given below correspond to the relevant clause numbers given in the Waste Supply Code of Australia (WSA-03)	***Clause No. in WSA-03***
The definitions of service reticulation and trunk main shall be as per **Clause C401.07** Definitions above.	**Glossary**
Council's minimum requirements for reticulation and trunk main pipe materials are as follows: (a) mPVC, uPVC or oPVC: rubber ring jointed, minimum Class 16 Series 2, blue in colour, fittings for pvc pipe shall be DI. (b) PE: electrofusion or butt fusion or compression fittings, minimum PN16 pressure class. (c) DI: rubber ring jointed or flanged, polyethylene sleeved, cement or epoxy lined, minimum Class 21 (d) Steel: rubber ring jointed, flanged or welded, FBPE or epoxy coated, cement or epoxy lined, minimum steel barrel wall thickness of 6mm or diameter/120 whichever is the greater (e) GRP : rubber ring jointed couplings, minimum SN10000 stiffness, PN16 pressure class (f) ABS : solvent welded, minimum PN16 pressure class. (g) Cu: copper pipes shall be to AS1432 in the range of DN6 to DN200 Type A. Compliance with AS3500. All products and materials used for the creation of infrastructure shall comply with the relevant sections of WS-SPEC as applicable for the respective pipe materials. The Contractor shall not use any damaged or defective materials, including coatings and linings, outside the manufacturers recommended limits. **STEEL PIPES AND FITTINGS** Steel pipes and fittings shall be compliant with WS-SPEC Section SP1. Steel pipes shall be provided with cathodic protection if required in accordance with geotechnical recommendations. Flanges shall be to Figures B7, B8 & B9 of AS4087, as appropriate. Flanges shall be provided with SS316 bolts and SS304 nuts and washers. Pipes and fittings are to be handled, transported and stored as per manufacturer's guidelines. **DUCTILE IRON PIPE AND FITTINGS** Ductile iron pipes and fittings shall be compliant with WS-SPEC Section SP2.	***STEEL PIPES AND FITTINGS*** ***DUCTILE IRON PIPE AND FITTINGS***

Flanges shall be to Figures B5 & B6 of AS 4087, as appropriate. Flanges shall be provided with SS316 bolts and SS304 nuts and washers. Pipes and fittings are to be handled, transported and stored as per manufacturer's guidelines.	
PVC PIPES AND FITTINGS PVC Pipes and Fittings shall be compliant with WS-SPEC Section SP4. Pipes and fittings are to be handled, transported and stored as per manufacturer's guidelines. Pipes and fittings shall be handled and stored protected from sunlight. The Contractor shall provide protection for the pipes and fittings from ultra violet light and damage. The Contractor shall take account of the time for storage and type of shelter.	***PVC PIPES AND FITTINGS***
GRP PIPES AND FITTINGS GRP pipes and fittings shall only be used with prior approval of Council. If approved, GRP pipes and fittings shall be compliant with Section SP5. Pipes and fittings are to be handled, transported and stored as per manufacturer's guidelines. Pipes and fittings shall be handled and stored protected from sunlight. The Contractor shall provide protection for the pipes and fittings from ultra violet light and damage. The Contractor shall take account of the time for storage and type of shelter.	***GRP PIPES AND FITTINGS***
POLYETHYLENE PIPES AND FITTINGS PE Pipes and Fittings shall be compliant with Section SP6. PE pipes shall be manufactured in either PE80B or PE100 polymer material. Fittings up to DN110mm shall be PE in accordance with AS4129. Fittings larger than DN110mm shall be ductile iron in accordance with AS2280 and coated internally and externally with polyethylene in accordance with AS4129. The Contractor shall provide pipe of the appropriate external diameter consistent with the required internal diameter shown in the Design drawings. Pipes and fittings are to be handled, transported and stored as per manufacturer's guidelines. Pipes and fittings shall be handled and stored protected from sunlight. The Contractor shall provide protection for the pipes and fittings from ultra violet light and damage. The Contractor shall take account of the time for storage and type of shelter.	***POLYETHYLENE PIPES AND FITTINGS***
ABS PIPE AND FITTINGS ABS pipes and fittings shall be joined in accordance with the manufacturer's	***ABS Pipes and Fittings***

instructions using solvent cement. Pipes and fittings are to be handled, transported and stored as per manufacturer's guidelines. **COPPER PIPE AND FITTINGS** Copper tube shall be specified to be manufactured in accordance with AS 1432 in the range of DN6 to DN200 for Type A or Type B. 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. Copper pipework shall be insulated from ferrous mains.	***Copper Pipe and Fittings***
The Contractor shall not change the pipeline alignment without prior concurrence of Council. The Contractor shall provide full details, of any proposed changes to the pipeline alignment to Council prior to undertaking any such works. This action constitutes a **HOLD POINT**. The Contractor shall obtain the decision of Council prior to the release of the hold point.	**11.1 General**
The Contractor shall ensure all reasonable care is taken during the construction of the works to ensure that existing utility services are protected against damage or interference whatsoever. If existing utility services are damaged during the course of the works, through any cause whatsoever, the Contractor shall be fully responsible for all costs associated with rectification of the utility services, to the satisfaction of the Council or the utility service owner as appropriate, regardless of the accuracy of any prior location advice given by Council, the utility service owner or its agent. Where it is necessary to relocate or alter existing utility services, the Contractor shall make all necessary arrangements with the appropriate authorities concerned. The Designer is to ensure that all known utility services detailed on the engineering drawings are accurately located by non-destructive field location immediately prior to construction, and it is the Contractor's responsibility to have such services confirmed in the field prior to any excavation commencing in their vicinity of the works.	***11.5.2 Protection of Other Services*** ***Damage*** ***Relocations and / or Alterations*** ***Field Locating of services***
The Contractor shall not use damaged or defective materials, including coatings and linings, outside the manufacturer's recommended limits. Any materials showing any visible signs of delamination, deflection, cracking, or other defect as per the manufacturers guidelines shall be immediately rejected.	**12.2 Rejected Products and Materials**
All concrete work shall be compliant with WS SPEC Sections SP43, 44 & 45 and TR10. Classes of concrete used for the construction of the works shall be as follows:	**12.5 Concrete Works**

Application	Grade (F'c at 28 days)	Min cement content (kg.m3)	Max w/c ratio
Blinding concrete, mass concrete	N15	-	-
Surface footpaths and driveways	N25	-	-
Unreinforced thrust blocks, anchor blocks, bulkheads, and conc. encasement in all environments	N25	-	-
Reinforced thrust blocks, anchor blocks, bulkheads, and conc. encasement in all environments	N32	-	-
Valve chambers and flowmeter pits in non–aggressive environments	N32	-	-
Valve chambers and flowmeter pits in aggressive soil and groundwater environments	S40	380	0.50
Underground booster pump stations, building foundations, in non-aggressive environments.	N32	-	-
Underground booster pump stations, building foundations, in aggressive soil and groundwater environments.	S40	380	0.50

Aggressive environments are defined as exposure to :
1. seawater, anaerobic waters, swampwater, tidal flats and the like, including exposure to intermittent saturation.
2. relatively high levels of chlorides and /or sulphates, relatively high or low pH levels, as defined within Appendix B of SW-SPEC Section SP-43, exposure classification 3 (moderate) and above.

Cementitious materials for concrete shall comply with Appendix B of WS-SPEC SP-43.

Cover to reinforcement shall comply with the relevant Exposure Classifications within AS3600 but shall not be less than B1 normally, or C for aggressive conditions.

Concrete surfaces exposed to aggressive environments shall be provided with a protective coating compliant with WS-SPEC Section TR-20. The protective coating applied shall be in addition to the concrete cover requirements.

The Contractor shall carry out all excavations for structures and pipelines to the lines, grades and forms shown on the Drawings or as directed by Council within the specified tolerances. The Contractor shall comply with all requirements of Council including having regard for drainage, dewatering, silt control, noise abatement, proximity to existing buildings and generally for the amenity of adjacent owners.

13. Excavation

When excavation of the trench has been completed the Contractor shall obtain the Council's approval prior to commencing pipe laying, jointing and bedding. This action constitutes a **HOLD POINT**. The Council's approval of the excavated trench is required prior to the release of the hold point.

All excavation, bedding and backfilling for pipelaying operations in adequate foundations shall be compliant with Council Drawing No. WA3-835.

All excavation, bedding and backfilling for pipelaying operations in inadequate and poor foundations shall be compliant with WSA-03 Drawing No. WAT 1203.

13.1 Safety

The Contractor shall install safety fencing to statutory requirements along the edges of open excavations to isolate them from the public. The Contractor shall provide fenced walkways and vehicular crossings across trenches to maintain access at all times from carriageway to individual properties or within individual properties and advise all affected residents beforehand. All installations shall be of adequate size and strength and shall be illuminated to prevent accidents.

The Contractor shall take account of safety issues and possible wet weather effects to limit the extent of excavation left open.

13.2 Limits of Excavation

The Contractor shall leave a clear space of 600mm minimum between the edge of any excavation and the inner toe of stockpiles. No excavated materials shall be stockpiled against the walls of any building or fence without the written permission of the owner of such building or fence. The Contractor shall take account of safety issues and possible wet weather effects to limit the extent of excavation left open. The Contractor shall locate, protect and repair, as necessary, all services affected by the Works at the Contractor's expense.

Where the Drawings provide for a trench to be excavated across a paved surface, the width of the trench shall be kept to a minimum. Bitumen and concrete surfaces shall be carefully cut, by sawcutting or other means approved by the Superintendent, so as to provide a neat straight line free from broken ragged edges.

The Contractor shall widen the trench where necessary for the installation of valves and fittings and application of protective coating systems.

The minimum clear width of trench (inside internal faces of timbering or sheet piling, if used) to a height of 150mm above the top of the pipe shall be as shown in Table below:

NOMINAL SIZE OF PIPE (DN)	MINIMUM CLEAR WIDTH OF TRENCH (mm) (inside timbering or sheet piling, if any)
100	600
150	600
200	600
225	600
250	600
300	900
375	900

400	900
450	950
500	1200
525	1200
600	1200

Where the Drawings provide for a trench to be excavated across a paved surface, the width of the trench shall be kept to a minimum. Bitumen and concrete surfaces shall be carefully cut, by saw cutting or other means approved by Council, so as to provide a neat straight line free from broken ragged edges.

The Contractor shall widen the trench where necessary for the installation of valves and fittings and protective coating systems.

The Contractor shall ensure that suitably qualified trained personnel are engaged to undertake all work associated with shoring and support, specifically in compliance with statutory obligations (refer specifically to Sections 203-212 of the WH&S Act). All temporary support shall be appropriately designed, be adequate and effective to maintain stability of excavation, having account for all possible loadings that could occur.

The Contractor shall adequately support all excavations as the works proceed. When withdrawing supports, the Contractor shall exercise every precaution against slips or falls.

The Contractor shall ensure that timber support be left in place where its removal may endanger structures in the vicinity of the excavation.

Where steel shoring is used, such shoring shall comply with AS4744.1.

13.6 Support of Excavations

Where foundation material shows any signs of movement, groundwater ingress or any other possible instability, and such instability cannot be controlled by conventional means, the foundation material shall be assessed by the Designer for adequacy of structural support. If ground conditions dictate the need for remedial works, such works shall be of a detailed nature provided in writing by the Designer to the Contractor.

13.*8 Foundations & *Foundation Stabilisation

Topsoil from excavations shall be stockpiled separately and utilised to restore the site after backfilling.

Excess spoil shall be removed from the site and disposed off site at an approved landfill location.

Excess acid sulphate and contaminated soils disposed off site shall be treated as per the environment management plans for such materials prior to disposal.

13.9 Surplus Excavated Material

Refer to Council drawing No. WA3-835 Revision A.

14 Bedding for Pipes

The Contractor, employees, or subcontractors, engaged in excavations, including tunnelling, are to be accredited for the work. Proof of accreditation constitutes a HOLD POINT. The Approval of Council, to the supplied

15 Pipe Laying and Jointing

documentation, shall be required prior to the release of the hold point.	
The minimum depth of cover to be provided for water supply pipework measured vertically from the finished ground level to the top of any socket shall be in accordance with Council Standard Drawing No WA3-835 Revision A. Lesser cover may be provided where special protection of the pipelines has been shown on the drawings or as directed by the Council's representative.	***15.1*** **Installation of** ***Pipes*** ***Cover***
The Contractor shall ensure that the interior of the pipeline is clean and free from obstructions. Plugs shall be used to prevent foreign matter entering sections of pipeline which are left uncompleted overnight. Before being laid, all pipes, fittings, valves, and materials to be used shall be cleaned and examined by the Contractor and jointly by Council. The Contractor shall suspend each pipe length in a sling to enable Council to inspect it. For field cuts, a mechanical pipe cutter shall be used, except that PVC/PE pipes may be cut using a power saw or a fine toothed hand saw and mitre box. For field cuts of ductile iron or steel, the Contractor shall ensure that fire fighting equipment, in working order, is on the site prior to the field cuts being made. If the Contractor proposes to use a petrol engine pipe cutter in an excavation, the Contractor shall ensure that a safe atmosphere is maintained in the excavation at all times. The Contractor shall prepare the ends of any pipes cut in the field to the manufacturer's written instructions, or as directed by Council. Where pipes are cut in the field, the Contractor shall make a witness mark on the pipe using a felt-tip marking pen at the length specified by the manufacturer from the end of the pipe. The Contractor shall not use PVC/PE pipes with scored witness marks. Where the same manufacturer does not make spigots and sockets, the Contractor shall refer to the socket manufacturer for the correct marking depth. Cut surfaces in metallic pipes shall be suitably protected from corrosion by end treatment with equivalent protective coatings and linings as originally provided by the manufacturer. Cut surfaces in GRP pipes shall be suitably protected from deterioration by end treatment with a resin layer to the manufacturer's guidelines. For valves, if directed by Council on examination, the Contractor shall oil valves and repack valve glands. After laying and jointing of a pipeline has been completed the Contractor shall present the laid and jointed pipes for inspection by Council prior to the commencement of trench backfilling. This action constitutes a HOLD POINT. Council's approval to the laid and jointed pipes is required prior to the release of the hold point. Backfill shall not be placed until Council has given approval.	***15.1.2 Cleaning Inspection & Joint Preparation*** ***Examination*** ***Pipe Cutting*** ***Inspection of laid pipes by Council***
The Contractor shall make the joint such that the witness mark shall, at no point, be more than 1mm from the end of the socket.	***15.1.4 Laying*** ***Witness Marks***

Where PVC pipes are to be joined to ductile iron pipes, the joints shall be made by inserting a PVC spigot into a ductile iron socket. Ductile iron spigots shall not be joined to PVC sockets. Alternatively, multi-fit mechanical couplings or flanged adaptor couplings may be used to join pipes of different materials. The Contractor shall conform to the relevant Statutory and OH&S requirements when cutting and disposing of asbestos cement pipes. Unless otherwise directed by Council, the Contractor shall lay pipes on continuously rising grades from scour valve to air release valve, notwithstanding any minor irregularities in the ground surface. Detectable identification tape shall be laid along the line of non-metallic mains within 150mm of the finished surface.	***Dissimilar Materials*** ***Existing AC Pipe*** ***Grade*** ***Detectable Tape***
Flexibly jointed pipelines with gradual changes in alignment or grade shall be laid with the joint being deflected after it has been made. The Contractor shall comply with the manufacturer's written recommendations in respect of maximum deflection for each joint provided that no joint shall be deflected to such an extent as to impair its effectiveness. The maximum angle of deflection between adjacent pipes shall be limited to 2^{o} or 0.035 radian in areas subject to mine subsidence or slippage.	***15.2.2 Deflection at a Pipe Joint*** ***Limit of Joint Deflection***
The Contractor shall take all necessary precautions to prevent flotation of pipes during laying, backfilling and initial testing. Any temporary supports shall be removed prior to completion of backfilling.	**15.4 Flotation Control**
The Contractor shall provide permanent thrust and anchor blocks of 20MPa concrete. Thrust blocks shall bear against undisturbed material normal to the direction of thrust resulting from internal pressures over the bearing area shown on the Drawings. The Contractor shall obtain the consent of Council for the type and use of restrained joints, as an alternative to thrust blocks, in the case of congested service corridors and urgent commissioning. The Contractor shall provide temporary anchorages adequate to restrain the pipe when under hydrostatic test. The Contractor shall provide all other temporary anchorages and supports as required for other service to avoid any damage during construction. The Contractor shall consult with Council and the Designer in this regard to ensure all temporary works are adequate.	**15.5 Thrusts & Anchor Blocks and Restrained Joints** ***Restrained Joints*** ***Temporary Anchorage***
Ductile iron pipework shall be provided with protective polyethylene sleeving installed in accordance with the pipeline manufacturer's instructions or epoxy coating as specified in the design. Steel pipe work shall be protected by fusion bonded polyethylene (FBPE, known commercially as Sintakote) or epoxy coating. At welded joints, the pipeline shall be protected from corrosion by the application of either polyethylene heat shrink sleeves or by a suitable petrolatum tape wrap system in accordance with the manufacturer's installation requirements.	**15.9 Corrosion Protection**

Cathodic protection shall be provided as per the design requirement. The type of external corrosion protection of buried valves and hydrants shall be as per Council's specifications within PSP 15.12 Development Design Specification - Water Supply (D11).	***Cathodic Protection*** ***Valves and Hydrants***
Construct trenchstops as detailed in WS-SPEC Section TR-14.	**15.7 Trenchstops**
Construct bulkheads as detailed in WS-SPEC Section TR-14.	**15.8 Bulkheads**
All valves are to be anti-clockwise close type. Valves shall be installed such that: (a) Manual operation of the valves may be carried out with ease and without the need for any other extra equipment. (b) All valves and their actuators shall be easily accessible for maintenance purposes and shall be capable of being removed from their location in a pipeline without obstruction by the pipeline or other equipment. (c) Valves shall be located in positions where they may be readily exercised and maintained. All valves shall be closed by an anti-clockwise rotation of the hand wheel or handle. The face of each hand wheel shall be clearly marked with the words OPEN and SHUT with arrows adjacent to indicate the direction of rotation to which each refers. (d) Spare parts shall be readily available. The Contractor shall ensure that the valves and hydrants supplied are compatible with the pipework such that proper sealing is provided between the pipe flanges and the valve. Concrete lining in pipework shall not be chipped away or reduced to provide clearance from the working parts of valves. Valves shall be located to avoid conflict with driveways, telephone house service pits, underground electrical boxes and any other street side furniture. Location of valves and hydrants shall be marked with a Council approved marking post or alternatively a stainless steel kerb marker. The location of pipes crossing roads shall be indicated by a stainless steel kerb marker. The valve shall be capable of opening against full unbalanced head and closing against full flow and shall open and close smoothly without vibration or cavitations. The maximum effort required at the hand wheel shall not exceed 135 N under the worst conditions of differential head or unseating force. The size, shape, strength and rating of all parts shall be of sufficient strength to provide an ample factor of safety under all working conditions. Flange connections for valves shall be to AS4087, minimum pressure rating PN16. Bolts shall be SS316. Nuts and washers shall be SS304. All ferrous alloy (cast iron, spheroidal graphite cast iron, plain carbon and	**15.11 Valves, Hydrants and Surface Fittings** ***Installation*** ***Compatibility with pipework*** ***Location*** ***Flanges***

alloy steel) valves shall have protective epoxy coatings complying with WS-SPEC Section SP-30 Protective Coatings for Valves.

All parts requiring grease lubricating shall be fitted with hydraulic grease nipples.

The valve shall preferably be drop tight in the closed position. If not, the leakage rate shall not exceed that specified in the relevant Australian Standard or this specification.

An approved lifting attachment shall be incorporated on the body of the valve. The mass of the valve shall be stated.

The valve internal surfaces shall be devoid of sharp protrusions which may initiate secondary cavitation at high flow velocities.

Sluice/Gate Valve

Sluice Valves

Sluice valves shall be resilient seated compliant with WS-SPEC Section SP-21.

Valves shall be flanged unless shown otherwise on the Drawings.

Ball Valves

Ball Valves

Ball valves shall be compliant with WS- SPEC Section SP-22.

Valves shall be flanged unless shown otherwise on the Drawings.

Butterfly Valves

Butterfly Valves

Butterfly valves shall only be used with prior approval of Council. If approved, butterfly valves shall comply with WS-SPEC Section SP-24.

Valves shall be flanged unless shown otherwise on the Drawings.

Knife Gate Valve

Knife gate Valves

Knife Gate valves shall comply with WS-SPEC Section SP-23.

Valves shall be flanged unless shown otherwise on the Drawings.

Scour valves

Scour Valves

Valves shall be sluice valves. Scour valve assemblies shall be as shown on the Drawings.

Air Valves

Air valves

Air valves shall comply with WS-SPEC Section SP-27.

Minimum size of air valve is DN80mm.

Each air valve shall be provided with an isolating sluice valve.

Council's nominated brand of air valves is Ventomat.

Reflux Valves

Reflux Valves

Reflux valves shall comply with WS-SPEC Section SP-25.

Reflux valves shall be Flexichek Resilient Sealed Non-Return Valves without level arm and without counterweight. Council's nominated brand of reflux valves is Crevet.. For vendor supply pumping packages, the vendor nominated reflux valves system shall be acceptable. **Spring Hydrants** Spring hydrant valves shall be compliant with WS SPEC Section SP28. The top of spring hydrants shall be between 100mm and 200mm below finished surface level.. If necessary, this shall be achieved by the use of hydrant risers of various heights. Hydrants shall be DN100 flanged spring type (SWASH) hydrants without isolating valves. Pillar type hydrants shall be installed where directed by Council. Maximum spacing between hydrants shall be 80m. **Pressure Reducing Valves** Pressure reducing valves shall comply with AS/NZS 4020 at a scaling factor of 0.1. Pressure reducing valves shall be installed with isolating valves upstream. Valves shall be flanged unless shown otherwise on the Drawings.	***Spring Hydrants*** ***Pressure Reducing Valves***
For pipework equal to or greater than DN375mm, the Contractor shall provide bypass pipework and shall construct around each valve a chamber of the type and to the details shown on the Drawings. Valve chamber covers shall be painted with red pavement marking paint while hydrant chamber covers shall be painted with yellow pavement marking paint. Where the type of valve chamber is such that the body, or part of the body, of the valve is to be backfilled before the valve chamber is constructed, and any parts of the valve remain unprotected, the Contractor shall either wrap the valve using a tape consisting of synthetic fibre open weave cloth impregnated with saturated hydro-carbons, applied in accordance with the valve manufacturer's written instructions, or apply at least one coat of corrosion preventing material to the valve body after the valve has been installed but before backfilling. The coating material shall be compatible with the coating material which has been applied to the valve prior to delivery. Covers and frames shall not be warped or twisted. Surfaces shall be finished such that there are no abrupt irregularities and gradual irregularities shall not exceed 3mm. Unformed surfaces shall be finished to produce a surface that is dense, uniform and free from blemishes. Exposed edges shall have a minimum 4mm radius. Tolerances for the dimensions on the COVER shall be - 3mm + NIL. Tolerances for the dimensions on the FRAME shall be - 3mm + 3mm. Covers shall be seated as shown on the Drawings or as directed by	**15.11.2 Valve Chambers for Large Mains** ***Colour Designation*** ***Corrosion Protection*** ***Chamber Covers and Frames Finish*** ***Cover Tolerance*** ***Frame Tolerance*** ***Cover Seating***

Council. Covers shall be finished flush with the surface in road pavements, footpaths and other paved surfaces. Elsewhere, covers shall be finished 150mm above the surface of the ground, or such other level as directed by Council, in a manner designed to avoid as far as possible, the entry of surface water. Cast iron covers and frames shall be manufactured in accordance with AS 3996 and shall be installed and filled with concrete, as necessary, in accordance with the manufacturer's requirements. The Contractor shall take care to avoid lateral movement, cracking and subsidence when installing plastic covers and frames.	***Cover levels*** ***Installation*** ***Plastic Covers***
Where a pipeline crosses a Main road or a State road, a creek or involves features shown on the Drawings under the control of any other Authority, the Contractor shall carry out the work in accordance with the requirements of that Authority. The Contractor shall provide written notification to the Authority of the intention to carry out the work, and pay the appropriate fees. The Contractor shall obtain the written approval from the Authority prior to commencement of work. Such written approval shall be supplied to Council if requested. This action constitutes a WITNESS POINT. The Council shall advise at the time of notification by the contractor whether the option to request the written approval is to be exercised. Where shown on the Drawings, the Contractor shall use trenchless methods for the installation of the mains. The installation of the main by open trenching shall not be permitted over the lengths designated for trenchless installation. The Contractor shall address, in its Method Statement for trenchless conduit installation, the following: (a) General description of method and sequence of operation. (b) Size, depth and position of temporary pits required. (c) Use of specialist subcontractors. (d) Specialist equipment to be used. (e) Grout type and method of injection. The encasement pipe shall be as detailed on the Drawings. The encasement pipe shall extend 1.0m behind the back of the kerb on either side of the carriageway. The carrier pipe shall be positioned on support cradles and the carrier pipe shall be centrally located within the encasement pipe. After installation and pressure testing of the carrier pipe, the Contractor shall fill the annular space between the carrier pipe and the enveloper pipe if directed by council.	**15.13 Bored Pipes Under Roads** ***Contractors Responsibility*** ***Existing Road Crossings*** ***Trenchless Installation Methodology*** ***Grouting***
The Contractor shall clearly mark the position of each stop valve, scour valve, air valve and hydrant on completion of backfilling in a manner and position as approved by Council. The marking shall be made by one of the following methods but the location of the mark or peg shall be consistent with the method(s) in use by Council Where, in the opinion of Council, a valve or hydrant is at too great a distance from any existing wall, fence, kerb face, or post, the Contractor	**15.16 Location Markers**

shall provide and set in the ground a post with the relevant marking plate fixed at the top of the post, facing the fitting. The distance to the valve or hydrant in metres, to an accuracy of 0.1m, shall be permanently marked on the plate with legible numbers a minimum 80 mm high. Wooden posts are not to be used where there is evidence, by rotting or termite activity, that the integrity of the posts will be affected. The post shall conform to the following requirements: (a) The post shall be of sufficient length to be set firmly in place under saturated ground conditions. (b) When installed, the post shall project 1000mm above the ground, provided that where tall grass or crops are likely to obscure the post, its height above the ground shall be increased to 1500mm. (c) The post shall be painted with 2 coats of white enamel for exterior use. The Contractor shall fix marking plates as soon as practicable after each valve or hydrant is installed. However, the Contractor shall temporarily cover marking plates for hydrants using masking tape or other approved cover which the Contractor shall remove on satisfactory completion of the pressure testing of the pipeline. In addition to the marking plates, the Contractor shall affix two-way reflective raised pavement markers to the road pavement and kerb, where available, in accordance with the Drawings.	***Plates on Posts*** ***Post Details*** ***Fixed after Installation*** ***Pavement Markers***
The Contractor shall not lay continuously welded steel pipelines parallel to, or in close proximity with, high voltage power lines.	***15.18 Welding of Steel Watermains***
After laying and jointing of a pipeline has been completed the Contractor shall present the laid and jointed pipes for inspection to Council's representative prior to the commencement of trench backfilling. This action constitutes a **HOLD POINT**. The Superintendent's approval to the laid and jointed pipes is required prior to the release of the hold point. After approval of pipelaying and jointing, backfill and compaction can commence. Placement, material requirements and compaction of embedment and support shall be compliant with WS-SPEC Section TR-13 Pipeline Installation (Pressure) and AS 2166.2 Buried Flexible Pipelines (Part 2 : Installation).	**16 Pipe Embedment and Support**
Above the pipe embedment overlay, the trench shall be backfilled and compacted with select fill material. Placement, material requirements and compaction of trench fill shall be compliant with WS-SPEC Section TR-13 Pipeline Installation (Pressure) and AS 2166.2 Buried Flexible Pipelines (Part 2: Installation). Where the trench is within a roadway, proposed roadway, or footpath area, the trench shall be: (i)Backfilled to within 0.5m of the road pavement subgrade level with a non-cohesive granular material, with a grading falling generally within the limits detailed for pipe bedding and compacted to a Density Index of 70% when determined in accordance with AS1289.5.4.1 for cohesionless materials (ii)Backfilled with excavated material, and compacted to 100 per cent of the	**17.1 Trench Fill** ***Pipes Laid in Roadways***

standard maximum dry density of the material when determined in accordance with AS1289.5.7.1, when within 0.5m of the road surface, but excluding the road pavement layers. (iii)Backfilled with road base and sub-base material as per existing or proposed pavement layers and compacted to 100 per cent of the standard maximum dry density of the material when determined in accordance with AS1289.5.7.1	
The Contractor shall carry out backfilling and compaction without damaging the pipe or its external coating or wrapping or producing any movement of the pipe. The contractor shall carry out compaction tests 75mm to 100mm below the level being tested. The Contractor may compact backfill by trench flooding only where: (a) The ground and backfill material is cohesionless sand. (b) Water for flooding has been sourced at the site. (c) The process will not create mud which would be moved off site by vehicles or construction plant. (d) Additives are not used.	**19.3.4 Trench Fill Compaction Testing**
The Contractor shall pressure test mains to detect leakage and defects in the pipeline including joints. This action constitutes a **WITNESSPOINT**. Council shall advise at the time of notification by the Contractor whether the option to inspect the testing is required. Pipelines shall be tested in sections approved by Council as soon as practicable after each section has been laid, jointed and backfilled, provided that: (a) If so specified, or if the Contractor so desires, some or all of the pipe joints shall be left uncovered until the whole of the section has been successfully pressure tested to the satisfaction of Council; and (b) The pressure testing shall not be commenced earlier than seven days after the last concrete thrust or anchor block in the section has been cast. For the purpose of this clause, a section shall be defined as a length of pipeline which can be effectively isolated for testing, eg by means of main stop valves. Pressure testing shall not be carried out during wet weather unless otherwise approved by Council. During pressure testing, all field joints, which have not been backfilled, shall be clean, dry and accessible for inspection.	**19.4.1 Pressure Testing** ***General*** ***Section Definition*** ***Wet Weather*** ***Field Joints***
The hydrostatic test pressure, which shall be applied to each section of the pipeline, shall be equivalent to the pressure rating of the pipe specified.	**19.4.2 System Test Pressure**

Permissible leakage rate is determined by the following formula: $Q_1 = 0.0105\ D.L.\ (H)^{0.5}$ where: Q_1 =permissible leakage rate (litres per hour) D =nominal diameter of pipe (mm) L = length of section tested (km) H =average test head (m)	**19.4.3 Maximum Allowable Loss**
During the pressure testing of a pipeline, each stop valve shall sustain at least once, the full test pressure on one side of the valve in closed position with no pressure on the other side for at least 15 minutes. Before testing a pipeline section, the Contractor shall clean it to the satisfaction of the Council and fill it slowly with water, taking care that all air is expelled. Purging of air from rising mains shall be promoted by opening air valves. In order to achieve conditions as stable as possible for testing by allowing for absorption, movement of the pipeline and escape of entrapped air, the section shall be kept full of water for a period of not less than 24 hours prior to the commencement of the pressure testing. The Contractor shall maintain the specified test pressure as long as required by the Council while the Contractor examines the whole section. In any case, the specified test pressure shall be maintained for not less than 8 hours. For the purpose of determining the actual leakage losses, the Contractor shall carefully measure and record the quantity of water added in order to maintain the pressure during the period of testing.	**19.4.4 Test Procedure**
The pressure testing of a section shall be considered to be satisfactory if: (a)There is no failure of any thrust block, anchor block, pipe, fitting, valve, joint or any other pipeline component; (b)There is no visible leakage; and (c)The measured leakage rate does not exceed the permissible leakage rate.	**19.4.5 Satisfactory Pressure Test**
Any failure, defect, or visible leakage which is detected during the pressure testing of the pipeline or during the Defects Liability Period shall be made good by the Contractor at the Contractor's expense, provided that where a thrust block or an anchor block fails, and such thrust block or anchor block has been constructed in accordance with the Drawings, and the failure is not, in the opinion of the Council, the fault of the Contractor, the cost of strengthening or reconstruction of such thrust block or anchor block and the cost of retesting shall be paid as a Variation to the Contract at such rates as are determined in accordance with the provisions of the Contract. Alternatively, the main may be tested by the use of compressed air. In this case, the Contractor shall provide details of the alternative method proposed, for approval by Council, prior to its use.	**19.4.6 Failure of Test** ***Alternate Test***
The Contractor shall disinfect all water mains after satisfactory testing in accordance with this Specification.	**20.1 Disinfection of**

The Contractor shall adopt procedures for the disinfection of the mains with the concurrence of Council.	**Pipelines**
Connections to existing pipes carrying water shall be made at such times as will cause the least interference with the supply. The Contractor shall make arrangements with Council for the timing of work including the need to isolate the existing mains and notification of affected dwelling occupants. The Council shall be given five (5) working days notice of such arrangements.	**22.1 Connection to Existing Pipes**
The Contractor shall clean pavements, lawns and other improved areas and leave them in the same order as they were at the commencement of the Works. The Contractor shall restore any fencing removed during construction and shall restore lawns with turf cut and set aside from the original surface and with turf imported from a source approved by the Council. The Contractor shall provide notice to affected property owners of any pending works. The Contractor shall immediately restore any damaged or disturbed private property and services.	**23.1 Restoration of Surfaces** ***Original Condition*** ***Property Owner Advise***
The Contractor shall maintain all restored surfaces in the condition to which they are restored until the expiry of the Defects Liability Period applicable to those surfaces, notwithstanding that any deterioration of the restored surfaces, and the need for their maintenance may or may not be due to defects which become apparent or arise from events which occur during the Defects Liability Period. The Contractor shall maintain pavements with crushed igneous rock, gravel, asphaltic concrete or other suitable material allowing for consolidation and shall then restore them to a condition equivalent to that of the original pavement. Final restoration may include, if required by Council, the removal of temporary restoration. Should the Contractor elect to tunnel under paving, kerb and gutter or other improved surfaces in lieu of trenching, backfilling shall be so carried out as to restore full support to those surfaces, and payment shall be made for the restoration of the surfaces as though they had been removed and replaced. The Contractor shall remain responsible for the repair of the improved surfaces, if subsequently damaged due to subsidence of the backfill, until the end of the Defects Liability Period.	**23.2 Pavement Restoration** ***Tunnelling***
In other than roadways, the Contractor shall place the backfill sufficiently high to compensate for expected settlement and further backfilling shall be carried out or the original backfill trimmed at the end of the Defects Liability Period in order that the surface of the completed trench may then conform to the adjacent surface. Surplus material shall be removed and disposed of to areas arranged by the Contractor. Where dry weather conditions have persisted after the original backfilling, including during the Defects Liability Period, the Contractor shall take all necessary steps to consolidate the trench before removing surplus materials from the site. In locations where, in the opinion of Council, surplus material left in the vicinity of the trench would not be objectionable, the surplus material may be disposed by spreading neatly in the vicinity of the trench to the	**23.6 Provision for Settlement** ***Disposal of Surplus Material***

satisfaction of Council in such a way as to avoid future erosion of the backfill and adjacent ground surfaces. The Contractor shall maintain the backfill and adjacent ground until the expiry of the Defects Liability Period. Where, within public or private property, the reasonable convenience of persons will require such, the Contractor shall level trenches at the time of backfilling or otherwise as directed by Council. The Contractor shall make good any subsequent settlement, as required by placing additional fill.	
The Contractor shall maintain all restored surfaces in the condition to which they are restored until the expiry of the Defects Liability Period applicable to those surfaces, notwithstanding that any deterioration of the restored surfaces, and the need for their maintenance may or may not be due to defects which become apparent or arise from events which occur during the Defects Liability Period. The Contractor shall maintain pavements with crushed igneous rock, gravel or other suitable material allowing for consolidation and shall then restore them to a condition equivalent to that of the original pavement.	**23.7 Maintenance of Restored Surfaces**
The Contractor shall submit to the Designer work-as-executed details showing the actual location and alignment of pipelines, and all pump station details together with operating and maintenance manuals. Details shall include the size, type, levels of pipelines, valve and hydrant chamber types and cover details, easement requirements for maintenance, pump details, switchboard equipment details and station structural details. The Contractor shall ensure that a Registered Surveyor certifies the plans showing location and alignment. The Designer then shall prepare the work-as-constructed drawings in a form consistent for inputting into the Asset Register to be submitted by the Designer to Council. All drawings and documentation to be submitted to Council for approval shall conform to the requirements of Council's *Drawings and Documentation Guidelines*. A copy of these Guidelines will be made available upon request. Failure to comply with Council's *Drawings and Documentation Guidelines* may result in the drawings and/or documentation being returned to the designer without comment	**24. Work as Constructed Details** ***Main Requirements*** ***Additional Detailed Requirements Survey*** ***Asset Register*** ***Guidelines***
All amendments to WSA-03 Drawings are detailed on Council's Versions of the applicable drawings.	**Amendments to WSA 03**

C401.12 PUMPING STATIONS

C401.12.1 NEW PUMPING STATION

General Requirements

The Contractor shall take into account site access, site maintenance and restoration, easement requirements, power supply and construction laydown working areas when locating pump stations. This action constitutes a **WITNESS POINT** in the design process. Council shall advise at the time of notification by the Contractor whether the option to confer on the locations and land allocations is required.

Small booster pumping units may be housed in underground pits or aboveground buildings. Underground pumping installations shall be provided with watertight covers, approved access arrangements, adequate provision for maintenance and provision of drainage. Where required, larger pump units shall be secured within an aboveground purpose-designed building. Aboveground buildings and structures shall be subject to Development Approval (DA) by Council. The building shall match the aesthetics of the surrounding land use and shall accommodate any need for climate and/or acoustic control. For all pump stations structures and buildings, Occupational Health and Safety requirements shall be met, especially with regard to ease of access, clearances for maintenance, lifting equipment, and avoidance of trip hazards. The Contractor shall provide lifting equipment, including gantry cranes; monorails or permanently installed davits, as necessary, to comply with operational health and safety requirements.

Structural steelwork in pumping stations for ladders and access platforms, and brackets shall be SS316 or marine grade aluminium.

For above ground buildings, preformed components or system may be used in lieu of in-situ concrete, providing:

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

Pump data and selection criteria shall be documented in **Appendix B Pump Asset Registration Data in Development Design Specification – Water Supply (D11).**

PUMPING SYSTEMS

Pumping equipment

Pump Selection

For standardization of equipment, Council's preferred suppliers of pumping equipment are ;
(a) Grundfos
(b) KSB Ajax

NPV

(This is to minimize Council's maintenance costs in regard to provision and storage of spare parts).

Pump Types

Notwithstanding, pumping equipment shall be:

(a) Subject to Council approval.

(b) Readily available in the market place servicing the Council.
(c) Interchangeable with other Council approved makes/models.

Council has a single supplier purchasing policy in order to standardize pumping equipment. The Designer shall consult with Council to ascertain the current pump supplier. Final selection of the pump model and size shall be subject to Council approval.

Pump Selection

Pump Selection
Pump selection shall be consistent with the minimum whole-of-life (NPV) cost of the pumping station based on the calculated mean system curve. Each pump and its drive unit shall be suitable throughout the specified range of station requirements such as flow rates, heads and duty points.

Pumps shall be End Suction Centrifugal or Split Casing Axial type. All end suction pumps shall be arranged for back pull out. If either of these pump types is not suitable for the application, other pumps may be considered with Council Approval.

Pumps up to and including 80mm branch diameter may be single shaft with flange mounted drive motors. Pumps over 80mm branch diameter shall be close coupled with spacer coupling to enable pump rotating element removal with minimum disturbance of the drive motor. The pump casing shall be supported independent of the pipework.

The direction of pump rotation shall be clearly and permanently marked on the pump casing.

Standby Capacity

Standby
Standby pumping capacity shall be provided such that if one pump is out of service, the pump station will remain able to supply the required transfer capacity.

Electrical Standby

Electrical Standby
Unless otherwise advised by Council the Contractor shall provide a permanent on-site generator for each site and shall provide for connection of same.. Also refer to Section C401.14 Electrical Works of this specification.

Protective Coatings

Protective Coatings
The pumps, motors and guards shall be supplied with painted finish to the pump manufacturers' standard specifications. The base plate, where applicable, is to be hot dipped galvanised.

Installation

Installation
Pumps shall be fitted with air release cocks at the highest point of the casing and with a drain cock at the lowest point. Copper or suitable plastic drain pipes shall be provided from the air release cock and the glands to a common tundish. Horizontal close coupled pumps and their drive motors shall be mounted on a common cast iron or fabricated steel base plate.

Pressure Gauges

Pressure Gauges And Transducers

The Contractor shall install one direct mounted bottom connected pressure gauge, minimum gauge face 100mm diameter, complying with AS 1349, per pump installation.

Gauges and fittings shall be screwed into the pipe wall of steel and ductile iron pipes of DN150mm and larger. In steel and ductile iron pipework less than DN150mm, gauges and fittings shall be screwed into a tapping band. In pipes other than steel or ductile iron, tapping bands shall be used.

The Designer shall provide a pipe tee on the main to install the pressure gauge. An isolating ball valve shall also be provided to allow release of pressure prior to removal of the gauge. The pressure gauge range for single or parallel pumps duty shall be 0 to 1.7 times the closed valve head of the pumps. A minimum of two (2) pressure transducers shall be provided at each pump station. One (1) pressure transducer shall be provided on the suction side of the pump station and one (1) pressure transducer shall be provided on the discharge side of the pump station. The signals from both pressure transducers shall be connected to the site telemetry system. For pressure gauges and transducer details refer to Council Standard Specification for Electrical Assets.	
Electromagnetic Flowmeters And Flow Switches: An electromagnetic flowmeter shall be provided at each pumping station. The flowmeter shall be housed within the pumping station or in a separate dedicated concrete structure. The flowmeter converter shall be housed in the pump station electrical switchboard and shall provide an input into the site telemetry system. For the flowmeter details refer to Council Standard Specification for Electrical Assets. Each pump shall be provided with IFM Effector flow switch for the flow detection. For details refer to Council Standard Specification for Electrical Assets.	***Flow meters***
Electrical Design: Electrical equipment design and telemetry shall comply with the requirements of Council Standard Specification for Electrical Assets.	***Electrical Design***
C401.12.2 UPGRADES TO EXISTING PUMPING STATIONS The provisions of this specification for new pumping stations as detailed shall also be applicable to the upgrade of any existing pumping stations that may be required to be undertaken as a result of the development works.	***Upgrades to Existing Pumping Stations***
PRACTICAL COMPLETION OF PUMP STATION The Contractor shall fulfil the following requirements before the Certificate of Practical Completion is issued: (a) Receipt by Council of a certificate of approval from the relevant statutory authorities. (b) Pump station is in working order as demonstrated by the testing and commissioning. (c) Approval by Council of Operating and Maintenance manuals. (d) Receipt and approval by Council of Asset Registration Data, including O & M Manuals and As-Built Drawings of the pump station.	

C401.13 ELECTRICALLY OPERATED ACTUATORS

Electrically Operated Actuators

Design

The Contractor shall be responsible for the design, manufacture, supply, and performance of the actuators.

Power

Electric motor actuators shall be 3 phase with a rated voltage 415, 50 Hz and shall be suitable for operation over a phase voltage range of 400 to 440 V. Phase rotation protection shall be provided integral with 3 phase actuators.

IP Rating

The actuators shall be suitable for indoor and outdoor installation. The actuator enclosures, including all auxiliary enclosures, shall be a minimum of IP56 to AS 60529

Motor Sizing

Actuator motors for penstocks and valves shall be specifically designed for penstock or valve actuator service and winding insulation shall be Class F. It shall be the Contractor's responsibility to determine the rated output (kW) of the motor, in conjunction with the gear reduction unit used, to suit the operational requirements of the respective penstock or valve.

Operating Times

The rated speed and the direction of rotation of the motor, in conjunction with the gear reduction unit used, shall suit the operational requirements of the penstock or valve. The time to operate the penstock from fully closed to fully open and visa versa shall range between 2 to 3 minutes. The time to operate a valve from fully closed to fully open and visa versa shall range between 4 to 6 minutes.

Interchange-ability

Where possible, actuators shall be selected to be interchangeable with existing actuators at the plant.

Design Calculations

The Contractor shall have the valve and penstock suppliers prepare calculations of the maximum opening and closing torques for each penstock and valve. These calculations shall be submitted to the Council as verified design for acceptance. Actuators shall be sized for non-overload operation at these loadings.

Mounting

Electric actuators shall be mounted directly on the valve or penstock capstan so that all forces are confined to the valve or penstock. All electric actuators shall be suitable for remote operation from the PLC. All electrical connections, controls, and the like shall be accessible from platforms or walkways.

Switches

The actuators shall be fitted with integral adjustable position and torque switches which shall be arranged to stop the actuator at the extremes of travel.

Handwheel

All actuators shall be provided with a manual override which shall be a handwheel. Hand wheels shall be located not more than 1000 mm or less than 700 mm above the operating floor level and shall not exceed 600 mm diameter. The hand wheels must be of a diameter which shall require a force of no more than 130 Newtons at the rim to operate the penstock or valve from fully open to fully closed under all operating conditions. Where this cannot be achieved due to the limit on the hand wheel diameter, a gear reduction unit shall be used. Minimum handwheel size shall be 500 mm and minimum clearance 150 mm for penstocks

Hand wheels shall be rotated anti-clockwise to close the valve, and shall be clearly marked with the words “OPEN " and " CLOSE " and arrows in the appropriate directions. The rims of the hand wheels shall be machined to a smooth finish.

Remote & Local Operation

Each actuator shall have integral open and close contactors, local open/close/emergency stop control pushbuttons and Local/Remote control selector switch together with all ancillary equipment such as control transformers, relays etc. Contactors for modulating duty actuators shall be solid state type.

Each actuator shall be supplied with an integral reversing DOL starter and associated control equipment. It shall be possible to control electrically actuated valves and penstocks either locally manually or remotely.	
Operation of the emergency stop push button shall stop the valve or penstock regardless of selector switch position.	***Emergency Stop***
The actuators shall be fitted with open, close and stop interposing relays which shall enable the actuators to be opened and closed by the control system when remote is selected.	***Interposing Relays***
The actuators shall be provided with voltage free contacts for remote connection of monitoring signals including the following: • Open and close status; • Actuator available (ie. voltage present and remote selected); • Actuator fault – e.g overtorque, motor overload/over temperature fault	***Signals***
Actuators shall have a local mechanical position indicator. Where specified the actuators shall have a position signal transmitter with an isolated 4 to 20 mA output suitable for connection to the PLC.	***Indicator***
Each actuator shall be fitted with a Grade 316 stainless steel nameplate,	***Nameplate***
Actuators shall be fitted with temperature sensing devices which shall be embedded in the motor phase windings and shall be arranged to prevent motor overload. Non-modulating actuators shall be rated for 60 starts(reversals) per hour.	***Sensors***
Actuators shall be fitted with 240 V ac anti-condensation heaters.	***Anti-Condensation***

C401.14 ELECTRICAL WORKS

COMPLIANCE WITH AUTHORITIES, STATUES, REGULATIONS AND STANDARDS

All electrical works shall be carried out in accordance with the requirements of:

a) AS/NZS 3000 and other relevant Australian Standards;

b) Power Supply Authority Service Rules and Regulations;

c) Other relevant Statutory Authorities;

d) Mackay Water & Waste Standard Specification for Electrical Assets

SCOPE OF WORK

The scope of electrical work shall include but shall not be limited to the following:

a) Negotiations with Power Supply Authority unless another power supply Authority is nominated in the project specification. The name and the phone number of the Power Supply Authority contact shall be as indicated in the project specification. The Contractor must fill all relevant application forms and pay all relevant fees.

b) Supply and installation of consumer mains;

c) Supply and installation of electrical switchboard;

d) Supply and installation of all instrumentation and field mounted control equipment;

e) Supply, installation and termination of all cabling;

f) Supply and installation of all telemetry equipment including aerial and aerial mast;

g) Supply and installation of all junction boxes, conduits, cable trays, cable ladders and fittings;

h) Supply and installation of a standby diesel generator set for backup power to ensure continuity of service, or provision of connection facilities for same, as required by Council at the development approval stage;

i) Carry out factory testing of the switchboard;

j) Carry out site testing and commissioning;

k) Provide “As Constructed” design documentation and also Operation and Maintenance Manuals;

l) Provision of Defects Liability Period;

m) Liaison with Council;

n) Any other work as required in the project specification.

INCOMING POWER SUPPLY

The Contractor must carry out all works as required by Power Supply Authority to provide 3 phase 415V, 50 Hz power supply to site;

The Contractor must upgrade or provide new metering facilities at each site as required by Power Supply Authority.

The Contractor must ensure the minimum power factor of 0.9 at each site. The prospective fault level of each electrical installation shall be as nominated by Power Supply Authority but in any case the minimum fault level shall be as follows:

- Not less than 15kA for 1 second for the Main Switchboards rated 100 Amp or less, and
- Not be less than 25kA for 1 second for the Main Switchboards rated over 100 Amp.

If VSD drives are used the level of total harmonics distortion (THD) at the point of common coupling (PCC) must be as required by Power Supply Authority;

The consumer mains with a cross section greater than 120 mm^2 shall consist of single core XLPE/PVC cables;

The current carrying capacity of the consumer mains shall suit the maximum demand plus 30% spare capacity;

The consumer mains shall be sized to ensure the voltage drop at the incoming terminals of the switchboard does not exceed 2.5% under maximum demand conditions plus 30% spare capacity;

Power supply metering must be provided as required by Power Supply Authority.

STANDBY DIESEL GENERATOR

Standby Diesel Generator

For the diesel generator details refer to Council Standard Specification for Electrical Assets.

Where provisions only are required for the standby diesel generator these provisions must be in a form of external weather and vandal proof socket inlet or a junction box rated for the full load of the relevant switchboard and as required in the Project Specification.

Sufficient space shall be allowed for the mobile diesel generator installation.

POWER SUPPLY CHANGE-OVER ARRANGEMENT

Power Supply Changeover Arrangement

Where a permanent diesel generator is required to be provided on site, the main switchboard shall be fitted with an automatic transfer switch (ATS) to facilitate an automatic transfer between the power grid and the generator supplies. For all other sites where only provisions for connection of mobile diesel generators are required the changeover switch shall be manual switch. For details of ATS refer to Council Standard Specification for Electrical Assets.

EARTHING

Earthing

The Contractor must provide M.E.N. earthing system at each site. The earthing system must comply with requirements of AS/NZS3000 and Power Supply

Authority Service Rules.

Each earthing rod must be a minimum 16 mm stainless steel copper clad rod with a minimum length of 3 metres. Each earthing cable must be provided with a PVC sleeve. Bare earthing conductors must not be used. All earthing cable connections to earthing rods must be by means of approved earthing clamps

The Contractor must provide an earth inspection pit at each rod. Each pit must be marked for easy identification.

LIGHTNING AND SURGE PROTECTION

Lightning Protection

The need for lightning protection shall be assessed for each site and shall comply with the requirements of AS1768.

Surge Protection

Suitable surge protection must be provided at each site to protect equipment against lightning strikes, motor starting and stopping or sudden loss or application of power supply. Surge protection devices must be provided as follows:

- Inside each Main SCA or Switchboard/Panel/Distribution Board across incoming power supply
- Across power supply to all instrumentation loops mounted outside in the field
- All signal lines run to and from outside. Instrument surge diverters must be provided on both ends of each loop.
- On all data and cable communication lines.

Minimum size surge protection earth cable must comprise stranded, 16 mm² or as recommended by the manufacturer, green/yellow PVC insulated cable installed such that it is segregated from all other cables.

For details of surge protective devices refer to Council Standard Specification for Electrical Assets.

STARTING OF PUMPS

Starting of Pumps

DOL starting of the pump motors shall be with Ergon Energy approval only. Otherwise, all motor starters must be either soft starter or VSD (Variable Speed Drive) as required by the process.

The maximum number of starts per hour shall be 12 starts.

Where electronic starters are used the disturbance to the electrical supply system shall not exceed limits set down in AS61000.3.6 and AS61000.3.7. Radio interference external to the electronic starters shall not exceed limits set down in AS/NZS CISPR 11:2004. A suitable R.F.I. filter shall be provided to ensure compliance with AS/NZS CISPR 11:2004.

The level of total harmonic distortions at the point of common coupling (PCC) must be limited to planning levels as set by Power Supply Authority. Appropriate harmonic filters shall be provided on each VSD unit to comply with Power Supply Authority requirements.

NOMINATED SUBCONTRACTORS

Nominated Subcontractors

Refer to Mackay Water & Waste Standard Specification for Electrical Assets for the details of nominated equipment suppliers and service providers.

APPENDIX A – TESTING, PRE-COMMISSIONING AND COMMISSIONING OF ELECTRICAL AND MECHANICAL EQUIPMENT

# TESTING **Definitions** Inspection is defined as inspections during the construction of equipment to be supplied. Inspections are to be carried out by the Contractor to ensure that the construction is in accordance with the specified and tendered requirements. Testing is defined as tests by the Contractor prior to demonstration. Testing includes both works testing, at the manufacturer's facilities and site testing. Inspection and Testing Program (ITP) is the Contract Program, which must include the times for inspection and testing, and lists all tests and test procedures.	**Definitions**
Works Testing Witnessed works testing is required for the flow measuring equipment, some of the mechanical equipment and electrical switchboards and control panels. The Council reserves the right not to witness the testing of any of this equipment. Forward certified test reports and test certificates to the Council. All the electrical switchboards and control panels must be tested in Australia. Provide type test certificates for all Main Switchboards. The switchboards must be type tested to AS3439.1 or AS1136 by any NATA accredited testing facility. Use a NATA accredited testing facility to carry out all flowmeters and other measuring instruments tests and calibration and provide test certificate for each item of instrumentation.	**Works Testing**
FACTORY INSPECTION AND TESTING OF SCA'S **Factory Inspections** Each SCA will be inspected by the Council or its representative during manufacture and prior to delivery. The following are specific milestones for witnessed inspection: • First Inspection - Metalwork finished • Second Inspection - Metalwork finished and painted • Third Inspection - All electrical equipment installed • Final Inspection. Inspections, other than the final inspection, are intended to maintain constructional standards and are not intended, unless otherwise arranged, as functional tests, therefore the manufacture of the SCAs must not cease during these inspections.	**Factory Inspections of SCA's**

The Contractor must notify the Council at least seven (7) working days before each inspection is required. Any work carried out by the Contractor beyond or in excess of the work necessary for the final inspection must be at the Contractor's risk. If any inspection is called for by the Contractor before work has reached a stage where the inspection is warranted, the cost of the premature inspection must be paid by the Contractor or deducted from the Contract sum. **Factory Testing** Testing as specified must be performed during the final inspection. All tests must comply with the requirements of AS3439.1 The Contractor in the presence of the Council must perform the following tests as a minimum for each SCA: • Visual inspection, equipment mounting and wiring termination checks; • Insulation tests before and after power (high pot) tests, including each phase to earth, each phase to neutral, between phases using a minimum of 1000 V megger; • Power tests (high pot) with ac voltage of 2.5 kV; • Operational test of all protective devices; • Simulated functional tests for all drives and electrical equipment in manual model and in automatic mode where applicable **Test Certificates** Following completion of all tests the Contractor must submit to the Council a full set of test certificates for each SCA.	**Factory Testing of SCA's**
FACTORY INSPECTION AND TESTING OF MECHANICAL EQUIPMENT **Factory Inspection** The following are specific milestones for witnessed inspection by the Contractor of specifically fabricated items: • First Inspection - Metalwork finished. • Second Inspection - Metalwork finished and painted. • Third Inspection - Fully assembled equipment. • Final Inspection. Inspections, other than the final inspection, are intended to maintain construction standards. The Contractor must supply a brief report on each inspection. **Factory Testing** Testing at the factory for materials and of major items of equipment supplied by the Contractor under this contract must be carried out on the following as a minimum: • Pumps with motor sizes greater than 11 kW must be works tested at the supplier's factory in accordance with AS2417.2 (Pumps Hydraulic Performance Acceptance Test); • All other mechanical equipment as nominated in the Tender	**Factory Inspections of Mechanical Equipment** **Factory Testing of Mechanical Equipment**

Document.

Test Certificates

Following completion of all tests the Contractor must submit to the Council a full set of test certificates for each item of mechanical equipment.

Test Certificates

TESTING OF VALVES

Testing of Butterfly valves

Butterfly valves shall be tested in accordance with the test procedures of the WS-SPEC SP 24, Appendix A.

Butterfly Valves

Testing of Knife Gate Valves

Knife Gate valves shall be tested in accordance with the test procedures of the WS-SPEC SP 23, Appendix A.

Knife Gate Valves

Testing of Air Valves

Air valves shall be tested in accordance with the test procedures of the WS-SPEC SP 27, Appendix A.

Air Valves

Testing of Gate, Reflux Valves

The Contractor shall carry out the following tests at his own cost in the works of the Valve Manufacturer before the valves are shipped.

Reflux Valves

Test No.1 — Body Test.

The valve shall be blanked off at both ends and a body test pressure of 1.5 times the valve rated pressure shall be applied for 5 minutes with the plug in the partially open position. No leakage shall be visible.

Test No.2a — Plug or Gate Test

The valve shall be blanked off at the upstream flange only, and a test pressure of 1.5 times the valve rated pressure shall be applied for 5 minutes with the valve in the closed position. There shall be no visual evidence of structural damage to the plug or of leakage through the plug itself.

Test No.2b

While the valve is set up in this position a test pressure equal to the working pressure specified shall be applied and the valve shall be partially opened to prove that the rim force required on the hand wheel does not exceed 180N.

Test No.3 — Seat Test

The valve shall be blanked off at the downstream flange and a test pressure equal to the valve rated pressure shall be applied for 5 minutes with the valve in the closed position. No leakage past the valve seat shall be observed when the test is made. All tests shall simulate a valve in a terminal position held rigidly at one end only. In this condition, the valve shall be blanked off in such a manner that the axial hydraulic force is not externally restrained. This simulates a valve in a fully differential pressure

situation held rigidly at one end only.	
SITE TESTING ***General*** 1. When the Works are substantially completed and the equipment is in a condition to be tested, site testing may begin. 2. Arrange inspections with the relevant statutory authorities having jurisdiction over the works to ensure that all equipment has been installed and functions in compliance with their requirements. 3. Submit to the Council a program for testing two (2) weeks prior to the commencement of any site testing. The program must clearly indicate the dates proposed to conduct each phase of site testing. The Council may alter the proposed dates or specify any additional tests not included in the program to be carried out. 4. All testing equipment, labour and necessary facilities for all tests must be supplied by the Contractor. 5. All plant maintenance and clean-up must be undertaken by the Contractor. 6. Have representatives present on site during all site tests and have available the necessary labour and equipment to carry out all repairs and modifications that may be required during the site testing period. Site testing of all equipment must be supervised by the Contractor and representatives of the relevant sub-contractors. 7. Site testing must be conducted in three distinct phases, as follows:- (a) A static and dimensional inspection to establish that all items of equipment are complete and the equipment is ready for no-load operation; (b) No-load operation to demonstrate that all equipment functions successfully, both separately and as components of integrated systems; (c) Design load/acceptance operation to demonstrate that all equipment can successfully and reliably operate under working conditions. 8. Notify the Council in writing of successful completion of phase 1 of testing, giving at least 48 hours notice before commencing phase 2. The Council will arrange for the Council's representatives to be present on site during phase 2 and 3 to witness their successful completion. 9. Prior to commencement of the design load/acceptance operation (phase 3), ensure that the system is functioning correctly, with no known deficiencies or faults that could impair the load testing. 10. If it is not possible to activate any electrical protective equipment or device, use a simulate test. 11. Site testing must include, but not be limited to the following**:-** (a) Performance tests of the mechanical and electrical equipment (b) Adjustments and setting of all field control and safety devices (c) Noise level measurements (d) Electrical and control tests as detailed below (e) Functional check of all control and instrument loops and logic testing	**Site Testing**

of circuitry and programs (f) Verification of calibration of all flowmeters (g) Setting and calibration of all other instrumentation (h) MEN Earthing: Conformation of effective earthing of exposed metal of electrical equipment. In addition, perform all other checks and tests that may be required by the Australian Standards and Power Supply Authority. ***Electrical and Control Tests*** 1. The Contractor must be responsible for site testing of the completed electrical installation at each pump station. 2. The following works must be carried out as a minimum: **Calibration** All process instrument loops. **General** Circuit continuity, point to point checks, termination checks and component installation checks. **All SCAs and Panels** (a) Check all terminations installed under this contract for tightness (b) Check earthing cables and connections (c) Check insulation resistance at 1000V between phases and to earth of busbars, with all isolators closed after ensuring disconnection of all electronic devices. (d) Check mechanical operation of all switch devices and interlocks **Control and Operation including SCADA** (a) Point to point testing of all I/Os (b) Functional operation of all equipment as specified. (c) Operation of all hardware and software as required. **0.6/ 1 kV Cables** (a) Point-to-point checks (b) Bell all cores (c) Check insulation resistance of 0.6/1 kV cables with 1000 V megger (phase-to-phase, phase-to-neutral, phase-to-earth) (d) Check earth or shield continuity, where applicable (e) Test insulation resistance of all control cores in a cable, as a group, to earth (f) Check for correct identification of cable markers (g) Check for compliance with AS 3008.1 where cables have been	**Electrical and Control Tests**

derated

(h) The Contractor must be responsible for ensuring that megger testing does not damage any electronic equipment.

Motors

(a) Manual turning of the rotor to ensure mechanical freedom

(b) Insulation resistance at 1000V between phases and each phase to earth

(c) Continuity of earth connections, and check on phase and earth connections in terminal boxes

(d) Continuity of all hard-wired control and monitoring circuits associated with respective motors

(e) Functional check of all control circuits and devices to ensure correct operation before motors are energised

(f) Local start/stop operation and/or control station operation to check direction of rotation

(g) Check motor for run and direction

(h) Record no-load currents.

Uninterruptible Power Supply

(a) Operational tests on all items of equipment including simulation of all alarms to prove correct operation.

(b) Simulation of supply failure, charger failure, inverter failure, battery failure and static switch failure to prove that the output remains within specified requirements at all times under any condition.

(c) Voltage levels of each cell must be measured during charging and under float conditions to prove that all cells voltages are within allowable limits.

(d) A full load test must be conducted on the complete UPS system to prove that the unit can deliver full rated output for the specified time with battery end voltage not lower than the specified minimum.

Earthing

(a) This Contractor must demonstrate that the continuity of the earthing system is in compliance with the requirements of AS 3000 and the relevant standards and that all specific installation requirements have been adhered to.

(b) The Contractor must:

(i) Check the earthing resistance for each section of the earth after isolating sections of the earth from the relevant test points.

(ii) Test all earthing conductors for continuity after installation.

(iii) Check all earth connections for correct termination.

(iv) Provide an earthing report showing:

- Resistance to earth of each earth electrode.
- Resistance to earth of each installation when all bonds are

connected.

Lightning Protection System

All sites tests as required in AS 1768.

Light and General Power

The Contractor must test and demonstrate the operation of the complete lighting and general power installation for compliance with the drawings and must:

(a) Test all light fittings and record lux levels throughout the plant.

(b) Test the operation of the switching circuits and the Emergency Lighting Installation

(c) Test all power outlets and confirm phase rotation and circuit connections as applicable

(d) Test all RCDs and earth leakage devices.

Field Mounted Equipment

(a) The Contractor must perform component integrity and terminations check.

(b) Any defects associated with the supplied equipment and incorrect installation instructions disclosed during testing must be rectified by the Contractor, and fresh tests must be carried out if required. The Contractor must meet all the costs of remedial work and tests.

(c) The Contractor must provide all testing and calibration equipment and instruments as necessary.

(d) Test results must be recorded and submitted as test certificates.

PRE-COMMISSIONING

GENERAL

The Contractor shall test and/or inspect all materials, equipment, installation and workmanship to prove compliance with the Specification requirements. The submission to the Council of satisfactory test results constitutes a HOLD POINT. The approval of the Council is required prior to the release of the hold point. Tests and inspections shall comply with relevant Australian Standards.

Testing shall include pre-commissioning, field testing and performance testing of each part of the whole installation.

Precommissioning General

PRE-COMMISSIONING

Pre-commissioning is the preparation of plant or equipment so that it is in a safe and proper condition and ready for commissioning and operation. It includes all aspects of plant operation such as safety, electrical, mechanical and instrumentation.

The Contractor shall conduct pre-commissioning in a logical sequence in accordance with the programme prepared by the Contractor and approved by the Council.

The Contractor shall prepare pre-commissioning record sheets for each item of equipment to ensure results of tests are satisfactorily recorded and that all necessary checks or tests have been performed.

Specific requirements for pre-commissioning shall include, but are not limited to:

(a) Initial charges of lubricant in addition to any special lubricant requirements for initial flushing or treatment of the system or for "running in".

(b) Physical checks and tests such as completeness of assembly, rotational tests (including checking that the rotation of electrical motors is in the correct direction), alignment checks, balancing and vibration checks, temperature, pressure and flow measurements, clearances, belt alignment and tension, etc, depending on the type of equipment.

(c) Electrical and instrument installation tests, including motor insulation tests and checking instruments against certified instruments and correcting as necessary.

(d) Tests of the correct functioning of automatic and manual control and protection equipment, including simulating danger conditions, mal-operations or failures, to check that all instruments and controls function correctly. These tests shall also include adjusting instrument set points and alarm settings and proving correct operation of alarms.

(e) Equipment and system operating tests. The Contractor shall certify

Precommissioning

compliance of each item and submit a signed copy to the Council prior to commissioning. The Contractor shall carry out pre-commissioning tests to the satisfaction of the Council's Representative and shall record the results of the tests on the appropriate Pre-commissioning Record Sheet. The Contractor shall furnish the Council with one signed copy of each completed Pre-commissioning Record Sheet countersigned by the Council's Representative who witnessed the test.	

PRE-COMMISSIONING CHECKSHEETS

Date of Commissioning	Job Name:	
	Job Number:	
Commissioning Checksheet Document No:	ITP Reference:	
Description :	Category :	

Mechanical Pre-Commissioning Checksheet			
DESCRIPTION:	**CIRCLE**	**CHECKED SIGN / DATE**	**COMMENTS**
Check the installation of pumpset & its associated instrument, equipment and fittings. Does it comply with Council specifications e.g. Layouts, P&IDs ?	Y/N/NA		
Is equipment safety adequate? (guards for all rotating parts, ladders, platforms, handrails, kick plates, safety showers etc)	Y/N/NA		
Check all holding down bolts are fastened and tight	Y/N/NA		
Visually check alignment of connections of drive systems	Y/N/NA		
Is the oil / grease level adequate?	Y/N/NA		
Checking correct selection of construction material	Y/N/NA		
Check site corrosion protection and that painting is adequate.	Y/N/NA		
Can pump be lifted clear without interference or obstruction?	Y/N/NA		
Check that equipment labels and tag numbers are correct.	Y/N/NA		
Check that safety signs comply with Regulations.	Y/N/NA		
Confirm that vendor Factory Testing Certificates or Type Test Certificates and pump curves have been obtained (attach copy of pump curve)?	Y/N/NA		
Check motor shims such that vibration during operation will not cause movement or dislodge them?	Y/N/NA		
Confirm Motor frame and Terminal Boxes have been properly grounded?	Y/N/NA		
All valves operate from the closed to fully open position	Y/N/NA		
All valves seal when closed	Y/N/NA		
All valves are anti-clockwise close, easy to operate and have no sharp protrusions on hand wheels	Y/N/NA		
All fasteners and mountings are tightened correctly	Y/N/NA		
Pressure gauge cocks provided on the pump side of each reflux valve	Y/N/NA		
General Comments			

COUNCIL'S COMMISSSIONING REPRESENTATIVE	**SIGNED:**	**DATE:**
CONTRACTOR'S REPRESENTATIVE	**SIGNED:**	**DATE:**
DEVELOPER'S REPRESENTATIVE:	**SIGNED:**	**DATE:**

Date of Commissioning		Job Name:	
		Job Number:	
Commissioning Checksheet Document No:		ITP Reference:	
Description :		Category :	

Electrical Pre-commissioning Checksheet

DESCRIPTION:	CIRCLE	CHECKED (SIGN / DATE)	COMMENTS
Electric supply has been connected and energised	Y/N/NA		
Earth Electrode installed in specified connection box	Y/N/NA		
Earth pit, main earth electrode and water service bond installed	Y/N/NA		
Meter panel(s) are equipped and wired to Supply Authority requirements	Y/N/NA		
Shielded cable used on VSD starters	Y/N/NA		
Motor wiring and earth conductor is enclosed together in a continuous metallic sheath or conduit which has a good contact to both the motor and the invester chassis on VSD starters	Y/N/NA		
Cable supports for the pump cables are correctly located and properly fixed	Y/N/NA		
Appropriate lugs fitted to all cables, and cables correctly identified terminations	Y/N/NA		
Motor terminations are in accordance with the connection diagram	Y/N/NA		
All power cable terminations tested for tightness	Y/N/NA		
All equipment checked against equipment schedules and marked up schedules adjusted as required	Y/N/NA		
All wiring holes are bushed	Y/N/NA		
Where parallel cables may be installed on site, provision has been made to ensure only one cable lug needs to be installed on each side of terminal lug	Y/N/NA		
Labels identifying all neutral connections located adjacent to neutral link	Y/N/NA		
All unit isolating switches are labelled	Y/N/NA		
Rating of all fuse elements is marked by label adjacent to the respective fuse	Y/N/NA		
All labels fixed to insulating panels and enclosures are fixed with insulated bolts, nuts and fixings	Y/N/NA		
Station identification labels mounted at top of each outer door on outdoor pump station SCA's	Y/N/NA		
SCA rating plate complying with AS3439.1 has been fixed to indoor type SCA and all detail have been confirmed	Y/N/NA		
SCA tested for dielectric strength as specified	Y/N/NA		
All power cables in each soft starter tested with ohmmeter for continuity. No cross-overs exist between starter, bypass contactor and thermal overload	Y/N/NA		
All control wiring terminated with crimp lugs or crimp ferrules	Y/N/NA		
Confirm sufficient terminals installed to allow an individual terminal for every incoming field wire	Y/N/NA		
Ratings for all motor starter equipment and ammeters	Y/N/NA		

checked against specification and information from pump/fan drive motor supplier			
Pump detail and rating plate installed and all pump details engraved on the plate have been confirmed against pump manufacturers info	Y/N/NA		
Correct orientation and fixing of the switchboard.	Y/N/NA		
Switchboard plinth and all gland plates sealed	Y/N/NA		
All cables properly glanded at the switchboard	Y/N/NA		
Dust seals fitted to all outer door openings and fixed securely	Y/N/NA		
All locking bars on multi point lock systems are fixed securely into lock mechanism	Y/N/NA		
All rubbish, sand and dirt removed from cable trench	Y/N/NA		

General Comments

COUNCIL'S COMMISSSIONING REPRESENTATIVE	**SIGNED:**	**DATE:**
CONTRACTOR'S REPRESENTATIVE	**SIGNED:**	**DATE:**
DEVELOPER'S REPRESENTATIVE:	**SIGNED:**	**DATE:**

Date of Commissioning	Job Name:	
	Job Number:	
Commissioning Checksheet Document No:	ITP Reference:	
Description:	Category :	

Control Pre-commissioning Checksheet			
DESCRIPTION:	**CIRCLE**	**CHECKED SIGN / DATE**	**COMMENTS**
Inspect telemetry and radio supply cable connections for correct polarity	Y/N/NA		
Check correct rating of protective devices for radio and telemetry	Y/N/NA		
Check for mains voltage rated insulation on data cables where mixed with mains voltable cables	Y/N/NA		
Measure telemetry supply voltage and back up battery voltage	Y/N/NA		
Check correct positioning of telemetry unit in relation to other PLC cards	Y/N/NA		
Check hardware configuration of telemetry unit	Y/N/NA		
Check software configuration of telemetry unit	Y/N/NA		
Check address switch (es) of telemetry unit for correct addressing.	Y/N/NA		
Visual check of antenna installation, clearance from surroundings and Mountings secure	Y/N/NA		
Check antenna magnetic bearing and polarisation (as specified on licence)	Y/N/NA		
Check antenna mounted with weep hole to bottom	Y/N/NA		
Check for secure earth on radio coax surge protection (if applicable) and Coax continuity	Y/N/NA		
Check telemetry transmit level to network device .Set as required by network device	Y/N/NA		
Check telemetry receive level from network device, and set as required by the network device (or if not adjustable, ensure level is below telemetry threshold level)	Y/N/NA		
Monitor radio audio clarity and set audio control off or to min. volume	Y/N/NA		
Monitor telemetry messages for error	Y/N/NA		
Enable RTU and check telemetry unit is configured correctly	Y/N/NA		
Check for correct labelling of telemetry, radio equipment and associated protective devices	Y/N/NA		
Check that correct locks are fitted to telemetry cubicle.	Y/N/NA		
General Comments			

COUNCIL'S COMMISSSIONING REPRESENTATIVE	**SIGNED:**	**DATE:**
CONTRACTOR'S REPRESENTATIVE	**SIGNED:**	**DATE:**
DEVELOPER'S REPRESENTATIVE:	**SIGNED:**	**DATE:**

COMMISSIONING

Commissioning

General

After successful completion of testing and pre-commissioning the commissioning stage must be carried out.

During commissioning stage the completed pump station will be operated automatically and manually.

The following must be proved during each pump station trials:

1. Each fixed speed pump operates at flow and head required under all operating conditions to achieve the performance requirements;
2. Each variable speed pump operates at flow and head required under all operating conditions over the entire range of operating speeds to achieve the Performance Requirements; and
3. The power consumption at each pump station does not exceed the guaranteed power consumption.

Commissioning is not complete until the pump station has been run continually without any faults for a minimum of fifteen (15) days in accordance with required control and operation procedures. If during this period any mechanical or electrical equipment does not operate as specified then the commissioning must be repeated after rectification of defects. All rectification works and the cost of additional commissioning will be to the Contractor's expense.

Manufacturers Compliance Certificates

Manufacturer's compliance certificates for supply of pipes, valves, pumps, flow meters and electrical equipment shall be provided to the Council's Commissioning Representative.

COMMISSIONING CHECKSHEETS

Date of Commissioning			Job Name:		
			Job Number:		
Commissioning Checksheet Document No:			ITP Reference:		
Description :			Category :	**Pumps**	
General Information					
Equipment Tag No.:			Serial No.:		
Equipment Location:			Weight:		Kg
Hazardous Area Rating:			Design Flow:		M3/hr
Manufacturer:			Design Head:		M
Pump Type:			Liquid Description:		
Rated Motor Power:		kW	Paint Specification:		
Pump Speed:		rpm	Casing Material:		
Pump Motor Data					
Motor Manufacturer:			Motor Speed:		rpm
Model Number:			Speed if Fixed:		rpm
Serial No.:			Max Speed (VSD):		rpm
Full Load Current:		Amps	Min Speed (VSD):		rpm
Rated Volts:		V	Gearbox:		
Motor Weight:		kg	Ratio of gearing:		
IP rating:			Gearbox Weight:	-	Kg

General Comments:

Wet-Commissioning Checksheet

Description:	**Circle**	**Checked By Sign / Date**	**Comments**
Have all pre-commissioning checks been signed of as per ITP.	Y/N/NA		
Have electrical pre-commissioning Checksheets been completed or sign off	Y/N/NA		
Has manufacturer pre-commissioning. Checksheets been completed or sign off	Y/N/NA		
Check that adjustments and setting of no-flow, torque limit switches and thermal overload relays have been set.	Y/N/NA		

Test any associated field devices. Eg isolating switches and safety devices.	Y/N/NA		
Test pump for Field start / stop and emergency stop control.	Y/N/NA		
Uncouple motor and check direction of motor by jump-start. Is direction of rotation of pump correct?	Y/N/NA		
Test pump for Remote Manual start / stop control?	Y/N/NA		
Test pump for SCADA start / stop control?	Y/N/NA		
Check that the equipment Input / Output signals are consistent with the control system Feedback signals?	Y/N/NA		
Has Motor Been Re-coupled from direction test?	Y/N/NA		
Have all dry-commissioning checks been signed of as per ITP?	Y/N/NA		
Is there any leakage in the system?	Y/N/NA		
Do up stream and down stream pressure gauges read the same?	Y/N/NA		
General Comments:			
COUNCIL'S COMMISSSIONING REPRESENTATIVE	**SIGNED:**	**DATE:**	
CONTRACTOR'S REPRESENTATIVE	**SIGNED:**	**DATE:**	
DEVELOPER'S REPRESENTATIVE:	**SIGNED:**	**DATE:**	

Commissioning and Performance Testing			
Description:	**Circle**	**Checked By (sign and Date)**	**Comments**
Have all wet-commissioning checks been signed of as per ITP?	Y/N/NA		
Is there any leakage in the system?	Y/N/NA		
Complete attached Performance Test sheet as per commissioning procedure.	Y/N/NA		
Does equipment fulfil its designed function under Wet-commissioning? (Delivers design flow rates, current draw etc.)	Y/N/NA		
Is equipment deemed ready for Process Commissioning / demonstration? (eg can be operated under Remote Manual control for a process cycle without tripping alarms)	Y/N/NA		
General Comments:			

COUNCIL'S COMMISSSIONING REPRESENTATIVE	**Signed:**	**Date:**
CONTRACTOR'S REPRESENTATIVE	**Signed:**	**Date:**
DEVELOPER'S REPRESENTATIVE:	**Signed:**	**Date:**

Pumps / NRV Performance Test					P&ID No.: Location: Date :						Job Name: Job No: ITP No:		
Description	Current	Rated Motor Current	Current-draw acceptance ((1)-(2))/(2)<10%	Pressure test results							*Flow rate*		Vibration visual observation and instrument reading. Nor./abnor.
				Pressure In main before test (Pumps off)	Pump Running Pressure at	Pump Running Pressure at	Pump Running Pressure at	Pressure Drop across Pump ((6)-(5))	Pressure Drop across NRV ((7)-(6))	Duration of Test	Design (Units)	Measured (Units)	
	Amp.	Amp.	Y/N	M	M	m	m	M	M	S	L/sec	L/sec	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Pump No. (Tag. No.):													
Test 1													
Test 2													
Test 3													
Comments:													

Notes:
1 Pump curves or works tests results should be available before site test
2 Site test is not intended to reproduce pump curve, rather check if the pump can deliver adequate head under certain range of flow specified in designed by means of pump curve

Tested by: (Council's Commissioning Representative) Signed: Dated:	Witnessed by: (Contractors Representative) Signed: Dated:	Approved by: (Developers Representative) Signed: Dated:

APPENDIX B - OPERATION AND MAINTENANCE MANUALS

Manuals shall contain the following information: (a) Contractor's name, address and telephone number. (b) Client's Contract number, job name. (c) Pump station general arrangement drawing showing pumps, motors, valves, pipework, switchboard and electrical installation.	**General**
Manuals for pumps shall contain the following information: (a) Manufacture. (b) Type and model number (c) Serial number. (d) Dimensioned general arrangement drawing of pump and motor. (e) Sectional arrangement drawing with parts and list. (f) Dimensioned sectional arrangements detailing: (i) Maximum and minimum shaft/bearing clearance (radial) (ii) Maximum and minimum impeller/bowl clearance (radial) (iii) Maximum and minimum impeller/bowl clearance (axial) (iv) Impeller/bowl wear rings. (v) Motor/pump coupling - type, make and model number. (vi) Mechanical seals where applicable.	**Pumps**
Manual for motors shall contain the following information: (a) Manufacture. (b) Type and model number. (c) Serial number. (d) Dimensioned general arrangement drawing. (e) Sectional arrangement drawing for submersible motor power cabling where applicable. (f) Gland sealing arrangement drawing for submersible motor power cabling where applicable. (g) Cables where applicable. (h) Terminal block arrangement drawing where applicable. Manuals for valves shall contain a dimensioned sectional arrangement drawing with parts and material list for all valves.	**Motors**
Manuals shall contain the following test curves:- (a) Pump witnessed test curves. (b) Motor test curves. (c) Motor torque/speed/efficiency characteristic curves.	**Test Curves**

The operating and maintenance manual shall include: (a) Safe working procedures: For switching and isolating the supply and distribution system; (b) Description of Operation; (c) Maintenance procedures: Recommended maintenance periods and procedures; (d) Tools: Particulars of maintenance equipment and tools provided, with instructions for their use. (e) Equipment: A technical description of the equipment supplied, with diagrams and illustrations where appropriate; (f) Dismantling: Where necessary, procedures for dismantling and reassembling equipment; (g) Spare parts: A list of the spare parts provided. Trouble shooting instructions shall be included for pumps, motors, valves and SCA. Step by step procedures for dismantling and reassembly of pumps, motors and Valves using any special tools shall be detailed together with step by step procedures for replacement of wearing parts such as bearing, seals, wear rings, etc.	**Other**