MACKAY CITY COUNCIL

DEVELOPMENT DESIGN GUIDELINE

SEWERAGE SYSTEM DESIGN

Planning Scheme Policy No. 15.14

DATE POLICY TOOK EFFECT:
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DEVELOPMENT DESIGN GUIDELINE
SEWERAGE PSP 15.14

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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
ERS	Emergency Relief Structure
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
SS	Stainless Steel
WSAA	Water Services Association of Australia
WS-SPEC	Water Services Specification
WWSS	Wastewater Swirl Separator

ENGINEERING DESIGN GUIDELINE SEWERAGE SYSTEM DESIGN (D12)

1 SCOPE

Scope

This Guideline sets out the requirements to be used in the design of sewerage system infrastructure within Mackay City to met the required service standards, design life, environmental requirements and adherence to Council's preferred plant and equipment needs.

This Guideline includes the design of a sewerage system as either a stand-alone project or part of a development and its integration into the existing sewerage system.

The design shall be undertaken under Council's Asset Creation process (as outlined in this Guideline) and shall comply in all respects with relevant Legislation, Codes of Practice, Australian Standards and with Council's local laws, policies and Guidelines.

The Designer shall ensure that all assets to be procured in the Asset Creation process shall comply in all respects with the requirements of and/or intent of this Guideline and referenced documentation.

This Guideline contains procedures for the design of the following elements of a sewerage system:

(a) Gravity sewers, including trunk mains and reticulation sewers,
(b) Junctions and property connections.
(c) Maintenance holes and other structures.
(d) Rising mains.
(e) Pump stations, including odour control facilities, emergency storage, emergency backup power, monitored emergency relief structure and other ancillary facilities to effect a fully operational pump station.

This Guideline does not cover the design of alternative sewerage systems such as low pressure sewerage, vacuum sewerage and common effluent pumping. These systems are subject to separate Council review and approval.

2 STRUCTURE

Structure

This Guideline, is based on the national Sewerage Code of Australia (WSA-02) and the Sewage Pumping Station Code of Australia (WSA-04) and is complimented by the strategic product specifications and technical requirements contained within WS-SPEC.

In doing so, this Guideline is structured as follows;

- 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 City Council Area of jurisdiction.
- To specify parameters, requirements and functions contained within the Codes that Council is to nominate or to amend.
- 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).
- To specify any technical requirements not covered by the Codes.
- To identify materials, solutions and methods permitted by the Codes that are not acceptable to Council.

To specify preferred options where the Codes provide for several methods to deal with a particular issue.
WSA-02 & WSA-04 are 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.

3 CONSULTATION

Consultation

The Designer is required to prepare one concept Sewerage Master Plan of the proposed development and indicate how the proposed gravity pipeline collection system for the proposed development will transport fresh sewage, or effluent, and how it relates to the current/proposed road layout, existing utility services, streetscape and sewerage network system. These services and infrastructure are to be plotted onto the plan and cross-sectional views.

The Designer is encouraged to consult with the relevant Authorities prior to, and during, the preparation of a design concept to ascertain service plans and specific requirements of the relevant Authority as they relate to the proposed gravity pipeline (and possible sewerage pump station and rising main) and installation.

The Designer is strongly encouraged to discuss the Master Plan during initial consultation with Council (Mackay Water) officers to ensure planning and the Designer considers know constraints prior to the lodgement of any Operational Works application. The plan may also be required to be prepared and consultation held with Council officers prior to lodgement of a MCU or RoL Development Application. As a minimum, the following aspects of the proposed development should be included on the plan;

- Legend
- All allotments
- Boundary of the subdivision
- North Point
- Location and size of existing sewers
- Invert levels of existing lines
- Location of other services which cross sewer lines
- Location of manholes with manhole numbers (including dimensions where not shown on alignment)
- Identification of allotments, which are currently sewered
- Finished surface contours sufficient to enable verification of house connection design
- Grading information for new sewer lines including distance between manholes, pipe grades, pipe diameter, pipe material and class of each pipe length

- Manhole inlet types
- Locations of sewer house connections
- Details of pumping stations including location, inlet/outlet levels, overflow, cut-off levels, electrical switchboard layout and water supply, size of pumping plant
- Diameter, material class and route of pressure main(s); including air valve and scour valve locations
- Clear identification of any alterations / connections to existing sewers

4 ENVIRONMENTAL RISK ASSESSMENT

Environmental Risk Assessment

The Designer shall ensure that the design of infrastructure shall be planned and executed to minimise risk to 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.

5 CONNECTIONS TO COUNCIL'S INFRASTRUCTURE

Connections to Existing Infrastructure

The connection of new sewerage infrastructure to Council's existing system forms part of the infrastructure realisation to be carried out at the Developer's expense. Generally, the Contractor shall carry out the connection unless:

(a) prior approval is given by Council, in exceptional circumstances, decides to carry out the connection work. Such circumstances may include connection to trunk mains, complex systems and connection in areas with operational difficulties.

(b) The Developer requests that Council makes the connection on the understanding that the connection work will be carried out at Council's convenience subject to its other work commitments.

(c) Council's representative believes that the Contractor is not competent to make the connection or that the Contractor is not adhering to safe working practices.

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 Consulting Engineer 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. The Contractor's are not permitted to operate Council's infrastructure unless written approval has been obtained from–Council. The placement and removal of plugs within live sewers must be done under direct monitoring of Council's representative. Council reserves the right, on advice of its 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. Property connection requirements shall be met by providing a connection point to each property in accordance with Clause 5 of WSA-02 as amended herein.	

6 DEFINITIONS

Definitions

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

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

Council means Mackay City Council and the Mackay Water business unit.

Designer means an experienced Professional Engineer who is certified as a Registered Professional Engineer Queensland (RPEQ) and is competent to perform the engineering works required for the Asset Creation process.

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 sewerage infrastructure.

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 Realisation of Infrastructure on behalf of the Developer.

Sewer Reticulation means pipework less than DN375 and for which 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

Trunk Mains means pipework equal to or greater than DN 375, and for which no connections are permissible.

The Code means the Sewerage Code of Australia (WSA-02) and the Pumping Station Code of Australia (WSA-04), both published by the Water Supply Association of Australia (WSAA).

WS-SPEC means the national standard water industry specifications.

7 ORDER OF PRECEDENCE

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 Guideline
(b) Mackay City Council Standard Policies Specifications and Drawings
(c) Sewerage Code of Australia (WSA-02) and the Sewage Pumping Station Code of Australia (WSA-04) (equal)

8 REFERENCE DOCUMENTS

Reference Documents

Documents referenced in this Guideline are listed below. The Designer shall possess, or have access to; the latest edition of all documents required to enable compliance with this Guideline. The Designer shall include all relevant specifications and requirements of these documents into the design of the works.

a) Council Construction Specifications

Development Construction Specification - Sewerage (C402)

Council Planning Scheme Policies

b) Council Policy Documents

Council Policy - MW16 Clearance to Water and Sewerage Assets
Council Policy - MW02 Building Over or Adjacent to Sewers
Council Policy – MW Headworks
Council Policy – D20 Drawings and Documentation Guidelines

Council Policies

c) WSAA Codes of Practice,

WSA-02 – Sewerage Code of Australia
WSA-04 Sewage Pumping Station Code of Australia

WSAA Codes of Practice

d) WS-SPEC Water Services Specification,

WS-SPEC

e) Australian Standards

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

Australian Standards

The Designer shall use the latest edition of all relevant Australian Standards, including all current amendments, supplements and replacements applicable thereto.

Australian Standards are listed within WSA-02 & WSA-04

(f) Council Standard Specifications

Council Standard Specifications

Council Standard Specification for Electrical Assets

g) Other Documents

Other Documents

Water Resources Guidelines for the Planning and Design of Sewerage Systems". Department of Natural Resources TB No.: xx/1997

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 sewerage pipes).

WSA-02

h) WSAA WSA-02 Drawings (as amended by Council)			*Drawings*
SEW 1100	Design Layouts	A3-04196B	
SEW 1101	Design Layouts	A3-04197B	
SEW 1102	Design Layouts	A3-04198B	
SEW 1103	Pipelaying Typical Arrangements	A3-04199B	
SEW 1104	Pipe Connection Details	A3-04200B	
SEW 1105	Pipe Connection Details	A3-04201B	
SEW 1106	Pipe Connection Details	A3-04202B	
SEW 1107	Pipe Connection Details	A3-04203B	
SEW 1108	Pipe Connection Details	A3-04204B	
SEW 1109	Pipe Connection Details	A3-04205B	
SEW 1200	Soil Classification Guidelines	A3-04206B	
SEW 1201	Embedment & Trenchfill	A3-04207B	
SEW 1202	Standard Embedment	A3-04208B	
SEW 1203	Special Embedments	A3-04209B	
SEW 1204	Special Embedments	A3-04210B	
SEW 1205	Special Embedments	A3-04211B	
SEW 1206	Trench Drainage	A3-04212B	
SEW 1207	Trench Drainage	A3-04213B	
SEW 1208	Verticals	A3-04214B	
SEW 1300	Maintenance Holes	A3-04215B	
SEW 1301	Maintenance Holes	A3-04216B	
SEW 1302	Maintenance Holes	A3-04217B	
SEW 1303	Maintenance Holes	A3-04218B	
SEW 1304	Maintenance Holes	A3-04219B	
SEW 1305	Maintenance Holes	A3-04220B	
SEW 1306	Maintenance Holes	A3-04221B	
SEW 1307	Maintenance Holes	A3-04222B	
SEW 1308	Maintenance Holes	A30-4223B	
SEW 1309	Maintenance Holes	A3-04224B	
SEW 1310	Maintenance Holes	A3-04225B	
SEW 1311	Maintenance Holes	A3-04226B	
SEW 1312	Maintenance Holes	A3-04227B	
SEW 1313	Maintenance Holes	A3-04228B	
SEW 1314	Maintenance Shafts	A3-04229B	
SEW 1315	Maintenance Shafts	A3-04230B	
SEW 1316	Maintenance Shafts	A3-04231B	
SEW 1317	Maintenance Shafts	A3-04232B	
SEW 1400	Buried Crossings	A3-04233B	
SEW 1401	Buried Crossings	A3-04234B	
SEW 1402	Buried Crossings	A3-04235B	
SEW 1403	Buried Crossings	A3-04236B	
SEW 1404	Aerial Crossings	A3-04237B	
SEW 1405	Aerial Crossings	A3-04238B	
SEW 1406	Aerial Crossings	A3-04239B	
SEW 1407	Ventilation Systems	A3-04240B	
SEW 1408	Ventilation Systems	A3-04241B	
SEW 1409	Water Seal Arrangements	A3-04242B	
SEW 1410	Water Seal Arrangements	A3-04243B	
SEW 1411	Water Seal Arrangements	A3-04244B	
SEW 1412	Emergency Relief Structures	A3-04245B	
SEW 1500	Repair Systems	A3-04246B	
SEW 1501	Repair Systems	A3-04247B	
SEW 1502	Repair Systems	A3-04248	
SPS 1100	Concept Plan	A3-04134B	
SPS 1101	Pumping Station Concept Design	A3-04135B	
SPS 1102	Pumping Station Concept Design	A3-04136B	
SPS 1103	Pumping Station Concept Design	A3-04137B	

SPS 1104	Pressure Main Concept Design	A3-04138B	
SPS 1200	Typical Site Plan Sydney Water	A3-04139B	
SPS 1201	Typical Site Plan SA Water	A3-04140B	
SPS 1202	Typical Site Plan SA Water	A3-04141B	
SPS 1203	Typical Site Plan Brisbane Water	A3-04142B	
SPS 1204	Typical Site Plan Water Corporation	A3-04143B	
SPS 1205	Access Roadway	A3-04144B	
SPS 1300	General Arrangement	A3-04145B	
SPS 1301	Detailed Arrangement	A3-04146B	
SPS 1302	Civil Plan	A3-04147B	
SPS 1303	Wet well Construction	A3-04148B	
SPS 1304	Wet Well Construction	A3-04149B	
SPS 1305	Electrical & Telemetry	A3-04150B	
SPS 1306	Valve Chamber adjacent to Wet Well	A3-04151B	
SPS 1307	Valve Chamber adjacent to Wet Well	A3-04152B	
SPS 1308	Water Supply	A3-04153B	
SPS 1309	Mobile Pump Connection Arrangement	A3-04154B	
SPS 1310	Mobile Pump Connection Arrangement	A3-04155B	
SPS 1400	Grit Collection MH	A3-04156B	
SPS 1401	Grit Collection MH	A3-04157B	
SPS 1402	Emergency Storage	A3-04158B	
SPS 1403	Emergency Storage Details	A3-04159B	
SPS 1404	Emergency Relief System	A3-04160B	
SPS 1405	Discharge MH	A3-04161B	
SPS 1500	Pump to Pressure Main Connection	A3-04162B	
SPS 1501	Pump to Pressure Main Connection	A3-04163B	
SPS 1502	Pump to Pressure Main Connection	A3-04164B	
SPS 1503	Pump to Pressure Main Connection	A3-04165B	
SPS 1504	Pump to Pressure Main Connection	A3-04166B	
SPS 1505	Hydraulic Level Sensor	A3-04167B	
SPS 1506	External Hinged Covers	A3-04168B	
SPS 1507	External Hinged Covers	A3-04169B	
SPS 1508	Miscellaneous Details	A3-04170B	
SPS 1600	Design	A3-04171B	
SPS 1601	Pipe Installation Support and Trench Fill	A3-04172B	
SPS 1602	Scour Arrangement	A3-04173B	
SPS 1603	Scour Arrangement	A3-04174B	
SPS 1604	Scour Arrangement	A3-04175B	
SPS 1605	Gas Release Arrangement	A3-04176B	
SPS 1606	Gas Release Arrangement	A3-04177B	
i) Council standard drawings			***Council Standard Drawings***
SA3-850	Standard Access Chambers		
SA3-851	Sample As Constructed Plan		
SA3-852	Pressure Main Discharge Details		
SA3-853	Pump Station Overflow		
SA3-854	Pipeline Construction Types		
SA3-855	Sewer House Branches		
SA3-856	Sewerage Manholes		
SA3-857	Sewerage Pump Station		
A3-04320	Flowmeter Pit		
A3-04321	Location of Assets		
A3-04322	Remote Monitoring of ERS		
A3-04323…	…Wastewater Swirl Separator		

9 CODE AMENDMENTS	*Amendments to WSA-02 & WSA-04*
The Designer shall ensure that the design of water supply system elements shall comply with The Code unless specified otherwise in this Guideline. Amendments made by Council to the Code are included below. The design of gravity sewers shall comply with the Code (WSA-02) unless specified otherwise in this Guideline. The design of pump station and rising main components shall comply with the Code (WSA-04) unless specified otherwise in this Guideline Amendments made by Council to the Codes are included below	*Gravity and Reticulation Sewers* *Pumping Stations and Rising Mains*

Amendments to WSA- 02

Note : The Clause numbers given below correspond to the relevant clause numbers given in the Sewerage Code of Australia WSA-02 (2002).

Amendments	*Clause No. in WSA-02*
The average dry weather flow (ADWF) shall be taken as 230 L/EP/day.	***Glossary***
Except where specified otherwise, the division of responsibilities between the Council and the Designer shall be in accordance with the DEVELOPMENT CONSTRUCTION SPECIFICATION SEWERAGE C402. The Designer shall confirm the design criteria with the Council and shall design a gravity pipeline distribution system with pump stations and rising mains, where necessary, to comply with the requirements of this Guideline, to transport fresh sewage, or effluent, for treatment. The Designer shall not provide for common effluent or vacuum discharges to gravity sewers or conventional wastewater treatment plants without the concurrence of Council.	***1.3.3 Design Responsibility***
The Designer is unlikely to have to undertake any System Planning as part of any proposed development. The responsibility for System Planning will normally rest will Council. However, when required, the Designer may need to submit to Council the peak load demand, and any other required data, to allow Council to assess the impact of the proposed development on Council's existing sewer network, downstream from the site. The network impact assessment may need to be undertaken all the way to the Sewerage Treatment Plant involving a series of pipes and pumps and not merely consider the immediate downstream pipe.	***2. System Planning***

The analysis of the impact of the proposed development on Council's network will generally be required when; a. The proposed development is outside Council's existing sewer network, or b. The likely peak load demand created by the proposed development is greater than has been assumed for the site – where the proposal is inconsistent with the land use zoning and generic loadings assumed for the site by Council.	
The area to be served by an extension to the sewer network shall be determined in accordance with Council's requirements. Council may require that the analysis make provision for any future additional upstream sewerage loads. The analysis Brief, to be prepared by the Designer, will indicate the level and size of any existing pipes, as well as the anticipated flows to be allowed for in the analysis and provide adequate allowance for such loadings in the analysis on Council's network The depth of sewer shall be sufficient to allow a minimum of 90 per cent of each lot to be serviced. All lots shall be served by gravity sewers wherever possible.	***2.2 Planning Principles*** ***Upstream Sewer*** ***Depth*** ***Provision of Sewerage***
The Average Dry Weather Flow (ADWF) is 230 L/EP/day, plus an infiltration allowance of 40 kl/km/day and a Peak factor of 5.	***2.3.1(c) Loadings***
The Designer shall undertake geotechnical investigations to determine any considerations which will impact upon the design and / or construction of the works. In particular, the geotechnical investigations will include, where appropriate, any necessary consideration of soil conditions relating to: (a) The presence, impact and management of Acid Sulphate Soils (b) The presence, impact and management of soil or other material at any contaminated sites (c) The impact of soil and groundwater aggressivity on the durability of underground concrete structures and pipework (d) The impact of saline / marine environments or tidal flats on the design of structures and pipelines (e) The need for protective coatings of concrete structures or cathodic protection of pipelines All geotechnical investigations shall be undertaken by a suitably qualified geotechnical engineer (RPEQ, Geotechnical) and shall be documented in a geotechnical report available to the Designer, Council and the Contractor.	***2.3.5 Geotechnical Investigations***
The Peak Wet Weather Flow (PWWF) shall be 1150 l/EP/day, with an assumed density (detached dwellings) of 2.7 EP/ET.	***3.2.1 Design Flow Estimation***

Common effluent, vacuum and pressure sewer systems shall only be considered after consultation with Council. Where it is necessary for sewers to be located on private property outside of the proposed development, the Local Government Act 1983 requires the Designer to obtain written approval from the affected property owner or tenants to enter and/or undertake any construction work on such private property. The Developer shall obtain easements over any rising mains to be constructed within private property at the Developers cost prior to commencement of works.	***4.2.3 Sewer Layout***
Council requires all sewerage pumping stations to be located on freehold land owned by Council, Land dedicated to Council as park, open space or similar <u>cannot</u> be used to locate a sewerage pump station on. The land on which the pumping station is to be located shall have a minimum of 5m wide access around each side of structure. No easements are required over a gravity sewer when the pipe is proposed to be laid across the front of the lot and within 3m of the street frontage.. Council requires all sewer easements to be registered in its favour when pipelines and appurtenances relating to pipelines are constructed in freehold land.: (a) Where the sewer is laid across the front of a lot and at a distance greater than 3m from the street frontage, and (b) Where the sewer is laid along the side or rear of a lot. Easements for pipelines shall be a minimum 3 meters wide where the pipe is laid up to 2.5m deep (below the finished lot level) and is to be located centrally over the pipeline. Where the pipe is to be laid at a depth greater than 2.5m and up to 4m deep, the easement width shall be 4m wide. Separate Council approval is to be given for sewer pipes to be laid greater than 4m deep and advice on the easement width will be provided at the time of approval for the deeper sewer. Where a pipeline is laid on standard alignment of 1.5m from a property boundary, the boundary of the lot and one boundary of the easement may be coincident. Where the Designer proposes to install a sewer greater than 2.5m deep along the side of a lot smaller than 700m2, then the Designer may need to consider the impact of Council's Policy - *MW02 Building Over or Adjacent to Sewers* on the future lot owner and their ability to construct a house. Separate Council approval is required to locate a sewer rising main in freehold land <u>not</u> owned by Council. Where approval is given, then a minimum 5m wide easement in Council's favour is required over the rising main.	***4.2.5 Easements***

Where sewers are proposed to be located within existing road reserves, the Designer shall check that the sewers do not conflict with other utility services and locate the sewers in accordance with established protocols. Where control of the trench width is practical or effective, the design may be based on wide trench conditions. The Designer shall call up the need, on the Design Drawings, for the Contractor to supply special construction control with a method statement when there is economic or practical justification to design to narrow trench condition.	***4.3.2 Road Reserves and Open Space***
The designer is to ensure there are no dead ended mains. All sewers are to terminate with a maintenance hole.	***4.3.6 Dead Ends***
Horizontal curves in sewers are not permitted by Council.	***4.3.7 Horizontal Curves in Sewers***
Refer to Council Policy - MW02 Building Over or Adjacent to Sewers.	***4.4.4 Clearance from Structures***
The Designer, and/or its contractors, shall ensure that all reasonable care is taken during the design and construction of the works to ensure that existing utility services are protected against damage or interference whatsoever. If existing utility services are damaged by the Developer and/or its contractors during the course of the works, through any cause whatsoever, the Developer and/or its contractors shall be fully responsible for all costs associated with rectification of the utility services, to the satisfaction of 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 Designer shall make all necessary arrangements with the appropriate authorities concerned at no cost to Council for such relocations or alterations. The Designer is to ensure that all known utility services are detailed on the engineering drawings by Dial Before You Dig (DBYD) investigations and accurately located by non-destructive field location, and it is the Contractors responsibility to have such services confirmed in the field prior to any excavation commencing in their vicinity.	***4.4.5.1 Underground Obstructions and Services*** ***Damage*** ***Relocations and / or Alterations*** ***Field Location of Services***
Refer to Council Policy - MW16 Clearance to Water and Sewerage Assets	***4.4.5.2 Clearance Requirements***
At the design flow, the calculated flow depth in gravity pipes shall be not more than 70% of the pipe diameter to allow for ventilation and free air flow above the sewage.	***4.5.3 Minimum Air Space***
Minimum allowable reticulation sewer size is 150mm diameter.	***4.5.4 Minimum Pipe Sizes***

To Council Drawing Location of Assets. Lesser cover may be provided where special protection of the pipelines has been shown on the Drawings or as approved by Council.	***4.6.3 Minimum Cover over Sewers***
Maximum depth of point of connection for vertical riser (jump up) is 1000mm from existing surface level. The Designer shall ensure that house connections to the pipeline shall be not more than 1000mm in depth below the finished surface.	***4.6.5.4 Depth of Connection Point***
Council requires prior written approval for use of internal drops in maintenance holes.	***Table 4.10***
Vertical curves are not permitted by Council.	***4.6.7 Vertical Curves***
Compound curves are not permitted by Council.	***4.6.8 Compound Curves***
The Designer shall show on the Drawings the extent of external corrosion protection required to be provided by the Contractor. Ductile iron pipework shall be provided with protective polyethylene sleeving wrapped and taped in accordance with the pipeline manufacturers instructions. 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 tape wrap system in accordance with the manufacturer's installation requirements. The Designer shall assess the need for cathodic protection (sacrificial anode or impressed current) for metallic piping systems based on the aggressivity of the soil and groundwater characteristics along the alignment of a proposed pipeline and with particular reference to construction through old landfill sites, low lying anaerobic wetlands and coastal/tidal areas. The assessment of the aggressivity of the soil will be part of the geotechnical investigations for the work and the Designer will assess the geotechnical advice to determine whether cathodic protection is required.	***4.7 Corrosion Protection***
Gravity sewers and rising mains shall generally be spigot and socket joints with elastomeric rubber rings complying with AS 1646, or butt or electro fusion welded in the case of polyethylene pipe. The Contractor shall make the joint such that the witness mark, at no point, be more than one (1) mm from the end of the socket.	***4.8.2 Joints***
Flanged joints connecting pipes, fittings, valves and pumps shall comply with AS 2129 (Flanges shall be Table E) or AS 4087, Class PN16, as	***4.8.4 Flanged Joints***

appropriate. Mating pipe flanges shall be drilled to suit the specified drilling of the adjoining valve or equipment. Raised face flanges shall be mated with raised face flanges. Flat faced flanges shall be mated with flat face flanges. Flanges on all steel, ductile iron, PVC, and GRP pipes shall be fully fixed flanges. Flanges on ABS and PE pipes may be stub flanges with loose metal backing rings or full face up to 100 mm pipe diameter. On ABS and PE pipes of 100 mm diameter and larger, stub flanges with metal backing rings shall be used. Backing rings shall be manufactured from 316 or 316L stainless steel. All bolts shall be stainless steel Grade 316 and all nuts and washers shall be stainless steel Grade 304. Uniflanges shall only be used with prior written approval of Council.	
Council requires a property connection marker to be installed on all property connections to sewer except where the property connection is provided from a maintenance hole. The marker shall consist of a 50mm x 40mm x 200mm yellow painted peg located above the property connection end cap with the top of the marker peg 50mm above the finished surface level. An approved brown plastic tape 50mm wide shall be attached to the end cap and brought vertically to the surface and stapled to the marker peg.	***5 Property Connections***
A property connection shall be provided to each property at the lowest point of the sewer serving the property. It shall be capable of draining the total area of the property that can be developed, with house drains being laid at required grades and positions, in accordance with AS3500. Connection branches shall be generally located 1.5m upstream of the property boundary. Property connections shall not be constructed across streets or reserves to enter sewer lines. Where practicable, property connection branches adjacent to maintenance holes should be constructed as inlet entries to the maintenance hole with internal drops, if necessary, and shall have inspection openings as per the standard drawings. Council parks and reserves shall be provided with a connection to the sewer utilizing a maintenance hole.	5.6 Location of Connection Points
Common property connections are not permitted.	***5.7 Y Property Connections***
Maximum allowable length of house connection line is 6m.	***5.8 Length of Property Connection Sewers***

All upstream ends of sewers shall terminate in a maintenance hole.	***6.2 Location of Maintenance Structures***
Maintenance holes shall be placed on gravity sewers. Maintenance holes shall be spaced at a maximum distance of 90 metres apart.	***6.3 Spacing of Maintenance Structures***
Maintenance structures shall be constructed at: (a) 1.5m upstream of allotment side boundaries and 1.5m from front and rear boundaries. (b) Wholly on a footpath or wholly in the allotment, not across the property boundary. (c) Consideration shall be given to future sewerage reticulation requirements and maintenance structures shall be located to facilitate the direct connection of future extensions directly to existing maintenance structures. (d) Any additional locations required by Council. Where maintenance structures are proposed to be located in footpaths, prior approval is required from Council. Connections to existing maintenance holes or sewers of the existing sewerage system are to be based on the Council's sewerage master plan. The provision of maintenance shafts and terminal maintenance shafts shall not affect the layout of maintenance holes or terminal maintenance holes.	***6.4 Special Considerations for Location of Maintenance Structures***
Connection options (a) and (c) are the only options permitted. Option(c) is permitted only at the end of a main which cannot be extended.	***6.5 Special Considerations for Connection of New Sewers to Existing Sewers***
No tapered sections are permitted for maintenance holes. External bitumastic seal tapes of 150mm wide over a coat of prime seal recommended by manufacturers shall be applied for all joints in pre-cast manholes.	***6.6.2 Types of MH Construction***
Precast MH's can be used for any area unless otherwise specified by Council. All concrete in MH's shall be as per Council Standard Concrete Specifications for Water and Wastewater Structures.	***6.6.3 Design of MH's***
The minimum internal diameter of MH's shall be 1050mm. A minimum of 1500mm internal diameter is required for sewer outlets greater than 300mm in diameter or maintenance holes greater than 3m deep.	***6.6.5 Diameter of MH's***
Step irons and landings are not permitted.	***6.6.8 Ladders, Step Irons and***

	Landings
Metal access covers to maintenance holes shall be as per Council Standards Drawings. Where the MH is located in a driveway or road then the cover MH cover shall be a "heavy duty" type.. All MH covers shall be watertight and gastight.	***6.6.9 MH Covers***
Maintenance shafts and terminal maintenance shafts shall be provided only as permitted by Council. In general, MS's & TMS's shall not be permitted for changes in horizontal or vertical direction of sewers without special approval from Council. A Designer considering using maintenance shafts and terminal maintenance shafts (MS & TMS) must obtain Council's approval in writing. Where used, a terminal maintenance shaft shall be no further than 70m from the nearest maintenance hole.	***6.7 Maintenance Shafts***
Water seals and boundary traps are not permitted.	***7.2 Water Seals and Boundary Traps***
The Designer shall provide a vent to the atmosphere for venting of maintenance holes which accept pumped discharges from rising mains.	***7.5.2 Design Parameters for vents***
Inverted Syphons are not permitted.	***7.8 Inverted Syphons***
Wet weather storage is not required as it is impractical in tropical conditions, however, it may be considered upon application to Council in writing. Wet weather storage is not permitted by Council for the purpose of reducing downstream infrastructure size.	***7.11.1 General***
CONCRETE WORKS 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:	***8.2 Products and Materials***

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	N25	**-**	**-**

conc. encasement in all environments			
Reinforced thrust blocks, anchor blocks, bulkheads, and conc. encasement in all environments	N32	-	-
Maintenance holes and benching – all environments	S40	380	0.50
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 pumping station wells - in all environments.	S40	380	0.45

Aggressive environments are defined as exposure to :
1. seawater, anaerobic waters, swampwater tidal flats, sewage, effluent and the like, including exposure to intermittent saturation.
2. relatively high levels of chlorides, sulphides 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.

For other than water retaining structures, 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.

For water retaining structures, cover to reinforcement shall comply with the requirements of AS3735.

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 Designer shall accommodate the movement associated with the ground strain for the area, as advised by the Mine Subsidence Board for sewerage jointing systems in proclaimed Mine Subsidence Areas, or in a known or expected area of subsidence or slippage. The design ground strain for the development shall be detailed on the Drawings. The pipe jointing system selected shall be capable of accepting ground movements, without impairing the water tightness of the joint, for the ground strain as advised by the Mine Subsidence Board. For areas with high ground strains a pipe jointing system using shorter effective length pipes and/or deep socket fittings shall be used. Where the Mines Subsidence Board does not cover an area of known, or suspected, subsidence or slippage, the above requirements shall still apply, unless stipulated otherwise by Council.	***8.6.5 Mine Subsidence***
Above ground sewers may be designed in a gravity system only where other options are not practical.	***8.7 Above Ground Crossings***

In addition to the requirements given elsewhere in this Guideline, the Council requires that the Designer obtain the prior approval where the depth of the cover exceeds 3m. Where the depth of cover does exceed 3m, the Designer shall submit calculations, charts or substantiating documentation proving sufficiency of pipe strength to resist buckling for the proposed pipe type and trenching conditions. The Designer shall use AS2566.1 Loads on Buried Pipelines as the basis of substantiation.	***8.8 Pipe Cover***
DESIGN REVIEW AND DRAWINGS In accordance with clause 12.08, the Designer shall submit to the Council for approval three copies of the proposed sewer design, including calculations and network analysis, if appropriate, prior to commencement of construction. The Council shall advise at the time of notification by the Designer whether the option to direct the submission to the Council is taken. **PIPELINES AND PUMPING STATIONS** In addition to the requirements of WSA-03, the Design Drawings shall show to scale: (a) Plan showing: (i) Lot boundaries and lot numbers (ii) Location and size of all mains, appurtenances and pump stations (iii) Existing mains (iv) Existing and proposed features and services (v) North point and scale bar (vi) Easement locations (vii) Arrangement of or for other utilities. (b) Longitudinal section, for all pipelines of DN150 or larger, showing: (i) Reduced levels for natural surface and design surfaces at all changes of grade (ii) Mains, appurtenances and pump stations. (iii) Appurtenances numbered in accordance with Council's Asset Register (iv) Invert levels where necessary (v) Size, type, class and grade of pipe (vi) Location, invert level and size of all drainage lines, sewer mains, and other utility services crossing the main (vii) Notation regarding all joining lines (viii) Property ownership (ix) Note "In road" trench conditions (c) General arrangement of pump stations with site plan; concrete and/or building outlines, number, make, model and details of pumps; inlet and outlet pipework details and levels; pump control levels and/or pressures~~,~~; switchboard location; pump station access details. (d) Details of corrosion protection required for pipes and fittings. (e) Areas designated for trench less pipe installation.	***9 Design review and Drawings***

Detail plans shall be drawn to a scale of 1:500 and longitudinal sections to a horizontal scale of 1:1000 and a vertical scale of 1:100. The Designer shall show locations of hydrants, stop valves, non-return valves, and air valves and scour valves, tees, tapers, creek crossings, trench dimensions and backfill, thrust blocks, and other existing and proposed services and installations including chambers and covers and items of construction which are project specific. Drawings shall be 'A3' and/or 'A1' size after consultation with Council. One (1) copy of A1 size and three (3) copies of A3 size drawings shall be provided. Drawings shall also be provided in electronic form comparable with Councils systems. 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. **ELECTRICAL AND CONTROL DOCUMENTATION** The Developer shall submit, to the Council for approval, prior to commencement of the manufacture of any switchboards and control equipment, three copies of all drawings required in Council Standard Specification for Electrical Assets The Council shall advise at the time of notification by the Designer whether the option to direct the submission to the Council is taken.	
For the estimation of EP's,Council's method is to apply EP densities from Council Headwork's Policy to derive total EP then apply DNRM Drg. 99480 if total EP exceeds 1000.	***Appendix A Estimation of Equivalent Population***
Council to provide	***Appendix B Flow Estimation for Undeveloped Areas***
For PVC gravity pipe, Council only allows SN10 for DN100 and SN 8 for other sizes, to AS1260. Jointing method shall be rubber ring seal. In any case, minimum pipe size is DN150mm. For DI pipes, Council will accept either cement lining (type SR cement) or epoxy lining.	***Table 10.1***
GENERAL All pipeline materials used for sewerage infrastructure shall comply with the relevant sections of WS-SPEC and the specific project requirements of	***10.4 Product and Standards Materials and Specifications***

Council as detailed herein.

Council's minimum requirements for gravity main pipe materials are as follows:

(a) mPVC, uPVC or oPVC: rubber ring jointed, SN8/SN10. Ultra rib pipe is acceptable for pipes greater than DN150mm.
(b) PE: electrofusion or butt fusion, minimum SDR 17
(c) DI: rubber ring jointed, polyethylene sleeved, cement or epoxy lined, minimum Class 21.
(d) GRP : rubber ring jointed couplings, minimum SN10000 stiffness, minimum PN10 pressure class
(e) VC: spigot and socket type using roll on rubber ring (elastomeric) joints.

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.

PVC PIPE AND FITTINGS (GRAVITY PIPES)

PVC gravity pipes and fittings shall be compliant with Section SP4 of WS-SPEC.

The Designer shall ensure that PVC pipe specified is compatible with ductile iron (DI) pipe where necessary.

Pipe shall have smooth external wall for DN150mm to AS1260. Ultra rib is acceptable for pipes greater than DN150mm.

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 cover. All exposed uPVC pipework shall be painted to protect it from UV light using a water based acrylic paint.

DUCTILE IRON PIPE AND FITTINGS (GRAVITY PIPES)

Ductile iron pipes and fittings shall be compliant with Section SP2 of WS-SPEC.

Pipes cast into concrete shall be power-tool cleaned to AS 1627.

VITRIFIED CLAY (VC) PIPES AND FITTINGS (GRAVITY PIPES)

VC pipes and fittings shall be compliant with WS-SPEC, section SP7**.**

Pipe and fitting shall be spigot and socket type using roll on rubber ring (elastomeric) joints.

Natural rubber shall not be used in rubber ring joints.

POLYETHYLENE PIPE AND FITTINGS (GRAVITY PIPES)

PE Pipes and Fittings shall be compliant with WS-SPEC, section SP6.

PE pipes shall be manufactured in either PE80B or PE100 polymer material.

Selection of pipe class shall take into account cyclic loading and fatigue.

GLASS REINFORCED PLASTIC(GRP) PIPE 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 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 cover. All exposed GRP pipework shall be painted to protect it from UV light using water based acrylic paint.	
All amendments to WSA-02 Drawings are detailed on Council's Versions of the applicable drawings.	***Amendments to WSA 02 Std Drawings***

Amendments to WSA 04

Note : *The Clause numbers and table numbers given below correspond to the relevant Clause numbers given in the Sewage Pumping Station Code of Australia WSA-04-2005.*

Council has a strong preference for the conveyance of sewage by gravity only and therefore Council's approval in writing is required for any pumping station proposal and its particular requirements including electrical and telemetry requirements, emergency relief arrangements and compliance with Council's current licence conditions.	***General***
Odour control facilities may be required to be provided at pumping stations or other locations. The Designer is to consult with Council at the planning stage to determine if odour control facilities will be required. If so, provision of such facilities to Council's performance requirements shall be made.	***2.9 Odour Control***
The Designer shall ensure selected components make a watertight system and have satisfactory surface finishes to ensure long-term durability of assets exposed to aggressive wastewater environments. Package pump station units may be used with the prior concurrence of Council, where the area being serviced is small and/or their inclusion contributes to overall benefits to the system and the environment. The Designer shall provide for the design of pump stations and valve pits against flotation both during the construction/installation stage and whilst operating under the 1:100 year ARI flood condition. For pumping stations and valve pits constructed by open excavation, the vertical soil backfill column above any base slab extension at floor level shall be taken into account in resisting uplift. For the installed operating structure, the minimum factor of safety against uplift (ie the ratio of stabilising to unstabilising forces) shall be 1.5.	***3.1 General Design*** ***Package Units*** ***Buoyancy***

For pumping stations constructed as caissons with a mass concrete floor plug, the soil skin friction against the external concrete face of the well shall be ignored. For the installed operating structure the minimum factor of safety against uplift (ie the ratio of stabilising to unstabilising forces) shall be 1.2.	
Council requires all, except that small pumping stations may, with State Government approval, be located in land that is owned by Council.. 1. Land dedicated to Council as park, open space or similar cannot be used for this purpose. 2. Generally approval can be obtained only for stations with no superstructure except for a vent stack and a control panel. Pumping stations that are not sited in road reserve shall be provided with a minimum 5m wide access easement either side of the structure dedicated to Council. Council requires easements to be registered in its favour as follows when pipelines and appurtenances relating to pipelines are constructed in land other than in what is, or will become, a dedicated road reserve or property owned by Council: (a) All rising mains. Easements for pipelines shall be a minimum 5 meters wide and located centrally over the pipeline, or in the case where a pipeline is laid on standard alignment near a property boundary, the boundary of the lot and one boundary of the easement may be coincident. A Licensed Surveyor shall survey easement reserves for pumping stations and pipelines.	***3.7 Easements***
Materials to be used in the pump station shall take into consideration the nature and composition of the sewage to be pumped. The designer shall select such materials to ensure durability for a nominal design life of at least 50 years.	***4.1 Materials Design***
Internal concrete surfaces in pumping station wet wells and in maintenance holes receiving a pumped discharge shall be coated with a protective coating in accordance with WS-SPEC Section TR20. External concrete surfaces in aggressive soil and groundwater environments shall also be coated with a protective coating compliant with WS-SPEC TR-20. See also Clause 5.4 below.	***4.2.2 Concrete Surfaces***
Ductile iron pipework in pumping stations shall be epoxy coated and epoxy lined. Steel pipework in pumping stations shall be SS316 or SS316L. Metalwork in pumping stations shall be either marine grade aluminium or SS316 or SS316L. All bolted connections within wet wells shall be stainless steel Grade 316	***4.2.3 Metallic Materials***

bolts with Grade 304 nuts and washers.	
The Designer shall take into account access, site maintenance and restoration, easements, power supply and operational working area when locating pump stations on land dedicated for that purpose. Where the pump station site is exposed to possible flooding, the Designer shall provide for the top of pump well to be 300mm above the 1 in 100 year flood level, or to such other level as provided by Council's planning instruments. The base of the electrical switchboard and / or generator shall be located one metre above the 1 in 100 year flood level.	***5.2 Location, Layout and Access*** ***Protection Against Flooding***
The Designer shall specify a protective coating to the internal concrete surfaces of pumping station wet wells. Preparation for and application of the protective coating shall comply with WS-SPEC Section TR20. The protective coating shall be a high build 2-pack solvent less epoxy, System W3-C.	***5.4 Wet Well Design***
The Designer shall provide for ventilation to each pump station. Natural ventilation is to be provided to all pump station wet wells by providing a minimum DN100 pvc pipe vent. The vent shall be provided with a stack which shall be a minimum diameter 150mm. The stack shall be a galvanised powder coated mild steel fabrication connected to the vent. The stack shall be of a minimum 6m height or higher if required to disperse any foul odour above the roofs of surrounding buildings. The pvc vent pipe shall be provided inside and for the full height of the stack. A stainless steel "Rota" vent with nylon bearings shall be provided to the top of the stack. Pumping stations with wet wells greater than DN4000mm diameter shall be provided with permanently installed extraction type forced ventilation system.	***5.5 Ventilation***
The Designer shall size pipes and pump station capacity to avoid surcharges under design flow conditions. The Designer shall provide an emergency relief structure (ERS) in strict accordance with the conditions of Council's EPA licence if permitting a sewage discharge. In addition, in areas to be environmentally sensitive, Council may require a wastewater swirl separator (WWSS) to be provided. Any proposal to provide an ERS and WWSS shall be referred to Council prior to undertaking the design. Wet weather storage is required to be provided at pumping stations compliant with the following volumetric requirement: Storage Required = minimum 4 hours at ADWF for the gravitational component of the flows arriving at the pumping station. Such storage may be provided as: (a) In-line pipe storage capacity between lowest upstream MH surface level and TWL in pumping station well	***5.6 Overflow Containment***

(b) Pumping station wet well storage between lowest upstream MH surface level and TWL in pumping station well (c) Supplementary on-site underground tank storage between lowest upstream MH surface level and TWL in pumping station well (d) Any combination of the above.	
Access covers shall comply with Council's Drawing. Pumping station wells and valve pits shall be provided with signage notifying all personnel that such structures are classified as Confined Spaces and that access limitations apply.	***5.8 Access Covers***
The Designer shall provide for all pump stations to be of the single well submersible pump station with self-contained freestanding switchboards suitable for external use. Pumping stations shall be, as a minimum, conventional duplex style arrangements with one duty and one standby pump. Pump sets are to be provided with automatic interchangeable duty rotation arrangements within each pump station.	***6.4 Pump Selection*** ***Size*** ***Interchange-ability.***
Where required, triplex pumping stations shall be provided with two duty pumps and one standby pump. Pump sets are to be provided with automatic interchangeable duty rotation arrangements within each pump station.	***6.5 Triplex Pumping Stations***
Each pump shall be capable of passing solids of not less than 75mm diameter unless grinding equipment is incorporated.	***6.6.2 Impeller Selection***
For pump stations less than 6m or under 30kW power rating, each pump shall be suspended by a chain as per Council Drawing For pump stations greater than 6m or over 30kW power rating, each pump shall be capable of being removed with the aid of fixed stainless steel guide rails as per Council Drawing	***6.6.6 Pumpset Lifting Equipment***
Flushing valves are not permitted by Council.	***6.7.1 Flushing Valves***
All incoming pipes contributing flows to a pumping station shall be connected to a collecting manhole exterior to the pumping station. The collection manhole shall be interconnected to the pumping station with a DI or Class 12 pvc inlet pipe. The inlet pipe shall penetrate the wall of the wet well and shall be provided with a flanged end in the wet well to allow connection to a knife gate isolating valve. The knife gate isolating valve shall be provided with a non-rising type extension spindle to the roof of the pumping station to allow isolation without entry to the well. On the downstream side of the valve a vertical T-piece dropper pipe as per Council Drawing Knife gate valves shall be compliant with WS-SPEC Section SP23.	***9 Wet Well Pipework*** ***Knife-Gate Valve***

Emergency bypass connection point shall be provided as per Council Drawing	***9.2.3 Emergency Bypass Connection***
Air release valves shall only be used with prior approval of Council. Air valves shall be compliant with WS-SPEC section SP27.	***9.2.4 Sewage Air Release Valves***
Council's minimum requirements for pressure main pipe materials are as follows: (f) mPVC, uPVC or oPVC : rubber ring jointed, minimum Class 16 Series 2 (g) PE : electrofusion or butt fusion, minimum PN16 pressure class (h) DI: rubber ring jointed or flanged, PE sleeved, cement or epoxy lined, minimum Class 21. (i) Steel : rubber ring jointed, flanged or welded, FBPE coated, cement or epoxy lined, minimum steel barrel wall thickness of 6mm or diameter/120 whichever is the greater, (j) GRP: rubber ring jointed couplings, minimum PN16 pressure class SN10000 pipe stiffness. 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. **PVC PIPE AND FITTINGS (PRESSURE PIPES)** PVC pressure pipes and fittings shall be compliant with WS-SPEC, section SP4. The Designer shall ensure that PVC pipe specified is compatible with ductile iron (DI) pipe where necessary. 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 cover. All exposed uPVC pipework shall be painted to protect it from UV light using a water based acrylic paint. Selection of pipe class shall take into account cyclic loading and fatigue. **DUCTILE IRON PIPE AND FITTINGS (PRESSURE PIPES)** Ductile iron pipes and fittings shall be compliant with WS-SPEC, section SP2. **STEEL PIPE AND FITTINGS (PRESSURE PIPES)** 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.	***10 Pressure Mains***

The Designer shall take account of congested service corridors, poor soil conditions and the need for additional security for strategic mains with regard to the provision of restrained joints. The Designer shall avoid the positioning of continuously welded steel pipelines in parallel with high voltage power lines. Steel pipes shall be FBPE (Sintakote) coated and lined with cement mortar type SR or epoxy. **POLYETHYLENE PIPE AND FITTINGS (PRESSURE PIPES)** PE Pipes and Fittings shall be compliant with WS-SPEC section SP6. PE pipes shall be manufactured in either PE80B or PE100 polymer material. Selection of pipe class shall take into account cyclic loading and fatigue. **GLASS REINFORCED PLASTIC(GRP) PIPE 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 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 cover. All exposed GRP pipework shall be painted to protect it from UV light using water based acrylic paint.	
The minimum class of pipes & fittings for pressure mains shall be PN16 or equivalent.	***10.5.4 Minimum Pressure Class***
The Designer shall provide pressure tappings and gauges in the valve pit for testing and commissioning of the main, as shown on Drawing	***10.9 Pressure Main Valves***
Sluice valves shall be provided to each pump connection pipe work in the valve pit. Sluice valves shall be resilient seated compliant with WS-SPEC Section SP-21.	***10.9.2 Isolating Valves***
Non-return valves shall be provided to each discharge pipe in the valve pit. Non return valves shall be resilient seated Flexichek type. Council's nominated brand of reflux valves is Crevet.	***10.9.4 Non Return Valves***

The Designer shall design the pump well taking into consideration the ground and site conditions. In particular, the geotechnical investigations will include, where appropriate, any necessary consideration of soil conditions relating to: (a) The presence, impact and management of Acid Sulphate Soils (b) The presence, impact and management of soil or other material at any contaminated sites (c) The impact of soil and groundwater aggressivity on the durability of underground concrete structures and pipework (d) The impact of saline / marine environments or tidal flats on the design of structures and pipelines (e) The need for protective coatings of concrete structures or cathodic protection of pipelines. All geotechnical investigations shall be undertaken by a suitably qualified geotechnical engineer (RPEQ, Geotechnical) and shall be documented in a geotechnical report available to both the Designer and the Contractor.	***11.1.2 Geotechnical Assessment***
The Designer shall design structural steelwork in accordance with AS4100 and all other relevant Australian Standards.	***11.2.3 Structural Steelwork***
Preformed concrete wall units are to be manufactured to AS4058. The Designer shall take into account the cover requirements for reinforcing steel & cement types to ensure minimum expected asset life of 50 years.	***11.2.5 Pumping Station Walls***
The Designer shall provide at all pump stations for ~~an~~ adequate water supply for cleaning purposes. The minimum size service allowable is DN63mm. Backflow prevention shall be compliant with Council Drawing	***12.1.2 Water Supply***
All amendments to WSA-04 Drawings are detailed on Council's Versions of the applicable drawings.	***Amendments to WSA 04 Std Drawings***

10 SEWAGE PUMPS

Sewage Pumps

General

Sewage pumps shall be submersible type, and either:

KSB Forrers, or

ITT Flygt

Other pumps may be considered with prior Council Approval. In seeking approval, the Designer will need to demonstrate the reliability of the alternate pump, the availability of spare parts in Mackay, ease of maintenance and the advantages to Council in adopting an alternate brand.

Pump shall be capable of operating at the required duty point for the application. Pump shall be

(a) capable of operating near optimal efficiency within the range of operating conditions;
(b) continuous operation;
(c) having non-overloading characteristics beyond the duty point close to zero head;
(d) having starting characteristics acceptable to the electricity supply company and the Council;
(e) having a minimum of 4 pole unless approved otherwise by Council.

Standby

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:
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 D11.13 Electrical Works of this Guideline.

Installation

INSTALLATION:
The design of the wet well submersible pumping unit shall be such that the complete pumping unit can be readily removed from the wet well by means of a simple lifting device, without the necessity of either de-watering the wet well or disturbing the permanent connection to the discharge pipe work, and without the need to descend into the wet well.

No portion of the pump shall be permanently fixed to the base of the wet well. The wet well units shall be supported off the discharge 'duck-foot' bend which shall be of a rigid design to take the complete pumping unit load and provide sufficient sealing.

Each submersible pump shall be checked for the operation against a closed discharge (shut-off head) to prove the effectiveness of the seal between the pump and the discharge bend.

When two or more similar pumps are supplied under the same Contract, the interchangeability of the units and the discharge bends shall also be checked.

The pump shall have suitable guide rails for withdrawal from and lowering into the wet well. When lowered down the guide rails the pump shall automatically connect to the discharge bend.

PRESSURE GAUGES

Pressure Gauges

The Contractor shall provide 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.

For pressure gauges details refer to Council Standard Specification for Electrical Assets.

LEVEL CONTROL

Level Measuring Devices

The Contractor shall provide one (1) continuous level measuring device in each wet well. The output of each level measuring device shall be in a form of 4-20 mA and shall be an input to the pump station controller.

The Contractor shall also provide two (2) float switches for the HH level alarm and HHH level alarm for each pump station. The digital signals corresponding to each of high level alarms shall be wired up to the pump station telemetry system.

For details of continuous level measuring device and the level switches refer to Council Standard Specification for Electrical Assets.

Flow meters

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.

Electrical Design

ELECTRICAL DESIGN:

Power supply requirements, electrical equipment design and telemetry shall comply with the requirements of Council Standard Specification for Electrical Assets.

Upgrades to Existing Pumps

UPGRADES TO EXISTING PUMPS

The provisions of this Guideline for new pumping stations as detailed above 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.

11 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.

Interchangeability

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 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 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 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.	
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 and other components as required. Contactors for modulating duty actuators shall be solid state type.	***Contactors***
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. Each penstock or actuated valve shall be fitted with the integral OPEN / CLOSE push buttons, a padlockable LOCAL /REMOTE rotary selector switch, and an emergency stop push button.	***Remote & Local Operation***
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, in accordance with AS 1359.	***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***

12 ELECTRICAL WORKS

Electrical Works

COMPLIANCE WITH AUTHORITIES, STATUES, REGULATIONS AND STANDARDS

Compliance

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) Council Standard Specification for Electrical Assets

SCOPE OF WORK

Scope

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

Power Supply

The designer must provide for all works as required by the Electricity Supply Authority to provide 3 phase 415V, 50 Hz power supply to site;

The Designer must provide for the upgrade or provide new metering facilities at each site as required by the Electricity 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 Generators

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 Changeover Arrangements

POWER SUPPLY CHANGE-OVER 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

Lighting 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 mm^2 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 Council Standard Specification for Electrical Assets for the details of nominated equipment suppliers and service providers.