1 GENERAL

1.1 RESPONSIBILITIES

Objective
Design requirement: Provide the design and documentation for sewerage system pump stations to transport sewage from proposed development to the treatment plant or to a defined discharge point on an existing sewerage reticulation system in conformance with all current relevant legislation. Provide for pumping plant, sewer mains and allow an appropriate point of connection to the reticulation system. Designer responsibilities include the following:
- Translate the planning output into a detailed pump station design. Prepare design drawings compatible with the Water Agency’s concept plan and the design parameters.
- Identify potential problems and provide appropriate solutions.
- Justify any variation from the requirements set out in this worksection or specified by the Water Agency.
- Obtain written approval from the Water Agency for any variation.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following worksection(s):
- 0010 Quality requirements for design
- 0076 Sewerage systems – reticulation (Design)

1.3 REFERENCED DOCUMENTS

Standards
General: The following documents are incorporated into this worksection by reference:

Australian standards
AS 1102-series Graphical symbols for electrotechnical documentation (Various)
AS 1210-2010 Pressure vessels
AS 2865-2009 Confined spaces
AS/NZS 3000:2007 Electrical installations (known as the Australian/New Zealand Wiring Rules).
AS 3439 Low voltage switchgear and controlgear assemblies
AS 3439.1-2002 Type-tested and partially type-tested assemblies
AS 3600-2009 Concrete structures
AS 3735 Concrete structures retaining liquids
AS 3735 Supp1-2001 Concrete structures retaining liquids - Commentary (Supplement to AS 3735-2001)
AS 3959-2009 Construction of buildings in bushfire-prone areas
AS 4024.1-2006 Series: Safety of machinery (26 parts)
AS 4100-1998 Steel structures
AS 4198-1994 Precast concrete chambers for sewerage applications
AS 4883–2008 Air valves for sewerage
AS 60947 Low voltage switchgear and controlgear
AS 60947.4.2-2004 Contactors and motor-starters - A.C. semiconductor motor controllers and starters
AS/NZS 61000 Electromagnetic compatibility (EMC)
AS/NZS 61000.4.6:2008 Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields
AS/NZS 61000.6.2:2006 Generic standards - Immunity for industrial environments

Water Services Association of Australia (WSAA)
WSA 02-2002 Sewerage Code of Australia, 2nd Edition Ver. 2.3
1.4 STANDARDS

General
Planning and design of sewage pump stations: To WSA 04 Part 1.

1.5 INTERPRETATIONS

Abbreviations
General: For the purposes of this worksection the following abbreviations apply:
- EIS: Environmental impact statement.
- ERS: Emergency relief system.
- ISO: International standards organisation.
- MH: Maintenance hole.

Definitions
General: For the purposes of this worksection the following definitions apply:
- Concept plan: A package of information provided to the designer by the Water Agency to allow the appropriate planning/design of major sewerage system components to be performed. It is the critical starting point of the design process as it determines the extent of sewers and the possible need for pressure or vacuum pumping stations.
- Designer: The person(s) responsible for a design output in conformance with the Water Agency’s project brief, contract or development agreement.
- Document: Record of information in written or graphical form.
- Water Agency: An Authority, board, business, corporation, Council or local government body with the responsibility for planning or defining, design, construction and maintenance requirements for water supply and/or sewerage systems.
- Septicity: The prolonged retention of sewage under anaerobic conditions, particularly during low flow periods.

2 PRE-DESIGN PLANNING

2.1 SYSTEM PLANNING

General
Reticulation: To 0076 Sewerage systems – reticulation (Design).
Application: Define the pumping strategy and the application of the complete sewerage system.
Parameters for option analysis: Obtain from the Water Agency.
Assessment of loads: Include future system loads.

Environmental considerations: Consider the environmental impact and conform to the local government environmental and heritage requirements.

Operation and maintenance considerations: Locate the pump stations to provide safe and easy access for maintenance and condition assessment.

Geotechnical investigations: Engage a geotechnical engineer to assess if any special investigation is required for ground instability and ground water infiltration.

2.2 SUBSIDISED SCHEMES

Funding
Government grant funds: If the works form part of a contract attracting Government grant funds, identify the following:

- Items which are not of the least cost option, that:
  - Are intended to have a much longer design life than the normal asset service life detailed in the Asset Management Guidelines of the International Infrastructure Management Manual.
  - Do not meet the project objectives and the requirements of the various Authorities for the least Net Present Value (NPV) but may become the preferred option for construction.
- Particular equipment which is procured without relevant competition through tendering.
- Duplication of equipment or unit processes in a system configuration.

2.3 CRITICAL INFRASTRUCTURE PROTECTION

Asset categorisation
Concept plans: Address the asset categorisation and review the final design for consistency with asset categorisation of the concept plan to conform to WSA 03 clause 1.2.4.1.

2.4 CONSULTATION

Council and other authorities
Approval: Obtain approval from the following public authorities:
Consulting Authority: Bellingen Shire Council

3 DESIGN

3.1 GENERAL

General
Design parameters: If conflict between this specification and the Water Agency requirements occurs seek clarification.

Concept design: Provide a concept design for the proposed pumping station in conformance with WSA 04 clause 1.3.

Modelling: Carry out models in conformance with WSA 04 clause 1.4 and in particular pollution.

Commissioning plan
Requirement: Provide a commissioning plan in conformance with WSA 04 clause 2.17, Appendix A and Appendix B including the following:

- Pre-commissioning procedures, including schedules, record sheets for each item of equipment and checklists. For pressure sewerage conform to schedule requirements in WSA 07 clause 2.13.2.3.
- Commissioning procedures, including procedures, schedules, notice periods for independent testing. For pressure sewerage conform to schedule requirements in WSA 07 clause 2.13.3.
- Handover requirements.
- Sign-off requirements.
- Documentation of supply requirements at handover and sign-off.
- Documentation required to operate, maintain and resource the facility including equipment technical specifications, work-as-executed drawings, risk analysis, operation and maintenance manuals, resource requirements for ongoing operation of the facility.
- Following final design, update the commissioning plan in conformance with design documentation.

**Location**

General: Document the layout of the pump station including consideration of the following:
- Right of occupancy and access requirements including truck turn around access.
- Proximity to residential boundaries: Conform to regulations.
- Precautions for flood prone areas: To WSA 04 clause 5.2.3.
- Environmental impacts: Visual impact and noise and odour impact during operation.
- Site maintenance and restoration requirements.
- Easements.
- Power supply requirements.
- Working area: To AS 2865.

**Inlet MH**

General: Document the inlet MH to conform with WSA 04 clause 5.3 including the following:
- Minimum clear opening.
- Minimum diameter.
- Type of cover and frame.
- Step irons: If removal is required.
- Invert levels.
- Grit collection if required.

**Wet-well design**

General: Document the wet-well to conform with WSA 04 clause 5.4 including the following:
- Isolating valve: Knife gate valve or equivalent required where there is only one wet-well to cater for any shut down periods.
- Number, location and size of wet-wells.
- Depth.
- Pumping control volume.
- Maximum number of pump starts per hour.
- Control levels: Default control levels to WSA 04 Table 5.1.
- Detention time.
- Base benching.
- Wet-well washer or submersible mixer if required.
- Natural ventilation.
- Forced ventilation where required.
- Educt vent shaft.
- Falls from heights protection.

Protection of internal surfaces: Document protection requirements for internal surfaces of wet wells. This may include epoxy paint, plastic lining or bare concrete.

Bolted connections within wet wells: Provide for stainless steel to ASTM A276 Grade 316.

Overflow containment: Provide for overflow containment to conform to WSA 04 clause 5.6 including one or more of the following as required:
- Emergency storage: Including the following:
  - Configurations: No dry weather overflows.
  - Invert, outlet and obvert levels.
- Filling protocol.
- Configuration of the emergency storage/wet-well relationship.
- Self-cleaning.
- Wall thickness.
- Roof thickness.
- Cover.
- Minimum floor and pipe grades.
- Design against flotation.
- Access openings.
- Minimum head room: 2.2 m.
- Locations of eyebolts for portable ladder tie offs.
- Emergency by-pass pumping to the pressure main if required.
- Covers and frames.
- Construction details.
- Permanent generator.
- Permanent by-pass pumping.


Emergency relief system (ERS): Document the ERS system including the overflow pipe, weir point, baffles arrangement and storage facility to hold gross solids/trash, scum and gas.

Ladders and platforms: If required provide for ladders in conformance with WSA 04 clause 5.7 and AS 1657.

Valves for pressure systems
Valves design and location: Document the location, type, class, end connections and arrangement for all valves in conformance with WSA 07 clause 5.3 and WSA 07 Standard Drawing PSS-1005.

Collection/pump units for pressure sewerage
Design flow: Provide the collection/pump capacity and overflow storage time based on minimum design flow in conformance with WSA 07 clause 7.1.

Collection tanks and pump units: Document the make and model of collection tank and grinder pump unit.

Grinder pumps, collection tanks (pump basins) including check and air or vacuum release valves: Document to WSA 07 clause 10.6 and NSF/ANSI 46 including the following:
- Grinder pump capacity.
- Grinder pump testing.
- Tank dimensions, positions and dimensions of access cover, connector fittings for pipework and electrical/control conduits including any brackets, supports or other elements.
- Tank and cover material.
- Class of access cover.

Collection chambers: Conform to WSA 06 clause 10.1.

Structural design of pump station building
General: To WSA 04 Section 11.

Ground and site conditions: To geotechnical site investigation report, including differential ground support and flotation.

Supports for pumps: To resist loads and hydraulic forces without vibration.

Dimensions: To suit selected equipment, handling, support and access.

Preformed components: Implement preformed components or systems instead of in situ construction in conformance with the following:
- Precast concrete chambers: Manufactured to AS 4198.
- Internal joints: Flush and watertight.

Concrete components: To AS 3600, AS 3735 and AS 3735 Supplement 1.
3.2 PUMPING SYSTEM

General
Staging proposals: If proposed, submit for approval. Do not use throttled variable flow control. Size access covers to provide for replacement of pumps if required for staging.

Hydraulic design: Conform to WSA 04 clause 6.2 and Appendix D and document the following:
- Design flow and total pump head.
- Invert level of the incoming sewer.
- Pumping station capacity (initial and long term).
- Internal diameter, length, route and materials of the pressure main, including surge and fatigue analysis.
- Levels and profile of the pressure main.
- Levels of the pressure main discharge point.
- High-points.
- Detention times for wet-well and pressure mains.

Pump selection: Select pumps that conform with WSA 04 clause 6.4 and the following:
- Interchangeable with other approved Water Agency makes/models.
- Readily available in the market place.
- Close coupled fully submersible electric centrifugal pumps and ancillary equipment in conformance with WSA 101.
- Submit proposals using triple-pump pumping for approval.
- Select impellers of a non-clog type.
- Select motors in conformance with WSA 101 and WSA 04 clause 6.6.3.
- Detail discharge connection including anchoring.
- Junction boxes: To WSA 04 clause 6.6.5.
- Pumpset lifting equipment in conformance with WSA 101 including guide rails and brackets where required.
- Flushing valves.
- Pump starters: To WSA 04 clause 6.8.
- Variable speed drives: To WSA 04 clause 6.8.

Removal: Provide for fixed guide rails to aid removal of pumps.

Harmonics and radio frequency interface: Document to conform with AS/NZS 61000.4.6, AS/NZS 61000.6.2 and WSA 04 clause 6.9.

Emergency stop: Document in conformance with AS/NZS 3000 and AS 4024.1.

3.3 POWER SYSTEM

Power supply
General: Determine the power supply requirements in conformance with WSA 04 clause 7.2.
Primary supply: Provide for 3 phase, 4 wire, 400V, 50 Hz, MEN system with capacity to operate at full pumping load.

Fault level protection: Determine the prospective fault current and design the electrical protection to withstand the prospective fault current level of the incoming supply at the equipment location.

Power supply security
Risk assessment criteria: To WSA 04 clause 2.5 and the following:
- Evaluation of reliability/security of power supply.
- Duplicate power supplies.
- An emergency on-site power generator.
- Provision for the connection of a mobile diesel generator.
- Detail security requirements against theft of on-site generators and connections for mobile generators.

3.4 PRIMARY SUPPLY

General
General: Determine the primary power supply requirements in conformance with WSA 04 clause 7.2.2.
Off-site electrical services: Liaise and provide for all off-site electrical services as required by the local Electricity Distributors.

Site specific substation
Electricity Distributor dedicated substation: Where required for the pumping station, determine the following:
- Location of substation.
- Type of service.
- LV connection point and route of the distribution mains to the point of supply.
- Protection equipment, particularly any LV transformer output protection.
- Easement details.
LV transformer output protection: Provide short circuit and overload protection at the transformer secondary supply using fault current limiting circuit breakers with adjustable overload and short circuit current setting features, where secondary output supplies are required to be installed by the Electricity Distributor.
Cascade protection: Include full discrimination and cascade protection with the Electricity Distributor’s incoming supply protection system and the downstream site protection devices.

Customer owned substation
HV customer service: Where a HV supply is provided to the pumping station site, meet the requirements of the Electricity Distributor for the following:
- HV reticulation.
- HV protection.
- Transformer and LV protection: Set out LV facilities and LV transformer protection in Electricity Distributor dedicated substations.

Electrical mains
On-site electrical mains: Run on-site electrical mains underground between electricity supply and the switchboard for the pumping station.
Point of supply for LV sites: Conform to the following types:
- Pole mounted at the site boundary, where from overhead supply.
- A private underground termination enclosure at the site boundary, where from underground supply.
- Direct connected consumers mains run underground from the Electricity Distributor’s connection point to the main switchboard.
Consumers Mains: Provide consumers mains, associated services and all necessary fault and overload current protection equipment to AS/NZS 3000 Section 3, the local Electricity Distributor’s standards, the local Service and Installation Rules and WSA 04 clause 7.2.3.
Minimum size of the consumer mains: Conform to the following requirements:
- Current carrying capacity to suit the maximum demand with an excess current carrying capacity of 30% minimum.
- A voltage drop less than 1.5% of the maximum demand as calculated.
- Single core PVC/PVC cables or XLPE insulated cable.
Pole termination method: Determine in consultation with the local Electricity Distributor.
Protected consumers mains: Provide short circuit and overload protection, where required by the Electricity Distributor.
Electricity Distributor’s service protective devices:
- Low voltage service protective devices: To AS/NZS 3000, the Electricity Distributor’s requirements and Service Installation Rules.
- For service protective devices > 100 A: Provide fault current limiting circuit breakers with adjustable overload and short circuit current facilities with full discrimination and cascade protection between the incoming supply protection systems and the downstream protection systems.

3.5 ELECTRICAL DESIGN

Design responsibility: Design the equipment suitable for the purpose in conformance with the requirements of the relevant standard specification.

Automatic operation: Design the pump station for fully automatic operation in the unmanned condition.

Switchboards

General: Document the switchboards in conformance with WSA 04 clause 7.3 and AS 3439.1.

Inter-changeability: If more than one item of equipment is designed to form a particular function, make sure that all such items of equipment are identical and completely interchangeable (e.g. pilot lights, pushbuttons, relays, etc).

Switchboard: Provide for installation in a visible location which is physically accessible above all areas at risk of flooding.

Ambient conditions: Determine the ambient conditions for the local area. Generally, normal accepted limits are 0°C to 45°C.

Switchboard construction form: Generally Form 2 to AS 3439.1. Segregate telemetry and communications equipment from the power and control sections of the switchboard.

Switchboard location:
- General: Locate switchboard on concrete plinth adjacent to the pump well. Provide plinth details and physical protection.
- Flood prone areas: Locate switchboards above the flood level on suitable support structures. Detail switchboard support structures and location. Provide suitable access facilities and working platform in front of switchboard for safe operation of the equipment.

Selection of equipment and devices: To WSA 04 clause 8.8.

Phase failure protection: Provide electronic phase failure relay to monitor the incoming power supply, incorporating:
- Detection of undervoltage (80% of normal voltage),
- Voltage or phase angle imbalance,
- Reverse phase sequence.
- 10 A fuse protection for connection to the three supply phases.

Surge protection: Provide, where considered necessary, Type I SPD shunt connected metal oxide varistor based SPDs between each phase and neutral at assembly incoming supply terminals.

- Surge protection devices: To IEC 61643-11 and IEC 61643-12.
- Installation: To AS/NZS 3000 Appendix F.

Metering requirements: To WSA 04 clause 7.3.3.

Lighting requirements: To WSA 04 clause 7.3.4.

Power factor correction: Consider power factor correction requirements as set out in WSA 04 clause 7.2.9, the energy cost in running the pumping station and cost savings to justify the installation of power factor correction equipment.

Connection facilities for mobile diesel generators: In addition to the requirements of WSA 04 clause 7.2.7, consider incorporation of safeguards to prevent inadvertent simultaneous connection of mains and generator power. Where necessary, provide mechanical interlocks and an isolation device or changeover switch to switch the mobile generator supply to the switchboard.

Anti-condensation heaters: Provide thermostatically controlled anti-condensation heaters to weatherproof switchboards with an external surface area greater than 4 m² based on 40 watts/m² of exposed surface area, where environmental conditions may cause condensation to occur within the
switchboard. Provide heaters of the black heater type, mechanically protected and able to be touched without harm.

**Protection devices**

General: To WSA 04 clause 8.8.8.

Selection: Provide full discrimination and cascade protection for overload and short circuit conditions.

**Motor starters**

Soft starters: Conform to AS 60947.4.2 using hybrid motor controller Form 1 or 2 as appropriate to the control requirements as defined in AS 60947.4.2 clause 3.1.1.2. Where the soft starter is not intended to continuously control the motor for the full duration of the run cycle, utilise a bypassed hybrid motor controller as defined in clause 3.1.2.

Variable speed drives: Use hybrid motor controllers as defined in AS 60947.4.2 clause 3.1.2.

### 3.6 CONTROL AND TELEMETRY

**General**

Control, telemetry and alarms: Document control, telemetry and alarm systems in conformance with WSA 04 clause 8 and the following:

- Compatible with existing systems.
- Record available storage volume in well.

Selection of equipment and devices: To WSA 04 clause 8.8.

### 3.7 PROTECTION DEVICES

**General**

To WSA 04 clause 8.8.8.

Selection: Provide full discrimination and cascade protection for overload and short circuit conditions.

Motor protection: Provide motor overload protection in conformance to WSA 04 clauses 8.8.8.5 to 8.8.8.7.

Thermal-overload relays: Conform to WSA 04 clause 8.8.8.5 and the following:

- Incorporate single phase fault protection using differential trip bar mechanisms operating at 60% of motor full load rating under single phasing conditions particularly for delta wound motors.
- Incorporated in motor protection design where thermistor protection is required.
- Manual reset on overload trip unless design conditions dictate automatic reset.

Protection CTs: Provide protection CTs and connect electronic motor protection relays to the secondary side of the CTs where motor currents do not allow for direct connection of the relays into the motor circuit.

Phase failure protection: Provide electronic phase failure relay to monitor the incoming power supply, incorporating:

- Detection of undervoltage (80% of normal voltage),
- Voltage or phase angle imbalance,
- Reverse phase sequence.
- 10 A fuse protection for connection to the three supply phases.

Surge protection: If considered necessary, provide Type I SPD shunt connected metal oxide varistor based SPDs between each phase and neutral at assembly incoming supply terminals.

Surge protection devices:

- General: To IEC 61643-11 and IEC 61643-12.
- Installation: To AS/NZS 3000 Appendix F.

### 3.8 ELECTRICAL REQUIREMENTS FOR PUMP STATION BUILDINGS

**General**

If the pumping equipment is installed within a pump station building, provide the following:

- Fluorescent lighting within the building using sealed corrosion resistant lighting fittings with electronic ballasts.
- 10 A, 240 V switched power outlets. Quantity and location to suit pumping station requirements.
- 15 A, 240 V switched power outlet suitable for electric welding requirements.
- RCD protection to AS/NZS 3000 requirements.

Lighting switches and power outlets: Ironclad or high impact polycarbonate industrial type.

Conduits:
- Electrical accessories: Heavy duty UPVC conduit.
- Pumping equipment: Heavy duty conduit, on tray or on cable ladder.

### 3.9 WET-WELL PIPEWORK

**General**

Pump discharge pipework: Document the pump discharge pipework in conformance with WSA 02 clause 9.1 and the following:
- Vertical pipework in the wet-well.
- Horizontal pipework up to the pressure main isolating valve.
- Emergency bypass pipework and valves.
- Sizing of pipework.
- Type of pipework.
- Air release valves to AS 4883.
- Valve chambers.
- Dismantling joints.
- Pipework supports.
- Main tappings.
- Access covers.
- Emergency pumping arrangements including condition monitoring and maintenance.
- Drain from valve pit back into wet well.

**Pressure main**

Site test pressure: Document the allowable site test pressure taking into account all parameters including surge.

Location: Document the location of pressure mains in conformance with WSA 02 clause 10.2.

Hydraulic design: Provide hydraulic design in conformance with WSA 02 clause 10.3 including total mean head, mean static head, friction head loss, fitting head loss. Document the hydraulic design including the following:
- Velocity in pressure mains.
- Sizing of pressure mains.
- Maximum design pressure.
- Surge.
- Pipe and fitting pressure class.
- Pressure main valves.
- Odour and septicity control.
- Receiving system including discharge MHs.

**Supporting systems**

General: Conform to WSA 04 clause 2.15.

**Health and safety**

General: Conform to WSA 04 clause 2.16.
4 ADDITIONAL DESIGN REQUIREMENTS FOR VACUUM SEWERAGE

4.1 GENERAL

Detailed design
Reticulation: Conform to 0076 Sewerage systems – reticulation (Design).
Vacuum generation rate: < 5 starts per hour for the sewage discharge pumps. Equates to approximately 1.33 times design flow.
Vacuum generators and pipework: Determine the following in conformance with WSA 06 clause 6.6:
- Vacuum generator capacity.
- Evacuation time.
- Vacuum generator selection: Liquid ring, sliding vane oil lubricated or rotary lobe vacuum generators.
- Vacuum generator operating vacuum: Determined from the reticulation design.
- Select electric motors.
- Vacuum pipework and valves.
- Make up water tank.
Emergency pumping: Provide facilities for emergency bypass pumping and/or pumpout within the vacuum station or in a separate pit.
Sewage discharge pumps: Determine motors, shaft seals, equalisation lines, total dynamic head (TDH), net positive suction head and delivery pipework in conformance with WSA 06 clause 6.8.
Gauges and recorders: Determine vacuum and pressure gauges and recorders in conformance with WSA 06 clause 6.9.
Skid-mounted packaged stations: Provide an assembly drawing including the dry weight of all packaged stations.

4.2 POWER SYSTEM

Power supply
General: Determine the power supply requirements in conformance with WSA 06 clause 7.2.
Primary supply: Provide for 3 phase, 4 wire, 400 V, 50 Hz, MEN system with capacity to operate at full pumping load.
Fault level protection: Determine the prospective fault current and design the electrical protection to withstand the prospective fault current level of the incoming supply at the equipment location.

Power supply security
Due diligence requirements: To WSA 06 clause 2.3, clause 7.2 and the following:
- Evaluation of reliability/security of power supply.
- Duplicate power supplies.
- An emergency on-site power generator.
- Provision for the connection of a mobile diesel generator.
- Detail security requirements against theft of on-site generators and connections for mobile generators.

4.3 PRIMARY SUPPLY

General
General: Determine the primary power supply requirements in conformance with WSA 06 clause 7.2.3.
Off site electrical services: Liaise and provide all off-site electrical services as required by the local Electricity Distributors.

Switchboards
General: Document the switchboards in conformance with WSA 06 clause 7.3.2, AS 3439.1.
Metering requirements: To WSA 06 clause 7.3.3.
Lighting requirements: To WSA 06 clause 7.3.4.
Power factor correction: Consider power factor correction requirements as set out in WSA 06 clause 7.2.8.

Connection facilities for mobile diesel generators: To WSA 06 clause 7.2.7.

### 4.4 CONTROL AND TELEMETRY

**General**

Control, telemetry and alarms: Document control, telemetry and alarm systems in conformance with WSA 06 clause 8 and be compatible with existing systems.

Telephone/telemetry lines: Conform with ACA and AUSTEL standards.

Selection of equipment and devices: To WSA 06 clause 8.2.

### 4.5 MOTOR STARTERS

**General**

Standard: To WSA 04 clause 6.8.

### 4.6 SUPPORTING SYSTEMS

**General**

Water provision: Provide metered water service to the vacuum station to conform with WSA 06 clause 16.1.2.

Water closet, wash trough and work bench: Conform to WSA 06 clause 16.2.

Materials handling equipment: Conform to WSA 06 clause 16.3.

Security: Document a security plan to conform to WSA 06 clause 16.4.

Lighting: To AS 4282.

Fire control: Document a fire control plan to conform to AS 3959 and WSA 06 clause 16.5.

**Detailed design**

Structural design for vacuum station: Conform to WSA 06 clause 14.1.

Vacuum station layout: To WSA 06 clause 6.3, VAC-1300, VAC-1301.

Permanent stairways: To AS 1657.

Vacuum vessel: Determine the operating volume and document vacuum and moisture removal vessels in conformance with AS 1210 and WSA 06 clause 6.4.3.

**Pumping system**

Hydraulic design: Conform to WSA 06 clause 11.2.

Pump selection: Conform to WSA 06 clause 11.4. Include for total dynamic head, net positive suction head, impeller selection, electric motors, shaft seals and equalisation lines.

Pump starters and variable speed drives: Conform to WSA 06 clause 11.5.

Emergency stop: Provide an emergency stop to conform to AS/NZS 3000 for electronic starter/controllers or variable speed drives.

**Pump discharge pipe work**

Hydraulic design: Determine and document the pump discharge pipe work to conform to WSA 06 clause 12.2 and the following:

- Internal level of the vacuum vessel flanged off takes.
- Internal vacuum within the vessel.
- Vacuum station capacity (initial and long term).
- Internal diameter, length, route and materials of the pressure main, including a surge and fatigue analysis.
- Level and profile of the pressure main.
- Level of the pumping discharge point.
- High-points.
5 DOCUMENTATION

5.1 GENERAL

Approvals
Authorities: Bellingen Shire Council

Design reports
Construction documentation: Prepare site investigation report, excavation/trench details, design assumptions, design constraints and other technical matters.

Specifications
Construction documentation: Prepare a project specific specification to 1361 Sewerage systems – pump stations (Construction).

Design certification
Requirement: Provide a signed and dated design certificate.
Structural design: Include certification against flotation.

5.2 DRAWINGS

General
Minimum drawing scale:
- Plans and sections: 1:50.
- Structural steelwork details: 1:10.

Electro technical symbols: To AS 1102.
All wires and terminals: Numbered.

Drawing presentation
Drawing size: Consult with the Water Agency.
Drawing format: Provide in electronic form after consultation with the Water Agency.
Title block: Include Water Agency details and a signature block.

Asset register
Maintain: Provide asset schedules and drawings in a form consistent with the existing or proposed Asset Register after consultation with the Water Agency.

Drawings content
General: To WSA 04 Section 15 and the following:
General arrangement of pump stations with site plan:
- Number, make, model and details of pumps.
- Inlet and outlet pipework details and levels.
- Pump cut in.
- Cut out and alarm levels.
- Switchboard location.
- Pump station access details.
- Design starts per hour.
- Overflow storage details.
- Electrical drawings.
- Switch and Control Gear Assemblies (SCA): Fully dimensioned manufacturing details, general arrangement (showing internal/external details) and foundation/gland plate details.
- Common control: Circuit diagram and description of operation.
- Schedule of equipment.
- Other engineering drawings fully describing the proposed equipment.
- Location of pipelines, valves, pipe materials, size pressure class, jointing methods and corrosion protection measures.
- Location of all obstructions.

5.3 WORK-AS-EXECUTED

Work-as-executed drawings
General: Provide additional set of final construction drawings for the purpose of recording the work-as-executed by the Contractor.

Final certification of completed works
Requirement: As per development 011 Development and subdivision of land.