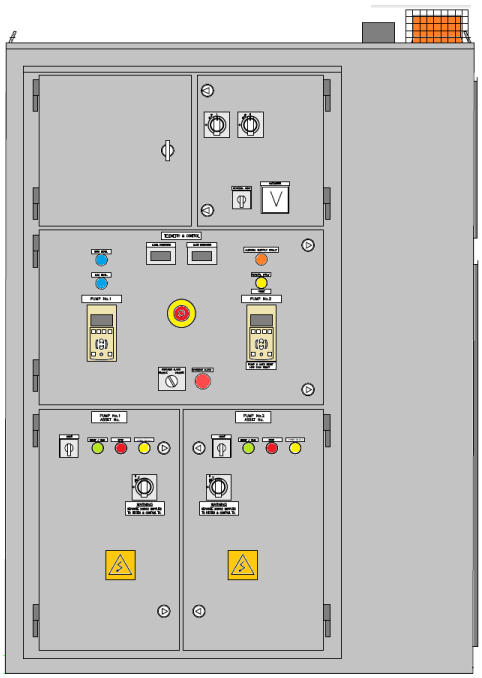
Small Sewage Pump Station Electrical Design & Installation Guideline

Version 1.0



Document Approval and Issue Notice

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1. Introduction

1.1. Sewage Pump Station

The Sewage Pump Station (SPS) is a commonplace asset owned and operated by TasWater. The function of the SPS is to collect the gravity fed and pumped catchment sewage in its wet-well and pump it up to a treatment plant or another SPS.

1.2. Standard SPS

TasWater have a Standardised SPS electrical design which must be used when designing & installing a new or upgraded, site-specific SPS. The standard design is based around a two pump, Duty/Standby arrangement where both pumps are identical in size and capability. Where specifically required, the pump arrangement can be modified to provide a Duty/Assist function. The SPS can also be used for single pump applications by isolating the second pump, however, alarm categories need to be reviewed. The SPS is normally operated in Automatic mode where it is controlled locally by the pump station RTU but can be operated manually locally via selector switches and pushbuttons. In both modes the operation of the pump station is monitored by the TW SCADA system.

1.3. Document Scope

This Design & Installation Guideline details:

- Steps that a builder needs to follow to complete a successful installation.
- Design features of the standard design.
- Standard settings necessary for intelligent devices (Soft-starters, RTU etc.)
- Technical requirements of the designer, manufacturer and builder
- Installation requirements on-site
- Necessary testing programme
- Operational & Maintenance requirements.

1.4. Stakeholders

The Principal –TasWater is the Asset Owner and Operator. All final Construction drawings must be accepted by them.
The Builder – The person or entity responsible for the complete, on-site installation.
The Designer – The person or entity 'designing' the site specific solution based on the TasWater standard design to fit the project specific needs. The Builder and the Designer maybe the same person/entity.
The Manufacturer – The person or entity manufacturing the SPS switchboard.
Electricity Utility – TasNetworks. The owner and operator of the electricity network which powers the pumping station.
The SCADA/RTU/Telemetry Integrator – A sub-consultant employed to complete the communications integration of the new SPS into the area network. TasWater has nominated a preferred consultant for each region. The Builder must contact TasWater for the respective area's Integrator.

1.5. Acronyms Used

Throughout this and related documents, these acronyms are used.

ACMA – Australian Communications and Media Authority
CT – Current Transformer
FAT – Factory Acceptance Testing
GL&P – General Light & Power
ITP – Inspection & Test Plan
LV – Low Voltage
GPO – General Purpose Outlet
MCB – Miniature Circuit Breaker
SPS – Sewage Pump Station
PLC – Programmable Logic Controller
RCD – Residual Current Device
RTU – Remote Terminal Unit
SAT – Site Acceptance Testing
SCADA – Supervisory Control And Data Acquisition
SS – Soft Starter
TCB – Terminal Circuit Breaker
TW - Taswater
STP – Sewage Treatment Plant

1.6. Phases of Work

The phases of work can be summarised in the following flow diagram. The diagram details the prerequisites necessary to progress to the next phase.

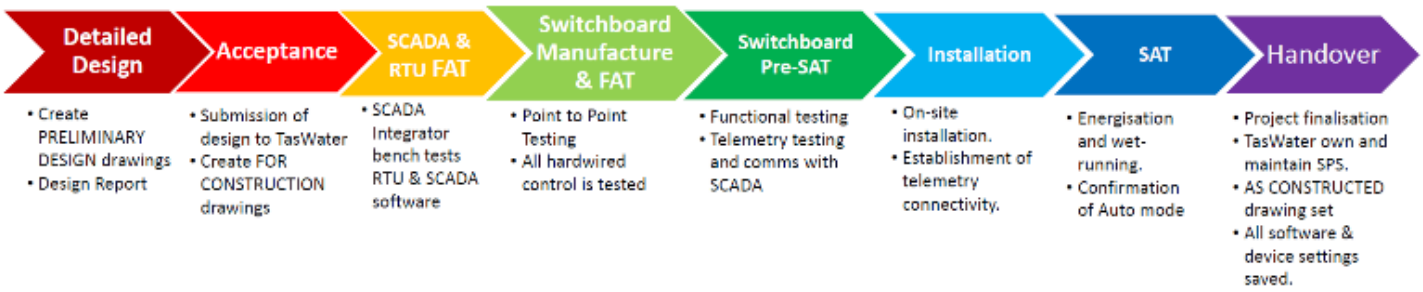


Figure 1 - Work Flow Diagram

The Standard SPS requires the following phases of work to be consecutively completed.

Stage		Description	Drawings & Documents	Responsibility
1	**Detailed Design**	The Designer designs the SPS to fit the application to TasWater requirements.	• Preliminary (Revision A)	Designer
2	**Acceptance**	TasWater reviews the design drawings, settings and calculations	• See section 2.13 for full list	TasWater
3a	**SCADA & RTU Software & Comms Configuration**	SCADA Integrator produces site specific software from TW standard software and defines the communication system requirements	• See Section 3	SCADA Integrator
3b	**SCADA & RTU Software FAT**	RTU and SCADA software fully bench tested	• See Section 3	SCADA Integrator (TW witness)
4a	**SWB Manufacturing**	SPS Switchboard is manufactured as per approved FOR CONSTRUCTION design.	• For Construction (Revision 1)	Manufacturer
4b	**SWB FAT**	Switchboard testing by manufacturer.	• FAT Inspection Test Procedure	Manufacturers, Designer, Builder (TW Witness)
5	**Pre-SAT**	RTU software installed, functionality tested, Communications tested	• Pre-SAT Inspection Test Procedure	Designer, Integrator, Builder, (TW Witness)
6	**Installation**	SPS Switchboard is installed at location along with necessary cabling and peripherals.	• For Construction (Revision 1)	Builder
7	**SAT**	Wet pump tests. Communications final testing. Automatic mode confirmation.	• SAT Inspection Test Procedure. • AS CONSTRUCTED (rev2 or later drawings)	Designer, Builder, (TW witness).
8	**Handover**	Handover of final documentation.	• O&M Manual supplement • See 8.1 for full list	TasWater

Table 1 - Expected phases of work

2. Design

The design phase must produce the following for TasWater's review and acceptance:

1. Detailed **SPS design** (designed from the Standard SPS drawing set but modified to suit the site specific aspects).
2. Detailed **site design** drawings which include the site plans and elevation details (with dimensions)
3. A **design report** which details:
    - Settings
    - Protection devices discrimination curves
    - Justification of design choices and calculations (including maximum demand, voltage drop & earth loop impedance)
    - Cable Sizing & type
    - Pump Station Wet Well Levels
    - Type of RTU and SCADA Communications System

A comprehensive list of documents for submission is listed in the final part of this section (2.9).

2.1. Site Layout Design

The Designer must provide during the design phase the following drawings:

- Plan and Sections (showing the proposed new layout of equipment)
- SPS switchboard orientation (switchboard and cableway) on the concrete slab
- Position of retaining wall *if required*
- Civil details of the installation
- Proposed position for conduits to wet well, access areas to pumps, land boundaries etc.
- Proposed antenna pole size & position
- Notes to be heeded before and during construction

Refer to section *2.13 - Design Documentation Submission to TasWater*

2.2. Standard SPS Switchboard Drawings

The TW standard design comprises of the following set of drawings and documents

Drawing & Document Set	Description
TWS-E-0001, sheets 1 to 4	Telemetry Pole, Antenna Installation Details
TWS-E-0002	*Type 1* DOL Starter for pumps equal to or less than 4.0kW each (Duty/Standby & Duty Assist)
TWS-E-0003	*Type 2* Soft Starter for pumps greater than 4.0kW and up to or equal to 37kW each, Duty Standby arrangement. (Duty/Assist arrangement ONLY up to or equal to 18.5kW)
TWS-E-0004	*Type 3* Soft Starter for pumps greater than 18.5kW and up to or equal to 37kW each Duty/Assist arrangement.
TWS-E-0005	*Type 4* VSD for pumps greater than 4.0kW and up to or equal to 37kW each, Duty / Standby arrangement.
TWS-E-0006	Additional sub-set detailing the Kingfisher™ telemetry option.
TWS-E-0007	Wet Well Levels
TWS-E-0008	Level Sensor & Floats, Installation Requirements
TWS-E-0009	Level Sensor & Float bracket, Fabrication Details
TDETEM01	SPS Switchboard Electrical FAT Sheet
TDETEM02	SPS Switchboard & SCADA Pre-SAT Sheet
TDETEM06	SPS SAT Sheet

Table 2 - TasWater Standard SPS drawing sets

This set of drawings have been produced by TasWater to ensure that all new outside sewage pumping stations are built to a standard. The reason for this is to provide a long life, robust installation with the identical operational and maintenance requirements.

2.3. Standard Design Application to Site Specific Projects

The switchboard design must be in accordance with the set of drawings above. However, the switchboard Designer is responsible that the switchboard satisfies all requirements of the project as well as applicable Australian Standards and other local statutory requirements. If the supplier wishes to deviate from this design this must be approved by TasWater Electrical Team in writing.

To modify one of the standard designs to suit the specific application, the Designer must carry out the following steps.

1. Select the applicable Standard Drawing Set Type (1, 2, 3 or 4) appropriate to the size and function of the pumps and whether the pump application is Duty / Standby or Duty / Assist
2. From the appropriate TW Standard Drawings create the site specific Asset drawings for the new pump station.
3. Drawing Sheet E02 of the TW Standard Drawings outlines the procedure for creating new TW Asset drawings for the individual pump stations.

2.4. Electrical Design

2.4.1. Electricity Utility Details

The pump station must be designed so that the devices and personnel operating and maintaining the the pump station locally are safe from any electrical faults. The electrical protection must be suitable for the electrical connection provided by the electricity utility. Therefore the designer must contact the electricity utility and identify the following details:

1. Supply Transformer and Size
2. Existing Supply Fuse Type and Size
3. Electricity Utility Supply Pole No. / Kiosk No. / Turret No.
4. Prospective Fault Current at the point of supply
5. Any running or starting Current limitations (Only if the MD or maximum starting currents are expected to increase. E.g. pump size increase or different starting methodology. Otherwise new current limitations do not need to be requested)

The above information must be included in the Electricity Supplier Table Details on the Single Line Diagram [sheet EP01].

2.4.2. Electrical Protection Co-ordination

The electrical Designer must ensure that the size of the electricity utility supply fuse will be of sufficient rating to allow full electrical discrimination with the switchboard main circuit breaker and still allow full discrimination with the switchboard sub-circuits. To minimise the let-through energy, the circuit breakers must be set to the minimum settings, however, a setting that allows 100% discrimination.

The settings required to achieve the above will be recorded next to the circuit breakers on the single line diagram.

The designer may also need to request increase fuse sizes from Electricity Supplier. This will need to be recorded on the For Construction drawings for the pump station.

The TasWater pump station standard electrical drawings show the use of either NHP (Teresaki & Sprecher Schuh) or Schneider (Schneider & Telemechanique) circuit breakers and contactors. TasWater will accept either of these suppliers but not a combination.

The functional requirements for the overall electrical design are to ensure:

- An overload or short circuit condition of a single pump supply only trips the pump main circuit breaker and not the station main circuit breaker
- The pump station main circuit breaker will trip under overload or short circuit before the electrical utility 400V (+10%/-6%) protection fuses

- The complete install is designed for a minimum of 25kA (for 1 second) fault current even if the existing prospective fault current level is below this, however, protection must be set to minimise the fault current and it's duration.

2.4.3. Electrical Cable Selection Co-ordination

The standard drawings identify the minimum mains cable size for the different types of pump station. The electrical designer must confirm via calculation that all cables, including the mains supply, satisfy AS3000 in the following areas:

- Maximum demand calculation
- Voltage Drop
- Earth Loop Impedance
- Prospective short circuit current

These calculations are to be provided to TasWater for review in the accompanying design report (see section 2.13 Design Documentation to TasWater).

The designer shall use a software package such as Power Cad 5 to confirm the system protection and electrical cable sizing are correct to satisfy the above design criteria.

2.5. Telemetry / RTU Selection

Each pump station site is part of an operational area which has specific requirements with regards to telemetry/RTU/SCADA and operator messaging systems. The Designer must identify the type of telemetry to be employed by the SPS. This will usually be based on the existing telemetry system in the area.

TasWater has a preference for radio communications over the 3G Network.

2.5.1. RTU Controller Selection

The SPS must consist of an RTU which must either be:

- Kingfisher, or,
- SCADAPack.

The Designer should contact the TasWater SCADA team to obtain the type of RTU system to be used and identify the TW Preferred SCADA / Telemetry Integrator to be used for this project. Refer to Appendix A – Design Information Checklist.

2.5.2. Communication System Selection

Connected to the RTU will be a communications system which will either be:

- Telemetry Radio (TasWater preference), or,
- 3G Network Modem.

The Designer must contact the TasWater preferred SCADA Telemetry integrator to identify whether the site can use telemetry radio or whether the site needs to use a 3G network modem and which option of antenna type and installation method is required.

The SCADA telemetry integrator will then perform a radio path analysis and determine the equipment required including the type of telemetry or 3G antenna and installation method required.

The designer will now complete the electrical drawings in line with the above telemetry system requirements, including any settings, by using the TW standard electrical drawings available.

2.6. Contactors, Motor Circuit Breakers & Motor Overload

The designer must identify the appropriate contactor, motor circuit breakers sizes and motor overload relay for the size of pumps and other motors in line with the TW standard drawings and associated options.

This information is to be completed on the new pump station drawings.

2.7. Soft Starters

The pump sizes must determine the size of the pump soft starter. Pumps 4kW or less do not require a soft-starter.
The Designer must:

- Identify the correct size of soft starter allowing for a minimum of 500% starting current and maximum 12 starts per hour.
- Set-up & programme the soft starter to ensure:
    - Starting Torque requirement is set to effectively overcome ragging.
    - Electricity Utility starting current limitations are achieved during starting
    - Stopping is coast to stop
    - Correct motor protection
    - Analogue and Digital inputs and outputs are correctly set-up
    - Motor Thermistors or Thermal switches are compatible.

Refer to Appendix C, however the Designer must review the initial SS settings for suitability.

The Designer must submit a completed setting sheet for each Soft Starter.

2.8. Pump Condition Monitoring

Pumps above 11kW will generally be provided with Pump Condition Monitoring Relays which monitor certain aspects of the pump and provide warnings or trip depending on the type of problem occurring. The designer will make sure these circuits are incorporated into the standard design and again ensure all settings and programming requirements are recorded.

2.9. Wet Well Level Set Points & Monitoring

In order for the wet wells to function correctly the operational levels in the wet well need to be established. TW drawing TWS-E-0007, Wet Well Levels, shows all the levels required to be used in the set up and programming of the pump station RTU programme. In addition, the drawing identifies the minimum and maximum positions of allowed levels compared to physical equipment, wet well floor or other well levels.

All levels are defined by two values:

1) Position compared to TOP OF CONCRETE.
This allows equipment to be easily installed and replaced if the original installation position is lost on site.

2) Position compared to Analogue Level Sensor Depth.
This allows the operator to see the actual depth of sewage in the wet well and the values which are used by the pumps station RTU controller.

The Designer must:

- Determine all the required levels and record these on the For Construction drawing (TWS-E-0007).
- Ensure that NEW wet wells are designed to accommodate these level requirements
- For existing wet wells, if the requirements of the Wet Well level drawing cannot be accommodated, propose non-conforming levels and these shall be identified to TasWater Design and Engineering department for written acceptance.

2.10. Additional Equipment

Depending on the location and the operational requirements of the SPS, additional devices such as Flowmeters and Odour fans may be required. This equipment must be taken into account to decide whether the standard switchboard has enough allowance to accommodate the requirements of the equipment in all aspects. TasWater has included designs for the most likely additional equipment such as flow meters, odour fans, wet well washer and emergency storage equipment. All such additional equipment will be included in the For Construction drawings showing both physical and electrical requirements.

2.10.1. Flow Meter

The TW electrical drawings show the electrical connections if a flow meter is required and an approximate position of the flow meter in the switchboard.
The designer is to determine the requirement for the flow meter and either:

1) Modify the drawings to show that the flow meter is to be installed including drawing the circuits in solid lines (changed from dotted) and draw the actual flow meter to be used.
2) If the flow meter is not required the drawings shall remain as is to show the required installation for the future.

In addition the designer must also:

1) Produce a flow meter parameter set up sheet to define the required parameters so the flow meter performs the correct functionality.
2) Record all part numbers on the switchboard equipment layout drawings

2.10.2. Odour Fan

The TW electrical drawings show the electrical connections if an odour fan is required and an approximate position of the odour fan starter enclosure in the switchboard.

The designer is to determine the requirement for the odour fan and either:

1) Modify the drawings to show that the odour fan is to be installed including drawing the circuits in solid lines (changed from dotted).
2) If the odour fan is not required the drawings shall remain as is to show the required installation for the future.

In addition the designer must also:

1) Record the odour fan; kW size, motor full load current & motor thermal overload setting
2) Calculate and size the motor cable for full load, voltage drop and short circuit current
3) Ensure full discrimination with the switchboard main circuit breaker
4) Record all part numbers on the switchboard equipment layout drawings

2.10.3. Wet Well and Emergency Storage Washers

The TW electrical drawings show the electrical connections if either or both a wet well and emergency storage washers are required and positions of these items in the switchboard.

The designer is to determine the requirement for the washers and either:

1) Modify the drawings to show that the odour fan is to be installed including drawing the circuits in solid lines (changed from dotted).
2) If the odour fan is not required the drawings shall remain as is to show the required installation for the future.

In addition the designer must also:

1) Record the number and rating of the solenoid valves
2) Record all part numbers on the switchboard equipment layout drawings

2.10.4. Other Additional equipment

If any other additional equipment or additional equipment which varies from the equipment identified above is required at the pump station the designer shall propose a preliminary design to the TW engineering department. The designer should be aware that this additional equipment may require a

Re-design of the switchboard to allow safe accommodation of the equipment to TW standards.

2.11. Site layout

To ensure the site provides the safest and economical methods of maintenance and operation the designer will provide a site overview showing proposed dimensions of equipment and their relationship to each other.

The designer will take into account the following:

- Position of switchboard to allow safe manual operation of the pumps whilst viewing the pump operation but at the same time allowing a safe distance from the manhole and assembly of the manhole railings.
- Access to the manhole for pump removal using TW vehicles
- No clashes between various items of equipment including open of equipment doors
- Prevailing weather conditions
- Pump Station valve pits
- Other services such as water and electricity
- Electrical conduit path to the wet well, from the electricity supply and to the antenna pole
- Other underground and overhead services not associated with the pump station
- Property boundaries
- General public access and pathways including clearances

2.12. Standards

In the absence of a specific standard reference, the work and materials must comply with the latest issue of relevant Australian Standards and International Electrotechnical Commission (IEC) standards with the Australian Standards taking precedence. Compliance with the local legislation and Regulations, the Electricity Utility Service Installation Rules, and the Building Code and recommended practices is mandatory.

In particular, the following standards must be complied with:

Standard	Description
AS3000	Wiring Rules
AS3008	Selection of Cables
AS3017	Electrical Installations – Verification Guidelines
AS3439	Low voltage switchgear and control gear assemblies
AS 60947	Low voltage switchgear and control gear
AS3012	Electrical Installations
AS4024	Safety of Machinery
AS 60529	Degrees of protection provided by enclosures (IP code)
AS 61000	Electromagnetic compatibility
AS3010	Electrical installations—Generating sets
AS3111	Approval and test specification - Miniature overcurrent circuit-breakers
IEC 60071-1	Insulation co-ordination
AS3768	Guide to the effects of temperature on electrical equipment
AS61386.1	Conduit systems for cable management

Table 3 - Applicable Standards

2.13. Design Documentation Submission to TasWater

At completion of the SPS specific design, and prior to manufacturer, the Designer must submit the follow documents for TasWater's technical acceptance.

✓	Document
	Drawing Set – based on standard template
	Drawing Set – Site Layout drawings (site plans, elevations etc. with dimensions, switchboard position, Proposed antenna pole size & position, construction notes)
	Drawing Set – Civil drawings (Position of retaining wall if required, position of all conduits, concrete slab details etc.)
	Design Report containing:
	• Calculation – Maximum Demand
	• Calculation – Voltage Drop
	• Calculation – Earth Loop Impedance
	• Graph – protection curves of CBs & 400V Fuse (include mains cable curve also).
	• Cable sizes and types
	• Pump Station levels
	• Type of RTU
	• Type of Communications and antenna options
	• Settings – Circuit Breaker trip settings
	• Settings – Soft Starter settings
	• Settings – Flowmeter settings

3. RTU/SCADA/Telemetry System Design

3.1. General

The RTU/SCADA/Telemetry system design is to be only carried out by a TW Approved SCADA Integrator who will be identified by TW for each individual project.

The System Integrator will complete the following design and engineering tasks:

1) Confirm the type of RTU to be used for the specific project
2) Determine the method, hardware and details of the telecommunications system to be used to communicate between the pump station and the TW SCADA system.

   WARNING! If a 3G telecommunications connection is required a significant period of time (Not Defined) will be required and therefore needs to be requested from Telstra as soon as possible
3) Produce the required site specific RTU software using the TW latest Pump Station Standard RTU software.
4) Produce the required site specific SCADA software in line with TW SCADA area standards.
5) Align the pump station alarming categories and escalation with the area operational requirements.

The Integrator is directed to the Control Software Functional Description document (TW Standard Document - **TDESTD25**) to understand the operating philosophy of the SPS.

3.2. Type of RTU Required

As stated earlier TW have standardised on two types of RTU for their operations which are either:

1) SCADAPack
2) Kingfisher

The type to be used on a particular site will depend on the area of operation that the pump station is situated in. The type will be established by the Integrator in consultation with TW SCADA Team.

3.3. Telecommunications Determination

TW have a preference for Radio Telecommunications with Sewage Pump Stations however some sites are unable to be reached using this method and therefore TW use a 3G communications via Telstra.

The Integrator will need to perform the following to determine the required method of communications:

1) Carry out a radio telemetry path analysis and test using a licensed frequency and confirm or otherwise the suitability of this method of communications
2) If the radio telemetry system is possible the integrator will provide advice to the Design Engineer as to which radio, which frequency and which option of antenna installation is suitable from the 2 options provided on the TW standard drawings. The required antenna Northing & Eastings will also be provided
3) If the radio telemetry signal path is of insufficient strength the pump station will require telecommunications via a 3G connection. The integrator will need to contact TW SCADA group to advise that a 3G connection will be required.

   WARNING A 3G connection will need to be provided by the TW preferred Telco which can take a significant period of time (Not Defined) and therefore needs to be requested as soon as possible

The integrator will provide any set-up information of the telecom modem required to the designer to be recorded on the site documentation.

3.4. RTU Software

Programming the specific RTU/ must be carried out by an approved TasWater System Integrator. The Integrator must request from TasWater:

- The latest standard TasWater RTU software.

The Integrator will then modify the TW standard RTU software satisfy the site specific requirements.
The site specific software will be named in line with TW software naming requirements.
To do this the integrator must take into account:

1) Duty/Standby or Duty/Assist pump configuration
2) Single Pump Configuration
3) Series pump Configuration
4) Various pump station system options

Once the software has been completed this will be bench tested as part of the RTU FAT. On completion of FAT this version A of the RTU software will be supplied to TasWater

3.5. SCADA Software

Programming the site specific SCADA requirements must be carried out by an approved TasWater System Integrator. The Integrator must request from TasWater:

- The latest TasWater SCADA system project from the area of operation.

The integrator will produce the SCADA functionality by:

1) EITHER identifying an existing site within the same area of operation with the same functionality and copying this and converting to the new site
2) OR integrating the required functionality of the pump station and creating SCADA functionality which is not too dissimilar to the existing SCADA functionality within that area. In this case, it is important that none of the pump station functionality is lost during this process.

3.6. Alarm Categorisation and Escalation

Ensure that all alarm categorisation and escalation is aligned with the operation regime being implemented especially in the case of single or series pump configuration.

3.7. SCADA/RTU FAT

Stage: Prior to Pre-SAT

Responsible Entity: SCADA Integrator

Template: As per SCADA Integrator's testing

The System Integrator will complete the RTU/SCADA programming and telemetry integration. This programming covers both the telemetry and, the automatic control function of the RTU's PLC.

Typically this will be bench testing at the Integrator's location and at the TasWater SCADA desk.

This needs to be a full SCADA FAT testing by the Integrator to prove all SCADA functionality including, alarm handling, messaging, and trending indications, in line with operational specific area requirements and will include as a minimum:

1. Site Specific RTU software
2. Site Specific SCADA page to include the new SPS functionality

3. Connection of new RTU software to SCADA software via a temporary dummy link.

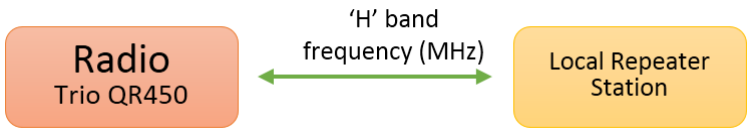
4. Testing of the RTU software for correct functionality corresponding to the site specific details.

Once this testing has concluded, the RTU Software can be installed in the switchboard RTU at the Manufacturers factory.

A copy of the Integrators completed test sheet and a copy of the finalised RTU and SCADA software is to be provided to the Principal.

3.7.1. Radio Telemetry Network

Typically, the data radio must be set up to transmit and receive to the local repeater station on a certain MHz frequency unique to that repeater network. Therefore, radio testing must take place on site and form part of the SAT programme.



The SCADA Integrator must attend the factory to install the RTU and radio software and facilitate RTU/SCADA programme testing.

The same Integrator must also attend site to facilitate the communications part of the Pre-SAT programme in line with TasWater's standards to confirm:

- Monitoring created by the RTU and confirm receipt by the SCADA
- All commands from the SCADA are received by the RTU and acted upon correctly
- All created alarms in the RTU, confirm receipt by the SCADA, confirm any escalation of alarms to mobile phones, acknowledge and reset alarms from the SCADA if specified to do so.

Detailed documentary evidence will be provided by the Integrator to TasWater.

3.7.2. 3G Modem

If a 3G Modem is used instead of a data radio, and, provided that the switchboard manufacturer's factory is located within 3G mobile network reception area, the communications system can be fully tested at the manufacturers.

The Communications Integrator must attend the factory to install the RTU and radio software and set up communication to the 3G network.

The same tests are performed here as described in 3.7.1.

4. Switchboard Manufacturing

4.1. General Requirements

The switchboard manufacturer is responsible for the correct build, function and safety of the switchboard. Even though the switchboard is based on TasWater standards and modified by the designer to provide the site specific design it is the responsibility of the switchboard manufacturer to ensure the switchboard and all its contents comply with the applicable Australian, State other applicable standards and requirements.. It is therefore required that the switchboard manufacturer review the site specific design for compliance and advise TW if the switchboard does not comply. Equally the switchboard manufacturer is not to make any changes to the design without first obtaining written approval from The TW Electrical Design & Engineering Team.

The switchboard manufacturer shall:

1) Review the switchboard design presented to them and confirm or otherwise that the switchboard complies with all applicable standards and requirements as identified above
2) Be satisfied that switchboard dimensions are sufficient to incorporate all the required equipment. Any changes are to be agreed with TW in writing.
3) If they believe the switchboard not to comply with these standards and requirements they are to inform TW in writing detailing the areas of concern
4) Build the switchboard in line with the design and any modifications agreed to by TW in writing
5) Add, Modify or remove any details of the drawings which are no longer correct including:
    a. Switchboard Manufacturers Details
    b. Switchboard Design Details and Ratings
    c. Equipment specific part numbers, where changed or only generic
    d. Positioning of Equipment
    e. Dimensions of the switchboards
    f. Where equipment or circuit options have not been included these shall remain shown in dotted line to show where these options should be included in to the future.

    The new details provided will be in line with the level of detail provided with the original design drawings provided
6) Carry out full Factory Acceptance Testing as outlined below and advising TW at least 4 weeks in advance to allow TW to attend the testing if required.
7) Provide a full set of Switchboard Operation & Maintenance documentation both hard copy and electronic copy
8) Provide a full set of testing and inspection documentation clearly demonstrating that the switchboard is complete and has been fully tested

4.2. Quality Control

4.2.1. Stainless Steel

The manufacturer must provide 3rd party, independent, confirmation of the quality of the 316 stainless steel being used in the construction of the switchboards and provide a minimum 10 year warranty on the stainless steel against rusting.

4.2.2. Painting & Galvanizing

The painting and galvanising system adopted for the whole of the switchboard must also carry a minimum of 10 years warranty against rust unless damaged by a third party. Any damage occurring during shipping, installation or testing will be corrected by the Builder to a level suitable, and in agreement with TW, to still provide the 10 year warranty.

4.3. Factory Acceptance Test (FAT)

Stage: After Switchboard manufacture

Responsible Entity: Manufacturer

Template: TDETEM01 - Switchboard Electrical FAT Template.

The FAT must test the switchboard construction and electrical functionality and will include the following as **a minimum**:

- All equipment installed is the correct manufacture, rating and part number and correctly represented on the switchboard equipment lists
- Mechanical Construction is correct
    - SWB doors hung correctly, rubber seals present and doors close on them well. All handles and locks function.
    - Paint work is finished without blemishes or scratches.
    - Overall IP rating is satisfied
    - all equipment is installed correctly, is securely mounted and provides sufficient maintenance access
- Mechanical circuit breaker interlock construction is sound and secure.
- Point to point testing of all cabling including through any connectors
- Earthing resistance from all exposed metal parts and equipment back to the earth bar.
- Insulation testing of all power cables (with any electronics disconnected)
- Operation of all circuit breakers and isolators, including ELCBs confirming isolation
- All relays and contactors operate as expected
- All power supplies output voltages are within specification including; dc power supplies and transformers
- Manual hardwired control on the 24VAC circuits, that is, all hard-wired logic on sheets ED01 and ED02 (pumps, odour fans etc.)
- All indication and alarm lights are functional
- All RTU I/O are activated and perform activation as expected
- Testing of Emergency Stop circuitry

- Calibration and Testing of all Instrumentation and displays including ammeters, level display, flow display, voltmeter (all settings)
- Stainless Steel certification
- Painting and Galvanising certification

NOTE: Where TW identifies that an area of testing appears to have been tested and inspected does not perform correctly of does not comply TW will at its discretion request either part or all of the switchboard to be retested. The manufacturer will accept TW decision as final.

Standards

AS3000 Wiring standard
AS3017:2007 Electrical installations - Verification guidelines
AS3439.1 Type-tested and partially type-tested assemblies

Notes

This testing does not include automatic functions performed by the RTU. All FAT sheets are to be signed and dated by the manufacture. Scanned copies are to be supplied to the Principal.

5. Combined System Testing (Pre-SAT)

Stage: Prior to Installation, after all FAT

Responsible Entity: SCADA Integrator, Builder, (TasWater may witness)

Template: TDETEM02 - Switchboard Electrical Pre-SAT Template.

Prior to Site Acceptance Testing (SAT), the SPS power, control & telemetry must be fully tested to minimise testing time out in the field. Pre-SAT testing must test the combined devices in the board.
This "Pre-SAT" testing requires more comprehensive testing of the control system and requires completion of the FATs (both the Switchboard FAT and the SCADA/RTU Software FAT) and installation of the RTU software programme as a prerequisite.

The Pre-SAT must cover the integration of switchboard hardware to the RTU software program and the communication of alarms to the SCADA/telemetry system back to the TasWater server.

At a minimum it must cover:

1. Automatic functional testing of all circuits
    - Power monitoring & alarms
    - 24VDC power supply & alarms
    - SPS access and monitoring (including event sequencing)
    - Level control integrity (level and float testing)
    - High level alarm (including alarms, strobe light action and auto resetting)
    - Flow Monitoring Integrity
    - Current Monitoring Integrity
    - Pump Control (Manual & Auto)
    - Odour Fan control (Manual & Auto)
    - Wet well washers Control (Manual & Auto)
    - Emergency Stop (action, alarming, events and resetting)
    - Low Level Alarm & control
    - Soft-Starter control and alarm
    - Pump ammeters and oil seal detections (if installed)
2. Functional testing of both pump control circuits and auxiliary control circuits
3. Alarming handling & messaging from the RTU to the SCADA network (in-line with operational area specific requirements)
4. Radio connectivity (if Pre-SAT location in correct area for radio area frequency). If a 3G modem is used, testing can take place if 3G available.
5. Dummy load testing using small motors or equivalent to ensure correct motor control

Detailed documentary evidence will be provided by the switchboard manufacturer to TasWater for acceptance before the switchboard is sent to site.

6. Installation Requirements

A scanned copy of the completed pre-SAT test sheet must be sent to TasWater and approved by the Principal prior to commencing on-site installation. Once the switchboard and software have satisfied the Pre-SAT testing the Builder must transport the switchboard to site and complete the site installation works.

All minor pieces of equipment must be provided with routine test certificates to confirm the correct operation. At a minimum these are to be provided for all equipment including:

- Hydrostatic Level Transmitter
- Flow Transmitter (if required)
- Odour fan (if required)
- Any other additional equipment

Items such as float switches and water solenoids do not need routine test certificates but must be tested before being installed on site.

6.1. Responsibility of the Builder

The Builder must be responsible for:

- Full control of each site including OH&S until full installation and commissioning testing have been completed and TasWater have accepted the installation.
- Design, supply and install all civil works required including concrete slab, trenching, electrical conduits and minor piping works.
- Design, test, supply and installation of all electrical switchboards including all RTUs, radios and communication equipment based on the 4 standard switchboard types.
- Design, supply, installation and testing of all electrical & associated works at each site including:
    - Electrical mains supply & earthing of the pump stations
    - All pump cabling to existing pumps
    - All communications equipment & cabling at each pump station site from switchboard up to and including the antenna.
    - All pump station instrumentation equipment and cabling
- Site Rehabilitation to ensure a safe, aesthetically pleasing site
- Design, test, supply & install SCADA software related to each site identified as using the preferred RTU, using TasWater current software standards and procedures (removal of legacy programing from the SCADA network may be required in some areas to prevent alarm errors).
- Design, test, supply & install RTU software related to each site identified as using a TasWater approved Integrator.
- Design, complete & document a full system of software and hardware testing, including FAT & SAT, in line with TasWater requirements, based on examples of similar testing previously completed on past projects
- Design, complete and supply a full set of ‘As-built’ documentation to TasWater requirements.
- Provide a Defects Liability Period Service Agreement

TasWater are responsible for supplying the items detailed in Appendix A.

6.2. Connection with the Electricity Utility

6.2.1. Liaison with the electricity Utility

The Builder will be responsible for issuing EWR (Electrical Works Request), Certificates of Electrical Compliance/Electrical Installation Notices and facilitating effective coordination with the Electricity Utility. Where works are required to be performed by the Electricity Utility within TasWater assets (i.e. the power metering device), the Builder will be responsible for making the initial enquiries for, lodging the required applications, gaining the required permits and for coordinating the installation works.

6.2.2. Electrical Mains Supply

The Builder must supply & install a new electrical supply to the new pump station.
The size of the supply and cable shall satisfy the requirements of the design for each pump station.
The cable shall be 3C&N orange circular XLPE construction. All underground cables shall be run in HD Orange conduit (minimum 40mm diameter, refer to Appendix B) with sweeping vertical bends and installed to Australian and local authority requirements. All underground conduits must be sized to allow easy renewals of the main cable if required.
Where an underground conduit changes horizontal direction or is no longer than 50m, a suitable cable pit must be installed. Every 50m maximum
The underground conduit from the authority supply point must be sealed at both ends to ensure no ingress of storm or ground water will enter the pump station outer enclosure.
In addition the Builder must supply and install galvanised cable protector to protect the mains cable above ground at the utility supply pole up to a height of 3 metres.

The builder will supply a drawing as part of the switchboard electrical drawing files to show all underground electrical services including:

- Mains Route identifying installation method used
- Earthing details including position and type
- All other underground conduits going to the pump station equipment

6.2.3. Private Power Pole Install

In cases where the 400V mains power is supplied from an overhead reticulated line, a private power pole may be necessary to the SPS design. The Builder must provide a design for a utility approved power pole and an appropriate footing for each site to AS/NZS 1170:2002, Structural design actions, taking in to account the existing soil conditions and wind loadings. The design drawings for each pump station must be provided to TasWater for acceptance during the design phase.

In addition the mechanical mounting and electrical connection of the cables must satisfy any utility Energy requirements. Refer to Section 4 of the TasNetworks Document DS-I-CA-01 "Distribution Standard: Service and Installation Rules"

The location of the pole must be shown on the layout drawing submitted during the design process.

6.3. Earthing

The Builder must supply and install an electricity supply authority acceptable earth stake next to the new switchboard which provides an acceptable level of earthing to the system. The connection between the earth stake and the switchboard shall be made by a suitably sized and identified earth cable of minimum size 6mm^2. This shall pass through an underground conduit (refer to Appendix B***Error! Reference source not ound.***) to the new switchboard via the underside of the concrete slab. The connection to the earth stake shall be below ground level but remain visible and be protected from damage by brushcutters etc. The TasWater slab layouts show a block out in the slab to provide a level of protection.

6.4. Wet Well Instrumentation Installation

The Builder must provide a new cable support bracket to accommodate the 3 new cable clamps (TasWater standard drawing TWS-E-0009), two for the floats and one for the level sensor. The float cables together with the level sensor cable are to be installed into the 3rd 100mm conduit leading to the wet well from the switchboard (the 1st and 2nd conduits being for the two pumps). Conduit seals must be chosen correctly for the cable diameters when they are combined and if the hole in the seal are a little too large the Builder shall use electrical tape around the cable(s) to provide a tight fit.

6.4.1. Float Switches

There are two float switches (high and low level) which are used as back-up control if the level sensor fails.

The Builder must supply and install 2 new Endress and Hauser cable suspension clamps, model 52006151 (5.5 to 10.5 mm diameter cable) and 2 new Flygt Float Switches (ENM10) so that the floats are positioned within ± 10mm of the specified distance from the top of the concrete plinth as shown on the layout drawings. The installation shall be line with TasWater standard drawing TWS-E-0008

This includes:

1. Setting float at correct position
2. Marking cable at top of concrete with white electrical tape
3. Attaching cable clamp to cable ensuring float stays in correct position
4. Using cable tie to secure cable clamp in correct position on cable
5. Using second cable tie to secure clamp.
6. Connect float correctly to plug and check correct polarity of switching for control purposes.
7. Record installed lengths on site specific wet well level drawing.

6.4.2. Level Sensor

The Builder must supply and install E&H Water Pilot FMX21 (Type FMX21-AA 221HGD15A CW25 and connection box) together with an E&H cable suspension clamp, model 52006151, to hold the sensor in position. The level sensor works on a scale of 0-10m. This will be positioned to clamp the cable so that the bottom of the sensor is at 150mm from the bottom of the wet well. The installation must be line with TasWater standard drawing TWS-E-0008 and the drawing installation notes.

This includes:

1. Installation of a stilling tube (drawing TWS-E-0008 sheet 2) if required by the wet well designer. This is dependent on the width of the wet well and the likely turbidity of the water.
2. Setting sensor at correct position in accordance with design drawing data table (sheet EL-07)
3. Marking cable at top of concrete with white electrical tape
4. Attaching cable clamp to cable ensuring stays in correct position
5. Using cable tie to secure cable clamp in correct position on cable
6. Using second cable tie to secure clamp.
7. Connect sensor correctly to connection box in line with manufacturers requirements
8. Record installed lengths on site specific wet well level drawing.

6.4.3. Level Sensor Stilling Tube

The stilling tube is simply a PVC tube and prevents the level sensor from physical damage in the case of turbulent water in the wet well. The tube must be affixed with a clamp at the top of the tube and a 'guide bracket' lower down in the wet well. Refer to TasWater standard drawing TWS-E-0008. The tube must not interfere with the level sensor cable and cause chaffing.

6.5. Pump Power & Monitoring Cable & Conduits

Each pump cable has been allocated its own 100mm HD orange conduit to transport the cable from the switchboard into the wet well. The Builder must supply and install a conduit bung to seal the cable coming out of the each conduit at the switchboard end. The following types are available from Cyclone Electrical (Adelaide) depending on the size of cable passing through the conduit:

Part No.	Description
CS 20+15/100	100mm conduit seal, 2 hole (20 +15 mm diameter) with split to allow removal of cable. Small bungs also provided to seal each hole.
CS 30+15/100	100mm conduit seal, 2 hole (30 +15 mm diameter) with split to allow removal of cable. Small bungs also provided to seal each hole.
CS 40+15/100	100mm conduit seal, 2 hole (40 +15 mm diameter) with split to allow removal of cable. Small bungs also provided to seal each hole.
CS 26+20/100	100mm conduit seal, 2 hole (26 +20 mm diameter) with split to allow removal of cable. Small bungs also provided to seal each hole.

The seals must be chosen correctly for the cable diameter and if the hole in the seal a little too large the Builder must use electrical tape to provide a good fit.

6.6. Conduit Installation Through the Wet Well Concrete wall

All conduits entering the wet well via drilled holes in the side of the concrete wet well need to have the drilled holes sealed and grouted to ensure seepage into and out of the wet well is prevented as well as ensuring there is no possibility of the concrete steel reinforcement corroding in the future.

For repair of concrete if coring is required for cables the following products should be used:

- Megapoxy PF – For steel treatment if any reinforcing bars are cut or exposed
- tecGroutBB – for reinstatement of concrete between installed conduit and existing concrete

When drilling the holes in the concrete for the holes this needs to be carried out in such a way that loose concrete does end up in the wet well as this can cause expensive damage to the submersible pumps. The contractor will devise a process to ensure this requirement.

WARNING- CONFINED SPACE. The space in the wet well below the top of concrete slab has been identified as a confined space and as such any entry into this are must conform to the latest confined space entry requirements.

6.7. External Lighting

A conduit must be installed to account for the presence of any external lighting (flood light etc.). The conduit will be at least 25mm dia and will be between the cableway and the edge of the concrete slab. The conduit must be installed even if external lighting is not required. The conduit must be shown on the site layout civil drawing along with the other conduits.

6.8. Flowmeter Install

The flowmeter must be installed as per the manufacturer's requirements and mounted as per the site drawings. A conduit will be installed between the switchboard cableway and the flowmeter location which will be 25mm dia. The flowmeter 'head' will be installed in the cableway section of the switchboard with the sensor installed on the pipework. Position of the conduit and the flow sensor on the pipe will be recorded on the site layout civil drawing. The conduit must be installed even if external lighting is not required. The conduit must be shown on the site layout civil drawing along with the other conduits.

6.9. Wet Well Washers

The wet well washers are simply controlled by 24VDC solenoids which actuate the wet well washer water sprinklers. If an emergency storage tank is included in the civil design, then additional washers will be added for the storage tank also.
The washer solenoids control cables must be installed in underground conduits of 25mm dia and run between the switchboard cableway and the solenoid location. The conduit must be installed, even if wet well washers are not currently required. Position of the conduit and the flow sensor on the pipe will be recorded on the site layout civil drawing.

6.10. Antenna & Pole Install

Depending on the type of telemetry, the SPS may or may not include a pole mounted antenna with an underground conduit between the pole and switchboard cableway. Depending on the site there is a requirement for different pole heights. The location of the antenna pole and conduit must be shown on the site layout, in addition the mechanical mounting and electrical connection of the radio antenna must be in line with TasWater drawing set TWS-E-0001.

In the case of a 3G antenna being required this will need to be carried out by the telecommunications company themselves. The builder will need to arrange for this installation via the TW SCADA group.
The location of the pole must be shown on the layout drawing submitted during the design process. Any alternative design will only be considered if it is accompanied by written reason why the standard design is unsuitable for the particular situation and must be submitted to TasWater and written acceptance gained from TasWater prior to installation.
If there is no requirement for an antenna pole, a conduit must be designed and installed regardless to the edge of concrete in case of future telemetry changes to the SPS. This shall also be shown on the site civil layout drawing.

6.11. Odour Fan

If required by the designer, the Builder must install an Odour fan appropriate to the size and location of the installation. The Odour Fan power will be run in a 50mm dia conduit between the cableway section and the fan box. This conduit must be installed and plugged regardless if the Odour fan is not required or installed. Position of the conduit and the flow sensor on the pipe will be recorded on the site layout civil drawing.

6.12. Spare Conduit

A spare conduit must be included in the design. It will be a 25mm dia conduit between the switchboard cableway and the side of the concrete slab. It will be appropriately bunged at both ends. Position of the conduit and the flow sensor on the pipe will be recorded on the site layout civil drawing.

Refer to Appendix B.

6.13. Electrical Conduit Alignment at the switchboard

The electrical switchboard has been designed to accept the electrical conduits in a certain arrangement as shown in the TW standard electrical drawings. This is designed to ensure that 3 100mm diameter conduits going to the wet well can be correctly sealed using the conduit seals in section 6.5. A steel flap attached to the switchboard will be screwed down over the conduit seals to ensure they will not lift in case a wet well overflow situation will occur thus ensuring no raw sewage will enter the cable zone of the wet well. It is suggested that the builder constructs a template which holds all conduits in place when pouring the concrete to ensure the conduits remain in the correct position

6.14. Switchboard Installation

The switchboard is to be installed on site in the orientation shown on the site specific pump station layout drawing. The switchboard installation must ensure as a minimum:

- The switchboard, is installed level with no twisting of the frame and all doors being able to be open and closed with no obstruction of any kind. Any supporting of the switchboard to make it level shall use an industry acceptable grouting material (not silicon based) to fill any gap between the outer enclosure and the concrete plinth.
- The switchboard correctly fits over the underground electrical conduits already cast in to the concrete slab providing sufficient clearance for the cable to enter the switchboard cable way cleanly.
- All wiring completed and correctly supported by the cable support trays provided.

6.15. Site Clean-up & Waste removal

At the end of the installation works it is important that every site is left in a safe condition and aligns with its surroundings. The Builder will:

- Level out the ground around the pump station by using soil and seeding the soil with an acceptable grass species.
- Ensure any required walling is professionally completed providing an aesthetically pleasing appearance
- Grind or cut away any protruding objects which remain as a result of the site works
- Repair and infill any holes left by unused conduits or similar. Any electrical conduits can be filled with 100mm deep concrete to allow possible re-usage in the future.

In addition all unused electrical cabling, conduits, enclosures and fittings shall be removed and disposed of following agreement by TasWater.

6.16. Site Control & Safety

The site will be identified formally as a construction site. The Builder will be responsible for all works and associated OH&S issues carried out on the site until the pump station has completed SAT testing, all works have been completed and TasWater have accepted the installation.

Hazards that have previously been identified at these SPS sites can include (but not limited to) the following.

6.16.1. Confined Space

TasWater has identified that wet wells, dry wells, valve pits and underground pump stations are to be considered as confined spaces. All works in and around these areas shall be carried out under a procedure which is to be accepted in writing by TasWater. Appropriate warning signage must be installed by the Builder to alert future maintenance teams of this hazard.

6.16.2. Asbestos

At sites which cover any previous installations that have been identified as having asbestos present where works need to be carried out, the Builder needs to ensure they have a safe method of work in place for working around the asbestos. This method shall be submitted to TasWater for acceptance.

6.16.3. Traffic Management

The Builder needs to allow for any necessary traffic control strategies at sites adjacent to roads or requiring road closures.

6.17. Civil Works

Each site will need some level of civil works associated with at least mounting of the new switchboard and installation of new electrical conduits.
The details associated with these works are provided on:

- Site Specific Pump station Layout drawings
- TasWater Standard drawing TBA (Electrical Switchboard Typical installation)
- TasWater Standard drawing TWS-E-0001 (Telemetry Pole Typical installation)

7. Site Acceptance Testing (SAT)

Stage: After Site Installation

Responsible Entity: SCADA Integrator, Builder, (TasWater may witness)

Template: ASW13/20090 - TDETEM06 – SPS Electrical Commissioning SAT Template.

The whole pump station will undergo a set of tests to ensure its correct operation including fault conditions. This will involve all the actual site equipment installed in its correct position.

The following tests are to be carried out on site:

- Pump Emergency Stop Test
- Level Sensor set-up
- Power Outage recovery
- Automatic Operation
- Failure of each pump in auto
- High level alarm
- Record Pump Currents and Flows (1 and 2 pumps)
- Low level interlock
- Float Level Test
- Intruder Alarm
- Odour fan control (if present)
- Generator connection and starting
- Data Radio Communication testing (Not applicable for 3G modem installations)
- Aerial & Cable Standing Wave Ratio (SWR) test
- All alarms received by TasWater SCADA system

The Builder must organise and carry out these tests on all sites and provide both an electrical Builder and software engineer who were involved in Pre-SAT testing. TasWater's representative will witness all SAT testing of the switchboards to ensure complete compliance and will sign off on the completion of specific tests.

Testing of each wet well will need a volume of water to provide true simulated operation. The Builder may organise a local water cartage contractor to provide water at each site when needed at the Builder's own cost. The SAT programme could require up to 8 times the volume of the wet well (up the high level float) and the Builder must calculate and make available this volume of water.

Notes

All SAT sheets are to be signed and dated by the Builder. Scanned copies are to be supplied to the Principal and will form part of the practical completion/SPS handover.

8. Finalisation & Handover

8.1. Documentation

TasWater requires the following before accepting ownership of the SPS:

- AS CONSTRUCTED drawing set (including all electrical and civil drawings)
- All completed test sheets demonstrating technical compliance
- A site-specific copy of the installed RTU & radio software programme
- SAT programme complete and scanned copies of the testing ITPs
- Provide all level information in the wet well of (included on pump station wet well level drawing :
    - Final level equipment positions (from top of concrete)
    - Existing construction levels (from top of concrete)
    - All Software programmed level control setpoints
- A list of all electrical equipment settings for each pump station including timers, relays, soft starters, CB protection setting and motor thermal overload settings (in Microsoft Word or Excel 2007)
- O&M Manual Supplement Sheet (only required if the installed SPS contains features beyond the normal standard). **TDETEM03**

8.2. Defects Liability Period Service Agreement

The Builder will provide in the Contract price a 12 month defects liability period which provides for the Renewals costs, labour and equipment, of pump station defected items in that period. In addition a 10 year warranty will be provided on all paintwork and galvanising with regards to rusting.
TasWater will respond to any breakdown and advise the Builder. The Builder must rectify the fault within 48 hrs. In the event that the fault requires urgent repair TasWater will repair or replace the defect item(s), in line with any repair procedures specified by the Builder, and return these to the Builder to be restocked at no cost to TasWater. The repair works carried out by TasWater will in no way affect the remaining defects liability period warranty provided by the Builder on that item or other associated equipment. The builder will replace any TasWater spares used in the first 12 months of operation at no cost to TasWater.

8.3. Spare Parts

Only in the case of the design including uncommon devices not normally used in SPSs, must the Builder supply spares of these devices.
Typically, the standardisation of SPS designs has allowed the TasWater store to hold enough common spare devices adequate for the SPS assets.
The Designer must ensure the parts list is included in the drawing set to the Principal. The Principal will indicate if any device spares must be supplied by the Builder prior to manufacture.

8.4. Training

Formal training to TasWater operational staff is not required as the SPS is based on a standard design which operators are already familiar with. However, the Builder must provide ‘site familiarisation’ to TasWater and point out any site specific features of the installed SPS.
If there are substantial differences/additional features at the SPS, the Builder must provide formalised training to the local operators along with a supplementary addition to the standard O&M manual.
Refer to **TOMMAN01** - SPS O&M Manual.

Appendices

Appendix A: Pre-Design Information Checklist

Civil / Works Designers	
	Necessary Pump sizes (kW), pump protection and monitoring
	Requirement of Odour Fan
	Wet-Well washers (and quantity) *A second Wet well washer may be necessary if wet-well diameter larger than 4m.*
	Presence of Emergency storage
	Requirement for flowmeter
	Requirement for any other equipment
TasWater	
	Standard Design Template (AutoCAD.dwg)
	SPS Name
	TWP number (for drawing naming)
	Asset number for SPS and for all other equipment.
	Communication Preferences, SCADA requirements
	Preferred Communications/RTU/SCADA sub-contractor (varies with region)
	Latest version of RTU software
Electricity Supply Utility	
	Supply Transformer and Size
	Supply Fuse Type and Size
	Electricity Utility Supply Pole Number or Kiosk number
	Prospective Fault Current at the point of supply
	Starting Current limitations
	Point of supply/type of supply

Appendix B: Table of Conduits

All conduits in concrete slab appear in the 'Cable way' area of the switchboard and are of Heavy Duty PVC Orange.

Conduit	Purpose	Diameter
1	Pump 1	Ø 100mm
2	Pump 2	Ø 100mm
3	Wet well instrumentation	Ø 100mm
4	Mains Power	Ø 40mm
5	Earth Stake	Ø 25mm
6	External Lights	Ø 25mm
7	Wet well washer solenoid	Ø 25mm
8	Antenna Pole	Ø 25mm
9	Flowmeter conduit	Ø 25mm
10	Odour fan	Ø 50mm
11	Emergency storage washers	Ø 25mm
12	Spare conduit	Ø 25mm

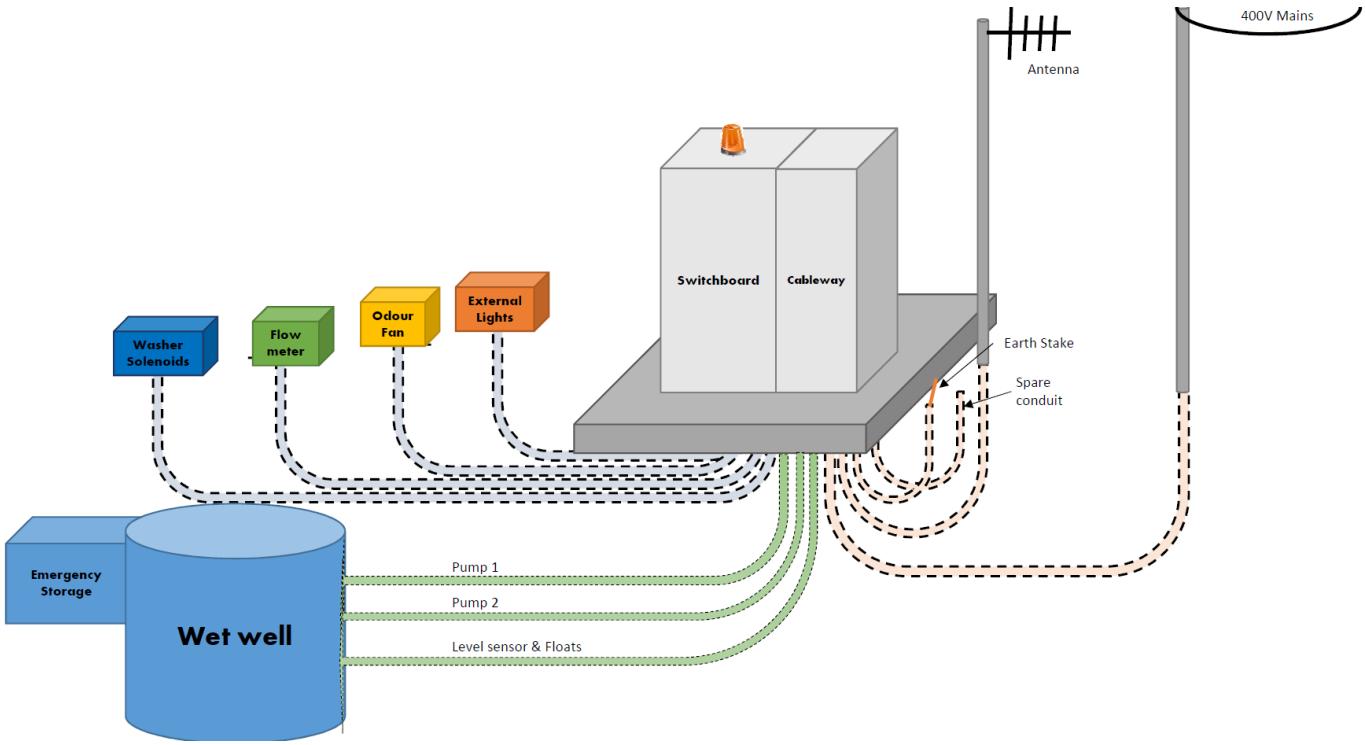


Figure 2 - Representational diagram of conduits required. Not to scale.

Appendix C: Initial Soft Starter Settings

Appendix D: FAT Testing Sheet

Switchboard & hardware FAT only. Refer to document TDETEM01

Appendix E: Pre-SAT Testing Sheet

Refer to document TDETEM02

Appendix F: SAT Testing Sheet

Refer to document TDETEM06