HUNTER WATER CORPORATION

WATER AND SEWER

DESIGN MANUAL

SECTION 5

WATER PUMP STATIONS

AMENDMENT HISTORY

Date	Clause	Amendment
May 2006	All	New document
September 2007	5.11.6	New clause – Pump operation to facilitate shutdowns
July 2008	5.2 Appendix C	Added references to Appendix 1A for electricity cost.
March 2026	All	Improvements and updates to document

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GLOSSARY OF TERMS

Term	Definition
ACMM	Automation Control and Monitoring Manual
air release valve	A manually operated or automatic valve to release or admit air
building	A brick structure with gable roof and concrete floor
butterfly valve	Quarter turn valve with disc and central shaft through valve body
close coupled	Pump whereby impeller is supported on a stub shaft connected to motor shaft or an extension of the motor shaft
commissioning	The running of the plant and equipment to ensure flow through the pumping system and carrying out any testing and adjustments required
Consultant	Designer
Corporation	The Hunter Water Corporation (HWC)
design life	Generally taken as a building 100 years, pit type station 80 years, switchboards 30 years, pumpsets 30 years for VSD driven, 40 years for fixed speed driven and telemetry 15 years
developer	A person or business that develops land and property
developer's representative	An agent representing the interests of the developer
direct driven	Where the pump shaft has its own bearings and is connected to the drive motor via a coupling
direct on line (DOL)	Starter which connects power direct to pumpset for instant starting, causing momentary high current draw on startup
duty cut-in level	The reservoir level or pressure setting at which the duty pump is requested to start
duty point	The rate of flow and the corresponding total head for which a pump is designed or selected
flowmeter	Electromagnetic flowmeter to measure instantaneous flowrate which is provided as a 4-20mA electrical signal
footpath	The paved section in a footway
footway	A public way largely reserved for the movement of pedestrians. More specifically the area between the property boundary and road carriageway.
generator	Diesel driven device to provide 415V AC power when mains supply fails
HWC	The Hunter Water Corporation
inground pit	A reinforced concrete structure set into the ground complete with covers and drainage
interlock	Interconnection between two devices to prevent their simultaneous operation
non return (reflux) valve	A valve which allows one-way flow only
Owner	Developer or Hunter Water
pneumatic	Operated by compressed air
pre-commissioning	Preparation of plant or equipment so that it is in a safe and proper condition ready for commissioning and operation
pressure main	A pipe through which water is pumped from the pump station under pressure into the distribution system
pressure switches	Control devices operating at single point levels to effect control of pump operation
pressure transmitter	A sensor that continuously measures water pressure variations in the pipeline and converts the pressure to an electrical signal for use in a monitoring, control or alarm circuit

Term	Definition
programmable logic controllers (PLC)	A microprocessor device for controlling processes
protection	Devices which will stop pump/motor operation in the event of a condition which may lead to damage
pumping installation	A pump station together with any associated pressure main(s)
pump station	Building, structures and equipment used to transfer water through a pressure main
radio path survey	A survey taken to determine the radio signal strength, and hence suitability of radio communications, between two telemetry stations
REF	Review of environmental factors
RTU	Remote terminal unit
SCADA	Supervisory control and data acquisition system which allows monitoring and control of remote sites via telemetry
soft starter	Electronic starter to start pumpset using reduced starting current to start item slowly
spacer coupling	Removable flanged make-up piece between pump and motor coupling to allow back section of pump to be removed from casing and pipework without disturbing motor
standby cut-in level	The station flow rate (based on the estimated flow) or in the case of pumping to a reservoir, the reservoir level, at which the standby pump is called to start
station	A pump station together with any associated pressure main(s)
station control	The operation of pump start/stop sequences, alarms and control devices
stop valve	A wedge type gate or sluice valve with non-rising spindle and full bore opening
strainer	Device to collect larger particles than the pump can safely pass without damage
surge	Surge occurs in a pipe transporting fluid as a result of a change in the flow velocity caused by events such as an emergency shut-down resulting from a power failure, a valve opening or closing too rapidly, or abrupt pump starts or stops. Surge generates pressures generally rising in excess of the allowable working pressure. Surge events are characterised by high-pressure rise rates with no time spent at the peak pressure. Surge from the collapse of separated water columns can be particularly damaging and must be managed. The duration of a surge event is dependent on multiple factors such as celerity and the length of pipe. Surge is also called water hammer or transient pressure surge. For more details see Section 5.6.7 Transient Analysis
swabbing	Insertion of a swab or 'pig' into pipeline to be propelled along by pump pressure to clean inside of pipe
telemetry	The transmission of data from one site to another via wiring or radio signals
telemetry unit	A unit that collects and stores operational data from the remote pump station and transmits data to the attended receiving station
variable speed drive (VSD)	A device able to vary the rotational speed of a motor
ventilation	Natural or forced movement of air to introduce outside air and expel inside air to remove heat from building or pit
water hammer	A vibration or shock occurring in a closed pipe system, usually accompanied by a thumping noise, caused by pressure surges due to sudden changes in velocity of fluid flow, for example, by pump start or stoppage. See Surge definition above

Term	Definition
WPS	Water Pump Station

5.1 Introduction

5.1.1 General

The purpose of this document is to provide guidelines for the design of small to medium sized water pump stations for the Hunter Water Corporation (Hunter Water). These stations range from small inground pit type stations to larger masonry buildings with up to four pumps and a duty capacity of up to 150 l/s with pump motors up to approximately 110 kW. This document is applicable to:

- The design of new schemes; and
- Extensions to or augmentations of existing schemes.

This document is primarily intended for designers that are involved in the design or construction of water pump stations that will become Hunter Water assets.

5.1.2 Design Objectives

The objectives of the design are to ensure that the water pump station is functional, reliable, fit for purpose, cost effective, is readily constructible, able to be maintained and complies with the requirements of Hunter Water.

In principle, the pumping system shall:

1. Satisfy the water demand criteria including fire flows as per Hunter Water's Water and Sewer Design Manual.
2. Have minimal adverse environmental and community impact.
3. Comply with environmental requirements.
4. Comply with WHS requirements.
5. Minimise energy consumption by efficient operation.
6. Have reliable and long service life with minimal maintenance and least whole of life cost.
7. Provide adequate weather protection and stormwater management.
8. Provide vehicular and personnel access for maintenance.

The initial process for design is to identify and establish the need and basic requirements for the water pump station.

The designer must design a water pump station that is fit for purpose by addressing the following:

Factors	Requirements
Functionality	Meet Hunter Water's water supply obligations
	Operate efficiently, effectively and automatically
	Have no adverse impacts on water quality
	Allow flexibility for Hunter Water to meet a variety of operating scenarios, including fire flows
	Provide security and protection for equipment
	Incorporate telemetry that allows remote operation and monitoring
	Include safe vehicular and personnel access
	Minimise impacts on the local community and environment
Maintainability	Be designed for low maintenance and minimal operator intervention.
	Be easily maintained using standard maintenance practices

	Provide safe working conditions for operation and maintenance personnel
	Utilise standard components that are readily available and interchangeable
Reliability	Use high quality, robust equipment that minimises life cycle costs
	Have redundancy so that failure of any one item shall not cause total failure
Constructability	Design a facility that is cost effective and readily constructible
	Satisfy local Council planning requirements

5.1.3 Safety

5.1.3.1 General

The designer must identify all hazards associated with pump station operation and to take steps to mitigate them in the design.

The design package must include a safety in design risk assessment. This risk assessment must include all risks associated with the design, construction, operation, maintenance, future upgrade works and closure/removal of the facility.

The design risk assessment must include a workshop with Hunter Water stakeholders to ensure all relevant hazards are captured.

Pump station pits may be a confined space. Only personnel who have undertaken approved training for entry and working in confined spaces are allowed to enter pump station wells. The design and risk assessment must include a familiarity with Hunter Water "*Procedures for the Safe Entry and Working in Confined Spaces*".

5.1.3.2 Safety in Design

Designs must meet the requirements of:

- *Work Health and Safety Act, NSW, 2011 (WHS Act)*
- *Work Health and Safety Regulation, NSW, 2025 (WHS Regulation)*

The design process and outputs must follow the *CHAIR Safety in Design* process. Outputs from the CHAIR sessions shall be addressed and incorporated into the design. Copies of the minutes of CHAIR meetings must be made available to Hunter Water if requested.

5.1.3.3 Hazards

At a minimum the designer must consider the following hazards in the risk workshop:

- Moving (rotating) equipment
- Oxygen deficiency as a result of accumulated organic matter breakdown
- Wet or damp conditions
- Electricity
- Working at heights
- Use of portable lifting equipment
- Chemical dosing equipment
- Delivery, storage, handling, use and disposal of hazardous substances
- Stored energy (pressure)
- Manual handling
- Ground conditions, buoyancy and depths of pipelines

5.1.4 Documentation and Drawings

Hunter Water has specific requirements for reporting, drawings and contract documentation. Refer to Appendix 1. This includes the requirement for both the Designer and the Constructor to provide information for the Operation and Maintenance manuals in compliance with STS 906 Operations and Maintenance Manual Requirements Template.

5.2 Site Selection

5.2.1 Location

The location of a water pump station is strongly influenced by hydraulic considerations so that the pumps and pipeline operate satisfactorily under the design demand conditions.

The pump station site must be selected so that a minimum gauge suction pressure of 10m is provided to the pumps under all demand conditions.

The location shall be selected so that there are not unnecessarily high heads (i.e. no greater than 50m) in the suction pipeline and also so that water pressure to consumers on the suction and delivery side of the pump station meets Hunter Water's criteria. Note that Hunter Water's standard control code for Water Pump stations provides a mechanism to modulate the pumping speed to maintain a minimum suction pressure, but it remains the responsibility of the designer to establish whether that control feature can be applied to the to the pumping situation, to both meet the design objective, and meet the minimum and maximum requirement for water pressure to customers on the suction and delivery side.

The choice of site is usually determined by land availability and aesthetic conditions, but the location should allow for a suitable layout for the incoming and outgoing watermains. There should also be sufficient clearance from surface and subsurface obstructions to allow for construction, operation and maintenance. Sites must not be located under or near to power lines. Sites to avoid trafficable areas.

To ensure that the proposed pump station location and layout are acceptable, the proposed site must be approved by Hunter Water.

Pits and buildings must be located above flood level, with the floors being a minimum of 0.3m above the 1% AEP level. The base of the electrical switchboard must be mounted a minimum of 0.6m above the 1% AEP Level.

The proposed site of the pump station must consider projected sea level rise over the life of the asset. Hunter Water must be consulted to determine appropriate sea level rise risk level and projections.

The average size of a pump station site for a small to medium pump station may be up to 30m x 30m, with an increase in site size requirements for larger installations. If the pump station is to be located within a road reserve, laneway etc., its position should be determined in conjunction with the local Council.

The pump station should be so located that the site and any easements will have the least detrimental effect on the property with regard to existing, proposed or potential development including possible subdivision etc. That is, the site should not be isolated in the middle of a block so that complicated and long access and watermain easements are required.

Consultation with the various stakeholders is required prior to and during the design process. This should be commenced early in the project as consultation can become prolonged. Consideration must be given to key issues associated with the project and relevant stakeholders associated with these issues.

Copies of relevant approvals from authorities and private landowners must be included in the designer's report as required in Section 1 of Hunter Water's Water and Sewer Design Manual.

5.2.1.1 Location Factors

The following factors must be considered during the site selection process:

Table 5.2.1-1: Location Factors

Factors	Requirements
Site selection	Located on a lot, ownership of which is dedicated to Hunter Water or an easement dedicated to Hunter Water
	Provide all weather access to and parking for the pump station for routine and emergency operation and maintenance activities
	Sufficient space for possible pad mount transformer, generator, flowmeter and strainer
	Power facilities should be available or able to be economically provided to the site
	Adequate radio communication access (radio path survey required)
	Site must have available safe access and consideration must be given to construction and maintenance requirements. A deceleration lane (turn off lane) may be applicable in some cases.
	The station should not be located on a localised high point in order to avoid air entrapment at the station in the event of a watermain failure on the suction side of the station
	Pit type stations should be located in areas of land away from significant pedestrian access such as footways or cycleways (for example, located in a dedicated reserve).
Amenity and environment	The station should be unobtrusive, and have sufficient buffer from residential dwellings, built up areas and designated future development to ensure compliance with EPA noise control requirements, REF requirements, and all other relevant planning requirements.
	Develop a landscape plan at the design stage in consultation with local residents and Council and be screened from neighbours by trees and shrubs
	Consideration of noise impacts and scheduling of main pumping hours
	Assess feasibility of using alternative energy sources
	Provision of suitable water discharge path for draining pipework
Design	Proximity to pipeline
	Accessibility
	Site slope and soil conditions
	Accessibility depth of incoming and outgoing pipelines
Easements	Easements for the site and services may be necessary. Hunter Water's Property Management team will advise the relevant easement terms
Flooding	Ensure that adequate stormwater management drainage from the pump station and site including access roads is designed so that flooding of the facility is avoided
	The site and access road shall not be liable to flooding during in 1% AEP level.
Supporting Systems	In conjunction with determining the requirements for the site infrastructure, the designer shall consider the requirements for supporting systems to enable efficient and safe operation of the pump station, as follows: – water supply – power and general lighting

Factors	Requirements
	– security – fire fighting facilities – telemetry (radio path survey required)

5.2.2 Land Selection

The order of preference for land choice for a pump station site is dependent on a range of factors, as a general rule shall be:

1. Land provided within the development by the person or business that is developing the land or their agent. (Hunter Water is to be given freehold title or easement rights)
2. Hunter Water owned land
3. Council land (Community land/Operational land)
4. Vacant private property
5. Road reserve
6. Crown land (compulsory acquisition processes apply)
7. Established private property

The consultant on behalf of the Developer must negotiate with the owner(s) and obtain easement rights and/or freehold title (vested in Hunter Water) for any pump station sites, access and services and water mains. The water pump station must be contained within an easement if wholly within a public reserve or a designated lot if not within a public reserve. The easement or lot must include batters, embankments, retaining walls and flow relief structures. Access, services and rising mains must be contained within an easement. The Developer must pay all costs associated with land or easement transfers.

Acquisition of land interests must be approved by Hunter Water, which will be in accordance with Hunter Water's Property Acquisition & Disposal Policy.

Consideration must also be given to the potential likelihood of future development.

5.2.3 Development Approval

Pump stations and water mains can be assessed under Part 5 of EP&A Act in accordance with T&I SEPP. A review of Environmental Factors (REF) must be completed for all new infrastructure and some maintenance and upgrade works.

5.2.4 Easements

As part of the planning phase, property requirements need to be taken into consideration.

Easements must be obtained for the access road, pipelines, water service, stormwater drainage and power supply. Site layout shall be arranged to minimise the number of easements. If possible, underground power supply shall not cross other services.

Approval of all relevant Statutory Authorities and bodies shall be obtained in relation to the proposed locations of access road, watermain, power supply, water service and stormwater drainage.

Minimum clear easement width for the access road shall be 4 metres. Where it is intended to lay stormwater pipes as well as the watermain, water service and power supply within the access road easement, the easement width must be increased to accommodate the services.

If the proposed works are to construct a water pump station on private land, then the Developer should seek to obtain from the affected landowner a Construction Licence over the land required for the pump station and for the storage of materials. The aim of taking out such a Licence Agreement is to recognise the inconvenience that may be caused during the construction stage. A Construction Licence is also required where access to private land is needed during construction even if the pump station will not be located on that private land.

Negotiations must take place with the affected landowner by the Developer for the granting of the Construction Licence for an agreed fee.

The construction contractor will be required to prepare a plan of survey at or near completion of construction, suitable for lodgement at the Land Registry Services NSW. The purpose of this plan is to delineate the land (and/or easements) that is required for the pump station site and associated services and access. If any part of the watermain is contained within private or public land, then the construction contractor will be required to supply Hunter Water a plan of survey showing the proposed 4 metre wide easements within the affected properties.

Following the registration of the plan of survey at the Land Registry Services NSW, negotiations must be held with the affected landowners for the transfer of land and/or the granting of the easements.

5.3 Site Infrastructure

5.3.1 Access Roads and Hardstand Area

5.3.1.1 General

Access roads to the pump station and the standing area at the site must be designed for all vehicle types required for the site during construction, operation and maintenance, including:

- Mobile lifting equipment,
- Maintenance vehicles
- Generator delivery truck (Tilt truck or side loader)
- Generator laydown area adjacent to generator connection point, and
- Tankers

The site and access road must not be impacted by flooding up to a 1% AEP event.

5.3.1.2 Design of Access Roads

Design access roads in accordance with the Austroads Design Reference Documents. Notwithstanding the requirements of the Road Design Reference Documents, minimum requirements include:

- Access roads and hardstand / turning areas and must be designed to accommodate a 19m semi-trailer.
- Road base for access roads must be a minimum thickness of 200 mm. Thickness must be determined by the designer in accordance with Austroads Design Reference Documents for traffic and geotechnical soil conditions.
- Access roads with grades steeper than 10 % and all hardstand areas must be sealed with one of the following:
  - 2 coat bitumen seal,
  - 40 mm asphalt, or
  - Reinforced concrete
- All vehicle turning areas must be reinforced concrete.
- Roads must be all weather and suitable for heavy vehicles.

5.3.1.3 Access and Turning Areas

Vehicle turning areas must be provided to minimise any traffic hazard caused by vehicles entering and leaving the site. In general terms, vehicle turning areas are required where either:

- The pump station does not front an adjacent roadway, or,
- The adjacent roadway is a main road.

Hunter Water and the relevant local council must be consulted in determining requirements for access.

The design must include one plan view showing vehicular access and turning circles of all vehicle types expected to be required at the facility.

5.3.1.4 Minimum Access Road and Hardstand Requirements

- Minimum pavement width 4 m
- Road maximum grade 12%

- Road preferred and minimum cross fall 3%
- Road maximum cross fall 5%
- Hardstand maximum grade 2%
- Hardstand maximum cross fall 2%

All proposals for access road grade steeper than 12% must be submitted to Hunter Water for written approval before proceeding with the design.

5.3.2 Drainage

Ensure that adequate stormwater management drainage from the pump station and site, including access roads, is designed so that flooding of the facility is avoided.

Drainage must divert all upstream runoff away from the assets.

All above-ground structures, including slabs and hardstand areas, must be designed with sufficient cross-fall to present water pooling on their surface.

5.3.3 Potable Water

The WPS site must be supplied with a potable water service.

The size of the service main to be provided will depend on distance from the water main and the available pressure. A minimum available pressure of 20 m head at a flow rate of 0.70 L/s is required at the pump station.

Where the service crosses a road, the service pipe must be laid in accordance with *Standard Drawing WAT-106-V – Property Services – Single Service Main to Meter*.

Where a CDU is required refer to STS 670 for requirements of water supply. i.e. safety shower and emergency eye wash requires separate RPZDs and has flow requirements. Designers to ensure sufficient water pressure is available to safety showers.

A pressure monitoring device is required to be installed on the mains side (upstream) of the meter to monitor mains pressure.

5.3.3.1 Service Meter

- An approved testable Reduced Pressure Zone Device (RPZD) must be installed at the meter stand in accordance with *AS 3500*.
- The meter stand location is site specific. Hunter Water must provide written approval for each location provided in the design.
- Where possible, the meter stand must be located 1m inside the property boundary of the pump station site.
- The service pipe from the main tap to the meter stand must be laid at right angles to the water main.
- Where the meter stand, including the RPZD, is at risk of damage by maintenance vehicles a DN50 galvanised pipe frame must be installed, to be indicated on the project drawings (Refer to *Standard Drawing SCP911 - Sewer Pump stations Water Service Details*). Meter and RPZD assemblies to have sufficient support.
- Vandal proof lockable or removable handles are required on all outlet taps.

The service must be sized in accordance with the following table:

Table 2 - Water Supply Service Requirements

Service Main Length (m)	Service Main Diameter (mm)	Meter Pipe Diameter (mm)	RPZD Pipe Diameter (mm)	Standpipe Diameter (mm)	Hose Tap Diameter (mm)
< = 30	25	20	20	25	20
30 to 130	32*	25	25	25	20
> 130	See note **	As required	As required	25	20

* Hunter Water may permit use of DN 25 water service where the available pressure in the water main is sufficient.

** Designed to provide a minimum pressure of 20 m head at the pump station hose tap at a flow rate of 0.70 L/s

A cast iron path box is required to be installed over the main tap in the water main in accordance with *Standard Drawing SCP-911* if either of the following occurs:

- The meter stand is located more than 30 m from the main tap.
- The service pipe from the main tap to the meter stand is not laid at right angles to the water main.

The path box, if required, must be shown on the drawings.

5.3.4 Fencing and Gates

Site access must be controlled so that only authorised vehicles can enter the site.

Fencing requirements must be established during the concept design. Pit style pump stations having minor above ground features do not normally require fencing. However, a site-specific assessment is required, and must include consideration of the following:

- Areas at risk to person or property or vandalism may require security fencing.
- Sites adjacent to developed residential property may require fencing.
- Fencing is required where Chemical Dosing Units (CDUs) are installed.
- Consider if provision of fencing will block an informal thoroughfare used by the public. If so, a designated access route through the site may need to be provided.

Fencing and gates of pump stations must be to Hunter Water requirements.
Where fencing is required, the type of fencing to be used at the particular site must be confirmed with Hunter Water and may be welded mesh type, timber paling type with galvanised posts, tubular steel type or Colorbond steel style fencing. Additional information and design requirements can be requested from Hunter Water.

As fencing can have an adverse visual effect on the local amenity, the fencing must be obscured from general view, either through planting screening vegetation, or locating the fence further back on the property out of visual view. Fences to have as low visual impact as possible and meet the aesthetic of the surrounding areas.

5.3.5 Traffic Barriers and Bollards

Wherever possible the pump station layout must use passive design to minimise the risks of plant and equipment from damaging buildings and infrastructure such as pipelines and switchboards. For example, separation of vehicles from plant, appropriate roadway design, designated parking areas etc.

Where the risk cannot be completely controlled through layout alone, the design must include protective measures such as barriers, bollards, wheel stops and the like. All measures must comply with STS 500 and STS 600. Any protective devices that could potentially impede maintenance tasks must be removable. The preferred style of protection is to use measures that provide tactile feedback and are easily replaced when damaged rather than hardened structures that absorb vehicle impacts.

These measures must also consider the risk of damage to pits and buried equipment and must consider activities such as grounds maintenance that may occur on the site.

5.3.6 Landscaping

The remainder of site, including all cut and fill batters and any surface table drains, must be topsoiled and turfed.

If requested by Hunter Water, the design must include a landscape plan which identifies landscaping of the site to improve visual amenity. The landscape plan is required to be submitted for assessment under the planning approval process.

The landscaping plans must consider issues such as the conservation of visual amenity, screening, noise reduction, access improvement and constraints, stabilisation of site, elimination of soil erosion risk, contribution to bushfire risk if applicable, and appropriate vegetation.

Approved landscaping plans must be incorporated into the construction environment management plan (CEMP) prepared for construction works.

Where possible, cut and fill must be designed to minimise removal of material from the site. For additional information refer to STS 413 Landscape Restoration and Revegetation.

5.4 Design Principles

5.4.1 Water Supply Code of Australia, Hunter Water Edition

Hunter Water has a water supply code that sets out the technical requirements for the design and construction of water infrastructure projects.

This code is published by the Water Services Association of Australia and is available from their web site:

Reference: WSA 03 Water Supply Code Hunter Water Edition

All pump station designs must meet the relevant requirements of this code.

All references to WSA 03 within this document relate to the Hunter Water edition above.

5.4.2 Coordination with Standard Technical Specifications

Hunter Water has a number of Standard Technical Specifications (STS) that detail the specifications and construction requirements for water infrastructure. The design must meet all requirements identified within the current version of any relevant STS.

All STS are available from the Hunter Water website.

5.4.3 Determination of Design Capacity

The design demands and design capacity must be calculated using the method set out in WSA 03 Water Supply Code Hunter Water Edition.

The pump station must be designed to meet the maximum future demands as specified in the servicing strategy requirements and cater for the full growth.

5.4.4 Criteria for Selection of Pump Station Type

Hunter Water has two styles of pump stations that are in common use:

- Inground stations where the pump station is contained within a pit
- Above ground stations where the pumps are installed in a building

For small to medium sized pump stations the pit style has proven to be an economical option. For larger stations this style becomes impractical, and a building is required.

Designers may use pit style stations for installations where:

- The pumps are no larger than 15 kW, with a maximum of four pumps installed
- The station can be designed to meet all relevant requirements outlined within this manual

Any pump station that does not meet all of the above requirements must be a building type, unless written approval is provided by Hunter Water.

5.4.5 Design Life Requirements

All pump station must be designed and constructed to achieve a minimum service life of:

Table 5.4.5-1: Asset Life

Item	Minimum design life (years)
Water mains, civil structures (building, pit)	100
Valves	30
Pumps [Note 1]	15-30
Pipework	100
Electrical switchrooms and equipment [Note 2]	10-50
SCADA and automation equipment	15

Note 1: Refer to STS 600 for pump design life.

Note 2: Refer to STS 500 for electrical equipment design life.

5.4.6 Economic Analysis

Designs which meet the engineering design requirements must be evaluated against the whole life costs of the asset and the system.

Where there are alternative designs, or options for equipment selection, the preferred option must be determined by comparative economic analysis (net present value, NPV) using discount rates.

The analysis must include:

- Initial procurement and construction cost
- Impacts of staging upgrades if required
- Energy costs (including demand/capacity where relevant) over the planning horizon (nominally 25 years)
- Any difference in maintenance costs or benefits between options
- The economic life of the equipment (including ancillary items such as switchgear, lifting equipment and ventilation equipment) and the associated cost of replacement or major refurbishment
- Any other costs or benefits relevant to the analysis
- Environmental impacts
- Community and customer impacts

The economic analysis must include the anticipated operating conditions of the options being considered. For example, if a different pipe option is being considered, and the station delivers water into a reservoir zone, then in addition to considering the capital cost of the different pipe, and the expected economic life of the pipe material, the designer must also determine the lowest Specific Energy Consumption operating point of the pump for that option and incorporate that appropriately into the assessment of the station operating cost.

The most favourable result from the present value of benefits minus the present value of costs must be used to identify the preferred option.

Notwithstanding a favourable result above, the designer must consult with Hunter Water where the preferred option involves an innovative or atypical approach that may have potential implications for the management of the asset.

Current discount rates, electricity rates and further guidance on economic analysis are available from Hunter Water.

5.4.7 Approved Products and Manufacturers

Hunter Water provides lists of approved products and product manufacturers for specific types of equipment. Select products, materials and equipment from the approved products and manufacturers lists available on Hunter Water's website:

www.hunterwater.com.au

Where suitable products, materials or equipment are not listed, submit full details of the proposed items and obtain written approval from Hunter Water prior to procurement.

Notwithstanding approval status, all products, materials and equipment must be specified to meet the requirements of all relevant STS.

5.4.8 Noise

The pump station must be designed and specified to limit noise to acceptable levels.

Internal noise must be controlled in accordance with WHS requirements. Noise levels within the pump station building or pit must not exceed 85dBA measured at one metre from the source.

External noise must be comply with NSW EPA noise control requirements and REF requirements.

The designer is responsible for the design and specification of all controls to reduce noise levels so that they are within acceptable limits. Controls must not impede Hunter Water's ability to operate, inspect and maintain the equipment. The use of acoustic covers directly over pumpsets to treat noise is not accepted as this restricts visual inspection and maintenance access.

The design report must have evidence that the installation will comply with the designated noise levels at the time of submitting the final design.

5.4.9 Geotechnical

A geotechnical investigation must be completed to identify the ground conditions at the pump station site. The investigation must include a minimum of one borehole at the proposed pump station site depending on site and design size.

The boreholes must be taken in the vicinity of the foundation level except where solid rock is encountered which may indicate that open excavation will be necessary.

A typical soil and groundwater analysis required from the boreholes is as follows:

- Classification properties
- Permeability
- Dispersion
- Shear Strength
- Lateral Pressure
- Settlement
- Groundwater lowering
- Elastic Modules Profile
- Chemical testing of soil and groundwater

The design must address all ground conditions that have the potential to adversely impact the construction, operation, reliability and service life of the pump station, including:

- The pump station pit or building foundations, including buoyancy
- Thrust restraint for the pipeline
- Pipeline material, design, trench and embedment materials

- Pavement design
- Loadings from machinery during both construction and maintenance
- Ground stability, bearing capacity and settlement issues

The technical specification and design report must address the treatment of all ground conditions to satisfy construction and operational requirements.

5.4.10 Site Survey

The whole of the pump station site must be surveyed by a registered surveyor to identify the boundaries, easements, surface contours and all services. This information must be used by the designer in siting the pump station, considering the levels for the pump station building and route of the suction and delivery sections of pipeline, flowmeter, strainer, bypass, water service, power supply and drainage as well as the access roadway and turning area.

The survey must identify the location of neighbouring property boundaries in all directions.

Origin of levels must be a state survey mark, permanent mark or Hunter Water benchmark. All levels must refer to AHD.

5.5 Station Design

5.5.1 Pit Type Stations

A pit type station comprises of a rectangular concrete pit, cover support beams, lockable aluminium treadplate covers with an outdoor switchboard mounted on a concrete slab. An indicative layout is shown in Appendix 3.

All concrete structures must be designed in accordance with AS 3600 and constructed in accordance with the relevant requirements of STS 404. The pit walls must be a minimum of 200 mm thick.

The structure supporting the pit cover must be designed in accordance with either AS 4100 or AS 3990 with all cold formed stainless steel to comply with AS 4673. The cover and supporting structure must be designed for platform and walkway loads identified in AS 1657 and STS 600. The designer to adopt Hunter Water's standard pit covers and supporting structures that are detailed on Standard Construction Practice (SCP) drawing set. Pits must have a maximum of 2 rows of covers. Where 2 rows of covers are not practical, additional rows of covers must be approved by Hunter Water.

The top of the pit must be located above finished ground level. Where the station is located in an area where pedestrian access will occur, the area surrounding the station must battered away from the station at 1 in 6 and turfed to minimise ingress of surface water.

The pump station and surrounding landscaping must be detailed to avoid trip hazards on any part of the station site where pedestrian access is likely. Any step up onto the pump station or change in level between different areas of the pump station must be identified by painting a yellow stripe along the edge of the step.

Where the pump station is not expected to have pedestrian access, the top of the pit must be minimum 100mm above finished ground level.

The maximum pit depth must be no greater than 1.8 m from the top to the floor of the pit. Hunter Water may approve deeper pits where there is a clear justification to continue with a pit design rather than a building type station.

Pits greater than 600 mm deep must incorporate safe internal access in accordance with AS 1657.

- Vertical ladders may be used to access pits up to 1.5 m depth.
- Full width (375mm minimum) polypropylene encapsulated step irons may be used to access pits up to 1.5m depth.
- For depths greater than 1.5 m metres an inclined ladder is required.
- Hand posts must be installed. The designer must confirm with Hunter Water if retractable or permanently fixed hand posts must be used.

If ladders are used, the designer may adopt Hunter Water's standard access arrangement for pits that is detailed on SCP-909.

The pit must incorporate a passive drainage system that has sufficient capacity to prevent all expected external inflows from flooding the pit. The floor of the pit must be graded and connected, in a straight pipe run (minimum DN100), to a discharge point that incorporates a headwall. A cover or flap must be installed on the discharge pipe outlet to prevent vermin from entering the pit. In locations where a discharge point is not practical, the station can discharge into a sullage pit that is designed to accept the anticipated flow.

Where passive drainage cannot be achieved either a venturi sump pump installation or a 400 x 400 x 400 mm sump containing an electric pump must be installed. Sump to be located at ladder access end of pit.

For electrical detail refer to Section 5.9.

5.5.2 Building Type Stations

Building type stations must comply with the relevant requirements of STS 410.

The typical layout for a building type pump station is:

- A single equipment room containing the mechanical plant.
- A dedicated switchroom is required when assessed in accordance with the criteria outlined in STS 510. Where not nominated by Hunter Water or the criteria are not met, the structure must not be classified as a switchroom under STS 510.
- Where a switchroom is not required, the switchboard can be installed internal or external to the building but must comply with STS 500 i.e.: Switchboards installed in wet environments.
- Delivery and suction headers outside of the building and parallel to the building axis with all pipework entering the building through wall penetrations
- Double outward opening doors for maintenance access plus a separate personnel door for general access.
    - Doors to be faced on both sides and along all edges with grade 316 stainless steel, and painted
    - Double doors required to have layback hinges to allow the doors to open 180°.
    - Double doors to be fitted with ventilation louvres with painted stainless steel or painted GMS security grilles to prevent removal or damage to the louvres and possible intruder entry to the building
- Lifting equipment located above plant to facilitate removal of pump station equipment for maintenance
- Floor graded to a central box trench drain along axis of building complete with cast iron or galvanised grating that is connected to a pit sump containing an electric pump.

5.5.3 Pits for equipment and services

All pits must have sufficient drainage. Backflow must be prevented from entering the pit.

All pits must be fitted with lockable treadplate covers. The designer may adopt Hunter Water's standard cover designs that are detailed on SCP drawings.

In addition to requirements in SCP drawings covers when opened in vertical position must be intrinsically designed to act as fall prevention and require manual intervention to close. Covers must be designed with weight and features to be opened by a single individual. Individual covers must not weigh more than 20kg.

All pits must include sufficient access for inspection and maintenance. The designer may adopt Hunter Water's standard access arrangement that is detailed on SCP drawings.

5.5.4 Materials

The designer shall adopt materials selection, application, design and protection measures to minimise material degradation and the need for ongoing maintenance needed to prolong the life of the station, fittings and equipment used.

5.5.5 Access to Plant

For both building and pit type stations, adequate access around equipment must be provided for all operational and maintenance activities. All equipment must be accessible from floor level. The pump station must be designed so that all equipment can be removed without the need to modify the building, develop an engineered solution or engage specialised resources.

The pump station design must allow the following minimum clear spaces:

Flanges to any wall	350 mm
Flanges to the floor in pit	200 mm
Between pumps in pit	800 mm

Between pump plinths in pit	600 mm
Between pump plinths and wall in pit	600 mm
Between pump plinths in building	600 mm
Between pump plinth and wall in building	800 mm

STS 500 details the clearance requirements around electrical equipment.

5.5.6 Lifting Equipment

For building type stations, permanent lifting equipment must be installed to facilitate installation and removal of all maintainable assets contained within the building. The design layout of the station must allow for either the pump, motor or pumpset complete with base frame to be lowered directly onto the tray of a Hunter Water maintenance vehicle or flatbed truck with a single lift.

The typical arrangement must have a monorail located above the pumps that runs out through the double doors. Larger stations may require a gantry crane.

The permanent installation must comply with the relevant requirements STS 600, and all components of the lifting system must comply with the relevant requirements of STS 640.

Lifting requirements for electrical equipment and switchboards must be developed and implemented in accordance with STS 500 and STS 510.

5.5.7 Staging for Future Demand

Hunter Water's preference is to avoid staged construction however it may be acceptable if:

- Hunter Water is consulted at the concept stage to evaluate the merits of the design
- The ultimate flow is expected to be reached within the servicing strategy report timeframes
- The proposed future works will not impact station operation
- The staged approach does not compromise either the initial or future performance (e.g. pumps operating at undesirable duty points, excess or redundant pumps in the future configuration)
- Both the initial and future constructions meet all relevant requirements of this design manual
- The approach is supported by economic and strategic analysis

Hunter Water will only accept the following approach to staged construction:

- The building/pit and site infrastructure is sized to suit the final configuration however components of the future mechanical and electrical plant may not necessarily be installed:
    - All site services must be sized and installed to suit the future station capacity
    - Electrical switchboards must be designed and fitted out to suit the final station configuration. Designs that propose to augment switchboards by adding a new tier are not acceptable.
    - The PLC must have sufficient capacity to suit the future configuration
    - Pipework must be designed and installed with take-off points to allow connection of the future pumps (e.g. blanked tees). Designs that require future modification of the suction or discharge main are not acceptable.
    - The building/pit is configured so that the staged works do not require excavation or structural modifications. All penetrations must be completed with pipework finishing inside the station ready for the future connection.
    - Future mechanical and electrical equipment is identical to the installed equipment (i.e. same model pump is used)

Hunter Water maintains sole discretion to approve or reject staged designs.

5.5.8 Ventilation

All pump stations must be provided with ventilation to ensure that the internal temperature does not exceed 5 °C above ambient or exceed 50 °C.

5.5.8.1 Pit Type Stations

For pit type stations, ventilation is to be provided for motor sizes 5kW and above. This ventilation is to comprise an induct and educt vent to allow the cross flow of air through the pit to remove heat. This will be by natural convection for motors less than 8kW. The induct vent penetration into the pit to be mid (50%) depth, with the educt vent penetration to located at 75% above pit floor.

For 8kW motor size and above, forced draught (mechanical) ventilation is to be provided by the use of an electrically driven fan. This is to draw fresh air in and exhaust the hot air. The fan is to operate on a thermostatically controlled switch to operate when the inside temperature reaches 30°C.

5.5.8.2 Buildings

For most pump station buildings, natural ventilation through low level louvres incorporated into the doors or building walls, combined with high level louvres or wind driven extractors, will generally be adequate.

Such systems, whether natural or mechanical ventilation, will rely on introducing fresh air at low level vents around the building and exhausting such air from one end or side of the building to ensure that it is drawn across motors and switchboards and exhausted from the building.

Pumps with large motors (for example, over 40kW) or VSD units can generate considerable heat and forced draught ventilation of the pumps, motors and VSD units is likely to be required. This is to prevent unreasonable temperatures being experienced for the equipment in the cabinets and personnel inside the building while the station is in operation. A thermostatically controlled fan switch is to ensure the ventilation system operates when the inside temperature reaches 30°C.

Once the thermostat operates the fan, sufficient outside air must be passed through the station to reduce heat build-up. This is to be determined from:

- Electrical load with all duty pumps in operation at full motor speed
- A portion of the electrical load being generated as heat

Where noise is of concern, ventilation using open ventilation louvres which would allow the passage of noise should not be used. In such cases acoustically treated louvres, ducts etc. must be used in the station ventilation system to prevent the noise from within the station escaping to the outside of the building. In such cases, forced draught ventilation may be required to achieve the required air flow.

5.6 Pump Station Pipework

5.6.1 Pipework Design

The designer must establish the design pressure of the delivery pipework. All operational scenarios must be considered including:

- Normal operation, including projected demands
- Abnormal network configurations (e.g. outages, maintenance, fire flows or the like)
- Transient conditions such as surge (see Transient Analysis 5.6.7)
- Failure scenarios (e.g. burst pipe, blockage, valve failure, control failure)
- The impact of any staged construction

The design pressure must be selected to ensure that subsequent component selections are resilient to damage under all foreseeable operational scenarios.

All pipes and pipeline components must be suitable for the selected design pressure and flows.

Acceptable pipe materials are flanged Ductile Iron Cement Lined (DICL) Flange Class, flanged seamless grade 316L stainless steel or flanged continuously welded grade 316L stainless steel. Stainless steel pipe must be a minimum of SCH40. Any spool pieces that are required to adapt DICL pipework to the pump flanges must be fabricated from grade 316L stainless steel.

All DICL pipework is to be flanged and bolted using HD galvanised or grade 316 stainless steel bolts, washers and nuts. Stainless steel flanges must be bolted using stainless steel bolts, washers and nuts.

All pipework must be a minimum of DN100, except for the straight section of pipe connected to the pump discharge which is to be sized in accordance with the pump.

Pipework layouts must follow 'best practice' principles to minimise frictional losses, air pocketing and reduce energy consumption. Wherever economical and practical the layout must minimise pipe lengths and changes in direction, use pipe sizes that minimise velocity, use wye tees and long radius elbows.

For end suction pumps, the pump suction pipework should branch from a manifold laid parallel to the building length and outside the building. The pump delivery pipes, where possible, should connect to a delivery header, again located parallel to the building axis. This can be installed inside or outside the building.

Pipe, flanges, fittings and fasteners must comply with the relevant requirements of STS 600. Adequate clearance shall be provided around all pipework for maintenance activities. At least one section of pipework connected to each side of the pump (suction and delivery) is to be removable to allow for pump removal and replacement.

Velocities within pump station pipework must comply with the relevant requirements of WSA 03 Water Supply Code Hunter Water Edition.

The Designer is responsible for confirming compatibility of piping flanges with selected pump flanges.

The designer is responsible for developing trench and thrust restraints specifications tailored to their specific designs, including embedment and trench fill requirements. These specifications must be grounded in sound engineering principles, informed by geotechnical investigations findings and aligned with appropriate trench supports systems. For additional information refer to WSA standards.

5.6.2 Suction Pipework

The section of pipe that connects to the pump suction flange must be at least the same internal diameter as the pump inlet and must be horizontal, uniform and straight with no points of disturbance (i.e. valves or fittings) for a minimum of five pipe diameters.

Inlet tapers (reducers) must be eccentric with the obvert horizontal. Tapers must be straight sided with an included angle of 15 degrees or less. Tapers must not be mounted directly to the pump suction flange.

Any tapers or valves must also be at least five pipe diameters away from the suction flange.

5.6.3 Delivery Pipework

Tapers used on the pump delivery may be concentric or eccentric but must be straight sided.

5.6.4 Vibration Control

Vibration control must comply with the relevant requirements of STS 600.

5.6.5 Thrust Restraint

The design must include adequate thrust restraint. Thrust restraints must be sufficient to resist the design pressure identified in Section 5.6.1. All flexible jointed pipes and fittings must be adequately restrained.

Thrust restraint for pipework can be achieved by the use of thrust type dismantling joints. The use of adapter type flanges (e.g. UniFlanges, Adapta-Flanges or TYTON–LOK joints) is not permitted.

The design must ensure that there is no loading on the pump flanges. The pump must not be used to support the pipework. The design must include sufficient thrust restraint for the pipework in the event of pump removal.

Puddle flanges must be incorporated to take thrust loads for all wall penetrations.

Where pipework is to be tested before trenches are backfilled, the anchorage design must either omit the soil load, or the test methodology must detail the temporary anchorage requirements.

5.6.6 Differential Settlement

The design must ensure that no fracturing of the pipework, joints or the building occurs due to differential settlement (refer to WSA 03). The designer must select appropriate flexible pipework jointing and restraint such as thrust blocks. Pipework in the ground leading into and from the pump station building may have either rubber ring or flanged joints. Where further flexibility is required flexible bellows may be utilised.

The geotechnical investigation must be used as the basis for evaluating the extent of treatment that is required.

The design drawings shall include references to all relevant geotechnical and engineering/design reports and a copy of such reports shall be provided to Hunter Water.

5.6.7 Transient Analysis

5.6.7.1 General

Hydraulic transient pressure surges, also known as ‘water hammer’, occur in pressure systems when sudden changes take place, such as pump failure. This results in pressure waves propagating through the piping network.

The damaging effects of unacceptable transient pressures include:

- High pressures
- Low pressures
- Reverse flow
- Column separation and cavitation
- Pressure oscillations

Hunter Water‘s water network includes aged pipework that has a risk of failure under fluctuating pressure. Hunter Water must be consulted to determine the appropriate maximum allowable transient pressures wherever a new pump station is to be integrated with existing networks.

The designer must assess the impact of transient pressure surges on the pump station and surrounding network. The results of the transient analysis must feed back into the station design (i.e. thrust block design and transient control measures).

5.6.7.2 Methods of Analysis

Hydraulic transient pressure surging must be modelled using appropriate computer software (such as INFOSURE, WATHAM or Bentley Hammer).

Multiple scenarios must be modelled to understand the range of dynamic system responses including:

- Normal station start up of pump/s
- Pump assist start up
- Pump assist shut down
- Normal station shut down
- Power failure at station

The results of the analysis must be included in the design report. The report must detail all relevant background information, list all assumptions and input information.

5.6.7.3 Transient Control Measures

The design must include control measures wherever the transient analysis indicates that there is a risk of damage to the network.

Wherever possible, the preferred treatment of transient issues must be to minimise or eliminate the problem through passive design. The use of mechanical and electrical measures must only be considered where passive measures are inadequate, impractical or not cost effective.

When selecting control measures the designer must assess the range of options that are available. The final selection must be based on a multi criteria analysis that, at a minimum, considers performance, reliability and life cycle costs. All life cycle costs must be based on discount rate economic analysis. Hunter Water can provide guidance on discount rates and other inputs.

Acceptable mechanical and electrical measures to manage transient pressure surge may include:

- Selection of VSD ramp up and ramp down times
- Placement and selection of non-return valves
- Slow opening and closing valves
- Air valves

Surge vessels must only be considered where there is no other practical alternative and must be approved by Hunter Water.

The designer must consider the effectiveness of control measures in a power failure scenario.

5.6.8 Testing of Pipework

The designer must specify the test pressure and testing methodology.

Further detail on Hunter Water's testing requirements can be found in WSA 03 Water Supply Code Hunter Water Edition.

5.6.9 Fatigue Analysis

Delivery pipework out of the pump station must be rated for dynamic stresses and fatigue to ensure the pipes can accommodate cyclical loadings throughout their nominal lifetime. Fatigue analysis of delivery pipework must be done in accordance with WSA 03 Water Supply Code Hunter Water Edition Clause 3.6.

5.7 Pipeline Detailing

5.7.1 Isolation Valves

Isolation valve supports for large valves must be detailed in accordance with SCP drawings.

Butterfly valves must not be used as isolation valves, except in some cases for pit or building type stations where space is limited. Lugged or flanged butterfly valves up to a maximum size of DN150 may be used as suction and delivery isolation valves but must be located within the station or a pit. These valves are compact and generally easy to operate. It is essential that the butterfly valves be either flanged or of the lugged design so that the valve can be retained in position on the flange of the pressurised pipe to provide pipeline isolation whenever an adjoining section of pipe needs to be removed. Wafer butterfly valves secured between two mating flanges must not be used.

Isolation valves must be provided at the following locations:

<u>Pumps</u>

Each pump must be fitted with a suction isolation valve and a delivery isolation valve. Both valves must be flanged gate valves with resilient seats, non-rising spindle and clockwise closing.

The delivery valve shall be located downstream of the non-return valve to allow isolation of both the pump and non-return valve for maintenance.

A typical station arrangement has these valves located outside of the station, direct buried in the ground with a pipe sleeve section over the spindles and valve boxes located at ground level. To ensure valve boxes remain accessible, they must be incorporated into and linked together using a continuous 600 mm wide concrete strip. Separate strips for suction and delivery valves may be used where appropriate.

<u>Air Release Valves</u>

All air release valves must include an isolating valve on the inlet to the air valve.

<u>Flowmeter</u>

The flowmeter must be fitted with upstream and downstream isolation valves.

The flowmeter bypass must be fitted with an isolation valve.

<u>Strainer</u>

The strainer must be fitted with upstream and downstream isolation valves.

The strainer bypass must be fitted with an isolation valve.

<u>Pressure gauges</u>

All pressure gauges must include isolation valves in accordance with STS 600.Further detail on the gauge board layout is provided in Section 5.7.10.

<u>Tapping Points</u>

All tapping points must be fitted with a stainless steel ball valve of minimum DN20. The valve arrangement must allow the tapping point to be rodded for maintenance without valve removal.

Section 5.7.9 provides details of the arrangement of tapping points for instrument connections

5.7.2 Non-Return (Reflux) Valves

A non-return valve must be installed in the discharge pipework of each pump to prevent backflow through the pumps or water recirculation, and in the pump station bypass line.

All non-return valves must meet the relevant requirements of STS 600.

Flanged long bodied non-return valves must be used unless there is limited space or pipework is DN100 or less. In these situations, the designer may elect to use lugged wafer type non-return valves to achieve a compact station arrangement. Wafer type valves must be lugged as these can remain in place when and functional when nearby pipework is removed.

When using lugged wafer type non-return valves, care must be taken to ensure that there is space immediately downstream of the valve to allow for the disc to fully open. In such cases a short flanged spacer pipe must be installed between the non-return valve and the isolation valve.

Non-return valves must be located inside of the pump station pit or within the building.

Non return valve supports must be detailed in accordance with SCP drawings.

5.7.3 Flowmeter

An electromagnetic flowmeter must be installed in either the delivery or suction pipework. The flowmeter must record all pumped flows and gravity flows where applicable.

All flowmeter installations must comply with the relevant requirements of STS 500.

The flowmeter installation must include a valved bypass that allows the flowmeter to be isolated and removed from service. A flushing hydrant must be installed on the downstream end of the bypass. Due to the short length of the bypass line it may be one size smaller than the main pipework. Note that this allowance does not override the minimum pipe size (DN100) specified in 5.6.1.

5.7.4 Strainer Assemblies

The suction pipework must be fitted with a strainer assembly to prevent foreign material from entering the pumps. Unless oversized to meet pressure loss requirement below, the strainer must match the nominal pipe size.

The pressure loss through the strainer at new must not exceed one metre (10 kPa) at the design maximum flow rate. If the nominal sized strainer is unable to satisfy the pressure loss requirements then either the next nominal size can be used or two nominal sized strainers may be installed in parallel.

The strainer body may be manufactured from iron, steel or stainless steel. Bodies from iron or steel must be supplied with a with fusion bonded epoxy protective coating on all wetted parts. The strainer element (basket) must be either wire mesh or perforated sheet metal and manufactured from 316 stainless steel. The strainer element aperture to be 50% of the throughlet of the pump impeller (ie 10mm impeller throughlet (clearance) means 5mm diameter hole in strainer basket) with a maximum aperture size of 10mm. The strainer must be installed so that solids fall to the bottom of the strainer basket and can be readily collected when the basket is removed.

The strainer cover must be removable by one person. For installations where the size, weight or location of the strainer cover introduces a manual handling risk when performing maintenance tasks, the installation must include a means of mechanical assistance to ensure the cover can be safely removed (e.g. attachment points for using lifting devices).

Strainer baskets must be removed from the top (i.e. H-style strainer type).

The strainer assembly must have a minimum DN25 316 stainless steel ball valve on the lower body of the strainer for draining.

The strainer installation must include a valved bypass that allows the strainer to be isolated and removed from service while keeping the pump station functional. A flushing hydrant must be installed on the downstream end of the bypass. Due to the short length of the bypass line it may be one size smaller than the main pipework. Note that this allowance does not override the minimum pipe size (DN100) specified in Section 5.6.1.

5.7.5 Air Release Valves

The designer must identify all locations where air could become entrapped within the pipework during operation. At each location the design must include an automatic air valve to allow this air to be released.

Automatic air valves must be of a type that can be forced open to admit air to the pipework during maintenance.

An automatic air release valve must be installed on the downstream side of all strainers.

The standard arrangement for automatic air valves is detailed in SCP drawings.

Air valves to have stainless steel ball drain valve on body. Where air valves are readily accessible by the public, the drain valve must have a lockable handle.

5.7.6 Bleed and Scour Valves

The pipework must be designed with manual bleed valves that allow air and water (scour valves) to be bled from the system during maintenance and commissioning tasks. Stainless steel ball valves must be used.

Where located outside the building, bleed valves must be pad-lockable in the closed position.

Any valves in publicly accessible areas must be provided with a cage or similar protection against tampering.

Scour discharge location must be defined in the REF. Scours for flushing and disinfection of pipelines must be compliant to STS 408.

The standard arrangements for manual air bleed valves and scour valves are detailed in SCP drawings.

5.7.7 Dismantling Joints

Dismantling joints must be incorporated into the station pipework to facilitate maintenance access.

Dismantling joints are available in thrust and non-thrust type and the designer must ensure the appropriate type is specified at each location.

90° elbows may be considered as dismantling joints where their location facilitates easy removal of the elbow and adjacent pipework and equipment.

The use of adapter type flanges for dismantling (e.g. UniFlanges, Adapta-Flanges, Gibault Joint, or TYTON–LOK joints) is not permitted on the discharge side of the pump.

Dismantling joints must be included at the following locations:

Pumps

Dismantling joints shall be installed adjacent to at least one flanged connection on each pump to allow removal and reinstallation of the pump without significant disturbance to adjacent pipework.
Where practicable, the dismantling joint shall be located between the pump discharge flange and the discharge isolation valve to also facilitate removal of the pump non-return valve.

Valves

Dismantling joints shall be provided at valves where adequate access for removal and maintenance is not achievable via the pump dismantling joints described above.

Strainers

Dismantling joints shall be installed at strainers where the removal of adjacent 90° elbows is not feasible to provide maintenance access.

Flowmeters

Dismantling joints shall be installed on the downstream side of flowmeters where required to facilitate removal and maintenance.

5.7.8 Tapping Points

Tapping points must be provided at the following locations:

- On suction pipework between suction isolation valve and the pump inlet flange for connection to the gauge board (station suction pressure)
- On discharge pipework between the non-return valve and the discharge isolation valve for connection to the gauge board (station discharge pressure)
- For stations that provide pressure control, on both suction and discharge pipework to allow recirculation under low flow conditions (see Section 5.7.11 for further detail)
- On either side of the strainer for connection to the gauge board (strainer differential pressure)
- On suction and discharge pipework for all pumps for pressure switches and insertion of pressure and temperature probes. These points must be 1/2 inch BSP and located two pipe diameters from the pump flanges.

Station tappings must be taken from the top of the full sized main.

Tapping points must comply with the relevant requirements of STS 600. Tapping points must be a minimum of 1/2 BSP however 3/4 is preferred where practical.

Tapping bands may be used for DN200 pipework and smaller. Larger pipework may either use a tapping band or may tap directly into the pipe wall. Tapping points on pipeline fittings such as non-return valves shall be factory supplied.

5.7.9 Instrument Connections

All tapping points used for instruments connections must include:

- A horizontal instrument connection with isolation valve
- An air bleed that discharges horizontally
- All valve handles are able to be fully opened and closed without pinch points

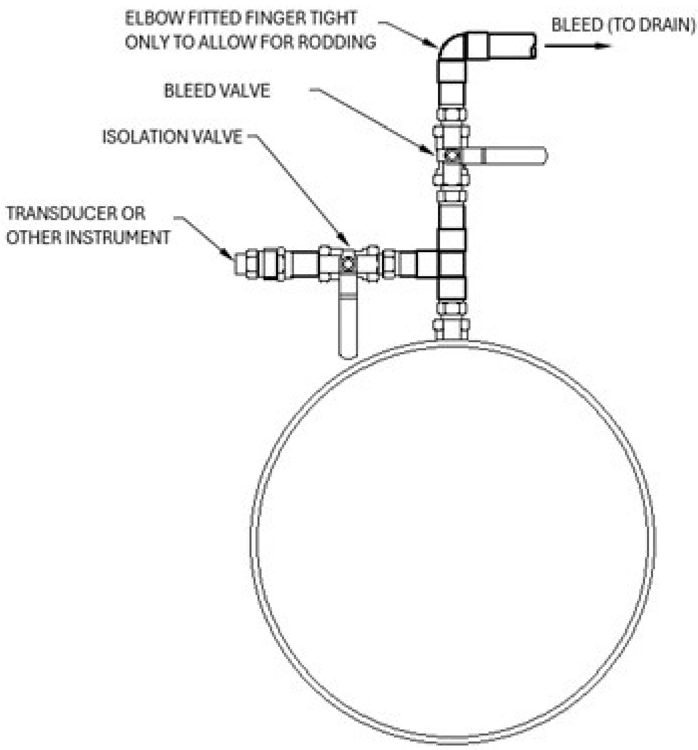


Figure 1: Tapping fitting layout

5.7.10 Gauge Board

All stations must include a gauge board. Hunter Water's standard gauge board layout is provided below. The designer may extend the board and add items to meet any additional needs of the station otherwise the layout must not be altered.

All transmitters must comply STS 500.

The gauge board must be located so that the gauges can be easily read, and transmitters can be accessed for testing, calibration and adjustment.

Sufficient isolation valves and test points must be provided to allow isolation of the pressure transmitters and switches from their respective pressure tubing to enable a test device to be connected via a tee and valve to check the various calibration and settings. Air bleed valves must be installed at the highest point for the respective instruments.

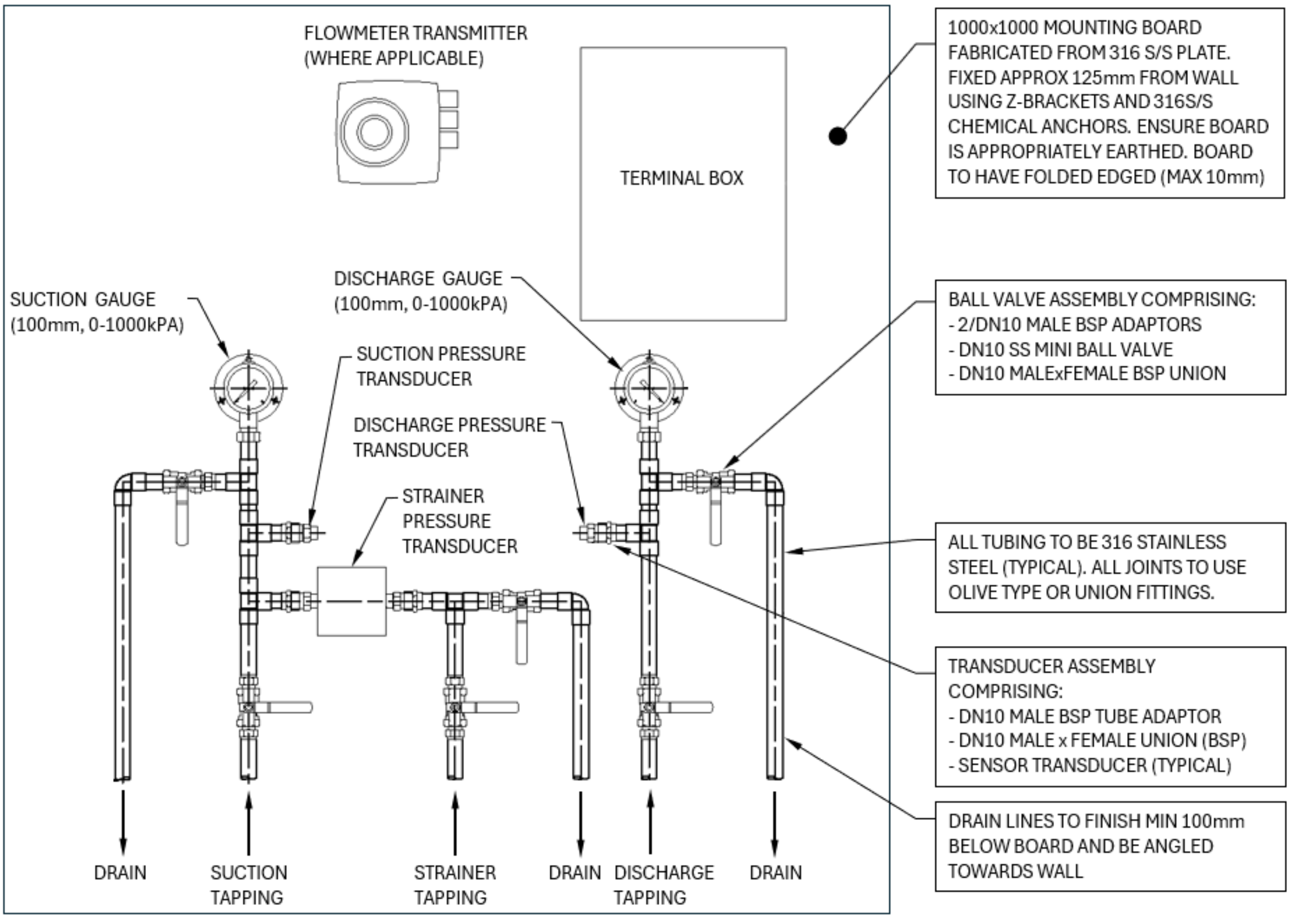


Figure 2: Gauge board layout

5.7.11 Low Flow Bypass (Recirculating Water Valve)

Stations that pump directly into the distribution network to maintain pressure must include an automatic bypass system to safeguard against overheating under very low flow conditions:

- The system must be solenoid controlled using pump casing temperature and allow 5% of the average pumped flow to recirculate back to the suction pipework.
- The system must discharge to drain if temperature continues to rise.

The diameter of the bypass line must be a minimum of 10 mm. Care should be taken when selecting the locations where the bypass connects to the main pipework to ensure that the bypass, when operated, distributes the heated water over a large portion of the station's pipework, regardless of which pump is operating.

The electrical section of this manual includes the electrical and controls requirements for this system, see Section 5.9.4.5. The operation of the recirculating water valve is detailed in the Water Pump Station ACMM.

5.8 Pumps

These design guidelines are generally aimed towards pump stations with duties able to be achieved with the use of single stage pumps. High head requirements for booster stations may require the use of multi-stage pumps.

All pumps must comply with the relevant requirements of STS 600. All water pump stations must have Variable Speed Drives (VSD) on pumps.

Hunter Water has four preferred pump types for water pump stations:

- Single stage in-line centrifugal pumps
- Single stage end suction centrifugal pumps, close coupled
- Single stage end suction centrifugal pumps (back pull out)
- Double suction split case centrifugal pumps

Pit style stations must use single stage in-line vertical centrifugal pumps.

The designer must select from the above types to suit the application, considering reliability, operation, maintenance and life cycle costs. Pumps over 15 kW must be the direct coupled and back pull out or split case type. Pumps over 30 kW must be the split case type as per STS 600, unless approved by Hunter Water.

Double suction split case centrifugal pumps must be adopted where appropriate to pump size. For double-suction split-case centrifugal pumps, adopt a standard pump station configuration with straight pipework and isolate pipe strain from the pump by supporting it from the building structure.

Further detail on VSD requirements is included in the electrical section of this manual and must be designed and implemented in accordance with STS 500.

5.8.1 Pump Selection

The designer must identify the duty point requirements across the range of expected operation. These duties must be approved by Hunter Water.

The pump selection must be suitable for continuous and intermittent operation throughout the above range. STS 600 provides guidance on acceptable duty points.

For pumps pumping directly into a distribution pressure zone, it is preferable to select a pump with a closed head pressure being significantly higher than the operating pressures as these tend to have a broader efficiency range more suited to variable speed operation. Similarly, the maximum duty should be to the right of the best efficiency point (BEP) on the pump performance curve so that lower speed operation typical of average demand is closer to the BEP. Strong preference should be given to pumps with a monotonic head/flow curve, sometimes referred to as a stable curve or CFC (Constantly Falling Curve).

5.8.2 Pump Station Configuration

There is interdependence between trunk main size, pump station capacity and reservoir storage. The best pump station configuration is determined via whole of life cost analysis. The most appropriate station configuration may not always be immediately clear.

Station duty is generally taken to be the maximum flow rate required from the station, including fire flow. Selecting pumps to meet maximum duty most efficiently will likely result in fewer pumps, however this tends to result in lower overall efficiencies as normal operation of the station will be at a considerably lower flow rate.

Historically, the best solution has been to size pump stations to efficiently supply the daily demand (normal operation flow rates) constantly over a 20 to 24 hour period, whilst ensuring that maximum flow rates can be met when required. Hence selecting smaller pumps and more of them may be the better option. This is discussed further below.

Note that all potable water pumps must be driven using a Variable speed Drive (VSD) regardless of the proposed operational style of the pump station.

The configuration of the pump station must take the following into consideration:

Pump Efficiency. By using the most efficient operating range on the pump curve more economical running costs will be achieved. The investigation should consider running the pump at maximum efficiency during average demand periods as against running during peak demand periods. When pumping to an open head (to a reservoir), the control scheme will be configured to preference running the pump(s) at the speed established to achieve the lowest specific energy consumption. For that reason, the designer must determine the operating speed that achieves the lowest Specific Energy Consumption, adopting the most typical suction and delivery pressure conditions. The designer must determine this speed for all combinations of pump selection and pipe selections being considered, and anticipate the portion of flows expected to be delivered that achieves this minimum Specific Energy Consumption so that it can be incorporated into the operating cost calculated for the various options.

Where the system demand is thought to exceed this minimum Specific Energy Consumption flowrate, the Specific Energy Consumption of that higher flow rate must be adopted for those times. In some applications the Specific Energy Consumption of running two pumps at a station to achieve a certain flow will be lower than achieving the same flow with one pump running at a higher speed. The designer must determine where a pumping arrangement fits this description and assume that the station control scheme will adopt the lowest Specific Energy Consumption operating condition to deliver the required flow. In such situations, the Design Report should note the flow ranges where a single pump running is the lowest specific energy option, where two pumps running is the lowest specific energy option and so on. Note that at Hunter Water, pumps operating in parallel will always be operated at the same speed.

For variable speed pumping that is to maintain a set delivery pressure, pump speed may vary significantly with demands. The designer must calculate the speed applicable the operating point corresponding to average day demand and adopt the corresponding specific energy consumption when making whole of life cost comparisons between pump options.

Pump Combinations. The pumping application will tend to guide the option to use one duty pump or instead adopt a duty plus assist pumps arrangement to meet the anticipated performance of the station. The designer must justify the preferred pumping arrangement. Ideally the selected option will achieve a minimum NPV, although site constraints or the need to allow for future growth are valid considerations when considering the optimal number of pumps chosen to meet the design criteria. The designer is strongly encouraged to select a battery of identical pumps to meet the pumping requirements.

Standby Capacity. The station must feature N+1 pumps and drive trains where N is the minimum number of operational pump drive trains required to achieve its designed flow performance including fire flow. Standby capacity must be equivalent to the capacity of the largest duty pump. The power supply must be adequate to allow for all pumps to operate at the station.

Existing Pump station Amplification. Amplification of an existing pump station may be achieved by increasing the number of pumps, increasing the impeller size on existing pumps or replacing the pumps with larger units.

5.8.3 Pump Materials and Construction

All pumps must comply with STS 600.

Pump construction and material selection must align with minimal maintenance design intent for the WPS (site maintenance expected to be limited to once per year).

Designer must state minimum and maximum suction and delivery pressure.

Generally pump bodies and bearing housings should be constructed of cast iron. Shafts must be stainless steel and impellers must be bronze or stainless steel.

Internal wetted surfaces of the pump (i.e. volute casing but excluding impeller and seal ring surfaces) must be coated with a non-toxic 2 part epoxy paint suitable for potable water. If epoxy coating is not possible, alternative materials of construction such as bronze or stainless steel must be considered. As operating efficiency is the major consideration in the pump selection process, if the specified materials are not available then this should be discussed with Hunter Water prior to selecting an alternative less efficient pump which can either be epoxy coated or is available in non-corrosive materials.

For lower duty applications involving pumps up to and including 15kW, a close coupled arrangement will be acceptable. This arrangement uses the motor shaft to support the pump shaft via a single coupling which encloses both shafts. Therefore the only bearings supporting the pump stub shaft are those of the motor. Such arrangements are generally used in in-line pumps. A common term for such a pump arrangement is a “motor pump”.

Pumps of the direct driven style must be fitted with renewable wear rings in the front and back of the body and on both faces of the impeller.

5.8.4 Pump Speed

Pump speed must comply with the requirements of STS 600.

Hunter Water does not allow motors to be run at higher than synchronous speed.

5.8.5 Electric Motors

Electric motors must be selected and designed in accordance with STS 500.

5.8.6 Pump Performance Testing and Commissioning

Non-mass-produced pumps must be performance tested in accordance with STS 600.

The designer must propose a methodology to verify the design performance of the pump station during commissioning. Further detail on commissioning requirements is included in STS 405.

5.9 Electrical

The electrical components of a pump station include but are not limited to:

- Incoming power supply (Contestable and/or private HV works)
- Low voltage (LV) switchboards.
- Electronic equipment (e.g. variable speed drives, active harmonic filters, PLC's, etc.).
- General light and power.
- UPS and batteries.
- HVAC and ventilation.
- Fire protection equipment (e.g. smoke detectors, VESDA, fire indication panel, etc.).
- Earth bar.
- Solar equipment (e.g. inverters, solar protection panels etc.)
- ICT and automation equipment.
- Security system.
- Instruments (e.g. flow transmitter, pressure transmitters, pressure switches, etc.).

All electrical works including but not limited to design, construction and equipment must be developed, implemented and selected in accordance with AS/NZS 3000, STS 105, STS 500, STS 501, STS 510, STS 550, STS 904 and the approved products list.

5.9.1 Electrical Design

All electrical equipment must meet the process requirements of each station.

The pump starters supply power to the pump motors based on a PLC control signal (e.g. reservoir level or pipeline pressure).

Telemetry provides remote monitoring and control (e.g. telemetered reservoir level for pump cut-in and cut-out).

Refer to standard electrical drawings. The drawings are a guide only; they may be changed however necessary to align with project requirements.

5.9.2 Power Supply

The power supply must be a three phase and neutral (L1, L2, L3 + N) 400V 50Hz multiple earthed neutral (MEN) power supply. Power must be supplied by the Distribution Network Service Provider (DNSP) (i.e. Ausgrid or Essential Energy) directly from the existing distribution system or via an extension/augmentation of the system.

The designer must undertake all works required to establish a connection between the station and the local DNSP (Contestable works and/or private HV works). It is the responsibility of the designer to liaise directly with the DNSP to determine the most appropriate connection arrangement.

The power supply requirements must allow for:

- Maximum demand of the pump station. The supply must be sufficient to operate all pumps, including the standby pump, at the same time. This includes any future provisions or upgrades.
- Frequency of pump starts (e.g. five per hour etc.).
- Method of starting (VSD only).

5.9.3 Generator Connection Point

All stations must incorporate a generator connection point, and dedicated concrete hardstand area to allow the connection of a portable generator, that is developed and implemented in accordance with STS 500 and STS 510.

An Operations and Maintenance Manual must be supplied in accordance with STS 405.

5.9.4 Instrumentation

The minimum requirements for all stations include the following below.

All set points to be determined in conjunction with Hunter Water and recorded in *"HW2009-2368/1/5.001 WPS Site Configuration and Operational Information"* form. The designer must request this form from Hunter Water.

5.9.4.1 Station Flow Transmitter

A flow transmitter must be installed at each station and integrated into the SCADA system.

An alarm must be triggered when the flow drops below a preset value. This is an option in Hunter Water's standard code and must be enabled and configured on a site-by-site basis.

The transmitter must be mounted on the gauge board (see Section 5.7.10). The transmitter must not be mounted in the switchboard.

5.9.4.2 Strainer Differential Pressure Switch

A pressure switch must be installed to the strainer differential pressure of each station and integrated into the SCADA system.

Strainer differential pressure is included as an option in Hunter Water's standard code, and it must be enabled and configured so that an alarm is generated on high differential pressure.

For mounting requirements see Section 5.7.10.

5.9.4.3 Station Suction and Delivery Pressures

Pressure transducers must be installed on both the suction and delivery side of each station and integrated into the SCADA system.

An alarm must be triggered when the suction or delivery pressure is either too low or too high. Suction and discharge pressure alarms are included in Hunter Water's standard code however must be configured to suit individual station requirements.

For mounting requirements see Section 5.7.10.

5.9.4.4 Pump Suction and Delivery Pressure Switches

Pressure switches must be installed on the suction and delivery side of each pump

An alarm must be triggered when the suction pressure is low or delivery pressure is high. These alarms must inhibit the pump and must be configured on a site by site basis.

For mounting requirements see Section 5.7.9.

5.9.4.5 Low Flow Bypass Temperature Switch

For stations that are providing pressure control, an RTD sensor must be installed to the outside of each pump casing and integrated into the SCADA system.

The RTD must provide an input for control of the low flow bypass solenoid. The operation of this bypass is detailed in the WPS ACMM.

For the mechanical configuration of the bypass system refer to Section 5.7.11

5.9.4.6 Pit Flooded Level Switch

Pit type stations must have two float switches installed at each station and integrated into the SCADA system.

An alarm must be triggered when the water level reaches 150mm depth and the pumps inhibited when the water level reaches 300mm.

Pit flooded detection for building type stations must be designed and installed in accordance with STS 410, STS 500 and STS 510.

5.9.4.7 Security

All hatches, doors and entrances containing Hunter Water assets must be monitored and integrated into the SCADA system.

Security requirements for each station must be developed and implemented in accordance with STS 105, STS 500 and Hunter Water during design.

5.9.5 Sump Pump

Pit type stations must have a sump pump installed at each station if passive drainage or a venturi sump pump installation cannot be achieved.

Sump pumps must have a 50mm camlock coupling on the discharge hose.

Sump pump requirements for pit type stations must be designed and implemented in accordance with STS 500.

Building type stations must be designed and implemented in accordance with STS 410, STS 500 and STS 510.

For additional information refer to Section 5.5.1.

5.10 Pump station Operation and Control

5.10.1 General

Hunter Water has standard PLC code that can be applied to largely any pump station regardless of the role the pump station serves in the network. The role of the pump station in supplying demand within the system must be clearly defined by the designer. The designer must then refer to the Generic WPS ACMM to determine which Category of standard control fits that role. By nominating the Category of the Station and completing the SCADA details Form ("*HW2009-2368/1/5.001 WPS Site Configuration and Operational Information"* form) the Designer is able to fully characterise the operation of the station. Information about the Categories is reproduced here but the designer should refer to the Generic WPS ACMM for an up to date description. The designer must consider also the requirements in STS550 – General Requirements for SCADA and Automation Systems.

5.10.2 Station Operational Categories

The pump station operational categories use a combination of level control and pressure control.

The operational categories are:

Category 1 - Delivery pressure control only

Category 2 – Maintenance of Reservoir level

Category 3 – Maintenance of Reservoir level with time of day control

Category 4 - Maintenance of Reservoir level with Pressure support

Category 9 – Custom Control Mode

5.1.1.1 Category 1 – Delivery Pressure Control

A Category 1 pump station is used for delivery pressure control in areas where the water network cannot provide sufficient water pressure to customers via reservoirs. This category is not compatible with SIPS control.

This mode uses the Pressure Control function.

If communication is lost from the pump station to head office SCADA, the pump station will continue operating as normal with the last SCADA settings.

5.1.1.2 Category 2 – Maintenance of Reservoir Level

This mode incorporates reservoir level control mode or pressure control mode with only one mode active at a time. The method of control is selected via SCADA. The normal mode of operation is reservoir level control. This control mode includes features that allow the pump(s) to be operated at a preferred speed. The preferred speed is generally selected on the basis minimising energy consumption which in turn is based on specific energy consumption analysis. Pressure control mode will be activated when the reservoir is selected to be Off-Line.

5.1.1.3 Category 3 – Maintenance of Reservoir Level with Time of Day Control

A Category 3 pump station is the same as a Category 2 pump station with the added feature of time of day control for reservoir level control. This is generally used for minimising electricity costs by operating the pumps at lower electricity tariff periods. Cut-in and cut-out levels are configured on SCADA in a similar manner to Category 2 with the addition of time of day/day of the week setup.

Reservoir level with time of day control is generally the normal mode of operation. Pressure control mode will be activated when the reservoir is selected to be Off-Line.

5.1.1.4 Category 4 – Maintenance of Reservoir Level Control with Pressure Support

A Category 4 pump station is always in pressure control mode. However the pressure controller may be started by either a low reservoir level or a low suction pressure. The pump will continue to operate until both the reservoir level is above the cut-out level and the suction pressure is greater than the cut-out pressure.

Category 4 is typically applied to booster stations that feed a reservoir where gravity flows are normally sufficient to supply the reservoir. The booster station is there because in peak demand the flow to the reservoir needs to be boosted to keep the reservoir in an acceptable operating range. In these cases the booster can potentially cause excessive pressures on the delivery side of the station, or too low pressures on the suction side of the station. Category 4 control manages this possibility by operating to a delivery pressure set point while relaxing the delivery pressure if required to maintain the suction pressure at the suction pressure limit. The boosted flow rate as a result of the booster station operating will be sufficient to maintain sufficient supply to the reservoir.

5.1.1.5 Category 9 – Custom Control

A Category 9 pump station has a custom control scheme using variable speed drives that should be documented in a site specific ACMM.

5.10.3 Pump operation based on SIPS

SIPS (Smart Integrated Pumping Scheduler) is a software designed to reduce the energy cost of operation while keeping within constraints such as operating reservoirs between their low and high level permissives. It does this primarily by exploiting the different tariffs throughout the day (e.g. running pumps when energy is cheap) and prioritising the most efficient pump combinations at each station.

Every 30 minutes, SIPS calculates an optimised schedule for the next 24-48 hours based on current equipment availability and its demand forecast. At half hourly intervals, SIPS will send commands to SCADA to start/stop pumps and choose speed set points of variable speed pumps to supply the network at the optimal energy cost. Generally, SIPS will schedule blocks of time for pumps to be on or off (i.e. avoiding frequent starts and stops).

Operators may interact with the SIPS interface, for example by forcing a pump station to be off at a point in the future in preparation for a shutdown. SIPS will then update its 24-48 hour forward-looking schedule to take this into account.

As SIPS can only send commands to SCADA every 30 minutes, there are safeties programmed into the PLCs to start or stop pumps in the event that a reservoir breaches its low/high level permissive for whatever reason.

Generally, for a station to be considered for SIPS control it must pump to a reservoir, and either have a design flow rate of at least 150 L/s, or be expected to consume more than 160 MWh per year.

Appendix 1. Drawing and Documentation Requirements

A1.1. Drawings

Refer to:

- STS 904 Preparation of Electrical Engineering Drawings
- STS 911 Preparation of Mechanical, Civil & Structural Engineering Drawings.
- STS 913 Preparation of Piping and Instrumentation Drawings (P&ID)
  STS 906 Operation and Maintenance manual and template requirements

A1.2. Design Reports

One electronic copy and one pdf copy of each document and drawings as relevant must be supplied to Hunter Water during each phase of design. Electronic copy of drawings must be in CAD and PDF format.

The Design Report, including any special assumptions or design details, includes the following:

- A Mechanical and Civil Design Report which includes:
  - Pump station pit and/or structure levels (e.g., floor level, roof level, 1:100 year flood level).
  - Discharge pipework and valves (diameters, materials).
  - Velocities in discharge pipework and rising mains.
  - Pump spacings and pump offsets
  - Suction and discharge pipework levels and diameters.
  - Methodologies of installation.
  - Duty points.
  - Initial pump selection report (refer Section **Error! Reference source not found.**).
  - Electrical requirements (eg motor rating).
  - Present worth analysis of pumps and rising mains.
  - Ventilation requirements.
  - Water hammer analysis details.
  - General comments (eg future upgrading by impeller change; triplex versus duplex station, special requirements).
  - Pump out and / or gravity scours and air release valves if necessary.
- An Electrical Design Report in accordance with the requirements of STS 500.

- A Geotechnical report for the pump station and discharge main.
- Dilapidation and Demolition Report
- Proposed Shutdown Management Plan
- Copy of NSW Mine Subsidence Board approval.
- Copy of all other relevant stakeholders (eg Council and Electrical) approvals
- Required amendments to technical specification.
- 1x set of fully detailed drawings (including civil, mechanical and electrical).
- Provide all updated Work as Constructed documents on completion of all works
- A Safety in Design Report.

  The designer's Safety in Design report identifies, as far as the designer is reasonably aware, hazards relating to the design which could create a risk to the health or safety of persons who are to carry out construction Works or operation and maintenance as per WHS Act, NSW and WHS Regulations, NSW.

A1.3. Contract Documentation

The designer must ensure that all drawings required including relevant standard drawings are included in the contract documents.

Hunter Water's Standard Construction Practice Drawings are subject to review. Before including any of these drawings in contract documents, the designer must ensure that drawing has not been revised. Current drawings may be obtained from Hunter Water.

The designer must provide a completed technical specification for the pump station. This specification must be based on the Hunter Water's Standard Technical Specification (STS) for construction of wastewater pump stations (STS 402) and must incorporate all amendments and / or additions as required for each particular pump station. These amendments must include:

- Nominating the required pumps, suitable alternative pumps, and pump station title
- Specifying the required pump duty point, estimated annual pumped volume, minimum motor cable length, the pump station title and pump station equipment number on the Schedule of Technical Data –Submersible Pump Sets
- Specifying the required switchboard components, the pump station title, and relevant drawing numbers on the Schedule of Technical Data - Switchgear and Control Gear Assemblies
- Incorporating the following Appendices:
  - Asset and Equipment Number Labels List
  - Numbers to be obtained from Hunter Water and list completed
  - Drawing List (Complete list of contract drawings)
  - Pipeline Characteristic Graphs

    - Bore Logs
    - Equipment data sheets

- Incorporating any other approved amendments and additions to the standard technical specification clauses as required for the particular pump station and associated equipment.

A1.4. Operation and Maintenance Information Package

The Operation and Maintenance manual (O&M manual) is compiled in two stages. The first stage is produced by the design consultant as part of the detailed design and the second/final stage by the Contractor as part of WAC requirements.

The designer must prepare an operation and maintenance information package to enable the construction contractor to complete stage 2 of the O&M manuals development.

The operation and maintenance information package (STS 906) contains:

1. Operations and Maintenance Manual Requirements Template
2. The Asset Data Collection Sheet Template (QT120)
3. The form “HW2009-2368/1/5.001 WPS Site Configuration and Operational Information” with designer sections completed. Please request this form from Hunter Water.

The operation and maintenance information package must be prepared in accordance with STS 906 Operation and Maintenance manual and template requirements.

If the asset is not a standard pump station (e.g. Dora Creek vacuum stations), the designer must revise the generic requirements for an O&M manual (tables of the information required, the template and the instructions), so that they accurately represent the operation and maintenance requirements for the pump station being designed. The determination if the asset is not a standard pump station and the revision of the requirements must be done in consultation with the Hunter Water.

Where the proposed works do not involve the construction or upgrade of pump stations but will include the installation of electrical or mechanical components then the requirements for the information package must be discussed with Hunter Water.

A1.5. WORK-AS-CONSTRUCTED (WAC) INFORMATION

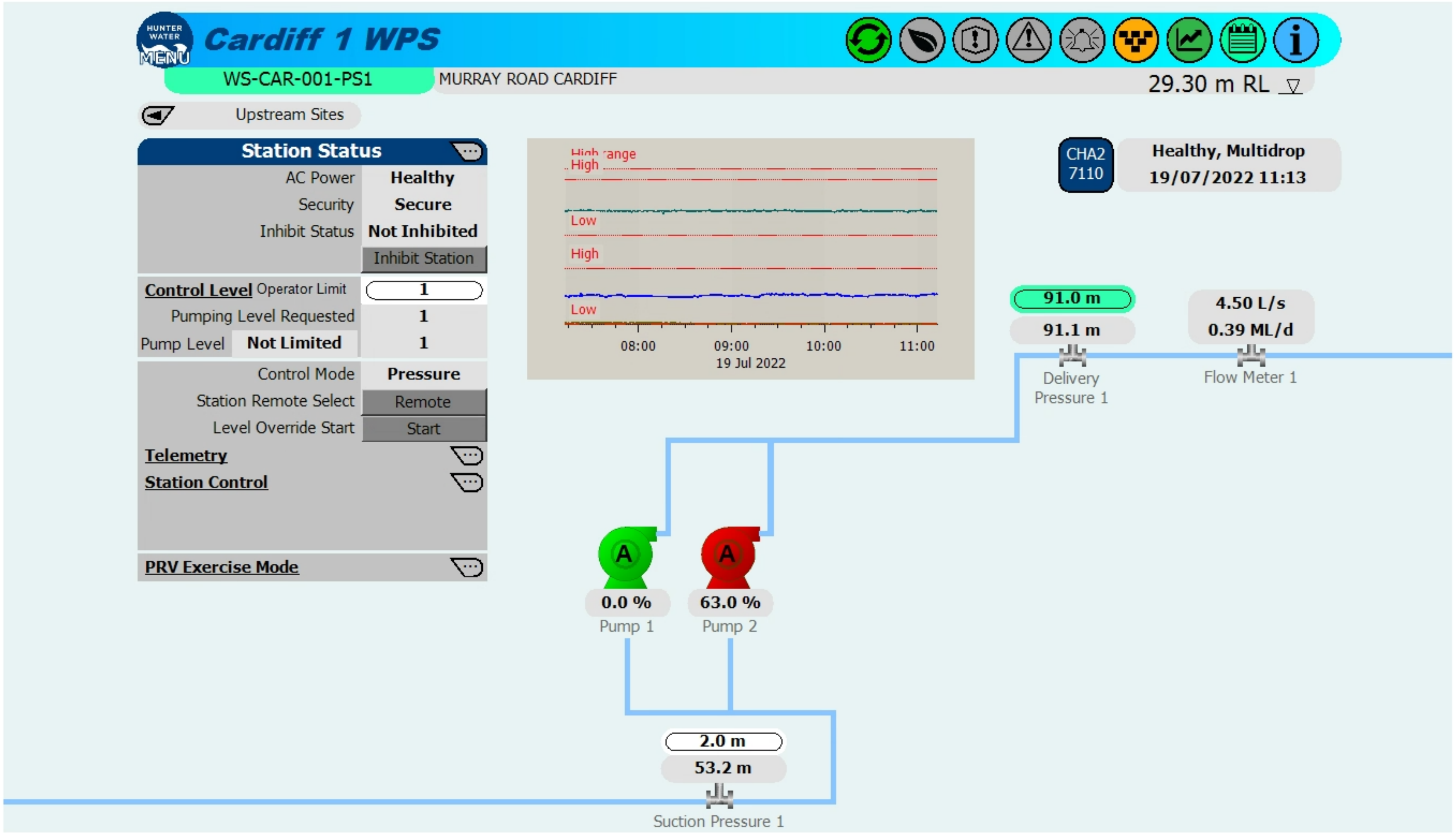
Prepare WAC Information in accordance with the Hunter Water Standard Technical Specifications:

- STS 903 Work-As-Constructed (WAC) Information.
- STS 911 Preparation of Civil and Structural Engineering Drawings. and
- STS 904 Preparation of Electrical Engineering Drawings.
- STS 913 Preparation of Piping and Instrumentation Drawings (P&ID)
- STS 906 Operation and Maintenance manual and template requirements

Make amendments if necessary and submit the following WAC information compliant with the design and completion of the construction:

a) one electronic copy in native file format and
b) one ‘pdf’ format

Appendix 2. Example of SCADA Interface



Appendix 3. Example of Triplex WPS Layout

This example is indicative only. Dimensions and layout shown in drawing are not fully compliant with all Hunter Water requirements.