Specification

Technical Specification - Renewal of Dry Well Sewage Pumping Stations

Table of Contents

Revision details

Version No.	Clause	Description of revision
3	Introduction, 1.1	Added upgrades & ref. to WSA04 and design checklist. Deleted testing & commissioning.
	Acronyms	Updated.
	General Terms & Definitions	Design life amended & Service life added.
	2	Updated list of ref. documents & doc. nos. added.
	3.1.1	Clarified design life for existing structures.
	3.1.2	Re-written.
	3.1.3	New ‘Heritage’ clause added.
	3.2.1.1	Resilient seated gate valves installation requirements added.
	3.2.1.2	Additional requirements for knife gate valves added.
	3.2.1.3	Minor amendments.
	3.2.2	Ref. to SW technical Specification – Mechanical added.
	3.2.3	Requirements for dismantling joints detailed.
	3.2.4	Heading changed to Testing & commissioning.
	4.1.1	Refs. to Share Purchasing & Supplement to WSA 101 added.
	4.1.4	Minor amendments.
	4.1.6	Minor editorial amendments.
	4.1.8	Major amendments and clarifications.
	4.1.9	Minor amendments.
	4.1.10.1 & 4.1.10.2	New sub-headings to distinguish pump removal where junction boxes are/aren’t provided.
	4.1.11	Minor amendments.
	4.1.12 & 4.1.13	Headings amended. Ref. to Tech Spec – Mech added.
	4.1.14	Detailed requirements for pump maintenance stands added.
	4.2	Minor amendments.
	4.3.1	Added pipework tie in points.
	4.3.2	Minor amendments, plus detailed requirements for pipe supports, discharge pipe layout & provision for clamp-on flowmeter added.
	4.3.3	Whole clause re-written.
	4.3.4, - 4.3.9	Minor editorial amendments.
	4.4.1	Requirements for actuated valve(s) where multiple pressure mains provided added.
	4.4.2 & 4.4.3	Minor amendments.
	4.5	Requirement for self-closing gates at ladder top landings added.
	4.7	Minor editorial amendments. Dry well floor repair added.
	4.8	Requirement for condition assessment added.
	4.8.3	Heading amended. Pendant requirements clarified.

Version No.	Clause	Description of revision
	4.9	Requirements to bolt down IMH and wet well lids in flood zones.
	5.1	New clause ‘General’ specifying CFD requirements added.
	5.3	Whole clause re-written.
	5.4	Minor editorial amendments.
	5.5	New clause ‘Wet well flushing’ added.
	6.1	Condition assessment elaborated.
	6.2, 7.1, 7.2 & 7.3	Minor editorial amendments (‘isolation valve’ changed to ‘stop valve’ throughout the document).
	7.4 & 7.5	Minor amendments.
	7.6	Requirement for inclined ladder in valve chambers added.
	7.7	Deleted. Text moved to 12.10.4..
	8.1	Heading amended and clause re-written.
	8.2, 8.3, 9	Minor editorial amendments.
	10	New clause 'Superstructure’ added.
	11.2 & 11.4.1	Cluses re-written.
	11.4.2	Changed heading & minor editorial amendments.
	11.4.3	New clause ‘Durability of wet well’ added.
	12.1	New el. switch room requirement added.
	12.2 - 12.4, 12.6 - 12.10.3	Minor amendments.
	12.10.4	New clause ‘Valve chamber instruments’ added.
	12.10.5	New clause ‘Flowmeters’
	12.11	Requirements for latch stop location added.
	12.12 - 12.14	Minor amendments.
	13.1	Clause expanded.
	13.3.2	Minor amendments.
	Appendix 1	New appendix added (reference to Design checklist).
2	Whole document	Format update, general update, references updated.
	3.1.2, 3.2, 3.2.1.1 - 3.2.1.3, 4.1.1 - 4.1.4, 4.1.6, 4.1.8 - 4.1.11, 4.1.14, 4.2, 4.3.2 - 4.3.8, 4.4.1 - 4.4.3, 4.5 - 4.7, 5.2, 5.3, 6.1 - 6.3, 7.1 - 7.5, 8.1- 8.3, 9., 11.2, 11.3, 11.5, 11.7, 11.8, 11.9.3 - 11.9.5, 11.10.2, 11.10.3, 11.11, 11.12, 12.2, 12.3.1	Amended.
	5.1, 6.1	Deleted. Subsequent clauses re-numbered.
	4.3.7, 4.3.9, 4.9, 7.7, 8.3, 11.1	New clauses. Subsequent clauses renumbered.
	10.	New clause ‘Structural assessment of existing structures’ added.
1	First issue	Not applicable.

Introduction

This Specification is for the renewal, including upgrades, of existing Sydney Water's dry well sewage pumping stations. It must be read in conjunction with Sydney Water's Technical Specifications Civil, Mechanical and Electrical and WSAA Sewage Pumping Stations Code of Australia WSA 04, Sydney Water Edition.

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Acronyms

Acronym	Definition
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ATS	Automatic Transfer Switch
ATWL	Above Top Water Level
CAD	Computer Aided Drafting
CFD	Computational Fluid Dynamics
CT	Current Transformer
DICACL	Ductile Iron Calcium Aluminate Cement Lined
DICL	Ductile Iron Cement Lined
DIFB	Ductile Iron Fusion Bonded
DN	Diameter Nominal
DTC	Deemed to Comply
GPO	General Power Outlet
IICATS	Integrated Instrumentation, Control and Telemetry System
IMH	Inlet Maintenance Hole
I/O	Input/output
IP	Ingress Protection
kW	Kilowatt

Acronym	Definition
LED	Light-emitting Diode
MPa	Megapascal
PLC	Programmable Logic Controller
PN	Pressure Nominal
RCD	Residual Current Device
RL	Reduced Level
RTU	Remote Terminal Unit
SPS	Sewage Pumping Station
TOC	Top of Concrete
uPVC	Unplasticized Polyvinyl Chloride
V	Volt
VSD	Variable Speed Drive
WSAA	Water Services Association of Australia

General Terms and Definitions

Term	Definition
Camlock	The generic term encompassing both Kamlok and Bauer brand name fittings.
Design life	The period adopted in design for which a product, equipment or component is required to perform its function within the specified parameters with periodic maintenance but without replacement or major overhaul.
Service life	The forecast life expectancy of a product based on operational experience and actual installed conditions during which it remains in use, which may include replacement of critical parts and major overhauls.
Supplier	The person or organisation responsible for the fabrication or manufacture and supply of products, materials, equipment and components described herein.
WSAA Codes	Codes of Practice issued by Water Services Association of Australia
WSAA Code – Sydney Water Edition	WSAA Code with Sydney Water's modifications for use in Sydney Water's assets, where available.

1. General

1.1 Scope

This Specification covers the design, supply and installation requirements for the renewals, including upgrades, of existing Sydney Water dry well sewage pumping stations. It supplements the requirements of WSAA Codes and Sydney Water Technical Specifications - Civil, Mechanical and Electrical. If a dry well pumping station were to be converted into a submersible sewage pumping station, Sewage Pumping Station Code of Australia WSA 04 – Sydney Water Edition must apply.

The content of this document is based on:

- Specific requirements from Sydney Water stakeholders,
- Lessons learnt from previous sewage pumping station renewal and upgrade projects, and
- All relevant Sydney Water specifications, WSAA codes and Australian Standards.

For a typical design checklist refer to Appendix 1.

1.2 Proprietary items

Nomination of a proprietary item by Sydney Water does not imply preference or exclusivity for the item identified.

Alternatives that are equivalent to the nominated items can be submitted to Sydney Water for acceptance. The submission must include appropriate technical information, samples, calculations and the reasons for the proposed substitution, as appropriate.

2. Referenced documents

This Specification must be read in conjunction with current versions of the following:

- Renewal of Dry Well Sewage Pumping Stations Design Checklist (D0002345)
- WSAA Sewage Pumping Station Code of Australia WSA 04, Sydney Water Edition
- WSAA Water Supply Code of Australia WSA 03, Sydney Water Edition
- WSAA Sewerage Code of Australia WSA 02, Sydney Water Edition
- WSAA Industry Standard for Submersible Pumps for Sewage Pumping Stations WSA 101
- Sydney Water's Supplement to WSA 101 WSAA Industry Standard for Submersible Pumps for Sewage Pumping Stations (D0000677)
- WSAA Manual for Selection and application of Protective coatings WSA 201
- Sydney Water Technical Specification - Civil (CPDMS0023)
- Sydney Water Technical Specification – Mechanical (BMIS0209)
- Sydney Water Technical Specification – Electrical (CPDMS0022)
- Sydney Water High Voltage Standards
- Sydney Water Technical Specification -– Protection (DOC0014)
- Sydney Water Computer Aided Drafting (CAD) Standard and Specification (CDPMS0021)
- Sydney Water Technical Specification - Instrumentation and Control - General (HSS0009)
- Sydney Water Instrumentation and Control Standards – Sewage Pumping Station Standards (HSS0007)
- Sydney Water Instrumentation and Control Standards – Flow Monitoring Standards (Flowmeters) (HSS0005)
- Sydney Water Technical Specification – Permanent Gas Engine Driven Pump (D0002174)
- Sydney Water Technical Specification – Permanent Diesel Engine Driven Pump (D0002169)
- Sydney Water Technical Specification – Permanent Diesel Generator (D0002061)
- Sydney Water Technical Specification – Permanent Gas Engine Driven Generator (D0002097)
- Sydney Water Design Specification for Sewage Pumping Stations Dry Well Ventilation (D0001896)
- Sydney Water Technical Specification – Arc Flash (D0002263)
- Sydney Water Share Purchasing Contracts for the Supply, Repair and Overhaul of Pumps and Mixers
- Sydney Water Specification – Commissioning, transitioning assets into operation (D0001440)
- Sydney Water Specification – Maintenance (D0001441)
- Sydney Water Specification – Management (1041412)
- Sydney Water's Customer Delivery Facility Safety Signage Specification (SDIMS0026)
- All relevant Australian Standards including all those referenced in the above Specifications and Codes

In addition to the above, the Sydney Water deemed to comply (DTC) drawings contain engineering solutions for various sewage pumping station related infrastructure and may be utilised in the design, where appropriate.

3. General SPS requirements

3.1 Design

3.1.1 Design life

For new equipment and structures refer to WSAA Sewage Pumping Station Code of Australia WSA 04, Sydney Water Edition.

For existing structures refer to section 11 of this Specification.

3.1.2 Flood levels

The designer must establish the current 1% AEP flood level for the site and show the flood level on the drawings.

The 1% AEP must be taken from the Council mapping using Australian Rainfall and Runoff flood estimation method based on Representative Concentration Pathway (RCP) 4.5. In the event where such information is not available and 0.5% AEP is higher than the station finished ground level, the designer must carry out a flood study using Australian Rainfall and Runoff method to determine 1% AEP based on RCP 4.5. Where the pumping station is deemed critical, high value or high risk, climate risk assessment must also be carried out for RCP 8.5 to identify adaptation actions which could be implemented at no cost or define actions if adaptation is required in future.

3.1.3 Heritage

Some SPS sites may be heritage listed (confirm by clicking on ‘Section 170 Heritage’ in ‘Overlays’ in Spatial Hub). Details of heritage significance can be found on Sydney Water’s web page in public Heritage and Conservation (Section 170) Register. If the scope of work affects elements of the site that have heritage value/significance (e.g. the superstructure), the impacts must be assessed as early as possible and approved as per Sydney Water Heritage Compliance Procedure SWEMS0031 prior to carrying out the works. Also refer to the NSW heritage regulator’s Minimum standards of maintenance and repair for heritage items.

3.2 General requirements

3.2.1 Valves

All valves must comply with Sydney Water Technical Specification - Mechanical.

3.2.1.1 Gate valves

Resilient seated gate valves complying to AS2638.2 are the preferred type of isolating valves for sewage applications. However, DN375 and larger resilient seated gate valves must not be installed in pipelines inclined >10^{O} from the horizontal plane or with their spindles positioned >45^{O} off vertical. If such installations are unavoidable, metal seated gate valves fitted with replaceable low friction gate shoes and guides must be used. All gate valves must be counterclockwise closing and fitted with non-rising spindles.

Buried gate valves must be supplied complete with extension spindle, extension spindle shroud and surface box. Unless installed under pavement, the surface box must be fitted with a 100mm wide and 150mm deep circular concrete surround to enable asset labels to be affixed. All surface boxes must comply with WSAA Water Supply Code of Australia WSA 03, Sydney Water Edition.

3.2.1.2 Knife gate valves

Knife gate valves may be used only where space constraints don't allow the installation of gate valves.

Knife gate valves installed in dry wells and valve chambers must be fitted with bonnets rated to the same pressure class as the valve body. They may be either ductile iron bodied fusion bonded epoxy coated, or stainless steel bodied.

Knife gate valves installed in wet wells, IMHs, emergency storage structures or where they can become submerged must be grade 316 stainless steel with grade 316 stainless steel extension spindles, extension spindle brackets and spindle caps, and be fitted with a grade 316 stainless steel shroud to prevent rags and other solids being deposited around the spindle, gate and gland.

Knife gate valves must be counterclockwise closing and fitted with non-rising spindles.

3.2.1.3 Non-return valves

All non-return valves must be long bodied swing check type complying with AS 4794.

Wherever possible, non-return valves must be installed horizontally to minimise collection of debris against the valve seat and trim.

Non-return valve levers and counterweights must be positioned away from the main walking area. Sufficient side clearance must be provided to ensure the valve top cover and spindle can be removed whilst the valve is in situ.

In cases where non-return valve levers and counterweights are being retained post commissioning, adequate guards must be provided in accordance with Sydney Water Technical Specification – Mechanical.

In cases where the levers and counterweights are being removed from the non-return valves, the lever and counterweights must be hung on metal hooks provided on the wall 1500mm off the floor near the non-return valves. In the dry well, the best location is usually close to the edge of the sump.

Non-return valves installed on discharges of all pumps must be supplied with proximity 'no-flow' switches for pump protection against no flow and, in case of variable speed pumps, for their speed ramp control during starting and stopping. The 'no-flow' switches must be easily accessible for adjustment.

Non-return valves must have a BSPP (parallel thread) tapping point with plug provided on the highest point of the valve body or the valve inspection cover, where fitted. The tapping point size must comply with AS 4794. Non-return valves installed in valve chambers and dry wells must be fitted with a grade 316 stainless steel two-part ball valve instead of the plug for air bleeding purposes. A grade 316 stainless steel tube with a downturn bend must be provided from the ball valve to direct air/sewage away from the non-return valve and adjoining pipework/fittings to the floor.

3.2.2 Supports

All pipework and valves must be adequately supported as per Sydney Water Technical Specification - Mechanical. All valves must be supported on concrete supports with 3mm thick neoprene sheet separating the valve body from concrete.

3.2.3 Dismantling joints

All pumps and stop and non-return valves must be provided with means for easy installation and removal, such as flanged pipe bends or dismantling joints.

Dismantling joints must be thrust type. Non-thrust type dismantling joints, unrestrained couplings or grip type flanges and couplings or similar must not be used.

Dismantling joints must be of full length whereby their tie rods remain within the dismantling joint body when retracted. Short body dismantling joints may be used only in existing installations where space restrictions do not allow use of full length dismantling joints, provided that their tie rods can be backed off to free up the adjoining valve or fitting without the need to remove the dismantling joint with it.

Where the dismantling joint and stop valve are installed vertically, the required vertical position of the valve (for operation) must determine whether the dismantling joint should be installed upstream or downstream of the stop valve. The loose ring of the dismantling joint must be installed nearest to the stop valve.

In pump discharge pipework, the dismantling joint must be installed between the non-return valve and stop valve with the loose ring of the dismantling joint positioned towards the non-return valve.

All non-return valves, stop valves and electromagnetic flowmeters ≥PN25 or ≥DN450, must be provided with a dismantling joint adjacent to them. All other valves and electromagnetic flowmeters must have a dismantling joint located no more than one fitting/pipe spool away.

3.2.4 Testing and commissioning

Refer to Sydney Water Specification – Commissioning, transitioning assets into operation and Sydney Water Specification – Maintenance.

3.2.5 Ventilation requirements

Refer to Sydney Water Design Specification for Sewage Pumping Stations Dry Well Ventilation for dry well and Sydney Water Edition of WSA 04 for wet well ventilation.

4. Dry well

4.1 Main pumps

4.1.1 General

The main pumps must be of a dry mounted submersible type. They may be vertically or horizontally installed, as required. The pumps must be selected in accordance with the requirements of:

- Sydney Water Shared Purchasing Contracts for the Supply, Repair and Overhaul of Pumps and Mixers
- WSAA Industry Standard for Submersible Pumps for Sewage Pumping stations WSA 101
- Sydney Water Supplement to WSAA Industry Standard for Submersible Pumps for Sewage Pumping stations WSA 101
- Sydney Water Technical Specification - Mechanical
- WSAA Sewage Pumping Station Code of Australia WSA-04 - Sydney Water Edition

4.1.2 Pump vendor scope of supply

Each pump must be supplied complete with the following items:

- Suction bend (vertical pumps only)
- Galvanised steel support stand (vertical pumps) or baseplate (horizontal pumps)
- Pump electrical and control cabling
- Protection relay (Xylem MiniCAS II or MAS801, depending on pump size)

4.1.3 Pumps with external wear plate adjustment

The wear plate on pumps from some manufacturers is adjusted externally. Over the life of the pump this may require the pump suction connection to be adjusted. To achieve this, vertically installed pumps must have a suction bend with slots or oversized bolt holes in the flange in vertical plane sized to accommodate the required adjustment. Horizontally installed pumps must have a load bearing dismantling joint with adjustable length installed on their suction pipeline.

4.1.4 Confirmation of pump selection

The designer must confirm existing system hydraulics by comparing actual test data for the pumping station with a calculated system curve. This will normally require reference to a combination of information such as:

- Technical data / Needs specification
- Pump test data report (for existing pumping units)

The designer must evaluate new pump performance for all approved vendors, taking into account any changes to pipework and/or static head. The most suitable pump with respect to performance and efficiency must be selected by the designer and accepted by Sydney Water.

Pump selection should also include consideration to site limitations such as space, weight, power, potential for excessive vibrations etc.

Pumps must be selected and installed such that they remain primed all the time while available for operation.

4.1.5 Life cycle costing

A 25 year life cycle costing analysis must be carried out to determine which pump supplier provides lowest life cycle cost. The life cycle costing analysis must include the following items as a minimum:

- Pump and motor efficiency and absorbed power at nominated duty point
- Pump purchase price including all vendor supplied items
- Pump installation and maintenance costs

4.1.6 Control levels and related information on drawings

The following information must be provided on the drawings:

- Invert RL of the Inlet Maintenance Hole (IMH)
- Invert RL of the incoming sewer in the wet well
- Suction safety RL
- Pump duty cut in and cut out RLs (all duties)
- Pump set point RLs (for variable speed pumps)
- Auto flush cut-in and cut–out RLs (if applicable)
- Above top water RL (ATWL)
- Station overflow RL
- Pump suction and discharge pipework RLs
- Pump stand RL or height above machinery floor
- All platforms RLs
- Invert and TOC RLs of the wet well, dry well and valve chamber floors

4.1.7 Pump and motor information on drawings

The pump and motor details must be provided on the drawings in a Pump and Motor Table as per below:

Pump		Motor	
Make:		Make:	
Model:		Type:	
Flow:	L/s	Power:	kW
Head:	m	Speed:	rpm
Impeller diameter	mm	Voltage:	V
Impeller No.		Phase:	ph
		Rated Current:	A
Pump and motor total weight:		kg	

For variable speed pumps the flow, head and speed ranges must be stated.

4.1.8 Pump position for lifting and maintenance

Pumps must be aligned with existing or new overhead lifting equipment, as appropriate.

Access to the top of the motor to attach a crane hook to the motor lifting lug or bridle must be provided. This may require a ladder and platform arrangement while still ensuring safe access to the pump suction bend connections, pump wear plate adjustment screws (where applicable), pump mounting bolts, pump volute bolts, suction bend drain and inspection cover (where fitted). A short length of a permanently attached suitably rated grade 316 stainless steel lifting chain may be provided, subject to with Sydney Water acceptance, where access to the motor lifting lug is difficult.

The designated pump set down area is to be shown on the drawings. The set down area must be rectangular, sized all around 150mm larger than the pumping unit footprint and marked with a 75mm wide yellow border with diagonal hatching.

The pump set down area must be sufficiently load rated. Load ratings must be written in prominent letters onto a suitable metallic label and affixed to a nearby permanent structure.

In stations without a superstructure over the dry well, the pump set down area in the dry well must align with the existing machinery openings at ground level to enable the pump to be lifted out of the dry well.

In pumping stations where there is insufficient room to provide adequate pump set down area, alternative arrangements must be discussed with and approved by Sydney Water.

Where new pumps are taller than the ones being replaced, the designer must consider removal and entry of pumps into the superstructure, e.g. a stub I-beam above the entry door. The I-beam must run across the superstructure ceiling and finish outside the superstructure such that the pump can be placed / lifted directly from a truck. For that purpose, the entry door must have sufficient headroom or provide a recess for the I-beam.

Where a pump is required to be lifted over another pump(s) or other plant to reach a set down point, the available lifting height from the overhead crane must be checked to ensure sufficient vertical lift is available for the required clearance of min. 500mm. The clearance must be confirmed for both motor and impeller (in case if maintenance stand is used) and for the entire pump including its volute.

Where handrailing comes in the way of removal and entry of the pumping units (pump and motor combined), the handrail must be of a retractable type while retaining the knee rail and toe board fixed. The handrail must be able to be secured in the retracted position. Where both the hand and knee rails are in the way of removal and entry of the complete pumping unit, a hinged gate opening inwards (i.e. towards the landing) must be provided in the handrailing. In such cases, a fall restraint system using anchor points (refer Sydney Water Technical Specification - Mechanical) must be provided.

4.1.9 Pump cables

The need for pump cable supports depends on their layout, size and required bending radius and must be confirmed with the pump supplier. Cable supports and cable harnesses must be shown on the drawings. Furthermore, the orientation, number and size of the cabling entering the pump must be confirmed with the pump vendor. This is necessary to ensure the cable support attached to the pump head is orientated correctly to facilitate lifting.

4.1.10 Pump removal

4.1.10.1 Where junction boxes provided

Where pump power and instrumentation cables junction boxes or turrets are provided, the cables will be disconnected at the junction boxes and the pumps will be removed with their cables.

4.1.10.2 Where no junction boxes provided

Where junction boxes or turrets cannot be provided, access must be provided to the pump head to facilitate the disconnection of the power and instrumentation cables and their entry assemblies.

The cable entry assemblies must be secured to suitable parking bases. The parking bases must be mounted close to the pumps where their cables can reach with no need to disturb the cable supporting structures.

The parking base flange faces must be able to provide watertight seal using the “O” ring seals on the cable entry glands. The parking bases must be sized to suit the pump cables so that the cables can be neatly enclosed in the bases without damage to the cable insulation considering the required bending radius. The parking bases must cater for multiple cable entry glands.

After disconnecting the cables and prior to the pump removal, the pump head must be fitted with suitable cable entry cover plate(s).

Adequate pump head cover plate(s) and cable entry assembly parking base(s) must be provided for each pump installed in the pumping station.

When the pump is re-installed, the cable entry assemblies must be re-connected and tested by a qualified pump supplier’s technician.

4.1.11 Metallic pump support stands (vertically installed pumps only)

Design drawings must clearly state the height of the stand from the base or show RLs of the top of the stand and the base.

Pump support stands must be kept as low as possible in order to minimise the overall height of the pump and motor and reduce the potential for excessive vibrations.

Vendor’s drawings for the pump support stands must be obtained to confirm stand dimensions and footprint is in accordance with the pumping station’s general arrangement drawings.

Support stands must be robust, fabricated from hot dipped galvanised mild steel or grade 316 stainless steel. Galvanising must be carried out off site.

The design of the pump support stand must eliminate areas for water to accumulate.

Support stands must provide easy access to pump suction bend connections, wear plate adjustment screws (where applicable), pump mounting bolts, pump volute bolts, suction bend drain and inspection cover, where fitted.

The dry well floor area under the stand must be grouted in a dome shape such that water disperses outside the confines of the stand. Grout must be compatible with epoxy grout ‘Conbextra EP65 Plus’ used between the dry well floor and underside of the pump stand. Where dome shaped grout cannot be provided due to site constraints, a drain through the grout must be provided.

4.1.12 Pump support stand - natural frequency

Refer to Sydney Water's Supplement to WSA 101 and Technical Specification - Mechanical.

4.1.13 Pump support stand levelling and anchoring

Refer to Sydney Water Technical Specification– Mechanical.

4.1.14 Maintenance stands

When the pump motor and impeller are separated from the volute (volute remains in situ), the pump must not be set down directly onto floors/platforms in the vertical position as this can cause damage or be unsafe. For pumps (50kW and larger), a maintenance stand is required to set the pump down. The maintenance stand must be procured from the pump vendor. Where they need to be fabricated, the details must be provided in the detail design drawings.

The maintenance stand must be able to take the full load of the pump. It must have bolt holes in the top plate so that the pump can be secured in place with suitably rated bolts. The maintenance stand itself must be secured to a sound base such as concrete floor with bolts before placing pump on it.

Provided there is sufficient space, the maintenance stand must be kept at the dry well floor. Preference is for it to be bolted to the dry well floor at a suitable designated location. Where an overhead crane is available, the maintenance stand can be stored in a lesser used floor area and brought to its place of use as long as it is within the operating envelope of the lifting equipment. In such cases, tapped grade 316 stainless steel inserts must be provided in the concrete floor to secure the maintenance stand. The tapped inserts must be plugged with grade 316 stainless steel hold down bolts once the maintenance stand is removed from its location of use and brought back to its storage place. Provision of a mobile or a permanent stand is site specific and must be confirmed with Sydney Water.

4.2 Sump pump

The sump pump must be of a submersible type and must incorporate a stainless steel body, impeller and motor casing. Wherever possible, a single phase, 230V pump must be specified. The pump must be fitted with an integrated float level switch control and starter. A hook must be provided on the dry well wall approx. 1500mm off the floor and adjacent to the pump to hang spare electrical cable.

To assist with the sump pump removal, the pump must be fitted with a PN16 flexible discharge hose with a camlock connection onto a rigid grade 316 stainless steel Sch. 40S pipe approximately 1000mm above the sump grate level.

A non-return valve, stop valve and a DN15 drain/tapping point must be fitted into the stainless steel pipe spool downstream of the camlock connection. The tapping point must be fitted with a two-part grade 316 stainless steel ball valve with 90^{O} elbow and a drain pipe finishing approx. 500mm above the sump. If fitted with a swing arm and counterweight, the non-return valve must be provided with a counterweight guard. The stainless steel spool must connect to the existing sump pump riser pipework.

The pump must discharge back to the wet well above the overflow level. The designer must confirm the total head required when selecting the sump pump.

Stainless steel or marine grade aluminium open grating is to be provided over the existing sump. A cut out complete with kick plates (similar to toe board) all around the cut out must be provided within the grating to enable the pump to be withdrawn without removing the grating.

A sump pump data table, similar to the main pump table, must be provided on the drawings.

4.3 Dry well pipework

4.3.1 Existing pipework tie in points

Pumping station suction and discharge pipework penetrating through the wet well, dry well and valve chamber walls if retained must be confirmed as acceptable for re-use. In cases where the existing pipework is to be retained, the new pipework and valves must connect to the flanges on the existing pipework.

Due to these being fixed tie in points, relative distances to other key interfaces within the dry well and valve chamber can be impacted, i.e. pump centreline, overhead lifting equipment, machinery hatches, valve chamber cover and discharge penetrations. Therefore, it is necessary to perform physical dimensional checks of the position of the existing pipework flange faces including their RLs to confirm the exact tie in points for the new pipework and valves.

4.3.2 Suction and discharge pipework and fittings

All new stainless steel pipework must be grade 316 Schedule 40S. Stainless steel pipes may be cut to correct dimensions and their flanges tack welded on site to get correct alignment and then fully welded and tested off site. Site welding is not allowed.

Ductile iron pipework and fittings may be used; however, the risk of dimensional tolerances should be assessed since site cutting and welding will not be possible.

Suction velocities must be kept to a maximum of 1.5m/s but no less than the self-cleansing and slime control velocities (function of pipe size). The velocity in the discharge pipework must also be sufficient to achieve efficient sediment transport through vertical bends and risers, usually in the range between 1.5m/s to 2.5m/s (also function of pipe size), but must not exceed 3m/s.

Sufficient pipe supports must be provided so that all pipes remain supported if any of the valves is removed. To support high level pipes such as discharge manifold, as far as practical the supports are to be provided from structures other than the dry well floor. This is to reduce obstructions at the dry well floor to allow easier movement of people/equipment and access to equipment.

The layout of the pump discharge pipes, manifold, risers and valves must be such to prevent filling the pipes with silt and debris when a pump is offline for maintenance. This may involve providing stop valves close to the manifold or alternatively, provide a stop valve at each end of the manifold where the individual pump risers meet.

Where possible, a grade 316 stainless steel straight spool piece min. 900mm long should be provided in the discharge pipework, preferably in the horizontal pipework, to allow installation of a clamp-on ultrasonic flowmeter sensors (two transduces) either for temporary or permanent means of flow measurement from each pump. The location for the flowmeter sensors to be confirmed in consultation with Sydney Water and nominated on the drawings.

4.3.3 Suction and discharge instrument connections

Tapping points for pressure measurement during commissioning and testing and for manual air release must be provided in the following locations:

- Each pump suction branch,
- Each pump discharge branch,
- On top of the discharge manifold in the dry well; and

- On discharge pipework / pressure main in the valve chamber downstream of the pressure main stop valve.

The tapping points must be positioned on top of pipe spools, 150mm from any pipe flange.

Tapping points in stainless steel spools must include a DN15 x DN15 BSPP grade 316 stainless steel hexagonal nipple into a threadolet of minimum 20mm height welded vertically to the stainless steel pipe/spool piece. Tapping points in ductile iron spools may be tapped into the pipes if they are provided with tapping bosses. Otherwise, tapping bands complying with AS 4793 must be used.

All tapping points must be fitted with two DN15 BSPP grade 316 stainless steel ball valves in block and bleed arrangement. The ball valves must be of two-part type.

Each pressure measuring tapping point must be fitted with an S-bend made from grade 316 stainless steel tube complete with a compression olive and DN15 BSPP hexagonal threaded union at each end. One end of the S-bend must connect to the open end of the block and bleed arrangement with a grade 316 stainless steel hexagonal nipple and the other fitted with a DN15 stainless steel BSPP male to female adaptor for connection of a pressure gauge (note pressure gauges used by Sydney Water typically come with a male connector). The upstream arm of the S-bend which connects to the block and bleed arrangement must be minimum 100mm high to the crest of the first bend. The other arm of the S-bend to which the pressure gauge will connect (provided by others) must finish minimum 100mm higher from the top of the crest of the upstream arm.

All open ends of block and bleed arrangements must be fitted with hexagonal end plugs/caps.

4.3.4 Pump suction bend (vertically installed pumps only)

Suction bends must be included as part of the pump scope of supply. These must be either grade 316 stainless steel Schedule 40S or ductile iron fusion bonded. Refer to the Sydney Water Supplement to WSA 101 for further details.

Suction bends must be provided with adequate inspection port. For bends DN300 or greater the inspection port must be minimum dia. 150mm.

Each bend must be fitted with a DN50 drain valve. The valve must be a two-part grade 316 stainless steel ball type. A male camlock hose connection must be fitted to the end of the DN50 drain valve.

A single lay flat hose of sufficient length to connect from the suction bend drain valve to the sump must be provided complete with a female camlock fitting and wall bracket to enable the hose to be stored within the dry well when not in use.

DN25 drain valves may be used if there is insufficient clearance to the dry well floor for installation of DN50 valves. This is subject to Sydney Water’s approval.

4.3.5 Pump suction reducer

Due to the limited space in the suction branch pipework, changes in diameter between the suction pipework and the pump suction flange may be achieved using a reducing bend (vertically installed pumps), or a reducer (horizontally installed pumps).

Where a reducer / reducing bend is used to taper the pump suction pipework, the soffit of the reducer must be horizontal (eccentric reducer with level soffit).

4.3.6 Discharge pipework drain points

A DN50 two-part Grade 316 stainless steel ball valve must be installed in each pump discharge branch to facilitate drainage of the pipework. Where there are space constraints, a DN25 valve may be used.

Where the pump discharge isolating valve is installed in the vertical riser pipe downstream of the duck foot bend, the drain valve must be located in the lowest point upstream of the duck foot bend. Where the isolating valve is installed in the horizontal pipe upstream of the duck foot bend, the drain valve must be installed in the lowest point between the valve and the bend and, in addition, a DN15 drain ball valve must also be provided between the non-return and isolating valves.

All pipe lengths between stop valves and between stop and non-return valves must be fitted with a DN15 stainless steel two-part ball valve installed at pipe inverts for pressure release and drainage. Where necessary, a grade 316 stainless steel tube must be fitted to the ball valve to direct the discharge towards the floor.

4.3.7 Discharge pipework air bleed

An air bleed / test point must be provided immediately downstream of each pump / upstream of the pump discharge non-return valve and upstream of the non-return valve in the valve chamber.

Where there is likely that air may be entrained in sewage entering the wet well, an automatic air release valve must be installed in each pump suction pipe. The air release valve exhaust must be piped back into the wet well above the maximum (overflow) level. Stop valves must be installed both, upstream and downstream of the air valve. The upstream stop valve must be resilient seated gate. The downstream stop valve must be grade 316 stainless steel two-part ball valve. The valves must be installed no more than 1800mm above the operating platform or floor level.

An air bleed point in the form of DN15 block and bleed two-part stainless steel ball valves must be installed in the discharge manifold to which the pump risers join within the dry well.

4.3.8 Riser discharge bends

The ‘duck-foot’ riser discharge bends must be fabricated stainless steel or ductile iron. They must be supported from the base of the dry well on a concrete support and held in place by chemical anchors and grade 316 stainless steel hold down bolts/nuts.

4.3.9 Pump air bleed

Where required (consult pump supplier), adequate air bleed to vent air from the pump motor jacket must be installed. The pump air vent port must be fitted with grade 316 stainless steel pipe with a two-part stainless steel ball valve. The pipe must be terminated at the dry well floor with a bend directed towards the floor sump/drain.

4.4 Dry well valves

4.4.1 Suction and discharge valves

A non-return valve must be installed downstream of each pump. As a minimum, stop valves must be fitted upstream of each pump, downstream of each pump non-return valve, on each suction pipe from the wet well upstream of the suction manifold, where installed, and on the suction manifold between the pump suction pipes.

For pumping stations with multiple pumps and pressure mains, the discharge pipework must be fitted with electrically operated stop valves to allow any pump to operate with any pressure main. These interconnecting stop valves may be installed in the dry well (e.g. on the discharge manifold), in the existing valve chamber, or in a new valve chamber provided for that purpose. Additional stop valve(s) must be provided to allow maintenance of the actuated valve(s).

Where there are space restrictions around suction pipework such that gate valves cannot be installed, bonneted knife edged gate valves can be used, subject to Sydney Water's acceptance.

Electric actuators must be fitted to all dry well and valve chamber stop valves DN450 and greater.

Handwheels must be provided on all stop valves in the dry well, including bypass stop valves, where applicable.

Chain wheels must be avoided wherever possible. Where chain wheels are required for valve operation, they must comply with the requirements of Sydney Water Technical Specification– Mechanical. Hooks must be provided on the valve support to tie the chain up safely when not in use.

4.4.2 Proof of isolation valves

DN15 stainless steel ball valves must be provided as test valves between branches on suction manifolds and between stop valves on the by-pass pump connection pipework. These must be provided in the pipe invert.

4.4.3 Wash down valves

One DN25 wash down tap must be provided in the dry well approx. 1200mm above the floor complete with a minimum 15m length of hose (sufficient length to reach the sump) in the machinery well. The hose must be stored inside the dry well on a wall bracket about 1200mm above the floor level.

4.5 Dry well access

Safe access to all regularly maintainable items in the dry well must be provided.

A warning sign must be installed at the entry door to the superstructure to state: "No Entry Without Torch".

All existing access facilities on site must be reviewed for condition, safety, structural integrity and compliance with AS 1657. This must include, but is not limited to the following:

- All step and rung ladders
- Platforms
- Handrailing, knee railing and toe board
- Stairs
- Gates / barriers

All existing access facilities deemed as non-compliant to AS 1657, structurally unsound or in poor or unsafe condition must be replaced or modified as required.

Consideration is to be given for access to both sides of the pumps for maintenance and removal activities. Crawling under or stepping over pipework is not considered acceptable.

Phosphorescent emergency exit signs must be provided.

All ladders must be provided with self-closing swing gates at top landings. Any existing chains on top landings of access ladders must be removed. A 5mm thick neoprene pad heat shrunk onto the strike plate of the swing gate must be installed on the strike plate of the swing gates.

A sign stating that minimum three points of contact must be maintained all the time must be provided at the top and bottom of each ladder.

Also, at the top of all ladders a sign must be provided stating to face ladder when descending.

All signs must comply with Sydney Water's Customer Delivery Facility Safety Signage Specification.

4.6 Redundant pump plinths and valve supports

All redundant concrete plinths and supports must be demolished to the dry well floor level and the remaining surface must be made good in a workmanlike manner such that it finishes flush with the existing floor.

4.7 Dry Well Cleaning

Prior to commencing the dry well renewal works, the Delivery Contractor must pressure clean the walls and floor in the dry well to remove loose paint, dirt and redundant material. The water pressure must be sufficient to remove loose paint and dirt from the walls but not so high such that good paint is removed. The floor may need to be degreased prior to pressure washing where oil spills are evident.

The Delivery Contractor must not use the dry well sump pump during pressure washing as it can get damaged by large solids or paint. A vacuum tanker or suitable temporary pump is to be used.

Painting / coating of the dry well walls is, generally, not required unless requested otherwise by Sydney Water.

Where required, the dry well floor must be repaired and, if possible, graded towards the perimeter drainage trench or sump to prevent water pooling.

4.8 Lifting facilities

Refer to Sydney Water Technical Specification– Mechanical.

The Delivery Contractor must undertake a condition assessment and an assessment of compliance against relevant standards of the existing lifting facility and consider replacement or upgrade based on this assessment in addition to the capacity assessment by the designer.

4.8.1 Existing overhead cranes

The designer must confirm the weights of the new pumping units, electric cubicles and other equipment and check these against the certified rating of the existing lifting equipment. If the rated capacity of the existing lifting equipment is not at least 20% greater than the heaviest item that needs to be lifted, including the weight of the combined pump, motor and electrical cable, the designer must:

- Establish whether the crane load rating can be increased to the required capacity and, if it can, the crane must be tested and re-certified as part of the project. All calculations must be performed by a qualified structural engineer, or
- Consider replacing the complete crane / lifting facilities.

4.8.2 Electrically operated hoists

Refer to Sydney Water Technical Specification– Mechanical for criteria on when electrically operated hoists have to be provided.

4.8.3 Pendants for lifting facilities

Pendants must not be battery operated due to the risk of batteries losing charge and preventing operation of lifting facilities. Where battery operated pendant is standard part of crane supply, an additional cabled/wired pendant must be provided.

4.9 Flood gates and bund walls

Dry wells of pumping stations located below 1% AEP flood level or in areas subject to overland stormwater flows must be protected from flooding. This may include:

- flood gates at the entry doors to the station superstructure,
- raising the entry point into the dry well,
- raising the concrete surrounds of the access hatches in the dry well roof slab, and
- erecting embankments or bund walls around the pumping station perimeter.

The top of the flood gate or any raised entry point or concrete surrounds must be min. 300mm above the 1% AEP flood level.

The flood gates must be on-seating and leak proof. The flood gates must be of lightweight, aluminium design. They must be hinged and preferably be able to open 180^{O}. They must be monitored (status only) and be able to be latched in open position.

Where embankments or bund walls are provided, the enclosed area must be drained to a sump that drains into the IMH via a P-trap and non-return flap in the maintenance hole. The wet well and IMH lids must be bolted down and all penetrations sealed to prevent surcharging within the embankment and flooding the site through the incoming sewers. Access stairs or ramps must be provided to cross over the embankment or bund wall.

All dry well wall penetrations must be sealed to Sydney Water approved method.

5. Wet well

5.1 General

Computational Fluid Dynamics (CFD) modelling must be carried out to confirm the hydraulic suitability of the wet well where the pumping station is being upgraded beyond its current design capacity or where major modifications to the wet well are proposed. CFD must also be carried out where sedimentation is considered an issue to assess if additional benching or/and wet well flushing is required. The wet well benching must encourage self-cleaning and be graded towards the pump suction pipes

5.2 Existing access steelwork

Existing ladders, step irons and platforms must be removed from the wet well to discourage unauthorised access. Following removal, all concrete surfaces must be made good, details and notes to which must be included in the drawings.

5.3 Wet well isolation

Inlet penstocks or valves to the wet well and in the wet well dividing walls, where existing, must be inspected and tested or replaced, if necessary, to ensure they can efficiently and safely isolate flows up to the maximum possible differential head both, in normal and abnormal (e.g. during maintenance) operation. The maximum differential head must be calculated to the station overflow level or to the 1% AEP flood level, whichever is higher. This is necessary for ensuring wet well and dry well works can be carried out safely. Wherever possible, the penstocks should be replaced with knife gate valves.

Electric actuators must be fitted to the wet well inlet pipe and dividing wall valves/penstocks with cross-sectional area ≥0.160 m^2 (e.g. ≥DN450). The actuators must be operable locally only. All the signals from the actuators must be provided with a marshalling panel located next to the IICATS cubicle, if possible, to permit future IICATS connectivity.

When new valves or penstocks are installed, their spindle cap must meet the requirements of AS 2638.1. This is to ensure Sydney Water can use standard valve keys and will not require special tools from the valve/penstock supplier.

Where feasible, stop board grooves and stop boards must be provided in the IMH to facilitate double isolation during wet and dry well maintenance or renewal activities. Facilities, such as a custom-built stand that allow the stop boards to be stored inside the superstructure while not in use must be provided.

5.4 Hatches

Wet well hatches and safety grilles must be inspected for overall condition and compliance. New valve spindle openings must be provided in existing hatches if the position of valve or penstock spindles is changed. Existing openings must be closed.

Where new hatches and/or grilles are required, these must be in accordance with WSAA Sewage Pumping Station Code of Australia WSA 04 Sydney Water Edition, and Sydney Water's Deemed-to-Comply drawings.

Where wet well access hatch size needs to be increased, the access opening must remain central to the dividing wall if provided in the wet well.

All new safety grilles must have a 125mm clear spacings starting from their perimeter. The level instruments must be accessed with the grille in place.

All new hatches and grilles must lay flat when fully opened. Where this is not possible due to existing obstructions, facility must be provided to enable the hatch and grille to be secured in open position to the adjacent structure to prevent inadvertent closure.

5.5 Wet well flushing

Where specified or identified by CFD, wet wells must be fitted with an automatic flushing system to facilitate stirring up of settled solids so that they don't accumulate in the well.

The flushing system must employ a grade 316 stainless steel return line which uses a portion of the pumped flow to stir up the wet well content for a short period of time at each pump start. The return flushing line must be tapped off the discharge manifold or pressure main upstream of the non-return valve and fitted with a timer controlled electrically actuated eccentric plug valve installed in the valve chamber or the dry well, and then piped back into the wet well. The flushing line must branch off in the wet well as required and terminates with a duck-foot bend(s) directed away from the pump suction bell mouths. The flushing lines must be sized so that the flow velocity does not exceed 7.5m/s.

6. Inlet maintenance hole

6.1 Existing access steelwork

Existing ladders and step irons must be inspected and assessed for safety, condition and structural soundness and compliance with AS 1657 and either retained if made from grade 316 stainless steel or replaced with a new stainless steel ladder. Following the removal of old equipment all concrete surfaces must be made good.

6.2 Access hatches

Inlet maintenance hole access hatch and safety grille must be inspected for overall condition and compliance with Sydney Water's requirements. Where required and if possible, the top of the inlet maintenance hole must be enlarged to provide a 1000mm x1150mm access opening.

Where a new hatch and safety grille are required, they must be in accordance with WSAA Sewage Pumping Station Code of Australia WSA 04 Sydney Water Edition, and Sydney Water's Deemed-to-Comply drawings. Inlet maintenance hole safety grille must be provided with a 'grille in grille' design for emergency pump discharge hose and dredging activities.

The new grille must have a 125mm clear spacings starting from its perimeter. The instrument hooks must be positioned so that they allow unimpeded removal of the instruments through the 125mm x 125mm openings. This is to enable level instruments to be accessed with the grille in place.

The new hatch and grille must lay flat when fully opened. Where this is not possible due to existing obstructions, facility must be provided to enable the hatch and grille to be secured in open position to the adjacent structure to prevent inadvertent closure.

6.3 High level inlet pipe

Unless already provided, a high level inlet pipe must be installed between the inlet maintenance hole and the wet well. Refer to WSAA Sewage Pumping Station Code of Australia WSA 04, Sydney Water Edition for details.

7. Valve chamber

7.1 Pipework and fittings

Pipework selection must comply with Sydney Water's Technical Specification– Mechanical.

All new pipework and fittings must be either Schedule 40S grade 316 stainless steel or ductile iron.

Existing stop valves must be tested to confirm they are in operable condition. Where existing stop valves are inoperable or leak, these must be replaced.

Where tapping points do not exist, new tapping points must be installed downstream of the stop valves for pressure testing. For details refer to section 4.3.3.

DN15 drain valves must also be provided at spool inverts between stop valves and between stop and non-return valves.

Where an existing pressure main load bearing dismantling joint exists within the valve chamber, this may be re-used provided that the O-ring and flange gaskets are replaced.

A review of thrust forces must be undertaken to establish whether additional restraint is necessary when making modifications to the existing scour pipework.

7.2 Below ground pipework

All exposed pipework and penetrations through structures must be metallic, i.e. either ductile iron or stainless steel.

All buried pressure pipework upstream of the valve chamber must be DICL or grade 316 Schedule 40S stainless steel.

All new buried scour pipework and high-level pipe between the inlet maintenance hole and the wet well must be DICACL or DIFB.

All gravity drain pipework, e.g. from the bypass bund and valve chamber must be uPVC to AS 1273.

Thrust restraints must be provided for all unrestrained pipework joints.

In all cases where flanges are installed below ground, they must be protected by PE sleeving as per Sydney Water Edition of WSA 03.

Break-ins to the pressure main outside of the valve chamber must be minimised if possible. Instead, connections (such as new scours) must be made off the new pipework, preferably within the valve chamber.

7.3 Valve chamber valves

As a minimum, the valve chamber must accommodate non-return and stop gate valves for each pressure main. Where a new valve chamber is constructed, it may be sized to also accommodate scour and bypass pump connection stop valves. Where the gate valve spindle is installed horizontally, a bevel gearbox must be provided complete with extension spindle, spindle support and opening in the cover for ease of operation without entering the valve chamber.

Operation of the pressure main stop gate valve, scour valves and by-pass pump stop valves installed within the valve chamber must be from surface level. Where required, the stop valves must be fitted with an extension spindle and spindle brackets. All valve spindles must be raised to 50mm below the valve chamber cover. Final spindles lengths must be confirmed on site by the Delivery Contractor.

Double isolation (two stop valves) is required on the scour line when the scour is located downstream of the pressure main stop valve.

Due to space constraints, there may be insufficient room to install gate stop valve(s) off the scour tee within the existing valve chamber. In this situation, the scour stop valve(s) may be buried.

The use of lugged PN16 bonneted knife gates for scour stop as an alternative to gate valves requires approval from Sydney Water.

Handwheels to gate valves must not be provided.

7.4 Valve chamber covers

Valve chamber covers are to be appropriately rated for vehicles when located in an access or public road. If located in a non-trafficable location the covers must be galvanized mild steel open grid type for fenced sites, or chequer plate for unfenced sites or near the shoreline. Galvanized mild steel or aluminium chequer plate may be used in unfenced public spaces. If less than one kilometre away from the shoreline the chequer plate must be marine grade aluminium or grade 316 stainless steel.

Valve spindle access holes in open grid cover must be fitted with a galvanised reinforcement ring. ‘Tear drop’ covers must be provided over valve spindle access holes in all solid (chequer plate) covers.

Where existing covers are being re-used, the alignment of existing access holes must be checked against changed valve spindle locations. New access holes must be provided where required. Redundant holes must be covered with plates from matching material.

All valve chamber hatches must be locked in place using padlocks either directly (preferred) or indirectly. In some instances, it may be necessary to ensure that a certain hatch is always opened first or to reduce the overall number of padlocks. Use of holding down plates welded to hatch(es) to lock other hatch(es) indirectly is acceptable.

7.5 Penetrations

All new pipework penetrations through concrete walls must be fitted with puddle flanges in accordance with Sydney Water’s Technical Specification – Mechanical.

7.6 Access into valve chamber

Existing access arrangements into the valve chamber must be reviewed along with any changes to the arrangement of the pipework and/or covers. A means of safe access and egress must be provided compliant with AS 1657.

Where space allows, an inclined ladder must be provided in place of vertical ladder. Individual rung ladder (step irons) may be provided as a last resort, subject to Sydney Water’s acceptance. Rungs for all ladders must be from deformed bar. Where individual rung ladders are to be provided these must be made of single rungs minimum 400mm long. Materials for ladders within 1km of shoreline must be grade 316 stainless steel.

All fasteners to secure the ladder into concrete surfaces must be grade 316 stainless steel and chemically set using Hilti HIT RE 500 V3, Ramset Chemset Reo 502 or equivalent.

Fixed or retractable hand stanchions must be provided at the top of all ladders.

8. Emergency bypass arrangement

The design of the emergency bypass pump connection arrangement and associated bund and enclosure must comply with the WSAA Sewage Pumping Station Code of Australia WSA 04, Sydney Water Edition.

8.1 Emergency bypass arrangement

The bypass pump connection pipework must be fitted with DN15 grade 316 stainless steel two-part ball valves. The valves must be located as follows.

- At the invert of the pipe spool between the Camlock hose connection and the non-return valve. This valve is used for depressurisation and drainage of the pipework between the Camlock dust cover and the non-return valve.
- In the vertical spool downstream of the bend prior to the bypass pipework going underground about 120mm above the concrete bund facing the concrete support of the gate valve and terminate with a 90^{O} elbow directed to the bund floor. This valve is used for testing isolation and must be installed between both bypass stop valves.

Tapping bands complying to AS 4793 may be necessary if installing on existing ductile or cast iron pipework.

In addition, a scour line must be provided to drain the bypass line if:

a) the bypass size ≥ DN200, or

b) the bypass pipework is more than 15m long, or

c) there are multiple bypasses.

The scour line must include a stop valve provided off the bypass line and discharging to the IMH.

Where there are multiple bypass arrangements in a single bund:

a) Provide minimum 600mm clear access between the bypass pipework in the bund.

b) Combine the bypass pipework into a single manifold before connecting to the pressure main. Where there is more than one pressure main, the manifold must join each pressure main with an isolating valve to allow individual pressure main operation with the emergency bypasses.

8.2 Emergency bypass connection in valve chamber

The emergency bypass pipe stop valve must be installed as close as possible to the pressure main. This will prevent solids accumulation in the bypass branch. If buried the valve must be supplied complete with extension spindle, spindle shroud and surface box.

8.3 Permanent bypass pump

Where nominated in the project scope, a permanent engine driven standby pump must be provided. The pump must be able to pump from the inlet maintenance hole bypassing the pumping station or, where impractical, from the wet well directly into the pressure main.

Unless specified otherwise, the pump must be sized to meet the ultimate peak dry weather flow to the pumping station.

The pump must be self-primed by means of a vacuum pump or ejector or similar without any need for manual priming. The priming mechanism must be able to fully prime the pump in no more than 180 seconds.

A gas engine driven bypass pump is preferred to a diesel engine pump where adequate gas supply is available.

The pump must comply with the Sydney Water Technical Specification – Permanent Gas Engine Driven Pump, or Permanent Diesel Engine Driven Pump, as appropriate.

9. Temporary bypass

This section relates to the temporary bypass requirements during the construction phase of the renewal or upgrade works and is not to be confused with the requirements for the emergency bypass arrangement.

The preference is to use diesel or gas engine driven pumps over a generator and electrical pumps where feasible to do so.

The bypass pumping methodology must be agreed as early as possible in the project. Confirmation of the following must be sought:

- Required maximum flow rate during bypass operations
- Suction and discharge points for the bypass pump
- Location of the bypass pump (some inlet maintenance holes are too small for bypass pumps)
- Suction static head available (when using diesel or gas engine pumps)
- Power supply
- Connections to IICATS
- Call out procedure/ hierarchy in event of a bypass pump failure.

10. Superstructure

Most of the dry well pumping stations have superstructures over the dry wells.

Typically, the superstructure houses the station electrical equipment, lifting facilities, ventilation fans and access steelwork to the dry well.

A condition assessment including waterproofing and roofing must be carried out to ensure structural integrity of the superstructure prior to any works. The assessment must also include the assessment of safety, serviceability, durability, protection of equipment within the superstructure, security of all entry doors and any other significant defects of the superstructure.

Common issues with the doors include paint peeling, water damage at the sill and absence of overhead protection. The Delivery Contractor must consider the prevalence of lead paint on the doors and heritage requirements (if any) to propose a cost-effective solution to repair or replace the doors to Sydney Water's acceptance.

Any graffiti on the walls must be removed and the walls to be applied with anti-graffiti clear coating as per WSA 201. Holes must be sealed to prevent ingress of vermin. Any vegetation that has grown and infiltrated the roof tiles, downpipes and walls must be removed to prevent dislodgement due to root jacking.

11. Structural assessment of existing structures

Structural assessment of the of the wet well, dry well, inlet maintenance hole and other structures must be undertaken to ensure that the residual service life is a minimum of 25 years. Where the assessed residual service life of the station is less than 25 years, refurbishment works must be carried out to ensure that the residual service life is extended to a minimum of 50 years.

The structural assessment must take into consideration items that are necessary to predict the current residual life, including but not limited to the following:

11.1 Concrete deterioration

- The depth of concrete deterioration.
- Existing cracks and depths.
- The remaining sound concrete cover to reinforcement (if reinforced).
- Number of existing and proposed new penetrations through walls and their locations.
- The alkalinity level (pH) of the sound concrete cover to reinforcement (if reinforced). A pH reading of ≤10 at the surface of reinforcement must be deemed to have reached the service life as at this level the concrete no longer provides adequate level of alkalinity to prevent the corrosion of reinforcement.
- The existing daily weighted average of the hydrogen sulphide gas concentration (H_2S) in the wet well and inlet maintenance hole.
- Future operational mode that can change the hydrogen sulphide gas concentration in the wet well and inlet maintenance hole.
- The predicted rate of ongoing deterioration of concrete including the reduction in the level of alkalinity.

11.2 Loading

- Liquid pressure associated with normal operating mode of all structures.
- Liquid pressure associated with flooded condition of wet well and IMH.
- Liquid pressure associated with dry well flooding for any reason in combination with minimum depth of liquid level in the wet well.
- External earth pressure: upper bound value for design action and lower bound value for design resistance (refer to Sydney Water's Technical Specification – Civil for limits on these values).
- External ground water pressure corresponding to 1% AEP flood level or assumed at ground level, whichever is higher.
- Buoyancy forces associated with external ground water table corresponding to 1% AEP flood level or assumed at ground level, whichever is higher, assuming station is on bypass, i.e. empty.
- Restrained shrinkage stresses in unreinforced concrete, particularly in horizontal directions.
- Thrust transfer from pressure mains penetrations through the walls. It must be assumed that anchorages provided outside the structures may not relieve thrust transfer to the walls. Any reduction in the full thrust transfer to the walls as the first line of anchorage must be

demonstrated with good degree of confidence, unless special provisions are made to ensure that thrust forces are not transferred to the wall.

- Vibration associated with the operation of the mechanical equipment, such as pumps, non-return valves etc.

11.2.1 Earth pressure coefficients and load combinations

Earth pressure coefficients and load combinations must be in accordance with Sydney Water Technical Specification – Civil, depending on whether they are for design action or design resistance.

11.3 Structural analysis

A three-dimensional finite element analysis must be carried out for all unreinforced concrete walls.

11.4 Design parameters for material properties

11.4.1 Characteristic compressive strength of concrete

The characteristic compressive strength of existing concrete must be assumed to be max. 25MPa, unless proven otherwise by testing of core samples.

Design strength (ultimate) of unreinforced concrete in tension and shear (corresponding to characteristic compressive strength of concrete of 25 MPa) are given in the table below.

Location / Design Strength (ultimate)	At Monolithic Construction[2]			At Vertical Construction and Cold Joints[2]			At Horizontal Construction and Cold[2] Joints[2]			At Cracks		
	External Wall	Dry / Wet Well Wall	Roof	External Wall	Dry / Wet Well Wall	Roof	External Wall	Dry / Wet Well Wall	Roof	External Wall	Dry / Wet Well Wall	Roof
Axial Tension (MPa)	1.1	1.1	0.55	0.28	0.28	0.28	0.55	0.55	NA	0.0[1]	0.0[1]	0.0[1]
Flexural Tension (MPa)	1.8	1.8	0.9	0.45	0.45	0.45	0.9	0.9	NA	0.0[1]	0.0[1]	0.0[1]
Shear (MPa)	0.26	0.26	0.13	0.07	0.07	0.07	0.13	0.13	NA	0.0[1]	0.0[1]	0.0[1]

Notes:

1. Cracks assumed to be full depth. Cores required to confirm if crack depths are assumed to be less than the full thickness of concrete.

2. Nominated values don't include any reduction due to restrained shrinkage stresses. The designer must assess the residual restrained shrinkage tensile stresses and adjust the design strengths accordingly.

11.4.2 Design for strength and serviceability of reinforced concrete members

The strength of existing reinforced concrete members must be assessed in accordance with AS 3600 where the asset was constructed in or after 1975.

Where the asset was constructed before 1975, ultimate strength design to AS 3600 may be used but a reduced value for capacity reduction factors (Φ) shall be adopted to reflect the age of construction.

In addition, a serviceability check must be carried out to AS3735.

11.4.3 Durability of wet well

11.4.3.1 Assessment

The following assessment must be carried out:

- The extent of concrete deterioration
- The remaining sound concrete cover to reinforcement, if reinforced
- The pH of concrete adjacent to reinforcement, if reinforced
- The weighted average of hydrogen sulphide over a one-month period (excluding during wet weather flow days).
- The potential for increased septicity of the sewage within the next 20 years

11.4.3.2 Plain concrete

No protective coating is deemed necessary if the assessment satisfies all the criteria listed below:

- Depth of concrete deterioration over the past years is <0.5mm per year.
- The weighted average of hydrogen sulphide gas over one month period of dry weather flow <5ppm
- Sydney Water confirms that the septicity of the sewage is unlikely to increase considerably over the next 20 years.

If any of the above criteria is not met, protective coating to WSA 201 is deemed necessary.

11.4.3.3 Reinforced concrete

In addition to assessing whether protective coating is required or not according to clause 11.4.3.2, The following criteria must be satisfied for the existing reinforced concrete:

- Existing sound concrete cover to reinforcement is >35mm.
- pH of concrete adjacent to reinforcement >11

If any of the above criteria is not met, the existing sound concrete cover to reinforcement must be increased by the application of structural polymer modified repair mortar of minimum thickness of 20mm so that the total sound concrete cover to reinforcement is >40mm.

12. Electrical and control requirements

12.1 General

All critical electrical switchgear, including motor starters, power distribution boards, RTU panels, ventilation panels, junction boxes/turrets, etc. must be moved to a location within the pump station building above ground level and min. 300mm above 1% AEP flood level. If there is no enough room to fit new electrical equipment in the existing building/superstructure, or if the current pump station doesn't meet the requirements for the location of electrical equipment, it must be installed in a new electrical switch room.

12.2 Mains supply upgrade

Where the station refurbishment increases the site maximum power demand the designer must consider whether a mains supply upgrade is required. A mains supply upgrade must include:

- Assessment of maximum demand. Maximum demand calculations must exclude connected loads that cannot operate simultaneously (for example duty / standby pumps).
- Prepare and submit an “Application for Connection” to the electricity distributor including payment of all necessary fees.
- Where the increase in maximum demand requires an upgrade of the electricity distributor’s network, prepare and submit a Level 3 Accredited Service Provider design for certification by the electricity distributor. This must include payment of all necessary fees.
- Provide a service protection device where it is not currently fitted or the existing device is underrated.
- Where an upgrade is required to an existing Form 1 Main Switchboard then it must be replaced with a Form 3b / Form 4 switchboard. Pump stations with an outdoor kiosk may be exempt from this requirement but must be verified with Sydney Water.
- If a new Main Switchboard is required, the designer must include the provision of a portable generator connection with manual change-over switches. Switches must be accommodated in separate cubicles if the switches have protection functions. This facility must be provided even if the site has a permanent standby generator. Controllers for automatic transfer switches (ATS) to be in a separate compartment from the ATS changeover switches.
- Upgrade from direct metering to current transformer (CT) metering including a CT metering panel as required.
- Provide a new panel where the service protection device and/or CT metering cannot be accommodated within the existing switchboard.
- Provide adequate protection grading between the electricity distributor supply and all downstream protective elements. The protection design must comply with Sydney Water Technical Specification – Protection.

12.3 Portable generator connection

All new main switchboards must be fitted with a portable generator connection regardless of whether a permanent generator or dual power supply exist on site. The same requirement must apply to sites where a permanent generator or second dual power supply is to be provided as part of the project scope.

On sites where an existing portable generator connection does not exist, a portable generator connection panel must be provided adjacent to the generator set down area.

Power cabling between the generator breaker and connection panel must be provided.

A mechanical key interlock must be provided between the generator incomer and the normal supply incomer circuit breakers, to prevent the supplies from being inadvertently paralleled.

The generator panel, switching arrangement, and cabling must be as per the standard SPS electrical drawing templates.

12.4 Permanent generator

Where nominated in the project scope, a standby generator set must be provided. The generator must comply with the Sydney Water Technical Specification – Permanent Diesel Generator.

The generator must be sized to supply the calculated load based on its continuous prime rating. It must be capable of starting and running all duty pumps plus the station auxiliaries, i.e. sized for the full SPS load.

The scope must include an automatic transfer switch (ATS) on the main switchboard, power cabling and protection as required by the Service and Installation Rules of NSW and local power authority requirements.

12.5 Electrical switchboard modifications

The main switchboard is to be upgraded if any of the following applies:

- motor starter sizes or types are modified,
- pump motor current ratings are increased beyond the capacity of the existing starters and the switchboard,
- the equipment is deemed unserviceable,
- main power or auxiliary distribution boards are modified,
- additional loads are to be added,
- the main switchboard does not comply to the current service and installation rules, or
- there are no protective devices for the revenue metering units.

Pump feeder breakers must be sized to be larger than the associated motor rated current and of sufficient capacity to carry the starting current dependent on the starting method. The breakers are to be economically sized, however with sufficient capacity to prevent tripping on start-up. Protection must be selected to achieve discrimination minimising the impact of any potential fault.

Refer to Sydney Water standard SPS drawings power schematic E0105, Power Distribution Section GA E0300 and Power Distribution Section Equipment Schedule E0305 for typical main switchboard circuit arrangement and equipment details. Refer to Sydney Water Technical Specification – Electrical for switchboard and starter technical requirements.

Starters are to be upgraded based on the typical pump starter schematics, which are provided in the following standard Sydney Water standard SPS electrical drawing sets:

- S1 – Direct metered switchboard with pump motor soft starters with Mini CAS protection relays and one wet well;
- S2 – CT metered switchboard with pump motor soft starters with Mini CAS protection relays and one wet well;

- S5 – CT metered switchboard with pump motor soft starters with MAS801 protection relays and one wet well;
- S6 – CT metered switchboard with pump motor VSD starters with MAS801 protection relays and one wet well;
- S12 – CT metered switchboard with pump motor VSD starters with MAS801 protection relays and two wet wells.

Typical pump starter panel modifications, specific to dry well upgrades where conventional pump motor units are replaced with submersible units are:

- Provision of new Flygt Mini CAS or MAS801 relays and associated bases, replacing the existing relays (generally these are ATS Tritronics type relays);
- The upgrade of 2A, 24V DC power supplies to 5A units and associated changes to the control circuitry within the existing starter panels;
- Removal of the Unit Flooded switch and associated wiring for each pump. Bridging of the Pump Station Flooded switch terminals within the starter panels and removal of the indication lamps and associated labelling.

Additional supply breakers that are to be included, if nominated in the project scope, are cranes, motor actuated valves, sump pump and ventilation fans. Additional breakers must be included for power factor or active harmonic filters as determined necessary in the assessment of the site power quality to meet AS 61000 and local power authority requirements.

The crane supply is generally a 3-phase breaker providing supply to the vendor supplied equipment box.

Motor actuated valves are generally 3-phase valve units complete with a local starter supplied by the pump station power distribution panel and controlled by the RTU. Schematics must be based upon the latest templates issued by Sydney Water.

The sump pump supply is generally from a single phase 10A RCD located in the pump station distribution board.

The ventilation fan starter and control panel are as per the standard drawings included in the Design Specification for Sewage Pumping Stations Dry Well Ventilation.

Temporary provision must be made to supply temporary bypass pump starters if required to continue maintaining well levels while the permanent equipment is undergoing refurbishment or replacement.

12.6 Actuated valve modifications

The common scope of work associated with actuated valves is as follows:

- Add or remove actuated valves (e.g. storm flow valves, wet well flush valves, stop valve and penstock actuators, etc.) in line with the approved project scope;
- Provide power supply, monitoring and control to the actuator;
- RTU I/O assignment to be confirmed with Sydney Water Instrumentation and Control Services;
- Drawings to be provided in accordance with the latest Sydney Water SPS electrical templates.

12.7 Electrical cables

Upsizing of pumps may result in an increase in the existing consumer mains, pump starters and pump motor cabling. All new cables and existing cables affected by the project scope are required to be reassessed. They must be sized based on AS 3008 taking into consideration the new loads and appropriate derating factor based on the number of cables on the shared route, cable support or enclosure, cable arrangement, insulation type, etc.

New dry mounted submersible pumps come with potted submersible motor power, protection and monitoring cabling of a pre-ordered length that would replace the existing surface or conduit supported cabling. New cable route length must be assessed to confirm pump cable lengths required. Pump screened cables must be of sufficient free length to allow removal and laydown of pumps in the centre of the dry well for maintenance without disconnection.

The new pump cabling needs to be supported above the pump motor location and terminated in junction boxes or turrets. In some instances where they cannot be installed above the 1% AEP flood level, Sydney Water may elect to dispense with junction boxes or turrets and terminate directly into the starter panels. Disconnection, if required, must be at the motor termination box.

Cable supports in the form of stainless steel half circles, cable hooks and stockings need to be provided to ensure the full weight of the pump cabling is not transferred to the terminals at the pump head, turret, junction box or starters. The cable supports are to be located to allow the cables to hang in a fashion that facilitates safe removal and does not obstruct dry well access.

Protection cabling will need to be modified to match the new submersible pump monitoring and protection equipment usually necessitating an increase in the number of cores in cabling from junction boxes or turrets back to the pump motor starters. Additional terminals must be provided in turrets, junction boxes or starters where the existing units are able to accommodate these, if not, the equipment that is space constrained must be replaced with new units.

New IP68 instruments and latch stops must be supplied complete with cabling where terminations are potted. Cable run lengths are to be determined to ensure the correct cable length is supplied. To facilitate equipment replacement, removal and installation of the cabling, new individual and continuous conduits with long sweep bends must be provided.

All necessary cabling must be provided to complete the installation as per the approved scope of work and required in the design. This may include, but is not necessarily limited to, the following:

- Relocation of pump station switchgear.
- Temporary bypass pump starters.
- Separate light and power wiring above flood level and below flood level circuits.
- New bypass connection flood lighting.
- New sump pump GPO.
- New motorised crane supply.
- New vent fans.
- New instruments.
- Any other pump station change that requires an electrical service.

The new and modified cabling details are to be updated in the site electrical cable schedule and block diagrams.

New cable penetrations are to be provided into the wet well, inlet maintenance hole, through kiosk bases or dry well entries as necessary to achieve the project objectives. The penetration details must be clearly and comprehensively covered in the site layout drawings. All existing or new penetrations must be fire stopped and properly sealed to be weatherproof, vermin proof and prevent the passing of sewer gases.

12.8 Pump power and instrument cable junction boxes and turrets

New junction boxes or turrets must be provided for the termination of pump and instrument cabling. These must be:

- Located above ground level and min. 300mm above the 1% AEP flood level.
- Located to facilitate the segregation of other services and power and instrument cabling.
- Located to minimise the installation of new or the relocation of existing pits and buried cable conduits.

New Sydney Water standard stainless steel turrets are to be utilised if there is sufficient space available on site. Care must be taken to maintain hatch and turret door opening clearances. Where space is limited, prohibiting the use of the standard stainless steel turrets, other options must be considered, such as Fulton FPB2TV green plastic turrets, or equivalent. Failing this, junction boxes may be mounted either off the exterior of the pump station walls or located on the entry or mezzanine level, provided these locations are above the flood and overflow levels. The turrets or junction boxes must be provided with cable glands or conduit penetrations as required to accommodate the new cabling.

12.9 Lighting, power distribution and GPOs

12.9.1 General

Light and power distribution boards, lighting and general power outlets (GPO's) must be provided as specified in the project scope and the requirements stipulated within the Technical Specification – Electrical.

New internal and external lighting, switches and GPO's must be provided to replace any existing unserviceable or incorrectly IP rated fittings.

New equipment must be provided to cater for any building plant layout or access changes.

12.9.2 Lighting

Lighting design is required where rearrangement of the dry well equipment has been required during the upgrade leading to obscuring of the lighting or casting of shadow on plant or access routes.

Renew existing lighting or provide new external lighting to facilitate the connection, running and dismantling of new bypass arrangements.

Ensure light fittings are easily accessible for the replacement. If they are not easily accessible, then the light fittings must be relocated to an accessible location. Lighting design must be performed to ensure required lighting levels are achieved.

The lights must be operated via a manual switch located inside the building, close to the personnel access door. A sign at each light switch must clearly identify the purpose.

Lighting installation and lux levels must be in accordance with the Sydney Water Technical Specification – Electrical.

Replaced or new luminaires located within the switchroom must be industrial type, LED type and must have an IP55 rating. Luminaires located outdoors or within the dry well must be non-corrosive rated IP56.

12.9.3 Distribution boards

Assessment must be carried out if the existing distribution board spare capacity is planned to be used. If there is insufficient capacity in the existing distribution board or the modification work to create additional spare capacity doesn't comply with SW Technical Specification – Electrical, Australian Standards or NSW Service and Installation Rules, then a new distribution board must be provided.

The GPO's and lighting power equipment must be segregated so that equipment above the flood and overflow level are powered from separate circuits to those below these levels. This change will ensure that if the dry well were to flood, the pump units and equipment above the high water level continue to operate but there would be no power supplied to general electrical fittings that are submerged. These separate circuits should be clearly labelled.

New RCD circuit breakers on the power distribution board must be provided where required.

12.9.4 General power outlets

All GPO's in the dry well must be installed on separate power circuits. If not already completed, GPOs must be changed to IP56 rated equivalents. RCDs are to be provided on all GPO circuits. All GPO's must be installed min. 1.5m above the dry well floor level.

12.9.5 Sump pump GPO

The sump pump power supply must be via a wall mounted single phase industrial type weather proof (IP56), 230V AC 10A GPO located in the dry well near the sump.

Where a 230V sump pump is not available, a three-phase sump pump with a 415 V 3-phase feeder must be provided in the low voltage distribution board supplying a new direct online starter. The sump pump motor must be connected to the starter directly or to a termination panel. The starter or the termination panel must be located above the flood and overflow levels in a similar location to the main pump starters. Where 3-phase sump pumps are specified, additional IICATS I/O will need to be provided.

Level switches to control the pump on / off operation and to provide monitoring are to be connected back to the starter via a local IP67 junction box.

12.10 Modifications to instrumentation

12.10.1 General

All existing dry well instruments must be replaced with potted IP68 type instruments. The cables must be run in a separate continuous conduit for each instrument to facilitate instrument replacement. All bends to be long radius type.

12.10.2 Wet well level instruments

Sydney Water's preference for the monitoring of wet well levels is via a hydrostatic level transmitter located in the dry well. The transmitter is connected to a 50mm manifold that is installed through the wall separating the dry well and the wet well. The manifold arrangement must be fabricated in accordance with the standard Sydney Water drawing.

The manifold and instrument must ideally be located below the centre line of the suction pipework and max. 300mm above the floor of the dry well.

12.10.3 Dry well level instruments

Replace all dry well float switches (machinery well flooded, sump level high unit flooded) where the potted cable has been terminated below the high water level.

Float switch cables must be terminated in an instrument junction box located above ground level and min. 300mm above the 1% AEP flood level.

Where conventional non-submersible pumps have been installed in the dry well the existing “unit flooded” level switches and redundant circuit components must be disconnected and removed.

12.10.4 Valve chamber instruments

Valve chambers must be provided with a buoyancy level switch to raise an alarm should it become flooded.

Each pressure main must be fitted with a pressure transmitter downstream of the stop valve for continuous pressure monitoring via IICATS. The pressure transmitter must be installed within the valve chamber.

12.10.5 Flowmeters

Where specified, a flowmeter(s) is to be installed on the SPS pressure main(s), either in the dry well where space allows, or in a separate valve chamber. Ultrasonic flowmeters are the preferred type for sewage applications, although electromagnetic flowmeters may also be used, subject to Sydney Water acceptance. The flow meter(s) and its installation must comply with Sydney Water Instrumentation and Control Standards.

12.11 Latch stop stations

A risk assessment must be performed to determine whether local latch stops or local start/stop control for each pump, or whether no local control is required. If local controls or latch stops are to be provided these must be IP68. Cabling is to be potted with lengths specified for site conditions and installed to facilitate replacement in separate conduits. All conduit bends to be long radius type. Each latch stop is to be installed within 2m from the pump that it controls and at the same floor level.

12.12 Modifications to IICATS I/O and control functions

During the upgrade, the designer must identify any changes to the pumping station functional description, RTU and emergency PLC I/O.

New pumping units are generally of a dry well submersible type and as such are designed to operate when submerged. Therefore, the existing “pump stopped due to flooding” function needs to be removed for each pump. All, “Pump Stopped Due To Flooding”, relay contacts are to be replaced with the pump “Water in Oil” alarm contacts in the RTU DI drawings.

One ball float must be maintained within the dry well to provide a “Machinery Well Flooded” alarm. This provides an IICATS alarm only and does not disable the pumping units.

The existing Omniflex RTU power supply must be replaced with Dyne Industries 5A custom analogue power supply based on the previously adopted Radameter unit. The voltage monitoring contacts are to be wired into the RTU DI monitoring circuit.

If not already implemented, dual power supply arrangement for the ATWL alarm circuit must be provided as shown on Sydney Water standard SPS electrical drawings.

All IICATS signals need to be checked with the I/O list provided by the Sydney Water Instrumentation and Control Services team. Drawings are to be updated in accordance with their requirements.

The standard RTU I/O allocation is specified in Sydney Water Instrumentation and Control Standards – Sewage Pumping Station Standards.

12.13 Electrical bypass

During the design of the upgrade works consideration is to be given as to what temporary arrangement is required to maintain operation of the pumping station during the works. If temporary electrical submersible pumps are to be utilised for bypassing operations these must be operated and controlled via temporary bypass panels. Sydney Water have developed standard electrical bypass panels for two power ranges, 4.5kW to 22kW and 22kW to 75kW. Standard electrical drawings are available for these panels and all bypasses of within this power range must have these panels installed.

12.14 Removal of redundant equipment

All equipment made redundant during the project must be isolated, disconnected and removed from the site. The Delivery Contractor must, in consultation with Sydney Water, identify redundant equipment that must be retained by Sydney Water and determine a suitable off-site location for its storage.

All decommissioned cables must be isolated, disconnected and removed from the existing pits, conduits and cable trays. The remaining cables must be rearranged in association with the new cable.

13. Site infrastructure

13.1 Survey labels

Survey labels showing RL of the roof in AHD are to be provided on all structures above instruments, including the IMH, wet well and valve chamber. Refer to WSAA Sewage Pumping Station Code of Australia WSA 04, Sydney Water Edition for details.

A survey datum line showing the RL to AHD must be marked on a clearly visible grade 316 stainless steel label (100mm long x 80mm high x 2mm thick) attached to the dry well / wet well dividing wall close to the wet well level sensor approx. 1600mm above floor to facilitate instrument installation and adjustment.

13.2 Anchor points

All anchor points must be located at 1.5m of the access openings and in line with the hatch hinges. The number and location of the anchor points must be confirmed with Sydney Water prior to commissioning.

All anchor points must comply with the requirements of WSAA Sewage Pumping Station Code of Australia WSA 04, Sydney Water Edition and Sydney Water Technical Specification - Mechanical.

13.3 Bollards

13.3.1 Permanent bollards

Permanent bollards must be provided to protect assets and/or structures on site from vehicles.

All permanent bollards to be concrete filled with concrete footings.

Two permanent bollards are required at each side of the vehicle entry doors to the station superstructure.

Vent shafts close to trafficable paths and in parks must be protected from vehicles using permanent bollards.

Where valve chamber, wet well, maintenance holes, emergency storage structures and other covers are not trafficable but there is a risk that traffic may drive over them, permanent bollards or alternative safety barriers must be provided.

13.3.2 Removable bollards

Removable bollards may be necessary to prevent unauthorised vehicle access to site entrances. The requirement for removable bollards is a site-specific requirement and must only be provided if requested by Sydney Water. The removable bollards must be provided with Sydney Water locks.

Document control

Ownership

Role	Title
Group	Engineering and Technical Support
Owner	Manager, Engineering
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Change history

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1	Ran Virdi	24/11/2017	B. Maunder, M. Pathirana, R. Madhok, M. Rubcic	Ken Wiggins	24/11/2017

Appendix 1 Design checklist

The document ‘Renewal of Dry Well Sewage Pumping Stations Design Checklist’ (D0002345) provides a typical design checklist for dry well renewals and upgrades.

The checklist is based on this specification and relevant standards. It applies to renewals and upgrades of existing dry well SPSs but may be modified as required and used for new dry well SPSs should any SPS of this type be built in the future.

The checklist is not exhaustive. Is should be considered as a guide only and full responsibility for complying with this specification, relevant codes and standards lies with the designer.

The checklist must be used by all designers preparing designs for Sydney Water. Design verification must be undertaken as part of the design process before submitting design documents to Sydney Water. The checklist must be completed by the design verifier and submitted with design drawings as a proof of verification. It may need to be updated during the design process as the design progresses.

The checklist must be included or referenced in Sydney Water’s contract documents for design only and design and construct projects. It may also be used as a quick guide by the designers, Sydney Water reviewers, project managers, project engineers and commissioning engineers.